SP01  SIMPLE VISUAL OBSERVATION AS A DIAGNOSTIC METHOD FOR SPACE ANALYSIS

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AIMS: Space analysis is a fundamental part of orthodontic diagnosis and treatment planning, especially when deciding about whether or not to extract teeth in order to gain space to solve tooth size-arch length discrepancies. Although some methods such as utilizing a brass wire or a gauge or even more sophisticated analyses such as Tweed-Merrifield total face analysis, the Howes analysis or Royal London Space Analysis, have been described, most clinicians prefer to just observe the study models, and then estimate the amount of crowding based on their own experience.

MATERIALS AND METHOD: A literature review in Medline, Google Scholar and PubMed was undertaken with the objective of evaluating simple visual analysis (SVO) as a diagnostic method for orthodontic treatment planning.

RESULTS: Among the few studies which have investigated SVO, high amounts of intraclass confidence intervals (ICC) were reported, indicating the fact that SVO can be considered as a reliable method. Evaluating the effect of SVO-based estimations on extraction decisions showed even less variation than that of estimates for crowding. The results reported concerning accuracy differed: in a study SVO showed some positive bias towards over-estimating the amount of crowding while in another study SVO was compared with the Moyers technique for space analysis in the mixed dentition. Neither were better in predicting the amount of crowding in the permanent dentition.

CONCLUSION: SVO is commonly utilized by orthodontists when evaluating the amount of crowding, which is an almost reliable method, but there is still doubt about the accuracy.

SP02  EFFECTS OF NASAL OBSTRUCTION ON DEVELOPMENT OF MOTOR REPRESENTATION WITHIN THE FACIAL PRIMARY MOTOR CORTEX IN GROWING RATS

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AIMS: Recent studies have indicated that the number of patients with breathing problems caused by obstructive sleep apnoea and allergic rhinitis is increasing, especially during the growth period. Nasal obstruction during growth changes orofacial morphology and function. However, the aetiologic mechanisms underlying these changes are unknown. The main focus of this research was on the facial primary motor cortex (face-M1), which controls orofacial motor functions including semi-automatic (e.g., chewing) and voluntary movements (e.g., jaw-opening). The purpose of this study was to investigate the effects of nasal obstruction during growth on development of the motor representation within the face-M1 using an electrophysiological technique.

MATERIALS AND METHOD: Seventy-two 6-day-old male Wistar rats were randomly divided into the control and experimental groups (n = 36). The experimental group underwent unilateral nasal obstruction at 8 days of age. Intracortical microstimulation (ICMS) was used to map the jaw and tongue motor representations within the face-M1. Electromyographic activities were recorded from the jaw-opening [i.e., left (LAD) and right (RAD) anterior digastric] and the tongue-protruding [i.e., genioglossus (GG)] muscles evoked by ICMS within the right face-M1 at 7, 9, and 11 weeks of age. Multivariate analysis of variance was used for inter- and intra-group comparisons. Simple main-effect analysis using the Sidak adjustment was used for multiple comparisons. Statistical significance was set at $P < 0.05$.

RESULTS: There was no significant difference in the mean body weights of the two groups. In the control group, the total number of positive ICMS sites significantly increased with age from 5 to 9 weeks, but there was no significant difference between the number of sites at 9 and 11 weeks. In the experimental group, the number of independent positive ICMS sites for the LAD was significantly larger than the control values at each age. Moreover, the number of independent sites for the GG...
and the number of overlapping sites for the LAD+RAD+GG were significantly smaller than the control values at each age.

CONCLUSION: The findings suggest that unilateral nasal obstruction during growth affects development of the representation of the face-M1. This may be related to orofacial functional changes.

SP03 RE-AUDIT OF PATIENT SATISFACTION WITH ORTHOGNATHIC TREATMENT IN LEEDS AND NORTH YORKSHIRE

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AIMS: 1. To assess patient satisfaction following orthognathic treatment in North Yorkshire and Leeds and 2. To assess whether patients are provided with sufficient information prior to the procedure.

SUBJECTS AND METHOD: Standards for the audit were set as: 90 per cent or more of patients receiving orthognathic treatment are satisfied with the outcome achieved and 100 per cent receive adequate information regarding orthognathic treatment and feel fully informed prior to surgery. This prospective audit was carried out within the orthodontic departments in the Leeds and North Yorkshire hospitals from February 2013 to January 2015. Patients who had completed their orthognathic treatment within the last two years were invited to participate. The questionnaire aimed to record demographic data, reasons for treatment, information provided, benefits of treatment and satisfaction with surgical-orthodontic treatment. The questionnaire used was based on the British Orthodontic Society’s (BOS) orthognathic questionnaire along with recommendations from a previous audit. An electronic platform (Survey Monkey™) was chosen for distribution of the questionnaire.

RESULTS: A total of 110 patients (74 Leeds, 36 York), completed the online survey. Seventy three per cent (n = 80) were aged between 18 and 29 years with a higher proportion of females (62%, n = 68) responding than males. The majority of surgical procedures were bimaxillary osteotomies (70% n = 77). Some of the patients’ motivations for treatment included improving self-confidence (95%; n = 104) and changing facial appearance (95%; n = 104). Changes to social life, eating ability and speech were lower with 56 per cent (n = 62), 60 per cent (n = 66) and 30 per cent (n = 43), respectively agreeing or agreeing strongly. Information leaflets were received by 97 per cent (n = 107) of patients. Ninety six per cent (n = 106) found these useful. Thirty per cent (n = 33) of patients watched or received the BOS orthognathic DVD provided. Post-operatively, 9.1 per cent (n = 10) of patients reported dental problems or eating difficulties.

CONCLUSION: The ‘gold standard’ target for patient satisfaction was met. The patient information target was consistently over 90 per cent but did not quite reach the standard set of 100 per cent. The results show, in addition to functional issues, psychological needs were significant motives for seeking orthognathic treatment. Areas to improve include providing consistent information to all patients in both leaflet and visual format. Make prospective patients aware of the new BOS orthognathic video clips once available online.

SP04 ANTERIOR CROSSBITE AND ORTHODONTIC ROOT RESORPTION

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AIMS: Orthodontic root resorption is a common iatrogenic effect of orthodontic treatment. Genetic and treatment related factors have been associated with root substance loss during tooth movement. An earlier study indicated that an anterior crossbite may be associated with the severity of root resorption. The aim of this research was to evaluate whether a crossbite of the anterior teeth is a risk factor for orthodontic root resorption.
MATERIALS AND METHOD: For this retrospective study, the records of 68 treated patients were used. Among them, 34 patients had one or more inverted incisors before initiation of treatment with fixed appliances. A matched control group of orthodontic patients without an anterior crossbite comprised 34 individuals. Crown and root lengths of the maxillary incisors were measured on pre- and post-treatment periapical radiographs corrected for image distortion. The percentage of root shortening and root length loss in millimetres was then calculated. A two sample t-test was performed to compare root resorption between the crossbite and the control group, for each tooth separately. In subjects with a crossbite on one side only, root resorption between the inverted and non-inverted teeth was compared by a paired t-test. The comparison was similarly repeated for the neighbouring to the inverted tooth incisor. Root resorption of the maxillary incisors on the inverted side was compared with the mean value (between right and left side) of resorption in the control group by two-sample t-test, separately for the central and lateral incisors. To assess any association between the percentage of root shortening of each tooth and the other variables recorded, multiple linear regression analysis was applied.

RESULTS: No significant differences were detected between the inverted and non-inverted incisors of the same patient, either between patients with an anterior crossbite and the control group. Similarly, the neighbouring to the inverted teeth did not suffer root shortening significantly more than their contralaterals.

CONCLUSION: An anterior crossbite does not seem to be a significant risk factor for root resorption during orthodontic treatment.

SP05 EVALUATION OF THE CLINICAL SURVIVAL OF REBONDED BRACKETS WITH THE ADHESIVE REMNANT INDEX
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AIMS: Bracket debonding is one of the most common occurrences in orthodontics. The aim of the present study was to evaluate the effect of adhesive remnant index (ARI) scores of debonded brackets on their clinical survival after debonding.

MATERIALS AND METHOD: Seventy six rebonded maxillary first and second premolars brackets during 2 years of active treatment in a private clinic were evaluated for their clinical survival. According to ARI scores at the time of debonding, they were assigned to three groups; group A with 27 brackets of ARI ≥4 and group B with 28 brackets of ARI ≤2. In 21 cases (group C), new brackets were used. The number of re-debonded brackets in each group was determined and compared with each other at three intervals of 6, 12 and 18 months after bracket rebonding. SPSS 17 software and the chi-square test was used for statistical analysis.

RESULTS: The percentage of re-debonded brackets was significantly higher in group B (ARI ≤2) than groups A (ARI≥4) and C (new brackets) (P = 0.002) but the number of the re-debonded brackets was not significantly different between groups A (ARI≥4) and C (new brackets) (P = 0.527).

CONCLUSION: Debonded brackets with ARI ≥4 could be rebonded with the same clinical durability as new brackets.

SP06 MIXED DENTITION SPACE ANALYSIS IN A NIGERIAN POPULATION
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AIMS: Mixed dentition space analysis is an essential part of orthodontic diagnostic procedures that enhances treatment planning. The objectives of this study were to evaluate the applicability of both the Tanaka and Johnston and the Moyers mixed dentition space analysis in a Nigerian population, and also to develop new regression equations and probability tables for this population.

MATERIALS AND METHOD: The mesiodistal crown dimensions of 54 dental casts of Nigerian subjects were measured with digital callipers. Gender differences were evaluated with an independent t-test. Correlation coefficients between the combined mesiodistal widths of the permanent mandibular incisors and the canine and premolars of the maxillary and mandibular
arches were determined. Linear regression equations and probability tables were derived and used to compare actual Nigerian tooth widths with those predicted by the regression equations of Tanaka and Johnston and Moyer’s probability table.

RESULTS: Tanaka and Johnston’s equations underestimated canine and premolar mesiodistal widths in the mandibular and maxillary arches. However, no statistically significant differences were observed in the mesiodistal widths of the maxillary canine and premolars for combined genders at the 75th percentile, and in the mandibular arch for males at the 85th percentile confidence levels when compared with those of Moyers’ probability tables, while there were statistically significant differences ($P < 0.05$) at all the remaining percentile levels.

CONCLUSION: Moyers and Tanaka and Johnston mixed dentition space analyses have limited application in this sample of the Nigerian population and the newly proposed probability tables would be more accurate for Nigerian subjects.

SP07 MANDIBULAR SYMMETRY IN SUBJECTS WITH A UNILATERAL CLEFT LIP AND PALATE
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AIMS: To retrospectively evaluate mandibular symmetry in subjects with a complete unilateral left cleft lip and palate (ULCLP) and to compare this with an Angle Class I control group using panoramic radiographs.

MATERIALS AND METHOD: Pre-treatment records of 163 subjects (mean age: 12.9 ± 3.5 years) were retrieved from the archives. Of these, 84 had a ULCLP and 79 an Angle Class I occlusion without a cleft. None of the study sample had a significant facial asymmetry, a syndrome and/or systemic disease. Ten anatomical landmarks were marked on the panoramic radiographs, and measurements were performed using the Pordios software. Intra- and inter-group differences were analyzed using a Student’s t-test.

RESULTS: Mandibular right and left ramus and total ramal heights, condylar height and lower molar alveolar heights were significantly smaller in the ULCLP group when compared to the controls ($P < 0.05$ to $P < 0.001$). In the ULCLP group, mandibular and corpus lengths on the left side were significantly shorter than on the right side ($P < 0.05$). In the control group, mandibular and corpus lengths, ramal and condylar heights and molar alveolar height were significantly smaller on the right side than on the left side. Ramus/corpus angles in the ULCLP group were significantly larger than in the control group ($P < 0.001$).

CONCLUSION: Right-side mandibular dimensions are generally larger than on the left-side in ULCLP subjects. Mandibular asymmetry exists to varying extents in ULCLP subjects and is characterized mainly by smaller cleft-side dimensions. Discrepancies in left-right mandibular dimensions also occur in normal subjects.

SP08 NASAL AND PHARYNGEAL AIRWAY VOLUME, SURFACE AND VERTICAL DISTANCE IN ECTODERMAL DYSPLASIA VERSUS CLASS I
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AIMS: To identify and compare the mean values of nasal and pharyngeal airway volumes, surfaces and vertical distances in ectodermal dysplasia (ED) patients against Class I healthy individuals.

MATERIALS AND METHOD: In this retrospective study three-dimensional computed tomographic records of ED patients ($n = 13$; mean age 18.02 ± 5.35 years) and skeletal Class I (taken for various dental problems) ($n = 10$; mean age 20.12 ± 3 years) were evaluated. Nasal and pharyngeal airway volumes, surfaces and vertical distances were measured and analysed by Mimics Software (10.0.1, Materialize, Leuven, Belgium). Male and female individuals were pooled in each group due to insignificant differences between nasal and pharyngeal volumes, surfaces, vertical distances and
RESULTS: The mean nasal airway volumes, surfaces and vertical distances were respectively 15006.76 ± 4298.5 mm$^3$, 8074.66 ± 1932.19 mm$^2$ and 12.87 ± 2.85 mm in the ED group. The mean pharyngeal airway volumes, surfaces and vertical distances were respectively 92343 ± 4777.46 mm$^3$, 3411.84 ± 1439.74 mm$^2$ and 32.1 ± 6.11 mm in the ED group. The mean nasal airway volumes, surfaces and vertical distances were respectively 176567 ± 67875 mm$^3$, 9811.31 ± 2153.19 mm$^2$ and 12.01 ± 2.67 mm in the control group The mean pharyngeal airway volumes, surfaces and vertical distances were respectively 11717.79 ± 3988.43 mm$^3$, 4697.52 ± 970.27 mm$^2$ and 41.54 ± 4.68 mm in the control group. Pharyngeal airway area and pharyngeal vertical distance significantly decreased in the ED group ($P$ ≤ 0.05 and $P$ ≤ 0.001). All other findings were statistically insignificant ($P$ ≥ 0.05).

CONCLUSION: Statistically significant differences were found in the mean pharyngeal airway area and pharyngeal vertical distance between ED and Class I individuals. Nasal measurements also decreased, but the mean differences for these measurements were statistically insignificant. ED probably has an effect on growth and development of the nasal and paranasal areas and pharynx. Further investigations should be undertaken to reveal the correlation between ED and the nasal and paranasal areas and pharynx.

SP09 MAXILLARY SINUS VOLUME IN ECTODERMAL DYSPLASIA VERSUS CLASS I
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AIMS: To identify and to compare the mean values of maxillary sinus volumes and surfaces in ectodermal dysplasia (ED) patients against Class I healthy individuals.

MATERIALS AND METHOD: In this retrospective study three-dimensional computed tomographic records of ED patients (n = 13; mean age 18.02 ± 5.35 years) and skeletal Class I (taken for various dental problems) (n = 10; mean age 20.12 ± 3 years) were evaluated. Maxillary sinus volumes and surfaces were measured and analysed by Mimics Software (10.0.1, Materialize, Leuven, Belgium). Male and female individuals were pooled in each group due to insignificant differences between sinus volumes, surfaces and cephalometric variables. Kruskal-Wallis, Dunn’s multiple comparison, chi-square and Fisher’s exact tests were performed for evaluation of the data using NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA).

RESULTS: The mean sinus volumes and surfaces were 9416.09 ± 3977.9 mm$^3$ and 2813.77 ± 8415 mm$^2$, respectively for the right side, and 8614.54 ± 3676.28 mm$^3$ and 2706.17 ± 729.75 mm$^2$ for the left side in the ED group. The mean sinus volumes and surfaces were 14589.86 ± 6403.03 mm$^3$ and 3649.69 ± 11101 mm$^2$, respectively for the right side, and 14548.36 ± 6770.39 mm$^3$ and 3559.34 ± 1240.37 mm$^2$ for the left side in the control group. The differences of sinus volumes and surfaces between ED and skeletal Class I individuals were statistically significant ($P$ ≤ 0.05).

CONCLUSION: Statistically significant differences were found in the mean maxillary sinus volumes and surfaces between ED and Class I individuals. Due to oligodontia, ED probably has an effect on growth and development of the maxillary sinuses. Further investigations should be undertaken to reveal the correlation between ED and maxillary sinuses.

SP10 UPPER AIRWAY EVALUATION IN CLASS III MALOCCLUSION SUBJECTS TREATED WITH RAPID MAXILLARY EXPANSION AND REVERSE HEADGEAR
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AIMS: To evaluate and compare sagittal airway dimensions before and after rapid maxillary expansion (RME) and reverse headgear treatment in skeletal Class III patients.

SUBJECTS AND METHOD: Thirty seven skeletal Class III orthodontic patients (23 males, 14 females; mean age 11.24 ± 4 years). All subjects were treated with RME and reverse headgear and
measurements of the sagittal airway dimensions taken from the initial and finishing archived lateral cephalometric radiographs. Fourteen airway measurements (ANS-PNS-SPT, PNS-SPT, SPC-SPD, SPT-SPpp, PNS-PWW1, SPTPPW2, SPL/SPS, SPL/IPS, sbti-phwl, PNS-Eb, Eb-Tt, GoGn-Hy, psp-phws ve sbtn-phwn) were made on the cephalometric radiographs taken before (T0) and after (T1) treatment. A paired t-test was used to compare changes at T0 and T1.

RESULTS: There was a mean increase in the PNS-PWW (upper pharyngeal airway), SPT-PWW (lower pharyngeal airway), PNS-Eb (vertical airway length), Eb-Tt (tongue length), psp-phws (upper pharyngeal airway in the psp’s posterior) and sbtn-phwn (lower pharyngeal airway in the sbtn’s posterior) measurements (P < 0.05). There was a statistically significant increase in SN-GoGN angle (P < 0.05). There was no statistically significant difference in other airway measurements.

CONCLUSION: Although the upper airway dimensions were decreased by growth and development in skeletal Class III patients, treatment with RME and reverse headgear revealed a positive effect on the upper airway dimensions.

SP11 DOES PIEZOCISION INDUCE ANY ROOT RESORPTION OR PERIODONTAL PROBLEMS IN CLASS II PATIENTS? A TWO-YEAR FOLLOW-UP STUDY
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AIMS: As piezocision is a new accelerated tooth movement technique, more knowledge about its effects is needed, such as the rate of tooth movement in different cases, root resorption or periodontal health. The objectives of this study were to determine whether any root resorption occurred after piezocision and to assess gingival status and mobility scores over a 2-year period.

SUBJECTS AND METHOD: Patients indicated for maxillary first premolar extraction and bilateral canine distalisation with a Class II malocclusion were selected. Twenty maxillary canines from 10 patients were included. At the beginning of treatment (T1) and at the 2-year follow-up (T2), root resorptions were evaluated according to a modified root resorption classification method; mobility scores and gingival indices for the canines were evaluated and also scored. To detect resorptions, panoramic and periapical radiographs were used instead of computed tomographs, because there was no need to use tomography according to Safety and Efficacy of a New and Emerging Dental X-ray Modality.

RESULTS: In terms of root resorption, there was no difference between the piezocision group and the control group, although on the control side root resorption of the lateral tooth was observed. For mobility scores at T2, there was no significant difference between the two groups. Similarly, the gingival health score decreased in both groups from T1 to T2 and there was no difference between the groups. In one case, a periodontal scar was seen on the piezocision side at T2.

CONCLUSION: Within the limitations of this study, piezocision did not induce any clinically significant root resorption or periodontal problems over a 2-year follow-up period.

SP12 MAXILLARY SINUS VOLUME IN FAMILIAL MEDITERRANEAN FEVER VERSUS CLASS I AND CLASS II
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AIMS: To identify and compare the mean values of maxillary sinus volumes and surfaces in Class II familial mediterranean fever (FMF) patients against Class I and Class II healthy individuals.

MATERIALS AND METHOD: In this retrospective study three-dimensional computed tomographic records of FMF patients (n = 19; mean age 11.98 ± 0.84 years), skeletal Class I (taken for various dental problems) (n = 18; mean age 11.92 ± 1.05 years) and skeletal Class II individuals (n = 16; mean age 11.85 ± 1.59 years) were evaluated. The reason for including Class II individuals as a control was the cephalometric findings of FMF patients after cephalometric analysis. Maxillary sinus volumes and surfaces were measured and analysed by Mimics Software (10.0.1, Materialize, Leuven, Belgium).
Males and females were pooled in each group due to insignificant differences between sinus volumes, surfaces and cephalometric variables. Kruskal-Wallis, Dunn’s multiple comparison, chi-square and Fisher’s exact tests were performed for evaluation of the data using NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA).

RESULTS: The mean sinus volumes and surfaces were 11653.8 ± 2418.54 mm³ and 3100.76 ± 538.49 mm², respectively for the right side, and 11343.99 ± 21922 mm³ and 3078.23 ± 459.13 mm² for the left side in FMF patients. The differences in sinus volumes and surfaces between FMF, skeletal Class I and Class II individuals were statistically insignificant (P ≥ 0.05).

CONCLUSION: No statistically significant differences were found in the mean maxillary sinus volumes and surfaces between FMF, Class I and Class II individuals. FMF probably does not affect growth and development of maxillary sinuses.

SP13 NASAL AND PHARYNGEAL AIRWAY VOLUME, SURFACE AND VERTICAL DISTANCE IN FAMILIAL MEDITERRANEAN FEVER VERSUS CLASS I AND CLASS II
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AIMS: To identify and compare the mean values of nasal and pharyngeal airway volumes, surfaces and vertical distances in Class II familial mediterranean fever (FMF) patients compared with Class I and Class II healthy individuals.

MATERIALS AND METHOD: In this retrospective study the three-dimensional computed tomographic records of FMF patients (n = 19; mean age 11.98 ± 0.84 years), skeletal Class I (taken for various dental problems) (n = 18; mean age 11.92 ± 1.05 years) and skeletal Class II individuals (n = 16; mean age 11.85 ± 1.59 years), were evaluated. The reason for including Class II individuals as a control was the findings for FMF patients after cephalometric analysis. Nasal and pharyngeal airway volumes, surfaces and vertical distances were measured and analysed by Mimics Software (10.0.1, Materialize, Leuven, Belgium). Male and female individuals were pooled in each group due to insignificant differences between nasal and pharyngeal airway volumes, surfaces, vertical distances and cephalometric variables. Kruskal-Wallis, Dunn’s multiple comparison, chi-square and Fisher’s exact tests were performed for evaluation of the data using NCSS (Number Cruncher Statistical System) 2007 Statistical Software (Utah, USA).

RESULTS: The mean nasal airway volumes, surfaces and vertical distances were 10307.14 ± 5364.48 mm³, 6708.75 ± 2874.53 mm² and 9.66 ± 3.59 mm, respectively in FMF individuals. The mean pharyngeal airway volumes, surfaces and vertical distances were 6562.74 ± 3331.66 mm³, 3020.79 ± 941.47 mm² and 34.86 ± 4.39 mm, respectively in FMF patients. Nasal vertical distance and pharyngeal vertical distance increased in the FMF group compared with the Class II group (P ≤ 0.05). All other findings were statistically insignificant (P ≥ 0.05).

CONCLUSION: No statistically significant differences were found in the mean nasal and pharyngeal airway volumes and surfaces between FMF, Class I and Class II individuals. On the other hand statistically significant increases were observed in the nasal vertical distance and pharyngeal vertical distance in FMF group compared with the Class II group. Further investigations should be undertaken to reveal the correlation between vertical findings and the most narrow axial surface and volume.

SP14 THE SUCCESS OF ORTHOGNATHIC SURGERY FROM THE PATIENT’S PERSPECTIVE: A PILOT STUDY
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AIMS: To assess the changes in aesthetics, function and social aspects in orthognathic patients using the orthognathic quality of life questionnaire (OQLQ).
SUBJECTS AND METHOD: Seven skeletal Class III patients who underwent orthognathic surgery. A OQLQ was answered during the pre- and post-operative phases. The OQLQ consists of 22 statements that contribute to four domains: oral function, facial aesthetics, awareness of dentofacial aesthetics and social aspects. It is based on a four point scale, with 1 meaning ‘it bothers you little’ to 4 meaning ‘it bothers you a lot’. There is also an option of ‘not applicable’. The OQLQ is a validated condition specific questionnaire. A higher score indicates a reduced quality of life. Responses at these two time points were compared using Wilcoxon’s analysis with the significance level set to $P < 0.05$.

RESULTS: The total OQLQ scores and those in the instruments’ four domains indicated that quality of life was improved by orthognathic surgery. There were significant improvements in ‘I have problems biting’ and ‘I dislike being seen on video’ answers between the pre- and post-surgical phases. Although most of the answers became more positive, there were no significant differences between pre and post surgical phases in some aspects.

CONCLUSION: Within the limitations of this pilot study, the results revealed improvements in Turkish orthognathic surgery patients’ quality of life, especially in oral function and facial aesthetics domains.

SP15 SHORT- AND LONG-TERM EFFECTIVENESS OF POWERED TOOTHBRUSHES IN PROMOTING GINGIVAL HEALTH DURING ORTHODONTIC TREATMENT: A META-ANALYSIS
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AIMS: Although powered toothbrushes reduce gingivitis more than manual toothbrushing in the general population, the evidence regarding orthodontic patients has been inconclusive. Thus, the aim was to compare their effectiveness in relation to gingival health in patients undergoing fixed orthodontic appliance treatment.

MATERIALS AND METHOD: A search, without restrictions, for published and unpublished literature and hand searching took place. Gingival health data from randomized controlled trials (RCTs) of at least four weeks duration comparing unsupervised powered and manual toothbrushing was reviewed. The data was classified as short- (1-3 months) and long- (>3 months) term and the random effects method was used to combine treatment effects. Individual study risk of bias was assessed using the Cochrane Risk of Bias Tool and the quality of evidence according to the Grades of Recommendation, Assessment, Development and Evaluation approach.

RESULTS: Two thousand and sixty seven references were initially identified and finally included data from eight RCTs involving 374 patients. Seven studies followed patients up to three months and one up to 12 months into treatment. One study was at low and the rest at unclear risk of bias. Overall, in the short-term, there is moderate quality evidence that powered toothbrushes provide a statistically significant benefit compared to manual with regard to gingival indices [standardised mean difference (SMD): $-0.541$; (95% confidence interval (CI): $-1.020 - -0.062$); 6 studies, $n = 314$; $I^2 = 76\%$] and bleeding [SMD: $-0.670$; 95% CI: $-1.277 - -0.063$; 6 studies, $n = 282$; $I^2 = 82\%$]. In the long-term, the only available study ($n = 40$) showed a statistically significant benefit of powered over manual toothbrushes with regards to gingival index and bleeding. No difference was observed in probing pocket depth and relative attachment loss. The greatest body of evidence involved rotation oscillation brushes. A statistically significant reduction in gingival indices and bleeding was demonstrated only in the long-term study.

CONCLUSION: Overall, powered toothbrushes may promote gingival health more than manual toothbrushing in orthodontic patients in the short-term. However, no type demonstrated clear superiority and the clinical importance regarding significant periodontal variables such as attachment loss remains to be clarified. Better study standardization and reporting in longer follow-ups are necessary.

SP16 DENTAL EFFECTS OF THE CARRIÈRE MOTION APPLIANCE EVALUATED WITH CONVENTIONAL AND THREE-DIMENSIONAL TECHNIQUES
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\textbf{AIMS:} To analyze tooth movements after treatment with the Carriere motion appliance (CMA), in both jaws and all three planes, and to assess the agreement between manual and three-dimensional (3D) measurements.

\textbf{SUBJECTS AND METHOD:} Fifty four patients (18 males, 36 females, mean age; 15 years) with a Class II molar relationship or moderate maxillary crowding were retrospectively collected after treatment using CMA. A CMA was bonded to the first molar and the canine (group 1) or the first premolar (group 2) in the upper jaw. In the lower jaw, hooks were bonded on the first molars and a passive Essix covered the lower teeth. Intermaxillary Class II elastics (4.5-6 oz) were used day and night. All patients were treated by one clinician. The upper second molars were erupted in 81 per cent of the patients and 15 per cent were in the mixed dentition. Study models were available from (A) before treatment (n = 54), (B) after removal of the CMA (n = 54), and (C) after initial alignment of teeth (n = 21). All models were scanned, 3D digitized, and superimposed on a predefined area in the palate (Planmeca Romexis Proface). Manual and 3D measurements were repeatedly recorded by one author who had not treated the patients.

\textbf{RESULTS:} Clinically significant molar distalization occurred in all patients. After eight months of treatment, the molar relationship improved by three-quarters of a cusp as a median. Between A and B, CMA rotated the first molars mesiobucally along with statistically significant tipping and intrusion. The mesial abutment teeth showed statistically significant distal tipping and extrusion. When the overjet was more than 7 mm at A it reduced 2 mm at B. The overjet was most reduced in group 1. The overbite changes were minor but with great variability between patients. Excellent cooperation was observed in 94 per cent of the patients. There was good agreement in linear measurements between two-dimensional (2D) and 3D techniques.

\textbf{CONCLUSION:} CMA was effective in distalizing and derotating the upper molars. The abutment teeth tipped distally and moved vertically. Patient cooperation at the early stage of treatment was good. 2D and 3D measurements corresponded well.

\textbf{SP17 PERFORMANCE OF ACRYLIC BASED RETENTION APPLIANCES DEPENDING ON REGIMEN: A SYSTEMATIC REVIEW OF RANDOMIZED CONTROLLED TRIALS}

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\textbf{AIMS:} Acrylic based retention appliances (Hawley, wrap-around, Begg, etc.) have traditionally been popular among orthodontists but the advocated retention regimens present a wide variation. The aim of this study was to investigate their performance in maintaining the orthodontic treatment result when worn full- and part-time.

\textbf{MATERIALS AND METHOD:} A search, without restrictions, for published and unpublished literature took place utilizing Medline via PubMed, the Cochrane Central Register of Controlled Trials, the Cochrane Database of Systematic Reviews, Scopus, Web of Science, Lilacs, IndMed, Scielo, Arab World Research Source, Deutsche Zentralbibliotek für Medizin, Google Scholar, ClinicalTrials.gov, International Standard Randomised Controlled Trial Number registry, OpenGrey and Pro-Quest Dissertation and Theses Global database. In addition, hand searching was performed. Data from randomized controlled trials (RCTs) that compared part- and full-time acrylic based retention appliances wearing protocols in terms of changes in tooth alignment, arch form and occlusion were reviewed. The risk of bias was assessed using the Cochrane Risk of Bias Tool.

\textbf{RESULTS:} Nine hundred and twenty seven references and were initially found and one RCT was finally identified analyzing 52 patients followed for 12 months post-treatment. The patients were instructed to wear upper and lower Hawley retainers either for 1 year at night-only or for 6 months full-time followed by 6 months night-only. The study was considered to be at low risk of bias. At the 12-month evaluation, Little’s Irregularity Index [maxillary dental arch, mean difference (MD): –0.02;
95% confidence interval (CI) –0.57-0.53; Mandibular dental arch MD: –0.26; 95% CI: –0.88-0.36] and crowding [maxillary dental arch, MD: 0.03; 95% CI –0.26-0.33; mandibular dental arch, MD: 0.16; 95% CI: –0.17-0.50] did not differ significantly between the two groups. Data on other parameters reflecting arch form and occlusion, such as, intermolar and intercanine width, arch length, overjet, overbite and Peer Assessment Rating score, as well as patient reported outcomes were not available.

CONCLUSION: It could be clinically acceptable to advise patients to wear their Hawley retainers at night only. However, more studies with long follow-ups are necessary to fully justify this suggestion.

SP18 ASSESSMENT OF UPPER THIRD MOLAR DEVELOPMENT IN RELATION TO CHRONOLOGICAL AGE IN PATIENTS WITH DIFFERENT SAGITTAL SKELETAL PATTERNS
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AIMS: To assess the effects of sagittal skeletal patterns on upper third molar formation controlling for chronological age.

MATERIALS AND METHOD: A cross-sectional study was conducted. High quality pre-treatment cephalometric and panoramic radiographs of 570 patients from the orthodontic department archive were included. Patients were divided into three sagittal skeletal groups according to ANB angle. Development of upper third molar teeth were rated according to the method developed by Demirjian et al. Analysis of covariance (ANCOVA) was conducted to test the effect of skeletal patterns on the development stages of the upper third molars. Dependent variable and covariate were set as third molar stage and chrononological age, respectively.

RESULTS: A total of 964 molar teeth were examined (502, 325 and 137 for ANB groups I, II, and III, respectively). Statistically significant positive correlations were found between chronological age and molar stage in all groups (P = 0.0001). ANCOVA showed that skeletal Class had no significant effect on molar stage when chronological age was disregarded (P = 0.124), chronological age had a significant effect on molar stages (P = 0.0001) and the interception of skeletal Class and chronological age also had a significant effect on molar stages (P = 0.040). Pairwise comparisons of the groups showed that the upper third molar teeth of skeletal Class III patients were advanced compared to Class I and Class II patients (P = 0.011, P = 0.043).

CONCLUSION: Skeletal Class III patients tend to have earlier maturation of upper third molars compared to skeletal Class I and II patients.

SP19 COMPARISON OF CONE BEAM TOMOGRAPHY AND CONVENTIONAL RADIOGRAPHS FOR ASSESSMENT OF ROOT RESORPTIONS INDUCED BY PALATALLY DISPLACED CANINES
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AIMS: To evaluate the accuracy of three radiographic techniques; cone beam computed tomography (CBCT), periapical radiographs (PA) and dental pantograms (DPT) in measuring oblique root resorptions compared to the true resorptions; gold standard.

SUBJECTS AND METHOD: Sixty-seven patients (10-13 years of age) with palatally displaced canines (PDCs) were consecutively recruited and randomly allocated to extraction or non-extraction of the primary canine. The patients were part of a prospective randomized study on interceptive treatment of PDCs. An ethical and radiation protection committee approved the study. A total of 45 primary canines were extracted, and 30 were included in this trial. The extracted teeth were cut in a buccolingual direction along the long axis of the tooth and the most central section was photographed under a light microscope and used as the true tooth length. All patients also had one set of three radiographic examinations: CBCT, PA and DPT taken before the extraction. The photographic and radiographic images were imported into analyzing software (Facad version 3.0, Ilexis AB, Linköping, Sweden). Assessment of root resorption of the most and the least resorbed side of the root was made. The image order was randomized and blinded to the two operators who made the
measurements. The measurements from the radiographic images were compared with the photographic ‘true values’ (gold standard) using unpaired t-tests.

RESULTS: On the side of the root with least resorption there was a statistically significant difference between the values on the DPTs compared to the gold standard, while CBCT values were similar to the gold standard followed by the PA values with no significant difference. Regarding the resorption level of the most resorbed side of the root, there was no significant difference between the conventional radiographs and the gold standard.

CONCLUSION: CBCT is the most accurate radiographic technique in detecting root resorptions followed by PA radiographs. DPTs are not an accurate diagnostic tool for detecting small root resorptions. When radiation dose is considered, the PA radiographic technique is the method of choice.

SP20 DO SELF-LIGATING BRACKETS CAUSE LESS DENTAL PLAQUE ACCUMULATION WHEN COMPARED TO CONVENTIONAL BRACKETS?
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AIMS: To compare changes in the amount and distribution of dental plaque associated with placement of elastomeric modules over a self-ligating bracket during orthodontic treatment and to relate these changes to periodontal inflammation.

SUBJECTS AND METHOD: A cross-arch randomization trial was carried out at Bristol Dental School, UK. Clinical measurements of periodontal inflammation and plaque accumulation were undertaken at the start and three months into treatment on 24 patients aged 11-14 years [mean (SD) age = 12.6 (1.01) years] wearing self-ligating appliances.

RESULTS: In the first 3 months of treatment, there was no statistically significant difference in bleeding on probing between incisors with and without elastomeric modules ($P = 0.125$ and 0.508, respectively). Furthermore, the difference in plaque accumulation and probing depths was not statistically significant ($P = 0.78$ and 0.84, respectively).

CONCLUSION: Based on this preliminary 3 month study, elastomeric modules were not significantly associated with any increased risk during treatment when compared to self-ligating brackets. The long-term results would be of great interest.

SP21 ORTHODONTIC AND SURGICAL PROCEDURES IN CLEFT LIP AND PALATE PATIENTS
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AIMS: To describe general cleft lip and palate (CLP) patient features and how to lead their treatment in order to improve facial and dental aesthetics, self-esteem and social interaction.

MATERIALS AND METHOD: A research was developed over the following primary and secondary electronic data bases: Medline/PubMed, Embase, Cinahl, Lilacs, Cochrane and OvidSP. A search strategy was made using the English terms: ‘cleft palate’ [MeSH] AND ‘cleft lip’ [MeSH] AND ‘treatment’, in Portuguese and English, performed in humans and regarding articles published between the 1st January 1995 and October 2015.

RESULTS: CLP patients’ treatment should consider both cleft type and patient’s age. Lip closure is the first stage, followed by speech therapy and palate closure. However, some of the most important clinical features in these patients are caused by CLP repair surgery, particularly deficiency in midface development, with a tendency to a Class III skeletal relationship, severe maxillary transverse hypoplasia and posterior crossbite. Therefore, in all CLP cases, dentofacial orthopaedic and orthodontic treatment are needed. In some cases, secondary bone grafting is also required to reconstruct the anterior alveolar defect. After complete growth, orthognathic surgery may be necessary, as well as rhinoplasty and scar reduction.

CONCLUSION: All oral health care professionals should be aware of these conditions and know how to perform correct patient referral to the orthodontist at an early age. Correct orthodontic and surgical treatment at the appropriate time provide physiological growth, normal functional
development and better aesthetics, which contribute to the psychological and social well-being of these patients.

**SP22 ASSESSMENT OF SKELETAL CHANGES IN CLASS III MALOCCLUSION PATIENTS**
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**AIMS:** To examine whether maxillary protraction leads to skeletal changes and whether maxillary protraction actually stimulates growth by comparing treatment and control groups during and after facemask therapy.

**SUBJECTS AND METHOD:** Forty one patients (23 females, 18 males) divided into two groups: treatment group (n = 23; 13 females, 10 males, mean age 6.2 years) using a facemask (model Delaire, type of anchorage fronto-mentum and force origin on canines) or a modified quadhelix during 12 months and a control group (n = 18; 10 females, 8 males, mean 8.6 years), without any treatment. The results were analyzed using a statistical platform (SPSS v.20, SPSS Inc., Chicago, Illinois, USA). The mean treatment and control data were compared with a Student’s t-test to determine statistically significant differences. All analyses were performed at the 0.05 level of statistical significance. Males and females were combined either in the treatment or control groups because statistical significance was not shown between them.

**RESULTS:** Based on the cephalometric alterations observed after 12 months of maxillary expansion and protraction during the early mixed dentition, dentoskeletal changes and improvements in dentofacial complex were recorded, mainly by a combination of forward displacement and rotation of the maxilla. These modifications demonstrated that this treatment at an early age is clinically indicated.

**CONCLUSION:** Significant orthopaedic changes can occur with maxillary expansion and facemask therapy. Early correction can improve the facial aesthetics and psychosocial development of a child. These results can help parents and patients realize the importance of early Class III malocclusion treatment.

**SP23 MANDIBULAR INTERCANINE WIDTH CHANGES DURING FIXED APPLIANCE MULTIBRACKET TREATMENT: EXTRACTION VERSUS NON-EXTRACTION CASES**
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**AIMS:** To investigate changes in mandibular intercanine width that take place during orthodontic multibracket treatment in lower premolar extraction and non-extraction cases.

**SUBJECTS AND METHOD:** Fifty patients, 30 treated without extractions (group 1) and 20 with extractions (group 2). Mandibular intercanine width was measured on models before (T1) and after (T2) treatment. A Student’s t-test was used to check if the difference between two periods was statistically significant for related samples. The Student’s t-test for independent samples was used to investigate if the difference between the groups was statistically significant at T2.

**RESULTS:** Intercanine width increased significantly during treatment ($P < 0.001$) in both groups (1.07 mm in group 1, and 2.73 mm in group 2). At T2 the increase in intercanine width was 1.66 mm higher in group 2 compared with group 1, which was statistically significant ($P < 0.001$).

**CONCLUSION:** During orthodontic treatment using fixed appliances mandibular intercanine width increases. This expansion is greater in patients treated with premolar extractions, due partially to canine distal movement during space closure, which means that the lower canines move to an area of higher transverse extent inside the dental arch.

**SP24 RELATIONSHIP BETWEEN MEAN GINGIVAL THICKNESS IN THE MANDIBULAR ANTERIOR REGION AND THE POSITIONS OF MANDIBULAR INCISORS**
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AIMS: To evaluate the relationship between the mean gingival thickness in the mandibular anterior region and the positions of the mandibular incisors.

SUBJECTS AND METHOD: A total of 187 periodontally healthy subjects who applied for orthodontic treatment were enrolled in this study. The participants were grouped as retrusive, norm and protrusive according to the position of the mandibular incisors. Gingival thickness was determined as the arithmetic mean of gingival thickness measured by the probing technique from the coronal mucogingival junction and from the apical of the free gingival sulcus. A Student’s t- and Chi-square tests were used to determine whether there was a significant difference between the groups in terms of mandibular anterior gingival thickness.

RESULTS: The mean gingival thickness was 0.726 ± 0.197 mm, 0.718 ± 0.158 mm and 0.691 ± 0.112 mm in the retrusive, norm and protrusive groups, respectively. All three groups had a thin gingival biotype with no statistically significant relationship determined between the mean gingival thickness of the mandibular anterior region and the positions of the mandibular incisors.

CONCLUSION: The findings of the present study revealed no relationship between the mean gingival thickness of the mandibular anterior region and the positions of the mandibular incisors.

SP25 RELATIONSHIP OF MAXILLARY AND MANDIBULAR ANTERIOR GINGIVAL THICKNESS WITH GENDER AND AGE
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AIMS: To evaluate the relationship of gingival thickness, which has been considered as an important factor in the development of gingival recession secondary to orthodontic tooth movement, with gender and age.

SUBJECTS AND METHOD: A total of 182 periodontally healthy individuals (117 females, 65 males), who presented for orthodontic treatment were enrolled in this study. There were two age groups; 131 individuals under the age of 18 years were assigned to group 1 and 51 individuals over the age of 18 years were assigned to group 2. Maxillary and mandibular anterior gingival thicknesses (MAXAGT and MANAGT) were determined by the arithmetic mean of gingival thicknesses measured by the transgingival probing technique from the coronal mucogingival junction and apical of the free gingival sulcus. The arithmetic mean of gingival thickness was determined by the ratio of the sum of gingival thickness of the relevant teeth to the number of teeth. A Student’s t- and Chi-square tests were used to determine whether there was a significant difference between males and females and between groups 1 and 2 in terms of MAXAGT and MANAGT.

RESULTS: The mean MANAGT was 0.703 ± 0.153 mm in females and 0.759 ± 0.197 mm in males and MAXAGT was 1.104 ± 0.239 mm and 1.165 ± 0.220 mm in females and males, respectively. The prevalence of a thin biotype was 65.5 and 34.5 per cent for the mandibular anterior region and 74.4 and 25.6 per cent for the maxillary anterior region in females and males, respectively. While there was no statistically significant difference between females and males in terms of prevalence of a thin biotype in the maxillary anterior region, gingival thickness in the mandibular anterior region was lower in females than in males (P = 0.036). MANAGT was 0.715 ± 0.171 in group 1 and 0.742 ± 0.175 in group 2; whereas, MAXAGT was 1.158 ± 0.233 in group 1 and 1.041 ± 0.217 in group 2. No significant difference was determined between groups 1 and 2 in terms of mandibular anterior gingival thickness, however, maxillary anterior gingival thickness was statistically lower in group 2 (P = 0.002).

CONCLUSION: Gingival thickness of the mandibular anterior region is lower in females than in males and gingival thickness of the maxillary anterior region is lower in group 2.

SP26 CONE BEAM COMPUTED TOMOGRAPHIC ANALYSIS OF BONE CHARACTERISTICS OF SUBJECTS WITH UNILATERAL TEMPOROMANDIBULAR DISORDERS BEFORE ORTHODONTIC TREATMENT
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AIMS: To evaluate the presence of degenerative bone changes of the temporomandibular joint (TMJ) in subjects with an orthodontic treatment need, suffering from unilateral temporomandibular disorders (TMD), before orthodontic treatment.

SUBJECTS AND METHOD: Twenty-five patients (17 women, 8 men, 50 TMJs; mean age 30.33 years; SD = 8.58, range 18-47 years) with unilateral TMDs were examined using cone beam computed tomography (CBCT; Planmeca ProMax 3D Mid). Images were evaluated using Planmeca Romexis Viewer, 3.8.2.R. The presence of osteoarthritic changes (condylar erosion, osteophytes, sclerosis, flat condyle) in each TMJ was evaluated according to the image analysis criteria and examiner reliability classification of TMD defined by the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD). The study group comprised the affected TMJs; the control group included the opposite TMJs of the same subject. The narrowest anterior and posterior joint space on the sagittal views and the narrowest superior space on the coronal views were measured. McNemar test compared paired proportions between the two study groups. The odds ratio (OR) for matched pairs was used to calculate the likelihood of bone changes with TMD.

RESULTS: A 5.5 times higher odds of having a flat condyle was found in those with TMD compared with those without TMD [OR = 5.5 (95% CI 1.2-51.07), P = 0.022]. A greater likelihood of osteophytes and sclerosis occurrence was observed in joints with TMDs (P = <0.001). Joints with TMD were 1.5 times more likely to have erosion [OR = 1.5 (95% CI 0.17-17.96)]. The narrowest superior space in the coronal view was reduced in subjects with TMD. On the sagittal views, the narrowest anterior and posterior joint spaces in TMD were decreased. The mean narrowest posterior space in TMD was 2.02 mm (SD = 0.48, range 1.65-3.4), compared to 2.15 mm (SD = 0.60, range 1.4-3.6) in the control group. The mean narrowest anterior space in TMD was 1.95 mm (SD = 0.30, range 1.65-2.70), and in the control group 2.02 mm (SD = 0.37, range 1.5-2.8).

CONCLUSION: This study emphasizes the importance of accurate assessment of bone changes in TMD before orthodontic treatment. No joint space alterations were observed in joints with TMD. Morphological bone changes were more likely to be found in subjects with TMD.

SP27  DENTAL AGE COMPARISON IN PATIENTS BORN WITH UNILATERAL CLEFT LIP AND PALATE TO A CONTROL SAMPLE USING DEMIRJIAN AND WILLEMS METHODS
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AIMS: To calculate the difference between dental age (DA) and chronological age (CA) using Demirjian and Willems methods in 10-year-old Caucasian boys and girls born with a non-syndromic unilateral cleft lip and palate (NSUCLP) and a matched control sample, and to analyze if a difference exist between method, group or gender levels.

MATERIALS AND METHOD: Two hundred and fifteen dental pantomograms (DPTs) of 108 NSUCLP and 107 control children, 9 to 11 years old, were retrospectively collected and blinded regarding age, group, and gender. All DPTs were cut to show the lower left mandibular teeth (except third molars) only. Visual examination was undertaken by two authors using the techniques of Demirjian and Willems. The difference between DA and CA was analyzed by a repeated two-way ANOVA.

RESULTS: Inter-examiner reliability was strong (ICC = 0.75). The control group had a larger DA/CA difference for both methods compared to the NSUCLP group (P < 0.007). Demirjian mean DA/CA difference was 0.8 and 1.09 years for the NSUCLP and control groups, respectively. Willems mean DA/CA difference was 0.2 and 0.47 years for the NSUCLP and control groups, respectively. Gender differences were statistically significant in Willems method only (P < 0.005).

CONCLUSION: Willems' method showed closer CA estimation compared to Demirjian’s method. NSUCLP children were significantly delayed in their DA with both methods compared to the control group, but their DA was closely related to their CA. Gender DA estimation was inconsistent between the methods.
AIMS: To investigate the variation and reasons for selecting bracket slot sizes and prescriptions by specialist orthodontists in the United Kingdom (UK).

MATERIALS AND METHOD: Following approval by the audit committee of the British Orthodontic Society, an anonymous online survey was emailed in April 2015 to all 978 members of the Consultant Orthodontists Group and Orthodontic Specialists Group. An explanation of the nature of the survey and an invitation to participate were provided. The survey included seven questions related to geographical location, level of experience, specialist registration, preferred bracket prescription and slot size, reason for using this bracket slot size, and the ratio of conventional versus self-ligating cases. To maximise the response rate, two email reminders were sent. Descriptive statistics and percentages were calculated for the whole survey divisions with Chi square analyses to determine statistically significant differences in the preferences for bracket slot size and prescription according to geographical location and experience in orthodontics ($P < 0.05$).

RESULTS: The response rate was 31.19 per cent of UK specialist orthodontists. The majority of respondents used either conventional brackets exclusively or 90 per cent conventional brackets and 10 per cent self-ligating brackets. The MBT prescription (81.6%) and 0.022 inch slot brackets (98.7%) were more frequently used than other systems. A perception of improved outcomes in addition to being trained using the 0.022 inch slot were the most common reasons reported by the respondents for using this bracket slot size. The findings were similar in all six geographical regions of the UK and for all levels of experience ($P < 0.05$).

CONCLUSION: This survey indicated that the vast majority of UK specialist orthodontists use conventional MBT prescription brackets with the 0.022 inch slot size. Many respondents indicated this preference was due to being trained using this combination and there is a perception that this provides improved treatment outcomes.

AIMS: To evaluate force levels exerted by levelling archwires with labial and lingual both conventional and self-ligating bracket systems.

MATERIALS AND METHOD: The tested orthodontic bracket systems were 0.022 inch slot size and were as follows: (1) labial brackets: A) active (GAC In-Ovation®C, and Speed™) and passive (Damon-Q®; Orthoclassic; FLI®SL) self-ligating brackets; B) conventional brackets (GAC Twin and Victory), C) low friction bracket system (Synergy), and (2) lingual brackets: A) self-ligating brackets (passive [Evolution SLT] and active [GAC In-Ovation®LM™]) and II) conventional brackets (Incognito and Joy™). The tested levelling archwire types were: (1) stainless steel coaxial (Triple Flex™ 0.0175”), (2) NiTi coaxial wire (Supercable 0.018”), (3) four thermalloy NiTi (0.013”, 0.014”, 0.015”, 0.016”) and (4) two conventional NiTi wires (Orthonol 0.014”, 0.016”). The materials were used in different combinations in a simulated malocclusion that represented a maxillary central incisor displaced 2 mm gingivally (x-axis)/intrusion and 2 mm labially (z-axis)/protrusion.

RESULTS: In general, the lingual bracket systems showed the highest force levels compared to the labial bracket systems. The Speed system showed the highest forces among the labial brackets in intrusion while GAC Twin showed the highest forces in protrusion. GAC In-Ovation showed the lowest forces among the labial bracket systems. The Incognito system showed the lowest forces in protrusion and intrusion while GAC In-Ovation®LM showed the highest forces among lingual systems. Supercable wire showed the lowest forces among all tested wires with labial or lingual systems.
CONCLUSION: Lingual bracket systems showed higher forces compared to labial bracket systems, especially active self-ligating system.

SP30  THE INFLUENCE OF DIFFERENT LIGATION METHODS ON FRICTION BETWEEN BRACKETS AND ARCHWIRES
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AIMS: To compare the percentage of force loss generated during canine sliding movement in three types of ligatures (active steel, passive steel and elastomeric ligatures) as compared to two types of self-ligating brackets (active and passive).

MATERIALS AND METHOD: Three types of brackets were included; conventional metal brackets (discovery\textsuperscript{R}, Dentaurum); active self-ligating brackets (In-Ovation\textsuperscript{R}, Dentsply GAC) and passive self-ligating brackets (Damon\textsuperscript{Q}, Ormco). All bracket groups (n = 5) had 0.022 × 0.025 inch slot with Roth prescription of maxillary canines. The conventional bracket was studied with three ligation methods: elastic (Alastik Easy-To-Tie, 3M Unitek); active steel (remanium\textsuperscript{R}, Dentaurum) and passive steel by loosening the ligature about 90 to 180 degrees. Two dimensions of stainless steel archwires 0.016 × 0.022 and 0.017 × 0.025 inch (Tru-Chrome\textsuperscript{R}, RMO) were ligated into the brackets. The brackets were mounted on the Orthodontic Measurement and Simulation System (OMSS) simulating canine retraction process into the first premolar extraction space. The retraction force was applied through a nickel titanium coil spring (GAC, Sentalloy) with a constant force of approximately 1 N. The OMSS measured the percentage of force loss over the retraction path by the difference between the applied retraction force and the actual force acting on each bracket. Comparison between groups was performed using one-way analysis of variance (ANOVA).

RESULTS: Force loss percentage was lowest in Damon Q (1622: 22%, 1725: 34%) followed by discovery with passive steel ligation (1622: 23%, 1725: 34%), respectively. There was no significant difference between them (P = 0.68). The highest friction was in discovery with active self-ligation (1622: 46%, 1725: 75%) followed by elastic ligation (1622: 37%, 1725: 69%), respectively without significant difference (P = 0.71). However, there were significant differences between the two dimensions of stainless steel archwire (P = 0.02).

CONCLUSION: It is recommended, when using conventional metal brackets with steel ligatures, to make a subsequent loosening of the ligature of approximately 90 to 180 degrees. This gives the user similarly low force losses as achieved with a self-ligating bracket.

SP31  PAIN RELIEF AFTER ORTHODONTIC ARCHWIRE INSTALLATION – A COMPARISON BETWEEN INTAKE OF PARACETAMOL AND USE OF CHEWING GUM
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AIMS: To compare the effectiveness of paracetamol with the use of chewing gum for pain alleviation, and to investigate the frequency of bracket loss during the initial stage of orthodontic treatment.

SUBJECTS AND METHOD: Thirty-nine patients (20 boys, 19 girls), between 12-18 years of age were randomly allocated either to a group prescribed to take paracetamol (25 patients) or to a group prescribed to use chewing gum (14 patients). After bracket bonding and insertion of the initial archwire, the patients rated the sensation of pain on a visual analogue scale (VAS) with the jaws at rest and when biting after 6 hours (T1), at bedtime (T2) and the next morning (T3). Paracetamol (1,000 mg) was taken one hour and chewing gum was used 10 minutes prior to pain recordings at T2 and T3.

RESULTS: At T1 the difference in VAS scores between the groups was not significant, while the increase of the score T1- T2 and T1-T3 was higher in the chewing gum group, significantly so for T1- T2 (P < 0.05). However, a multiple regression model, adjusting for age, gender and time point of pain...
assessment, failed to show any effect related to the mode of pain control. No bracket loss was observed in the chewing gum group while one patient in the paracetamol group lost one bracket.

CONCLUSION: The effect of chewing gum and paracetamol in reducing pain after initial archwire placement appears to be equivalent. Short term use of chewing gum is not a risk factor for bracket loss.

SP32 DENTAL FEATURES IN THE PARENTS OF CHILDREN WITH NON-SYNDROMIC OROFACIAL CLEFTS
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AIMS: To determine tooth size and arch width dimensions in unaffected parents of children with non-syndromic orofacial clefts (OFC) as a cleft-related subclinical phenotype.

MATERIALS AND METHOD: Digital study models (upper and lower) of a total of 155 participants of Celtic origin (81 parents, 74 controls) were obtained by scanning plaster study models using an R700™ scanner (3Shape, Aarhus, Denmark). MeshLab software (http://meshlab.sourceforge.net/) was used to measure the mesiodistal dimensions of all teeth (except second and third molars) along with the intercanine and intermolar distances. The reliability of the scanner and the MeshLab software were tested by comparing measurements made directly on 25 plaster study models with those obtained from the same digital study models using a paired t-test (P < 0.05) and an intraclass correlation coefficient (ICC). ANOVA was used to compare the data for the parents and controls, with independent t-tests used to compare fathers with male controls, mothers with female controls, and the parents of children with a cleft lip/palate [CL(P)] with the parents of children with an isolated CP (P < 0.05).

RESULTS: No systematic difference (P > 0.05) was found between digital and plaster study models and the ICC showed an agreement of 79.5 per cent. Statistically significant differences in tooth dimensions were found between the parents and controls and between fathers and male controls (P < 0.05). In contrast, no differences were found between mothers and female controls, and similarly between the parents of children with CL(P) and the parents of children with isolated CP (P < 0.05). The mandibular intercanine distance was significantly smaller in parents when compared to controls (P = 0.002), in fathers compared to male controls (P = 0.038), and in mothers compared to female controls (P = 0.021), but the mean intercanine distance was almost identical when the parents of CL(P) and isolated CP were compared (P = 0.938). The intermolar distance showed no significant differences between any of the groups.

CONCLUSION: Parental dental and arch width features represent a cleft-related phenotype.

SP33 SHORT-TERM CRANIOFACIAL GROWTH CHANGES IN TURKISH SUBJECTS WITH DIFFERENT SAGITTAL MALOCCLUSIONS: PART II
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AIMS: To compare the short-term growth changes of Class I, Class II and Class III, untreated Turkish subjects.

MATERIALS AND METHOD: The archived cephalometric radiographs of 94 untreated subjects (51 females, 11.6 ± 1.3 years; 43 males, 12.0 ± 1.4 years) obtained at different time-points. The mean time span between the radiographs was 2.2 years. The sample was divided into three groups in response to the sagittal skeletal relationship of the jaws which was determined according to the initial Wits appraisal (22 Class I subjects, 45 Class II subjects, 27 Class III subjects). Because there was a difference in the time of the growth-spurt between female and male subjects, the groups were evaluated separately. Several angular and linear parameters representing the anteroposterior dimensions and positions of the jaws, vertical growth pattern and the positions and inclinations of the teeth were measured to reveal the growth changes. The data were analyzed and compared among the groups with analysis of variance.
RESULTS: The statistically significant growth changes observed in the Class I, II and III subjects have been reported in Part I of the study. When the amount of growth changes were compared among the groups, some significant differences were observed. The difference in the measurement of A-Na perpendicular was significant between Class I and II female subjects ($P = 0.02$). U1-APo distance also showed a significant difference between Class I and Class II females ($P = 0.02$). On the other hand, there was no significant difference in the amount of growth changes in any parameter among Class I, II and III male subjects ($P > 0.05$).

CONCLUSION: Growth and development processes represent high individual variability in terms of timing and the amount of change, due to difference in the biological clock and the craniofacial phenotype. Although it was expected to find different amounts of growth changes in various skeletal malocclusion groups, the findings revealed almost no difference in any change, which may depend on the limited sample size.

SP34 COMPARATIVE ANALYSIS OF IMPACTED UPPER CANINES: PANORAMIC RADIOGRAPHY VERSUS CONE BEAM COMPUTED TOMOGRAPHY
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AIMS: To compare the way in which opinion differs regarding upper canine impaction when observing a panoramic image compared to a set of cone beam computed tomographic (CBCT) reconstructions.

SUBJECTS AND METHOD: Twenty patients (10 males, 10 females) with a total of 28 impacted maxillary canines were identified from the dentistry database. For each canine, two different images were available: a panoramic image and a set of CBCT reconstructions. After random distribution of both groups images, nine orthodontists completed a questionnaire where they were asked to evaluate 10 different questions. Statistical analysis was performed using Cronbach’s alpha statistics, Kappa statistics and McNemar test, considering $P < 0.05$ to be statistically significant.

RESULTS: The findings showed differences between the two images regarding tooth position. A statistically significant poor agreement was found between the two methods for the mesio-distal position of the apex and for the labio-palatal tip cusp. The adjacent root resorption showed poor and very poor agreement between the two methods. All other items were scored with an agreement between modalities ranging from moderate to strong.

CONCLUSION: The analyses of panoramic images versus CBCT reconstructions provide different information concerning tooth position (especially concerning the positions of the mesio-distal apex and the labio-palatal cusp) but also in the assessment of root resorption. Further investigation should be undertaken to determine in what cases a CBCT examination has a clear advantage over conventional two-dimensional, thus justifying its use.

SP35 DELAYED TOOTH ERUPTION WITH AN ABNORMAL PATTERN: AN INTERCEPTIVE ORTHODONTIC CLINICAL CASE STUDY
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AIMS: To analyse several factors that could influence permanent tooth eruption in an interceptive orthodontic clinical case of delayed tooth eruption with an abnormal pattern.

MATERIALS AND METHOD: A literature survey was performed using primary and secondary databases, Medline and Cochrane. Keywords used in the search included ‘delayed tooth eruption’, ‘permanent teeth emergence’ and ‘tooth eruption’. Articles in English and Portuguese published between January 1st 2000 and October 31st 2015 were selected.

RESULTS: Eruption is defined as the axial movement of a tooth from its non-functional position in the bone to the occlusal plane in the oral cavity. Formation of the tooth eruption pathway is a localized and genetically programmed event. This complex process occurs over a broad chronological age range and can be influenced by local and systemic conditions and genetic disorders. A case report of a 7-year-old boy with an abnormal pattern of eruption is presented. The medical and
dental history of the child was not meaningful, and there was no history of delayed tooth eruption in his family. Panoramic radiographs were used for evaluating the position of the teeth and the extent of tooth development. The treatment performed included space creation and guided eruption with orthodontic fixed appliances. Eruption of permanent teeth occurred slowly after space maintenance. CONCLUSION: The variation of the tooth path can affect diagnosis, treatment planning and the timing of treatment for orthodontic patients. Clinicians should check the appropriate clinical history, conducting a clinical and radiographic examination as well as a genetic evaluation at an early age. It is important to recognize the need for interceptive orthodontic treatment to prevent the progression of a malocclusion and to minimize more complex treatment.

SP36  COMPENSATING SEVERE CROWDING IN THE DENTAL ARCH IN THE EARLY MIXED DENTITION
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AIMS: The serial extraction of primary teeth (Hotz’s guidance of eruption) has been carried out for decades for space management in tooth-size/jaw-size discrepancy cases, as the procedure concluded with permanent premolars extraction. It is hard to predict the effect of the serial extractions on patients’ soft tissue profiles. Early extraction of primary canines, as part of serial extraction, disregards heredity and growth pattern, as well as the possible soft tissue response to treatment. The aim of this study was to evaluate cases, in which patients at the age of 7 years presented with indications for serial extraction. After comprehensive orthodontic diagnosis and family history assessment, serial extraction was dismissed and instead primary tooth exfoliation and permanent tooth eruption was monitored.

SUBJECTS AND METHOD: Twenty seven patients with 5 to 6 mm of space deficiency in the dental arch. Long-term observation of patients with tooth-size/jaw-size discrepancies with presented indications for serial extraction of teeth was determined. During the early mixed dentition stage orthodontic treatment was either not initiated, or the patients were treated with removable appliances to stimulate the development of the apical base of the basal bone. After first permanent premolar eruption, segmented or comprehensive fixed technique treatment was initiated.

RESULTS: Patient observation and active treatment continued for a 7-year period. For all 27 patients growth and contemporary orthodontic techniques provided sufficient space to avoid permanent tooth extractions.

CONCLUSION: The serial extraction procedure should be revised and orthodontic treatment objectives should be inclined towards maintaining the integrity of the dentition during the mixed dentition stage, when active physiological growth takes place.

SP37  ORTHODONTIC TREATMENT EFFECTS ON THE INTERCANINE DISTANCE DURING DENTITION FORMATION
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AIMS: When to initiate orthodontic treatment – early, during the mixed dentition, or after the eruption of the permanent teeth, is a question for every orthodontist. The aim of the current study was to evaluate the intercanine distance of patients in the early mixed dentition with a space deficiency of over 5 mm in the maxilla and over 4 mm in the mandible until the completion of the permanent dentition, during standard orthodontic treatment phases and after a final fixed technique phase.

SUBJECTS AND METHOD: Fourteen patients were followed-up from the early mixed to the permanent dentition stage. The intercanine distance was measured on plaster models at the beginning of orthodontic treatment, after completion of the first treatment phase and after treatment was concluded. Measurement points were constant: the lowest midpoint on the gingival margin of the canines, orally.
RESULTS: Statistical analysis of the evaluated parameters showed no significant increase in the maxillary intercanine distance from the mixed to the permanent dentition formation. In the mandible, however, the intercanine distance showed a notable increase.

CONCLUSION: Intercanine distance in the maxilla is markedly affected by the eruption of the maxillary incisors and the clinical options for orthodontic treatment are limited.

SP38 CERVICAL VERTEBRAL COLUMN AND POSTERIOR CRANIAL FOSSA DIMENSIONS IN OBSTRUCTIVE SLEEP APNOEA PATIENTS COMPARED TO CONTROLS
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AIMS: To compare: 1) dimensions of the first and second vertebrae and foramen magnum in obstructive sleep apnoea (OSA) patients with healthy controls; 2) first and second vertebrae dimensions with the posterior cranial fossa including the cranial base angle and foramen magnum in OSA patients.

SUBJECTS AND METHOD: Forty four OSA patients, 17 females aged 29-76 years (mean age 59.1 years) and 27 males aged 38-74 years (mean age 52.7 years). The apnoea-hypopnoea index (AHI) ranged between 7 and 57 (mean 20.7). The age and gender matched controls comprised 44 healthy subjects. Dimensions of the first and second vertebrae and foramen magnum were measured on cone beam computed tomograms for OSA and computed tomograms for controls. Posterior cranial fossa dimensions, including the cranial base angle in OSA patients, were measured on lateral cephalograms. Differences between and within the groups were analysed by multiple regression analysis.

RESULTS: The midsagittal length of the first cervical vertebra (AP; \( P < 0.05 \)) and the midsagittal dimension of foramen magnum (BA-OP; \( P < 0.001 \)) was significantly larger in OSA patients compared to the controls. Significant associations between the first and second vertebrae and the posterior cranial fossa, including the cranial base angle and foramen magnum, were found in the OSA patients; sagittal, vertical and transverse dimensions of the first cervical vertebra were significantly associated with foramen magnum dimensions and the cranial base angle (\( P < 0.05 \)). The vertical dimension of the second cervical vertebra was significantly associated with foramen magnum, the cranial base angle and the distance between sella turcica and the deepest point in the posterior cranial fossa (\( P < 0.05 \)).

CONCLUSION: The first cervical vertebra and foramen magnum was significantly larger in OSA patients compared to controls. In OSA patients cervical vertebrae dimensions were significantly associated with posterior cranial fossa dimensions. The findings are considered important in the aetiology and diagnosis of OSA patients.

SP39 AIRWAY DIMENSIONS AND HEAD POSTURE IN PATIENTS WITH OPEN BITE AND DEEP BITE
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AIMS: To analyze differences in head posture and in the antero-posterior dimension of the upper airway within and between groups of patients with a skeletal/dentoalveolar open bite and skeletal/dentoalveolar deep bite.

SUBJECTS AND METHOD: One hundred and ninety patients with an anterior open bite and deep bite were divided into four groups: 33 patients with a skeletal open bite (19 boys, 14 girls, mean age 11.2 years), 54 patients with a dentoalveolar open bite (16 boys, 38 girls, mean age 9.1 years), 46 patients with a skeletal deep bite (13 boys, 33 girls, mean age 11.7 years) and 57 patients with a dentoalveolar deep bite (29 boys, 28 girls, mean age 12.2 years). Head posture and upper airway dimensions were analyzed on lateral cephalograms. Differences between the groups, adjusted for age and gender, were tested by logistic regression analysis.

RESULTS: The cranio-cervical angles (NSL/CVT, \( P < 0.05 \); NL/OPT, \( P < 0.01 \); NL/CVT, \( P < 0.01 \)) and cranio-vertical angle (NL/VER, \( P < 0.01 \)) were significantly larger in the skeletal open bite group compared to the skeletal deep bite group. The upper part of the airway (Tu-ad1, \( P < 0.01 \); pm-ad2, \( P < 0.01 \)) was significantly smaller in the skeletal open bite group compared to the skeletal deep bite group.
< 0.01; pm-ad3, P < 0.01) were significantly wider in the skeletal deep bite group compared to the skeletal open bite group. The cranio-cervical angles (NL/OPT, P < 0.05; NL/CVT, P < 0.01) and the cranio-vertical angle (NL/VER, P < 0.01) were significantly larger, and the upper part of the airway (Tu-ad1, P < 0.01) was significantly smaller in the skeletal open bite group compared to the dentoalveolar open bite group. The lower part of the airway (uv-puv; P < 0.05 va-pva; P < 0.05) was significantly larger in the skeletal deep bite group compared to the dentoalveolar deep bite group.

CONCLUSION: The results confirm earlier published studies showing that patients with a skeletal open bite have a more extended head posture. Furthermore, the results indicate that patients with a skeletal open bite generally have smaller upper airway dimensions while skeletal deep bite patients are more likely have a larger lower part of the upper airway.

SP40 PREVALENCE OF POSTERIOR CROSSBITE AMONG ORTHODONTIC PATIENTS
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AIMS: A posterior crossbite is a common occlusal anomaly. Early diagnosis and treatment of a posterior crossbite is recommended because it allows for eruption of the permanent teeth into correct occlusion and also symmetrical growth. This study aimed to determine the prevalence of a lateral crossbite in an orthodontic population.

SUBJECTS AND METHOD: Three hundred and eighty four patients (220 girls, 164 boys), aged between 6 and 23 years (mean age 10.11 years) requesting orthodontic treatment over a 2-year period. The following data was collected from the orthodontic files: age, gender, social environment, type of dentition and the diagnosis of orthodontic anomalies (Angle classification: Class I, II, III anomalies). The occlusion of each patient was evaluated in three planes of the space. The chi square test was applied to obtain statistically significant results.

RESULTS: Eleven per cent of the patients had a posterior crossbite; a unilateral posterior crossbite being more frequent (8.3% ) than a bilateral crossbite (2.6% ). Statistically significant correlations (P < 0.05) were found between a posterior crossbite and orthodontic anomalies. The most frequent was a unilateral crossbite in 3.6 per cent of patients with an Angle Class I and 2.6 per cent in patients with an Angle Class II division 1. The chi-squared test showed no statistically significant results between a posterior crossbite and age, gender, social environment or type of dentition (P > 0.05).

CONCLUSION: A posterior crossbite was a frequently occurring anomaly in Romanian orthodontic patients, with a unilateral posterior crossbite being more common. There does not appear to be statistical differences related to age, gender, social environment or type of dentition in the occurrence of a crossbite in this population.

SP41 PREDICTIVE FACTORS FOR TEMPOROMANDIBULAR DISORDERS FOLLOWING COMBINED ORTHODONTIC SURGICAL TREATMENT IN PATIENTS WITH CLASS III MALOCCLUSIONS
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AIMS: To identify predictive factors predisposing to the development or worsening of temporomandibular disorders (TMDs) following combined orthodontic and orthognathic surgical treatment in patients with a Class III malocclusion.

SUBJECTS AND METHOD: A retrospective cohort study was performed on 88 patients with a Class III malocclusion who had undergone combined orthodontic and orthognathic surgical treatment, with a LeFort I osteotomy and/or a bilateral sagittal split ramus osteotomy. Temporomandibular joint (TMJ) and masticatory muscle anamnestic and clinical examinations were available prior to treatment and one year post-operatively. TMDs were classified according to research diagnostic criteria dividing disorders into myofascial pain disorder, disc displacement, and arthralgia. TMD severity was estimated using Helkimo’s anamnestic and clinical dysfunction indices. Multivariate logistic regression was used to predict the development of post-operative TMDs, and linear regression to predict the worsening of TMDs using Helkimo’s indices.
RESULTS: In this Class III malocclusion population, TMDs were present pre-treatment in 56 per cent of patients, with disc displacement being more common than MPD (43% versus 24%). The majority of patients (64%) did not change TMD status following treatment, and the average Helkimo scores did not undergo significant change. Concerning predictive factors, pre-treatment anamnestic TMJ clicking (OR = 5.8; P = 0.03) and bimaxillary osteotomy procedures (OR = 18.6; P = 0.04) predisposed to the development of TMDs. Pre-treatment anamnestic TMJ clicking was found to be the only significant independent predictor of post-operative worsening of the Helkimo clinical dysfunction score (mean difference = 0.35; P = 0.01).

CONCLUSION: TMD must be evaluated, monitored, and managed with caution in patients with a Class III malocclusion presenting with pre-treatment joint clicking and who are planned for bimaxillary osteotomies.

SP43 THREE-DIMENSIONAL FACIAL SOFT TISSUE CHANGES AFTER ORTHOGNATHIC SURGERY
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AIMS: A three-dimensional (3D) programme to analyze soft tissue characteristics has been available for orthodontic purposes during recent years. The aim of this study was to determine typical changes in soft tissue morphology after combined orthodontic-surgical treatment.

SUBJECTS AND METHOD: Ten patients (4 males, 6 females, mean age 40 years, range 29-62 years). Six patients underwent orthodontic-surgical treatment with a bilateral sagittal split osteotomy (BSSO), and four patients underwent a LeFort I osteotomy. The faces of the subjects were recorded by a portable 3D surface-imaging system based on stereogrammetry technology (3dMD, Atlanta, USA) before and after surgery. The follow-up after surgery ranged from 3 to 14 months. Pre- and post-operative facial shells were superimposed and changes in the soft tissues were evaluated by examining the facial landmarks.

RESULTS: In BSSO patients, the changes in soft tissues were restricted to the lower third of the face, especially as advancement of the chin point and lower lip. Typical changes after LeFort I were advancement of the middle face area, and expansion of the paranasal area. The changes in soft tissues were more heterogeneous after LeFort I, and changes were seen also in lower third of the face.

CONCLUSION: Soft tissue changes seem closely to follow the skeletal changes due to orthognathic surgery. 3D facial scanning is a valuable method to assess soft tissue changes.

SP43 A COMPARISON OF TREATMENT OUTCOME BETWEEN LINGUAL AND LABIAL FIXED ORTHODONTIC APPLIANCES
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AIMS: To retrospectively evaluate differences in treatment outcome between lingual and labial fixed orthodontic appliances.

SUBJECTS AND METHOD: Sixty patients (30 treated with lingual fixed appliance and 30 age-, gender- and extraction pattern matched labial patients). Treatment outcome by means of unweighted and weighted Peer Assessment Rating (PAR) scores, inter-premolar width and arch shape eccentricity was evaluated on digital casts. Information regarding the number of visits during treatment, number of emergency visits and treatment time was collected from the clinical records. Intra- and inter-examiner reliability was evaluated (Dahlberg’s test) and mean values and standard deviations were evaluated for each variable. A paired two-tailed t-test was used for comparisons between the groups where P < 0.05 was considered significant.

RESULTS: There was no significant difference between the two groups regarding the unweighted or weighted post-treatment PAR scores and arch shape eccentricity. The difference in inter-premolar variation after treatment was significantly larger (P < 0.001) in the labial group. A significant difference was also found regarding treatment time and the number of emergency visits. The lingual
group had both a longer treatment time (approximately 6 months longer on average) and more emergency visits (approximately 5 more on average).

CONCLUSION: Treatment with lingual and labial fixed appliance display similar treatment outcome, though, the lingual appliances seems to better preserve arch width. However, treatment time is longer and emergency visits are more frequent with lingual fixed appliances compared to treatment with labial fixed appliances.

SP44  LOSS OF SPACE ACCORDING TO THE TIMING AND TYPE OF PREMATURE EXTRACTED PRIMARY TEETH

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AIMS: To determine space loss in the both dental arches according to the time and type of premature extracted primary teeth.

SUBJECTS AND METHOD: Sixty children aged 6 to 9 years with premature loss of one primary tooth divided into two groups according to the time of premature extraction. Two biometric methods were used for the purpose of the study: the Moyers method and measurement of mesial and distal movement of the teeth by drawing perpendicular lines towards the midline.

RESULTS: The average amount of space lost was 0.033 mm for the first group and 3.17 mm for the second group. The lack of space when the first primary molars were extracted was greater in the upper arch (2.38 mm) and was due to mesialization of the second primary molar. In the lower arch the loss of space was 1.5 mm and related to distal movement of the primary canines. The lack of space when the second primary molars were prematurely extracted was 2.5 mm for the upper and 2.6 mm for the lower jaw and related to mesialization of the first permanent molars.

CONCLUSION: Time is a significant factor for loss of space. The reduction of space increases when premature extraction is carried out more than two months before measurement. The type of premature extracted tooth is another significant factor for the loss of space. The lack of space is larger when second primary molars are extracted, because of medial movement of the first permanent molars.

SP45  THE EFFECT OF BRACKET LIGATION ON THE PERIODONTAL STATUS OF ADOLESCENTS UNDERGOING ORTHODONTIC TREATMENT. A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: This systematic review aimed to critically appraise the evidence regarding the effect of bracket ligation type on the periodontal status of adolescents undergoing orthodontic treatment.

MATERIALS AND METHOD: An electronic database search of published and unpublished literature was performed (Medline via PubMed, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, Clinical Trials.gov and National Research Register). Search terms included randomized controlled trial (RCTs), controlled clinical trials, ligation, bracket, periodontal, inflammation, while data was extracted in standardized piloted forms. Risk of bias assessment was made using the Cochrane risk of bias tool and the quality of the evidence was assessed with GRADE.

RESULTS: Of the 93 articles initially retrieved, 10 were eligible for inclusion in the systematic review, while only four RCTs with unclear risk of bias were included in the quantitative synthesis, all comparing self-ligating to conventional brackets. Random effects meta-analyses were implemented. At 4 to 6 weeks after bracket placement there was no evidence to support the use of one type of bracket over the other for achieving improved periodontal status: Plaque Index (PI, mean difference: conventional versus self-ligating: −0.09; 95% CIs: −0.36, 0.18; P = 0.53) and Gingival Index (GI, mean difference: −0.02; 95% CIs: −0.22, 0.19; P = 0.88). At 3 to 6 months of treatment course, there was scarce evidence to support a greater PI increase for conventional brackets (PI, mean difference: conventional versus self-ligating: 0.14; 95% CIs: 0.0, 0.28; P = 0.0 prediction intervals: −0.76, 1.03).
GI (mean difference: 0.06; 95% CIs: –0.24, 0.36; \( P = 0.70 \)) and pocket depth (mean difference: 0.01; 95% CIs: –0.12, 0.14; \( P = 0.86 \)) pooled estimates did not reveal significant differences between the two bracket systems. The quality of the evidence was moderate according to GRADE for all outcomes.

CONCLUSION: Insignificant and clinically not important differences in the periodontal status of adolescents undergoing orthodontic treatment with either conventional or self-ligating brackets were detected, while further research is required to strengthen the confidence in the estimate of the effect.

SP46 TIPS AND TRICKS TO REDUCE MORBIDITY OF TRANSMANDIBULAR SYMPHYSEAL DISTRACTION
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AIMS: When transmandibular symphyseal distraction is performed, different problems have been reported, such as wound dehiscence, chronic gingivitis around the activation rods and root damage. The aim of this presentation is to provide a clinical orthodontic protocol prior to surgery in order to reduce morbidity.

SUBJECTS AND METHOD: A series of nine patients were treated following the same clinical protocol (age 14 to 35 years). Four months before surgery, fixed appliances were placed on the lower first premolars, canines and central incisors. Brackets on central incisors were placed with an inclination to upright roots distally. Orthodontic visits were scheduled monthly. At the third appointment, an active coil spring was inserted between the central incisors in order to create a small diastema of 1 mm. Because of the inclination of the brackets, this produced a diastema of at least 3 mm between the roots of the central incisors. One week before surgery, the brackets on the first premolars were removed and a hyrax expansion screw was cemented on the lower first premolars and molars. Figure of eight ligatures ran from the first premolars to the central incisors of the same side, to prevent them from moving into the created gap. Chlorhexidine rinsing was started three times a day, 3 days before surgery. When the desired expansion was achieved, the screw was blocked with composite resin, to prevent food impaction and irritation of the tongue. The appliance was left in place for 4 months after distraction, with the central incisors tied to the first premolars. Upon hyrax removal, the lower arch was fully bonded and the brackets on the central incisors were repositioned.

RESULTS: In all patients the desired amount of expansion was achieved. No infections occurred. No pain at the central incisors was reported by the patients and no root damage could be observed on the radiographs. Speech was disturbed for only a few days after inserting the hyrax screw.

CONCLUSION: Careful orthodontic preparation and the use of a tooth-borne expansion device, can reduce morbidity of transmandibular symphyseal distraction, making this treatment a safe alternative to extractions or extensive stripping therapy.

SP47 ORTHOGNATHIC SURGERY VERSUS ORTHODONTIC CAMOUFLAGE IN ADOLESCENTS: WHAT PATIENTS AND THEIR PARENTS WANT AFTER COMPLETE COUNSELLING
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AIMS: Patients and parents visiting an orthodontist are concerned about the appearance of the teeth. Very often, there is an underlying skeletal disharmony, resulting in the actual tooth position, which they are not aware of. Retreatment is often performed in patients who have had orthodontic camouflage treatment. The aim of this study was to evaluate possible factors that might determine a patient’s treatment decision when fully counselled about both risks and benefits of orthodontic camouflage or surgical treatment.

MATERIALS AND METHOD: In a retrospective way, all patient files from a private practice of the past 2 years were reviewed. Inclusion criteria: adolescent patients (< 15 years); no previous orthodontic treatment; dental or skeletal Class II; pre-treatment cephalograms, clinical photographs and study casts of good quality available. Orthodontic camouflage (functional appliance, fixed appliances, extractions) possible within the limits of the envelope of discrepancy, but obvious benefit of surgical treatment on facial and dental appearance (tooth inclination), functional stability and physical well-
being (snoring, mouth breathing). Patients were fully counselled on both treatment options. Measurements on cephalograms included: ANB angle, overjet and overbite. The Dental and Aesthetic components of the Index of Orthodontic Treatment Need (IOTN) were determined. Other factors evaluated were gender and age at time of decision. An independent samples t-test was used to compare means between groups.

RESULTS: In total 61 patients met the inclusion criteria. Twenty-two patients (36%) chose surgical treatment. Eighteen patients (29%) chose a treatment with functional appliance followed by fixed appliances. Thirteen patients (21%) chose treatment with only fixed appliances. Five patients (8%) chose treatment with extractions. No statistically significant correlations could be found between treatment chosen and any of the measurements on the cephalograms or IOTN nor with gender or age. Although statistically not significant, it seemed that older patients more often chose combined orthodontic-surgical treatment than younger patients.

CONCLUSION: Treatment decision seems to be subjective rather than objectively related to measurements on cephalograms or IOTN. In borderline cases, orthodontists should not decide, but fully inform patients and their parents on treatment options, so they can make the most appropriate decision for the patient.

SP48 – WITHDRAWN HOW DOES THE RADIOGRAPHIC POSITION OF IMPACTED CANINES AFFECT ORTHODONTIC TREATMENT TIME?
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AIMS: To ascertain how the radiographic position of impacted canines affects orthodontic treatment time. This would facilitate managing patient expectations.

SUBJECTS AND METHOD: A sample size of 44 patients (80% female, 20% male) aged up to 16 years with canines exposed and bonded from 2009 to 2013. The total number of canines was 54 (unilateral 77%, bilateral 23%). The time was measured from from traction to eruption. The following radiographic factors were measured: 1. Canine angulation to the midline; 2. Position of canine root apex antero-posteriorly; 3. Vertical canine crown height; 4. Canine overlap of adjacent incisor root; 5. Labio-palatal position of the canine

RESULTS: 1. Canine angulation to the midline. Canines over 31 degrees: mean 15.6 months; range 1-24 months. Canine angulation 0-15 degrees: mean 1.75 months; range 1-3 months. 2. Position of canine root apex antero-posteriorly. Canine root apex above the second premolar: mean 11.8 months; range 3-25 months. Canine root apex above the position of the canine: mean 6.3 months; range 1-19 months. 3. Vertical canine crown height. Canines with crowns positioned at a height between 1/2 and the whole root length: mean 11.7 months; range 1-25 months. Canines with a crown height below the cemento-enamel junction: mean 1 month; range 1 month. 4. Canine overlap of the adjacent incisor root. Canines with a complete overlap of the adjacent incisor: mean 9.4 months; range 1-25 months. Canines demonstrating no horizontal overlap of the adjacent incisor: mean 7 months; range 3-13 months. 5. Labio-palatal position of the canine. Buccal canines: mean 9.3 months; range 4-13 months. Palatal canines: mean 9.1 months; range 1-25 months. Canines in the line of the arch: mean 4.6 months; range 1-13 months.

CONCLUSION: The radiographic position of the canine can affect treatment time. Canines in the line of the arch erupt faster. Treatment time increases as canine angulation to the midline increases; the canine root apex position is further distal; the vertical canine crown height increases.

SP49 – WITHDRAWN AN AUDIT OF ORTHODONTIC TREATMENT DURATION
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AIMS: To determine the duration of orthodontic treatment at Birmingham Dental Hospital and the factors which affect this with a view to improve the treatment time of orthodontic patients.

MATERIALS AND METHOD: This was a retrospective audit which included 50 consecutive patients who had completed orthodontic treatment and had been debonded before November 2015. Cleft lip and palate patients and patients who had undergone an early debond for reasons including a high risk of demineralisation were excluded. All other patients treated by orthodontic consultants and
registrars were included to obtain a true representation of the duration of orthodontic treatment time of the average treated. A data collection sheet was completed for each case and the following information was recorded: start date of treatment; date of debond; length of treatment in months; total number of visits; total number of ‘did not attend’ (DNA) appointments; total number of unscheduled appointments and total number of cancelled appointments.

RESULTS: The mean treatment duration was 35.7 months with a range of 18-61 months. The mean number of visits was 22.4 with a range of 12-41 visits. The mean number of DNA appointments was 2.3 with a range of 0-9. The mean number of unscheduled appointments was 1.4 with a range of 0-8 and the mean number of cancelled appointments was 7.7 with a range of 2-18.

CONCLUSION: As expected, a dental hospital setting had an increased number of severe cases which can include multidisciplinary care hence extending the duration of orthodontic treatment time. However, this audit has recognised potential factors that increase treatment time which can be prevented. These factors include DNA’s, unscheduled and cancelled appointments. It is recommended: to ensure patients’ compliance, willingness and commitment to attending all their appointments before starting orthodontic treatment; to emphasize to patients the risk of prolonged treatment with DNAs, unscheduled and cancelled appointments; to carry out a re-audit.

SP50 IMPACT OF ORTHODONTIC TREATMENT ON ORAL HEALTH-RELATED QUALITY OF LIFE
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AIMS: To assess oral health-related quality of life (QoL) before and during orthodontic treatment.

SUBJECTS AND METHOD: A prospective study on a convenience sample of orthodontic patients was conducted. The Child Perceptions Questionnaire (CPQ) was used for data collection, an instrument that comprises 37 items, grouped in four domains: oral symptoms, functional limitation, emotional well-being and social well-being. Its interpretation is based on the score obtained, the lower the score, the better perceived the quality of life. The questionnaire was administered after patients and their care givers agreed to participate in this study and gave their written informed consent. The questionnaire was completed before (T1) and after (T2) orthodontic treatment, but not less than 6 months after T1.

RESULTS: Forty-two patients, aged 7-12 years (15 males, 25 females) were included. At T2, 39 patients were reassessed, after a mean period of the orthodontic treatment of 12 month (minimum 6 months, maximum 20 months). The mean CPQ score at T1 was 41.72, and at T2 25.13. The mean scores of CPQ's domains were: oral symptoms 8.82 at T1 and 5.44 at T2; functional limitations 8.21 at T1 and 4.44 at T2; emotional well-being 12.36 at T1 and 7.95 at T2; social well-being 12.33 at T1 and 7.31 at T2. Using Wilcoxon’s test a statistically significant difference in CPQ scores and its domains between T1 and T2 (all P < 0.001) were observed. Observing that at T2 the scores seem to be lower on CPQ and its domains, implies a better perceived QoL after implementation of orthodontic treatment.

CONCLUSION: The impact of the orthodontic treatment on the patient’s QoL is an aspect worth considering when assessing the advantages of orthodontic treatment. Its increase as a long-term effect is an aspect which should further be evaluated through long-term prospective studies.

SP51 DENTAL ALIGNMENT AS PERCEIVED BY FIRST AND SECOND GRADERS
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AIMS: To assess children’s ability to distinguish between more or less severe dental irregularities and through this to identify the level of need for dental aesthetics in the early stages.

SUBJECTS AND METHOD: A cross-sectional study was conducted on a convenience sample of 1st and 2nd graders from a public school in Bucharest. Participants were voluntarily included and their caregivers consent was obtained before the beginning of the study. For data collection the Aesthetic Component of the Index of Orthodontic Treatment Need was used, which has a 10 point severity scale from 1 least attractive to 10 most attractive. As images personal cases were used, similar to
those accepted by the World Health Organization. The questionnaire also included questions related to their state of mind for the day. Children received the questionnaire during class. Images were randomly arranged and they were asked to grade the images from 1 to 5 using the Likert scale. Data was analyzed using SPSS statistics.

RESULTS: The sample included 33 participants, with ages from 6 to 9 years, only a few, so far, receiving orthodontic treatment. Girls and boys scored images similarly, girls being slightly more indulgent. The children were able to distinguish between different clinical situations, they were best at identifying the normal occlusion (image 1) and were highly critical of image 5. Their appreciation of severe anomalies was higher (images 7 to 10) and their scoring was less even for images 1 to 6, which suggests that they were more able to grade severe rather than less severe situations, their ability to distinguish between clinical situations with moderate alterations being reduced. The Mann-Whitney test identified images 1 and 10 as the only clinical situations significantly different. Children were unable to distinguish between images 2 and 3, 4 and 5 and images 2 and 6; among these no significant statistical difference was registered.

CONCLUSION: Children’s ability to differentiate between more or less severe dental irregularities suggests that dental aesthetics is an important social issue that should be considered regardless of age.

SP52 PREVALENCE AND DISTRIBUTION OF TOOTH AGENESIS IN A SAMPLE OF PATIENTS IN A DENTAL UNIVERSITY CLINIC
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AIMS: To find the prevalence of tooth agenesis in a group of dental patients.
MATERIALS AND METHOD: Panoramic radiographs of 1677 consecutive patients of both genders (8-11 years old, mean age 9.78 ± 0.98 years) that attended the Dental University Clinic Alfonso X during the last five years were analyzed by a single operator.

RESULTS: At least one missing tooth was recorded in 3.40 per cent of the patients. The male to female prevalence ratio was 1.2:1. The most frequent missing tooth was the lower second premolar (36.84% of all patients with congenitally missing teeth) followed by the upper lateral incisor (308%).

CONCLUSION: In this sample 3.40 per cent patients had hypodontia and 0.0006 per cent had oligodontia (≥6 missing teeth). The lower second premolar was the most frequent missing tooth followed by the upper lateral incisor.

SP53 EVALUATION OF THE EFFECT OF TWO TYPES OF NICKEL-TITANIUM ALLOY ORTHODONTIC ARCHWIRE APPLICATION IN DIFFERENT TIME SEQUENCES: PRELIMINARY REPORT
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AIMS: To investigate the efficiency of copper-nickel-titanium (CuNiTi) versus nickel-titanium (NiTi) archwires in resolving crowding of the anterior mandibular dentition.
SUBJECTS AND METHOD: Thirty patients were included in this single-centre, single-operator, prospective randomized trial. All patients were bonded with Mini-Sprint brackets (Forestadent, Pforzheim, Germany) with a 0.018 inch slot, and the amount of crowding of the mandibular anterior dentition was assessed using Little’s irregularity index. The patients were randomly divided into two groups of 15 patients, one of the groups received a 0.014 inch CuNiTi 27°C (Ormco, Glendora, USA) and a 0.016 inch CuNiTi 27°C, while the others received a 0.014 inch NiTi (Ormco) and a 0.016 inch NiTi wire, respectively. Each of the wires was applied for 6 weeks. The application date of each wire was recorded, and all patients were followed at two weekly intervals for 3 months. At each two weeks, the mandible was intraorally scanned with an intraoral scanner (TRIOS, 3Shape, Copenhagen, Denmark) and alleviation of crowding, intercanine, interpremolar, and intermolar widths were measured by digital modelling program (OrthoAnalyzer, 3Shape). The Kolmogorov-Smirnov test was used to determine demographic and clinical characteristics between the groups. Repeated ANOVA was used to compare the treatment efficiency of the two treatment modalities.
RESULTS: The types of wire (CuNiTi versus NiTi) had no significant effect on alleviation of crowding. Intra-group differences were found to be statistically significant for Little’s irregularity index ($P < 0.001$) and intercanine width ($P < 0.05$) for both groups. For the NiTi group, inter second premolar width ($P < 0.05$) was statistically significant. For the CuNiTi group, inter second premolar width ($P < 0.001$), intermolar width ($P < 0.05$) and inter first premolar width ($P < 0.01$) were statistically significant.

CONCLUSION: Both archwires were effective for alleviation of crowding. There were no significant differences between the efficiency of CuNiTi versus NiTi archwires in alleviating crowding.

SP54 EVALUATION OF CHANGES IN AIRWAY DIMENSIONS FOLLOWING CLASS II FUNCTIONAL THERAPY WITH THE HERBST APPLIANCE

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AIMS: To determine changes of pharyngeal airway dimensions following functional therapy with the Herbst appliance in skeletal Class II malocclusion subjects.

SUBJECTS AND METHOD: Twenty patients (mean chronological age: 15.34 ± 1.16 years) including 13 girls and seven boys treated with the Herbst appliance. Lateral cephalograms were taken before (T0) and after (T1) treatment. For angular measurements SNA, SNB, ANB and SN-GoGN were measured. For pharyngeal airway measurements, D1 (the PNS-Ba line intersected the pharyngeal airway), D2 (the narrowest distance between the soft palate and posterior pharyngeal wall), and D3 (the narrowest distance between the base of tongue and the posterior pharyngeal wall) were measured. The pharyngeal airway area was measured as the area between D1 and D3. A paired t-test was used to compare changes in T0 and T1.

RESULTS: ANB angle significantly decreased with use of the Herbst ($P < 0.001$). SNB angle showed a statistically significant increase ($P < 0.001$). The distance between the posterior wall of the pharynx and soft palate significantly increased (D2, $P = 0.002$). The distance from the base of tongue to the pharyngeal wall (D3) showed a statistically significant increase ($P = 0.03$). However, D2, D3 and pharyngeal airway area significantly increased at T1 compared to T0 ($P < 0.001$). For all other airway variables, no significant difference was found between T0 and T1.

CONCLUSION: At the end of functional orthodontic therapy with the Herbst appliance statistically significant changes in airway dimensions were observed.

SP55 IN VITRO EVALUATION OF ENAMEL DEMINERALIZATION AROUND ORTHODONTIC BRACKETS AFTER LASER AND ACID ETCHING METHODS

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AIMS: Laser etched enamel surfaces are claimed to be acid resistant which would be of great interest for the orthodontist as demineralization of enamel adjacent to fixed orthodontic appliances can be an aesthetic problem for the patient, as well as a problem for the clinician that overshadows the success of treatment. A new Er:YAG laser handpiece (Xrunner) is unique in its ability to digitally control size, shape and depth of irradiated enamel areas. This study evaluated the enamel demineralization around brackets bonded following conventional acid etching and Er:YAG laser etching with this handpiece.

MATERIALS AND METHOD: Fifty freshly extracted human premolars were divided into two equal groups and received the following treatment: group 1, acid etching; group 2, Er:YAG laser etching through X-Runner handpiece. After placing the brackets, the teeth were cycled through a demineralization-remineralization procedure for 14 days. The solutions were changed daily in order to simulate saliva flow in the mouth. The teeth were brushed manually with a soft-bristled toothbrush for 30 seconds between each cycle to simulate mechanical wear. The mineral loss on the enamel surface was assessed using quantitative light-Induced fluorescence (QLF). Data was analyzed using the Mann-Whitney U test.
RESULTS: The mean lesion depth, expressed in percentile fluorescence loss (F[%]), and mean lesion volume (∆Q[%]) of the acid-etch sample was: $8.72 \pm 3.47$ and $-258.44 \pm 237.26$, respectively. The same figures were $-4.71 \pm 4.01$ and $-24.52 \pm 36.25$, respectively for the laser etched sample. The differences between the two test groups were statistically significant for both parameters ($P < 0.001$).

CONCLUSION: Within the limitations of this study it can be concluded that demineralization of acid etched enamel adjacent to orthodontic attachments is significantly higher than that of enamel etched with an Er:YAG laser using a novel handpiece as measured by QLF. Consequently, laser etching can be a promising alternative in high risk patients; however, further investigations are needed to extrapolate these findings to the actual clinical practice of multibracket treatment.

SP56  ADAPTATION AND VALIDATION OF THE ORTHODONTIC QUALITY OF LIFE SURVEY FOR 11-14 YEAR OLD CHILDREN FOR THE TURKISH LANGUAGE
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AIMS: The Orthodontic Quality of Life Survey for 11-14 year old (OQoLAS 11-14) children is a specific tool which was developed in an attempt to measure the effects of orthodontic differences on the quality of life (QoL). The aim of this study was to adapt the OQoLAS 11-14 to the Turkish language and to test its psychometric properties.

MATERIALS AND METHOD: The scale was adapted to Turkish utilizing a forward-backward translation method. It was found to be generally understandable in a pilot study which included 15 orthodontic consultation patients. Two hundred subjects participated in the main study. Along with the administration of OQoLAS, objective and subjective orthodontic treatment need were assessed by the Index of Complexity, Outcome and Need (ICON) and the Aesthetic Component (AC) scale, respectively. Validity and reliability tests were performed for OQoLAS.

RESULTS: Significant correlations were found between OQoLAS scores and global ratings of oral health, oral influence and oral satisfaction ($r = 0.382$, $r = 0.334$ and $r = 0.405$, respectively) supporting construct validity. There were no statistically significant differences between patients who had an orthodontic treatment need and those who did not according to ICON scores. There were also no significant correlations between OQoLAS and ICON scores. These results do not support the discriminant validity of the scale. However total scale, emotional well-being and social well-being subscales were positively correlated with AC scores ($r = 0.194$, $r = 0.197$ and $r = 0.176$) providing evidence for discriminant validity. Cronbach’s alpha and intraclass correlation coefficients were calculated as 0.906 and 0.745, demonstrating good internal consistency and acceptable retest reliability, respectively.

CONCLUSION: OQoLAS 11-14 was found to be reliable in this sample of orthodontic patients. Contrary to what was expected, no significant relationship was observed between objectively determined orthodontic treatment need and orthodontic QoL. This finding is in agreement with the fact that objective indicators and subjective impacts of a disorder may not necessarily have the same constructs. However further research is still advisable to test this assumption.

SP57  TREATMENT OUTCOMES OF MAXILLARY LATERAL INCISOR AGENESIS BY SPACE OPENING OR SPACE CLOSURE
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AIMS: This retrospective study aimed to assess the outcomes of treatment of patients having maxillary lateral incisor agenesis (MLIA) and being treated either by space closure or space opening followed by implantation with regard to gingival alignment and the survival rate of the used implants.

MATERIALS AND METHOD: For this investigation only non-syndromic post-growth MLIA patients with sufficient documentation details who were treated either with orthodontic space closure by fixed appliance ($n = 10$; group 1), or orthodontic space opening ($n = 10$; group 2) followed by Bicon-
short-implant placement were included. For both groups axis positions of the canines and incisors were measured based on radiographs after orthodontic treatment. In group 2 the gap widths were measured before implantation. The aesthetic results were judged based on ginvival alignment, and an evaluation of the survival rate was conducted by measuring the bone level before and 5 years after implantation.

RESULTS: Even though patients treated with space closure via fixed appliance showed irregularities in gingival alignment, they were still as satisfied with the result of their therapy as patients treated with space closure by implantation, thus the aesthetic results can be judged as equally satisfactory from a patient’s point of view for both treatment options. In cases of space opening, the canine can stay in place and even when there was a reduced gap width and length (<6 mm) it was possible to provide patients with Bicon short implants. No significant changes concerning bone level were observed. The 5 year implant survival-rate added up to 100 per cent.

CONCLUSION: Although canine-guidance is lost if treatment by space closure is chosen, and the gingival alignment is not optimal, it cannot be argued that the survival rate of natural teeth is usually the highest. In cases in which space opening is indicated due to occlusion or skeletal pattern, Bicon-implants can be successfully utilized even if there is reduced gap width and length, if the right insertion position and ideal implant design is used. In these cases, Bicon implants produced good aesthetic long-term results, which have yet to be confirmed by further studies with a wider timeframe.

SP58    A SYSTEMATIC REVIEW OF THE USE OF DISCRETE CHOICE EXPERIMENTS IN DENTISTRY TO QUANTIFY PATIENT PREFERENCES
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AIMS: To review discrete choice experiments (DCE) as a method for assessing patient preferences for dental care.

MATERIALS AND METHOD: A systematic search was undertaken to identify relevant studies using appropriate search terms in a number of databases (Medline, Embase, PSYCHarticles and EBM reviews via Ovid, PubMed, Econlit.) and through additional hand searching. All empirical studies carried out in the oral health context were eligible, including conditions part managed by dental care professionals such as sleep apnoea and craniofacial deformity. Studies employing the DCE methodology to elicit preference were included; non choice-based conjoint analysis, other value-clarification and trade-off methods were excluded. A standardised data extraction form was used to extract key information from each study. Quality assessment was undertaken using a framework developed from the International Society of Pharmacoeconomics and Outcomes Research (ISPOR) guidelines.

RESULTS: The search identified 519 studies; eight studies met the inclusion criteria. Three further papers outlining future studies using DCE were identified. Studies were carried out in Europe and the USA within the last 15 years. DCE was used as a method to measure patient preferences in relation to i) aspects of dental and orthodontic service provision, ii) treatment for missing anterior teeth and sleep apnoea and iii) oral health outcomes. The DCE purpose was to quantify patient preferences for use in service delivery (n = 3), organisation (n = 4) and policy (n = 1); none for shared decision making between patient-professional. The common domains were cost, time, service factors and aspects of outcome. There was variation in design and methods employed to identify, elicit and assess patient preferences, and poor alignment with ISPOR standards.

CONCLUSION: DCE is a valid method for quantifying patient preferences in healthcare but rarely utilized within dentistry. With growing emphasis on patient-reported outcomes in research and patient choice in care provision, DCE should be considered alongside other clinical and research measures to examine patient preferences. Following best practice guidance from ISPOR ensures robust experimental design.
A REGIONAL AUDIT TO EVALUATE THE IMPACT OF THE INDEX OF ORTHOGNATHIC FUNCTIONAL TREATMENT NEED ON CASE LOAD IN LEEDS TEACHING HOSPITALS

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AIMS: 1. To determine if orthognathic cases treated in Leeds Teaching Hospitals NHS Trust fulfil the proposed Index of Orthognathic Functional Treatment Need (IOFTN) criteria indicating treatment need. 2. To assess inter-observer reliability of IOFTN between members of the orthodontic team including a specialist registrar, a post-certificate of completion of specialist trainee and a consultant.

MATERIALS AND METHOD: A retrospective clinical audit of patients who had received orthognathic surgery in a one year period. Patients were identified from maxillofacial surgery theatre lists. Full records were reviewed including notes, photographs and study models. A standardised proforma was used for data collection. The Index of Orthodontic Treatment Need (IOTN) and IOFTN were independently recorded for each case by three members of the orthodontic team. The standards were: 100 per cent of cases should be classified as having moderate (Grade 3) - very great need (Grade 5) according to IOFTN; 90 per cent of cases should be classified as having great need (Grade 4) - very great need (Grade 5) according to IOFTN; 100 per cent of cases should have an IOTN score of 4 or 5; clinicians should have a good level of agreement in applying the IOFTN (kappa of 0.6) to show its usability in a clinical setting

RESULTS: Thirty patients were included in the audit with a range of skeletal anomalies. All patients treated had attended a multidisciplinary treatment clinic during the treatment planning process. One hundred per cent of cases scored an IOFTN of 4-5 and IOTN of 4-5. In general the IOFTN appeared more sensitive for Class III and anterior open bite malocclusions than the IOTN. The IOFTN was considered easy and quick to apply with 100 per cent agreement between clinicians.

CONCLUSION: The current orthognathic case load complies with the agreed standards of the audit indicating that those being offered surgery have a great need for treatment. The IOFTN was easily applied by clinicians of differing levels and experience.

ORTHODONTIC PATIENTS WITH DIABETES MELLITUS – THE NEED FOR SPECIALIZED PREVENTION OF COMPLICATIONS

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AIMS: Difficult oral hygiene typically associated with orthodontic treatment leads to a gradual destruction of the hard tissues of the teeth and inflammation of the periodontium. In addition to local factors, there are common factors in the development of periodontal diseases, therefore, standard hygienic measures are often not efficient. One of these common diseases is diabetes mellitus. The aim of this study was to improve the methods of oral hygiene in orthodontic patients with diabetes mellitus.

SUBJECTS AND METHOD: A preventative hygienic agent was used for orthodontic patients with diabetes mellitus. Mixed saliva and blood were the objects of examinations. Monitoring of the initial condition was undertaken using the primary method of statistical data processing. The patients were divided into two groups: group 1, 12 healthy volunteers and group 2, 20 patients with diabetes mellitus. All patients were treated with a fixed orthodontic appliance. A single test of the agent was carried out in group 1 and multiple tests in group 2. On day 1 saliva and blood of group 1 were taken twice, once on an empty stomach and 2 hours after the meal. On the second day the same was repeated but all patients rinsed their mouth immediately after the meal. Group 2 used the agent during 1 month on its own. For the first 2 weeks the patients measured and recorded in diaries the level of blood sugar fasting and 2 hours after the meal. For the following 2 weeks rinsing the mouth after eating was added to the same procedure.

RESULTS: This agent significantly reduced the level of glucose in the mixed saliva but did not reduce the glucose level in the blood. However, in most cases, in both groups, it prevented the increase of glycemic levels in the blood up to the usual high figures, especially for patients with diabetes.
CONCLUSION: This preventive hygienic agent reduces the risk of inflammatory and degenerative processes during orthodontic treatment, which is especially important for patients with diabetes, and accelerated the recovery process of the periodontium after treatment in both groups of patients.

SP61 BISPHOSPHONATES: AN UPDATE FOR THE ORTHODONTIST
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AIMS: To update the knowledge on complications and safety considerations in children and adults that are or have been under bisphosphonate (BP) therapy, and to underline the limitations of the use of BPs in orthodontic treatment. In addition, to evaluate, if local administration of BPs can safely favour orthodontic treatment outcome.


RESULTS: BPs are widely used for a variety of indications such as of osteoporosis, Paget’s disease, cancer, osteogenesis imperfecta and anorexia nervosa, in children, adolescents and older patients. From the latter group an increasing number are seeking orthodontic treatment. In younger patients BP treatment may affect body growth, root development and tooth eruption, and in older patients it may lead to impaired wound healing, incomplete space closure and longer duration of the orthodontic treatment. In addition, the risk factors for osteonecrosis after oral and maxillofacial surgery are increased, especially in older patients. Local application of BPs has been proposed for the prevention of root resorption and relapse after maxillary expansion, distraction osteogenesis and even after orthodontic tooth movement. BPs may be beneficial for patients with periodontitis and for the stability of dental implants, or temporary implants used for anchorage control. The few studies in orthodontic patients under BPs, are mainly case reports and retrospective cohort studies and there is no data on children under orthodontic treatment.

CONCLUSION: Orthodontic anamnesis should include identification of patients that are, or have been treated with BPs, and the possible limitations and complications should included in the informed consent form. Orthodontists should strengthen their knowledge and improve communication with medical practitioners in order to optimize treatment and minimize the risks in their patients. Future studies are required to prove the effectiveness and safety of local application of BPs in orthodontic patients.

SP62 DEVELOPMENT OF A METHOD FOR RATING NASOLABIAL APPEARANCE IN CHILDREN WITH BILATERAL CLEFT LIP AND PALATE
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AIMS: To develop a method for rating the nasolabial appearance in children with a bilateral cleft lip and palate (BCLP).

SUBJECTS AND METHOD: Children with a complete BCLP at 6, 9 and 12 years of age from four different centres (Nijmegen, Oslo, Gothenburg and Bauru) were included in the study. A panel of judges, consisting of 11 orthodontists, with experience in the treatment and outcome of cleft patient, were shown the frontal, profile and worm’s eye facial views of photographs of children with BCLP. The facial features (hair and eyes) were eliminated. The upper lip and nose were judged
separately. Three different features were assessed for the upper lip: red, white, length. Three features were assessed for the nose: shape, tip, columella. A five-point scale was used, rating nasolabial appearance from excellent (1) to very poor (5). A sample consisting of 50 photographs for each age group were discussed and analyzed by the panel of judges until they agreed on the photographs that would become part of each yardstick. To assess the validity, 30 randomly selected photographs were rated by the judges twice. Weighted Kappa (κ) statistics were performed to evaluate intra- and inter-rater reliability.

RESULTS: This yardstick had a fair to good level of reproducibility (κ = 0.21–0.8). The interrater weighted κ scores ranged, for the 6-year old patients, for the lip: 0.468-0.681, for the nose: 0.383-0.748, for the 9-year olds for the lip: 0.380-0.660 and for the nose: 0.338-0.738 and for the 12-year old group, for the lip: 0.267-0.680 and for the nose: 0.248-0.624. During the test runs, consensus was reached on the final use of the yardstick for three parameters for the lip and three for the nose.

CONCLUSION: The nasolabial appearance yardstick for BCLP patients has a good level of reproducibility for the youngest age group and for most of the parameters. The red of the lip and the tip of the nose have the best reliability in all age groups.

SP63 IMPACT OF THE DIGITIZATION METHOD AND REGISTRATION ACCURACY ON THREE-DIMENSIONAL ASSESSMENT OF ORTHODONTIC TREATMENT EFFECTS USING DIGITAL DENTAL MODELS
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AIMS: To assess the treatment effects of orthodontic appliances in three dimensions, surface registration of digital maxillary models was proposed as a radiation free alternative to cone beam computed tomographic (CBCT) based evaluations. However, accuracy of these analyses is limited by the quality of the digital models and potential registration errors. The aims of this study were (i) to identify the number of control points needed for reliable first-guess registration, (ii) to assess the reduction of registration errors using an iterative closest point (ICP) algorithm, and (iii) to evaluate the impact of different digitization approaches, i.e. CBCT cast scanning versus three-dimensional (3D) model scanning.

MATERIALS AND METHOD: The maxillary pre- (t0) and post- (t1) treatment models from 10 patients, who received upper molar mesialisation, were digitized using a 3D scanner (Dentaurum SmartOptics Activity 300) and a CBCT (Orange green3D). The respective surface meshes were generated and processed with Matlab R2014a. First, the t0 casts were self-matched with a randomly rotated and translated copy using varying numbers of automatically selected control points (3 to 20 control points, varying amounts of Gaussian noise) and the mean alignment errors and standard deviations were computed for each variable and group. Next, fine registration was achieved using a rigid ICP algorithm, and the respective registration errors were assessed. Finally, the t0 and t1 models of both digitization groups were registered using manually selected control points and the corresponding treatment outcomes were correlated using Spearman Rho.

RESULTS: Accurate registration was possible when at least five control points were used. With 10 control points, alignment quality converged showing that 10 control points yielded reliable registration results even in the presence of moderately inaccurate control point selection. ICP slightly improved registration results in most of the cases. In the 3D scan group, mean upper molar mesialisation was 6.5 ± 2.0 mm (upper right: 6.7 ± 2.6 mm, upper left: 6.4 ± 1.3 mm). These findings correlated significantly with the respective outcomes of the CBCT group (Spearman Rho = 0.91, P <0.0001).

CONCLUSION: Digitization with CBCT and 3D scanner yielded comparable results, but a minimum of five control points should be selected to achieve sufficient registration.

SP64 CLINICAL AUDIT ON PATIENT TREATMENT PRECEDING ACTIVE ORTHODONTIC TREATMENT
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AIMS: To determine patients' understanding and retention of information provided to them during the consent process and identify specific information which is poorly retained.

MATERIALS AND METHOD: A questionnaire was given to 200 patients who had already started fixed orthodontic treatment. The questionnaire was designed to reflect the important information that needs to be given by clinicians to patients before treatment. The questionnaire consisted of 10 questions: 1. Do you know why you need the orthodontic appliance?; 2. Do you know how your appliance will look like?; 3. Do you know how long your treatment lasts?; 4. Do you know how often you need to come for review appointments?; 5. Do you know how to clean your appliance?; 6. Do you know what to do if your appliance breaks?; 7. Are you aware of the effect of good oral hygiene on the progress of your treatment?; 8. Are you aware that you need to adapt your diet during your orthodontic treatment?; 9. Are you aware of possible pain/discomfort you might experience?; 10. Are you aware of the need for long-term retention?

RESULTS: All the 200 questionnaires were completed. The audit showed that 9 out of 10 questions achieved 100 per cent. Only information regarding understanding the need for long-term retention after completion of orthodontic treatment was at 90 per cent.

CONCLUSION: As 200 patients completed the questionnaire it was considered that they had interacted in the consent process and retained knowledge information that they had been given by their orthodontists. Even though the criteria of 90 per cent or above was met, the audit will be repeated in the near future to be able to maintain the quality of excellence.

SP65 EFFECT OF RESIN TYPE ON HARDNESS OF LINGUAL FIXED RETAINER FIBRES
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AIMS: To investigate the effect of different resin types on the hardness of Everstick™ fibres.

MATERIALS AND METHOD: Ten Everstick™ fibres (GC Europe) were assigned to two groups, five were polymerized employing Stickresin (i.e. a light cure single component enamel adhesive without fillers; GC Europe), and the other five with Flow Tain (flowable light cure composite with >50% wt glass fillers; Reliance Orthodontics, Itasca, Illinois, USA). The samples were polymerized for 40 seconds with about 50 per cent overlapping irradiation. The hardness of both groups was subsequently tested employing a Vickers indenter at 1 kp force and 15 second contact time. Three measurements were taken from each sample and the mean value was used for comparison. The results between the two groups were statistically analyzed with an unpaired t-test (alpha = 0.05).

RESULTS: No statistically significant differences were identified between the two groups [Stickresin group: HV 17 (SD ±6), Flow Tain group: HV 21 (SD ±4)].

CONCLUSION: Although copolymerized with fibre retainer, the use of filled resin does not significantly improve its hardness, probably owing to the inability of fillers to impregnate into the fibre.

SP66 EVALUATION OF HIGH-SENSITIVITY C REACTIVE PROTEIN AND OTHER BIOCHEMICAL PARAMETER LEVELS IN ORTHODONTIC PATIENTS
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AIMS: To assess the effects of fixed orthodontic therapy on high-sensitivity C-reactive protein (hs-CRP) level, complete blood count parameters and levels of aspartate aminotransferase and alanine aminotransferase, gamma glutamyl transferase, alkaline phosphatase, urea, creatinine, sodium (Na), potassium (K), calcium, total protein, and albumin.

MATERIALS AND METHOD: Blood samples (7 ml) were drawn at baseline, on days 1 and 7, and three months after appliance placement in the study group, while only one blood sample was drawn in the control group. Serum hs-CRP levels were measured using the nephelometric method. Friedman two-way variance analysis was used to assess values with skewed distribution obtained at baseline, on
days 1 and 7 and in the third month. Wilcoxon ranked sign test was performed if the median values were unequal.

RESULTS: During the measurement periods, there were significant increases in hs-CRP level, white blood cells count and neutrophil count but a significant decrease in Na level. K level was significantly decreased on day 1. No significant differences were detected in the other biochemical parameters evaluated.

CONCLUSION: Elevation in serum hs-CRP levels within the first 3 months indicates that a systemic immune response develops against therapy in patients undergoing fixed orthodontic treatment.

SP67 ASSESSMENT OF OBSTRUCTIVE SLEEP APNOEA SYMPTOMS IN MANDIBULAR RETROGNATHIC PATIENTS TREATED WITH THE ANDRESEN ACTIVATOR
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AIMS: To evaluate the effect of Andresen activator appliances for obstructive sleep apnoea (OSA) symptoms in mandibular retrognathic patients.

SUBJECTS AND METHOD: Thirty six patients; who had no systemic diseases and had not undertaken treatment for OSA. Five subject were excluded from the study due to their limited ability to cooperate. The study group consisted of 31 patients (13 females, 18 males; mean age 12.7 ± 1.37 years) who had a Class II relationship, with a normal or slightly forward maxilla, and retrognathic mandible. The patients were instructed to wear the Andresen activator for 18 hours/day during 6 months and then at night for 3 months to improve retention. A questionnaire, which contained 24 items about OSA symptoms, was distributed to the study group before and after Andresen activator treatment. The results were analysed using SPSS Version 21.0. (IBM Corp., Armonk, New York, USA) and McNemar’s test was used for comparisons before and after treatment. Regression analysis was used to determine associations between the variables. A value of $P < 0.05$ was considered significant.

RESULTS: Statistically significant differences were observed for eight of the 24 questions between pre- and post-treatment answers. A significant positive correlation were observed between variables ($r = +0.47$).

CONCLUSION: Mandibular retrognathic patients may have OSA symptoms. These patients may have remarkable benefits from functional orthodontic treatment with the Andresen activator appliance.

SP68 FACIAL GROWTH TYPE AND MOUTH BREATHING
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AIMS: Breathing and its possible problems seem to play a crucial role in the success and stability of orthodontic treatment, but does it correlate to the facial growth type?

MATERIALS AND METHOD: Fifty randomly collected case histories of patients treated with functional removable appliances (Bimler appliance) for a period of four years were compared regarding treatment outcome and the mouth/nose breathing pattern.

RESULTS: A vertical growth tendency can be associated with increased mouth breathing.

CONCLUSION: The association between vertical growth and an open mouth does not present a necessary causal relationship either one way or the other. Mouth breathing must be considered multifactorial.

SP69 NON-SYNDROMIC OLIGODONTIA – DOES THE ‘TOOTH AGENESIS CODE’ ENABLE PREDICTION OF THE CAUSATIVE MUTATION?
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AIMS: According to the literature, an association between phenotype and causative mutation seems to exist for non-syndromic oligodontia. This was to be verified in a cohort of consecutive non-syndromic oligodontia patients.
SUBJECTS AND METHOD: All non-syndromic oligodontia patients of the Department of Orthodontics, University of Giessen, Germany treated between 1986-2013 were contacted; at least one additional family member had to suffer from hypo-/oligodontia. After dental status assessment, the tooth agenesis data were analysed using the Tooth Agenesis Code (TAC; van Wijk und Tan, 2006) and a prediction for mutations of the genes MSX1, EDA, PAX9 and AXIN2 was given. Saliva samples were examined for mutations in the respective gene. In case of a positive result, all available family members were genetically examined.

RESULTS: Twenty out of 37 consecutive non-syndromic oligodontia patients fulfilled the inclusion criteria and agreed to participate in the study. Based on their TAC-codes, 11 patients were suspected to exhibit a MSX1-mutation, three patients an AXIN2-mutation and six patients an EDA-mutation. No patient was suspected to exhibit a PAX9-mutation. MSX1: The examination revealed variants in four patients, none of which was considered pathological as no functional mutation was caused. EDA: Two patients of the same family exhibited a pathologic gene mutation in exon 7 which was also seen in other family members and represents a novel missense mutation. AXIN2: None of the suspected patients revealed an AXIN2-mutation.

CONCLUSION: The present investigation revealed an association between oligodontia-phenotype, based on the TAC and a causative mutation in only 10 per cent of the consecutive non-syndromic oligodontia patient sample.

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SP70 ASSESSMENT OF EFFICIENCY OF SELF-ADHESIVE AND DUAL CURE RESIN IN LINGUAL ORTHODONTICS
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AIMS: In vitro reports on self-adhesive resins used on golden customized appliances (Incognito®, 3M Unitek) in lingual orthodontics show that good results are obtained if associated with conventional enamel etching. The aims of the current cohort prospective study were: 1. Compare, in a clinical setting, self adhesive resins, Maxcem (Kerr), Maxcem Elite (Kerr), Rely-X-Unicem (3M Unitek) to Nexus (Kerr) associated with bonding Excite (Kerr). All appliances were delivered by the laboratory, pre-treated with pre-bonding resin applied after a co-jet (SiO₂) treatment. 2. Compare stainless steel customized appliances (Harmony®, American Orthodontics) bonded on enamel with and without SiO₂ treatment of the tooth surface.

MATERIALS AND METHOD: Ninety dental arches were bonded with Incognito® brackets using a light cure bonding procedure. Randomization was performed for Maxcem, Rely-X-Unicem, Maxcem Elite and Nexus with Excite. Additionally 31 dental arches bonded with Maxcem Elite using Harmony® with and without SiO₂ treatment were randomized. Bracket loss was classified over 12 months according to where the bond failure occurred (failure at the bonding/enamel interface, within the bond or at the bracket/bonding interface ).

RESULTS: In vitro studies were confirmed. Maxcem Elite when associated with etching presents better efficiency in bonding than Nexus + Excite and Maxcem. No significant differences \( P > 0.05 \) between Maxcem Elite and Rely-X-Unicem were observed. There was no clinically significant difference \( P < 0.05 \) between the bonded bases with and without SiO₂ pre-treatment. Kaplan-Meier analysis showed a better survival rate for both Maxcem Elite and Rely-X-Unicem and no influence of SiO₂ treatment could be observed.

CONCLUSION: The use of self-adhesive and dual curing resins, Maxcem Elite and Rely-X-Unicem, associated with an enamel etching step is efficient and accurate, avoiding the application of primer. The metal tropism of these resins could avoid silicium preparation of the braces.

SP71 THREE-DIMENSIONAL ASSISTED MODEL ANALYSIS OF MAXILLARY TOOTH MOVEMENT
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AIMS: One of the most frequent dental malpositions with a treatment indication is an Angle Class II combined with an enlarged overjet and frequently dental crowding. One treatment option is distalization of upper the buccal segment teeth. The Carrière-Motion is a simple, economic but compliance-dependent orthodontic device for upper molar distalization, which, on account of its incorporated joint, also allows simultaneous derotation of the first molar. Although it is frequently clinically used, investigations are rare. The aim of this study was a three-dimensional (3D) evaluation of positional dental changes in the upper arch after Carrière-Motion-treatment and a possible assessment of the clinical success rate of this appliance.

SUBJECTS AND METHOD: Patients (n = 30) with an adolescent permanent set of teeth and dental Angle Class II, who had model casts from the beginning of therapy as well as after clinical success of one- or double-sided Carrière-Motion-treatment. A 3D scan and measurement was performed, so that every patient served as its own control. Furthermore, clinical outcomes were related to therapy time, measured from the insertion of the Carrière up to its removal. Statistical evaluation was performed by means of Wilcoxon and Duncan tests.

RESULTS: After double-sided Carrière treatment, statistically significant results could be evaluated with a mean molar distalization and derotation of 1.14 mm and 5.23 degrees, respectively. No statistically significant correlation to therapy time could be ascertained.

CONCLUSION: The Carrière-Motion is a favourable appliance for clinical space acquisition but compared to distalization space gain is predominated by derotation.

SP72 ADAPTATION PROCESSES OF MYOSIN HEAVY CHAINS AFTER INJECTION OF BOTULINUM TOXIN A IN THE RIGHT MASSETER MUSCLE OF MICE
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AIMS: The stomatognathic system is the controlling mechanism based on a close functional network of different muscle groups. Duchenne muscle dystrophy (DMD) is a genetically based disease with progressive muscle degeneration. In contrast to humans, in the mdx mouse the muscles are able to regenerate. Due to this fact, mdx mice are conditionally suited for any research. Therefore, the aim was to investigate whether similar effects can be achieved with the use of Botulinumtoxin A (BTX-A) as in muscular dystrophy, to break down muscle regeneration of mdx mouse.

MATERIALS AND METHOD: A paralysis of the right masseter muscle was induced in healthy mice (C57BL-10ScSn, 100d, n = 18) and mdx mice (100d, n = 18) by a specific injection of 0.3 IE BTX-A. After 4 (T1) and 21 days (T2) the following muscles were extracted: masseter right and left, temporalis right and left and tongue muscle. The mRNA expression of the myosin heavy chains (Myh1, 2, 4 and 7) in the muscle tissues was quantified in comparison to 18S rRNA using quantitative RT-polymerase chain reaction. Statistical analysis was performed using the Mann Withney U test.

RESULTS: In healthy mice a significant decrease of the Myh2-mRNA expression could be detected at T1 in the right masseter followed by a significant increase at T2 compared to the masseter muscle on the left side. In addition, at T2 the Myh7-mRNA was 2.5 fold increased in the treated masseter compared to the untreated masseter. In mdx mice however, no differences of any of the Myh-mRNAs tested in this study could be proven at either time point.

CONCLUSION: This findings suggest that a specific BTX-A injection is a suitable method to simulate DMD-pathogenesis in healthy mice. In dystrophic muscles no additional effect of BTX-A could be detected at the level of MyHC. Further investigations would be necessary to analyze the BTX-A effect to the muscles and to generate a sustained muscular atrophy.

SP73 A PREFABRICATED FULLY ADAPTABLE OCCLUSAL SPLINT FOR THE TREATMENT OF TEMPOROMANDIBULAR JOINT DISORDERS. RESULTS OF PATIENT QUESTIONING
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AIMS: Occlusal interference can cause an imbalance of muscle function affecting the stomatognathic system up to painful temporomandibular joint disorders (TMD). The most common symptomatic treatment is occlusal splint therapy. Since it is difficult to clinically capture the true relaxed jaw position, its fabrication and application is often misunderstood. To handle this source of error an occlusal adaptable split could be a helpful instrument to give the lower jaw the freedom to float in steady occlusion. Therefore a new water based fully adaptable occlusal splint (AquaSplint) was investigated using a questionnaire and whether the so-called advantages correspond with the patient’s perception were tested.

SUBJECTS AND METHOD: Patients, after conclusion of AquaSplint treatment (n = 100), were questioned using a standardized questionnaire, that contained, amongst others, questions concerning the wear period, improvement of TMD and pain as well as potential recommendations. Every question was evaluated separately and results were given in percentage.

RESULTS: In the majority of cases (82%) the wear period averaged 4, 5 or more weeks with 8 hours at night (48%) and 0 up to 1-2 hours (30% respectively) in the daytime. Seventy three per cent reported an improvement of symptoms; from 24 to 60 per cent, and 18 up to 30 per cent or up to 90 per cent, respectively. In most cases TMD and pain relief occurred in the first (32.87%), second (23.29%) or in the third week or later (17.8%). Forty seven per cent of the interviewees would highly recommend AquaSplint treatment.

CONCLUSION: With TMD caused pain, the AquaSplint is an excellent therapeutic tool for quick pain elimination, also during orthodontic rehabilitation.

SP74 PSYCHOSOCIAL IMPACT OF A DENTAL AESTHETICS QUESTIONNAIRE FOR ADOLESCENTS: TRANSLATION AND VALIDATION OF THE ITALIAN VERSION

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AIMS: Questionnaires are the most used tools to assess the influence of dentofacial aesthetics on the quality of life of a subject. The aim of the current study was to translate, cross-culturally adapt and validate the modified version of the Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) for adolescents, for its use among Italian adolescent subjects (aged 11-17 years).

MATERIALS AND METHOD: The original English version was translated, back-translated, cross-culturally adapted and pre-tested on a sample of 20 adolescents. Afterwards, the Italian PIDAQ was administered to a convenience sample of 677 adolescent between 11 and 17 years (328 males, 349 female, mean age 14.2 ± 2.1 years) along with two standardized instruments that aimed to objectively assess the self-reported degree of malocclusion: the Aesthetic Component of the Index of Orthodontic Treatment Need (IOTN-AC) and the Perception of Occlusion Scale (POS). Explanatory and confirmatory factor analyses were performed. A one-way ANOVA was used to assess differences between the groups, within each PIDAQ domain, according to POS and IOTN-AC scores. The correlation between PIDAQ domains and POS/IOTN-AC scores was measured as Spearman’s rank correlation. The internal consistency was measured as Cronbach’s alpha coefficient (α), and the test–retest reproducibility as intraclass correlation coefficient (ICC). P was set at <0.05.

RESULTS: The explanatory factor analysis detected three factors: Dental Self-Confidence, Psychosocial Impact and Aesthetic Concern. The confirmatory factor analysis proved that the tested model had high model fit indices (Comparative Fit Index = 0.88). The Italian PIDAQ domains were all statistically significantly different according to IOTN-AC and POS scores. Furthermore, all domains showed statistically significant correlations with both IOTN-AC/POS scores. The α ranged between 0.79 and 0.90, and the ICC between 0.93-0.97.

CONCLUSION: The Italian adolescent PIDAQ showed good reliability and validity. The psychometric properties of this questionnaire support its use for the assessment of the psychosocial impact of dental aesthetics among Italian adolescents.

SP75 THREE-DIMENSIONAL EVALUATION OF OROPHARYNGEAL AIRWAY VOLUME IN BILATERAL IMPACTED MAXILLARY CANINE PATIENTS
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AIMS: Three-dimensional (3D) cone-beam computed tomography (CBCT) has been used to diagnose and treat impacted canines. In recent studies, a correlation between impacted maxillary canines and the morphology of the maxilla was found. The purpose of this study was to examine whether there is a relationship between bilateral impacted maxillary canines and the morphology of oropharyngeal airway (OP) volume.

MATERIALS AND METHOD: CBCT scans of 20 patients (17 females, 3 males; mean age 16.25 years, range: 11.67-26.08 years) with bilateral impacted maxillary canines. Twenty subjects (10 females, 10 males; mean age 18.52 years, range: 13.25-26.92 years) were randomly selected for the control group to ensure a sample distribution similar to that of the bilateral maxillary impacted canine group. The patients were scanned in a supine position with the Frankfort plane perpendicular to the floor in centric occlusion. OP volume was defined as the volume of the pharynx between the palatal plane (ANS-PNS) extending to the posterior wall of the pharynx and the plane parallel to the palatal plane that passes from the most anterior inferior point of the second cervical vertebrae. Analysis of the oropharyngeal airway image using CBCT (NewTom 5G, QR, Verona, Italy,) was evaluated with the 3dMDVultus software program (3dMD, Atlanta, Georgia, USA).

RESULTS: The mean of OP volume was 7.40 cc for the study group and 9.49 cc for the control group. For the study and control groups, the minimum cross-sectional areas of the oropharyngeal airway were 46.28 and 42.30 mm² and the maximum cross-sectional areas of the oropharyngeal airway were 533.69 and 657.96 mm², respectively. The mean total area of the oropharyngeal airway was 2856 mm² for the study group and 3360 mm² for the control group.

CONCLUSION: Patients with bilateral maxillary impacted canines differed in oropharyngeal airway volume; the controls had slightly larger oropharyngeal airway volumes.

SP76 RADIOGRAPHIC EVALUATION OF IMPACTED MAXILLARY CANINES: A CONE-BEAM COMPUTED TOMOGRAPHIC STUDY
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AIMS: To examine the crown-root angle of impacted maxillary canines and to assess the relationship between the laterals and impacted upper canines using cone beam computed tomography (CBCT).

MATERIALS AND METHOD: In this study, 103 maxillary impacted canine archived CBCT scans of patients were examined. After the impacted maxillary canines that did not meet the inclusion criteria were removed, the subjects of this study consisted of 42 patients (18 males, 24 females, mean age 21.24 ± 12.25 years). Crown-to-root angulations, vertical zones (apical, middle, coronal), sectors I, II, III and IV (mesio-distal localizations were classified into four sectors) and the palatolabial position of all maxillary canines were determined on CBCT scans using Veraviewepocs 3D R100/F40 (J Morita Manufacturing Corporation, Kyoto, Japan). Resorption, dilacerations, root width and root length were also examined on the adjacent maxillary lateral incisors.

RESULTS: Thirty four per cent of the patients had bilateral and 64.5 per cent unilateral impacted maxillary canines. Crown-to-root angulations of all maxillary canines were determined to be 61.61 ± 21.80 degrees and mesially angulated. Of the impacted maxillary canine tips 40.5 per cent were palatally positioned and 59.5 per cent buccally positioned. Of 42 maxillary impacted canines; 18 caused resorption of the adjacent lateral incisors. Of the 18 maxillary impacted canines which caused resorption on the adjacent lateral incisors 33.3 per cent were buccally positioned and 66.7 per cent palatally positioned. While sector I impacted maxillary canines were 72.7 per cent buccally positioned, sector IV impacted maxillary canines were 80 per cent palatally positioned. Furthermore, the percentage for adjacent lateral incisor dilaceration was 40.5.

CONCLUSION: Unilateral maxillary impacted canines were found two times more often than bilaterally. The big part of maxillary impacted canines which caused resorption of adjacent lateral incisors was a palatoposition. If maxillary impacted canines move towards the midline, a
buccopalatal position of the maxillary impacted canines changes from a buccal position to a palatal position.

**SP77** COMPARISON OF THE ACCURACY OF THREE-DIMENSIONAL MODELS VERSUS DENTAL CASTS
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Aims: To compare measurements obtained from dental casts versus digital impressions.

Subjects and Method: A total of 30 subjects (20 females, 10 males, mean age 14.36 ± 6.30 years) were randomly selected. All patients presented with a Class I malocclusion and no missing teeth or tooth size anomalies. As part of their diagnostic records, all patients had alginate impressions (Orthoprint, Zhermark, Italy) poured with dental stone (Scheu-Dental, GmbH.D-58642, Iserlohn, Germany) and digital impressions obtained with a three-dimensional (3D) intraoral scanner (Trios-Color-P13 Shape) on the same day. Group 1 consisted of dental casts where manual measurements were performed and group 2 utilized 3 Shape Ortho Analyzer 2013 software to quantify the 3D obtained models. Bolton analysis, Hayes-Nance analysis, available arch length, required arch length and arch length deviation were calculated.

Results: No statistically significant difference was found between the two groups. The time required to perform all the analyses appears to be shorter with digital models compared to conventional casts ($P < 0.001$).

Conclusion: Measurements carried out on 3D models showed no statistically significant differences compared to dental casts. 3D models acquisition and quantification time is shorter than for dental casts.

**SP78** ASSESSMENT OF THE EFFECT OF VIDEO AND VERBAL INFORMATION ON ANXIETY LEVELS BEFORE MINISCREW APPLICATION
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Aims: To compare the effects of video and verbal information on patients’ anxiety levels before miniscrew application.

Subjects and Method: This prospective and randomized controlled study consisted of 40 patients (15 males, 25 females, mean age 18.27 ± 5.64 years). The participants were recruited from patients who were at the active phase of fixed orthodontic treatment. Miniscrew application was determined due to the need for skeletal anchorage. Patients were randomized into two groups with allocation of those with odd numbers to the control group and those with even numbers to the intervention group according to the date of application. Participants in the control group received verbal information, whereas those in the intervention group received the information through a video about miniscrew application. Verbal or video information before miniscrew application was provided by the same researcher and patients’ anxiety levels were determined on the day of application using the Turkish version of Spielberger State-Trait Anxiety Inventory just before the procedure. State anxiety, trait anxiety and total anxiety scores were analyzed with a Student’s $t$-test.

Results: State anxiety, trait anxiety and total anxiety scores showed no statistically significant difference between the control and intervention groups ($P = 0.337$, $P = 0.087$ and $P = 0.125$, respectively). The state anxiety score of females who received verbal information was significantly higher than for male participants ($P = 0.044$).

Conclusion: There is no evidence to confirm the dental anxiety level.

**SP79** COMPARISON OF PENETRATION DEPTHS OF SINGLE IRRADIATION WITH Er:YAG LASER ON DIFFERENT ORTHODONTIC ADHESIVES
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AIMS: To evaluate the effect of single irradiation with an Er:YAG laser used on three different orthodontic adhesives under polycrystalline ceramic brackets.

MATERIALS AND METHOD: Three different orthodontic adhesives: Transbond XT (3M Unitek, Monrovia, California, USA), Light Bond (Reliance Orthodontic Products, Itasca, Illinois, USA) and Opal Bond MV (Ultradent Inc, South Jordan, Utah, USA) were tested. Disc shaped, 10 samples, with a thickness of 0.5 mm and a diameter of 5 mm were prepared for each adhesive. The samples were place on a smooth surface and a polycrystalline ceramic bracket (Damon Clear, Ormco, California, USA), was placed on the samples. The output of the laser device was set to 600 mJ × 2 Hz (1.2 W) and 1000 µs (VLP) pulse duration (energy density = 45.4 J/cm²) with a contact handpiece. All samples were treated with a single irradiation. The depth of penetration on the adhesive discs were measured using X-ray microtomography systems (SkyScan, Bruker microCT, Kontich, Belgium). For statistical analysis one way ANOVA was used.

RESULTS: Penetration depths for Transbond XT, Light Bond and Opal Bond MV were found to be 0.09 (±0.04), 0.07 (±0.01) and 0.12 (±0.04) mm, respectively. No differences were detected between the groups (P = 0.062).

CONCLUSION: The penetration depths of Er:YAG lasers for the three orthodontic adhesives tested were found to be similar.

SP81 - WITHDRAWN

THE THERAPEUTIC POTENTIAL OF bFGF AND IGF-1 FOR MUSCLE REGENERATION IN CLEFT PALATE REPAIR
AIMS: After surgical closure of a soft palate, cleft muscle regeneration often fails, resulting in hampered speech development. Previously, it has been demonstrated that myofiber formation following excisional injury in the soft palate of rats is limited, despite early recruitment of activated and proliferating satellite cells (SCs). Therefore, whether the growth factors bFGF or IGF-I promote differentiation of SCs from head muscles (masseter and levator veli palatini) in vitro were investigated.

MATERIALS AND METHOD: SCs were isolated from the masseter and levator veli palatini muscles of 9-week-old Wistar rats by enzymatic digestion and trituration. SCs were seeded on Matrigel spots with 0, 2, 10, 50 ng/mL of bFGF or 10, 50 and 100 ng/mL of IGF-1. Cell cultures were evaluated at days 7 and 9 using markers of skeletal muscle proliferation and differentiation (Pax7, MyoD, MyoG) and myotube formation (MyHC). Staining was quantified by image analysis, and one-way ANOVA was used for the statistical analysis.

RESULTS: Few numbers of proliferating SCs were found after treatment with 10, 50 ng/mL of bFGF and 10, 50 and 100 ng/mL of IGF-1 compared with the negative control. SCs begin to differentiate and fuse directly after seeding. Consequently, multiple myotubes were evident at day 5. The percentage of nuclei inside myotubes of total nuclei (fusion index) reached more than 90 per cent at day 7.

CONCLUSION: On the basis of these results, bFGF and IGF-1 are putative candidates for further research on novel tissue engineering-based therapies to improve muscle regeneration and the function of the soft palate after cleft palate repair.
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AIMS: To assess the effects of muscle activity and cephalometric changes with the modified Twin Star appliance.

SUBJECTS AND METHOD: Twenty three adolescents (13 females, 10 males, mean age 12.2 years) with Class II division 1 malocclusions were randomly assigned. A modified Twin Star appliance was used for 8-12 months for at least 16 hours daily. A slow expansion screw were placed in an original Twin Star appliance. Dentofacial changes were observed by clinical evaluation, cephalometric radiographic measurements and electromyography recordings.

RESULTS: Mean ANB and mean overjet decreased (2.4° and 4.4 mm, respectively). In addition, effective mandibular length (Cond-Gn; 7.8 mm) and IMPA (4.1°) showed an increase. SN/GoGn and lower face height were unchanged. Digastricus venter anterior muscle activity during swallowing was progressively decreased. Maximum bite muscle activity measurements of the anterior part of the temporalis muscle showed a reduction in the first month but progressively increased and reached the starting value after treatment. Muscle activity at rest increased in the first months and reached the initial value in 6-10 months.

CONCLUSION: The modified Twin Star appliance showed success in growing Class II subjects. It can be an alternative option to the Twin-Block. EMG datas indicated that permanent adaptation in neuromuscular structure is achievable with a modified Twin Star.

SP84 NON-SURGICAL MANAGEMENT OF MANDIBULAR CONDYLE FRACTURES IN GROWING PATIENTS: A SYSTEMATIC REVIEW

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AIMS: To investigate the current evidence regarding the effectiveness of non-surgical treatment (NST) of mandibular condyle fractures (MCF) in children and adolescents.

MATERIALS AND METHOD: The PRISMA statement was used to guide this study. Keywords ‘mandibular condyle’, ‘fracture’ and ‘child’ were used to search PubMed, Latin and American Caribbean Health Science (Lilacs), Scopus, the Cochrane library and Scielo. The endpoint was March 2015. Records generated were initially selected on the basis of title. At a second stage, abstracts fitting the goals of this review were selected by consensus between two independent reviewers. Original articles were retrieved and evaluated to ensure they matched the inclusion criteria. Articles were assessed for the quality of their methodology by two examiners and a critical appraisal was performed regarding the following parameters: study design, sample selection description, prior estimate of sample size, adequacy of outcome measures and follow-up period, method error analysis and adequate statistics. The quality of the studies was ranked on a 13-point scale assessed as follows: high quality, (12 or 13 points); medium-high quality (10 or 11 points); medium quality (8 or 9 points); and low quality (≤ 7 points).

RESULTS: Fifteen out of the 491 articles identified matched the inclusion criteria. Analysis of methodology revealed quality scores ranging from low (13 papers) to medium (2 papers). Twelve articles were cross-sectional studies, whereas only three were prospective studies. The relatively low quality score of papers as well as the absence of homogeneously evaluated variables did not do a meta-analysis to be performed. Clinical outcomes have usually been reported as satisfactory after NSM of MCF, the results being on average better in children than teenagers. However, follow-up radiographic evaluations after NSM were unsatisfactory in most of the studies, thus highlighting a discrepancy among clinical and radiographic assessment.

CONCLUSION: On the basis of the data included and evaluated in the present review it is not possible to draw conclusions on the best NSM approach for MCF. Particularly, it seems worthy to mention that there is not a specific treatment which seem to be more effective than others.
EVALUATION OF DIAGNOSTIC PROTOCOLS AMONG TURKISH ORTHODONTISTS

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AIMS: To create a portrait of current orthodontic diagnosis protocol in Turkey.

MATERIALS AND METHOD: The study was conducted via an online, 12-question survey (Survey Monkey) on certain questions. The survey concluded approximately 4 months after the mailing. In this study, 183 orthodontists who were Turkish Orthodontic Society members participated. The introduction of the survey comprised questions on age, gender, education, work institution, how many years they had practised, the number of patients actively treated and the frequency of appointments. Statistical analysis was conducted to identify trends ($P < 0.05$) in the responses by using chi-square tests, and analysis of variance (ANOVA).

RESULTS: One hundred eighty-three responses were received. Of these 51.9 per cent were female. The average age of the orthodontists was 35.5 years. In this study, 51.37 per cent of participants were working at a university. The majority of them took panoramic and lateral cephalometric radiographs. Dental cast models were used by 76.8 per cent of participants and 8.86 per cent used an intraoral scanner. Three-dimensional photogrammetry was used by 6.33 per cent. Steiner and McNamara analyses were used for lateral cephalometry, preferably with computer assistance. Ricketts analysis was used for posteroanterior radiographs. The most widely used methods of model analysis were Bolton and Hayce-Nance with the use of callipers. Progress records were taken by 84.8 per cent of responders.

CONCLUSION: These findings provide information about the diagnostic approaches of Turkish orthodontists and highlights the work required to contribute to the development of orthodontics.

TEMPERATURE CHANGE ANALYSIS DURING THE STRIPPING PROCESS VIA A THERMAL CAMERA

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AIMS: To investigate temperature changes, measured with a thermal camera, on teeth due to the stripping process which is frequently used for reduction of interproximal tooth enamel in orthodontic practice.

MATERIALS AND METHOD: Eighty freshly extracted human premolar teeth were divided into four groups of 20 teeth each. The stripping process was undertaken with a metal handheld stripper, a perforated stripping disk and a tungsten carbide bur. A thermal camera was positioned on a tripod 4 cm from the occlusal surface of the teeth and connected to a computer by a data logger during the stripping procedures. Thermal video images were captured and recorded by a dedicated video card and transferred to the image processing software developed in the Matrix Laboratory (Matlab, numerical calculation and fourth-generation programming language) environment. Changes of temperature values measured during the stripping process in each group were statistically evaluated.

RESULTS: Statistically significant temperature rises were observed in all groups during the stripping process ($P < 0.001$). The highest temperature rise was observed when using a high-speed handpiece with a tungsten carbide bur ($P < 0.001$) and the lowest temperature rise during stripping with a metal handheld stripper ($P < 0.001$).

CONCLUSION: The safest stripping method is the use of a metal handheld stripper. A thermal camera can be useful for the thermal measurements.

THE ASSOCIATION OF DENTAL CARIES WITH MALOCCLUSIONS IN THE MIXED DENTITION

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AIMS: To investigate if high values of DMFT/dmft indices constitute risk factors in various types of malocclusions in the mixed dentition.

MATERIALS AND METHOD: Six hundred mixed dentition study casts. The World Health Organisation dental caries criteria were applied to both groups. The existence of an increased caries risk was determined from the dmft and DMFT indices related to age. Malocclusion was classified in the three planes in accordance with the major symptom. Statistical analysis was conducted in SPSS 16.0 for Windows. The risk factors were identified through calculating the odds ratio (OR) and relative risk.

RESULTS: The mean dmft/DMFT index in the mixed dentition was 3.64 ± 2.69. The highest values of the dmft/DMFT indices were found in patients with a normal overjet (4.73 ± 2.89) and normal overbite (4.04 ± 2.78). In the transverse plane, the lowest values of the DMFT/dmft indices were recorded in patients with spacing (2.63 ± 1.92), and the highest values in patients with a combined diagnosis of crowding and a lateral crossbite (4.97 ± 3.01) irrespective of crowding and spacing (4.65 ± 2.79). The presence of malocclusions in the three planes was not influenced by an increased DMFT/dmft index (DMFT/dmft >5) unless there was a combined diagnoses of crowding and lateral crossbite and crowding and spacing where the relative risks were over 2.5.

CONCLUSION: The prevalence of dental caries in children in the mixed dentition is higher in patients diagnosed with a normal overjet and normal overbite. In terms of the risk of developing a certain malocclusion, a combined diagnosis of crowding and lateral crossbite and crowding and spacing, respectively are present under a high caries activities.

SP88 SKELETAL MATURATION PATTERNS OF CHILDREN WITH A UNILATERAL CLEFT LIP AND PALATE
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AIMS: To assess, in a case-control study, skeletal maturity in children with a unilateral cleft lip and palate (UCLP) using the radiographic hand-wrist maturation method and to compare it with that of non-cleft children. Some studies have shown that children with a cleft lip and palate may be at risk of growth problems. Although there are studies regarding growth and development of children with clefs, research has mostly focused on changes in height and weight instead of skeletal maturation indicators, thus it was preferred to use hand-wrist radiographs in view of the fact that they are more elaborate and precise than the other methods.

SUBJECTS AND METHOD: Fifty patients (30 males, 20 females) with a UCLP. Their ages ranged between 8.58 and 15.83 years. There were compared with 50 skeletal Class I control subjects (30 males, 20 females) without clefts in an age and gender one-to-one matched control group (cleft group: 30 males 20 females, mean age: 12.37 years; non-cleft group: 30 males 20 females, mean age: 12.38 years). These two groups were compared with each other according to the norm values in Greulich-Pyle's hand and wrist growth atlas.

RESULTS: When the overall growth of cleft and non-cleft controls were compared with a Student’s t-test and one-way ANOVA, no significant difference was recorded. However, when the findings were evaluated according to the chronological ages of the subjects, cleft patients prior to or at the peak growth stages (S and MP3cap) showed significant delays in skeletal maturation when compared with the control subjects. Thirteen cleft patients (8 males, 5 females) showed retardation of more than one year compared with chronological age, but this difference was not significant.

CONCLUSION: Although overall skeletal maturation levels of cleft and control subjects was not statistically significant, individual evaluation of subjects with a UCLP exhibited a slight delay in skeletal maturation at earlier growth stages when compared with non-cleft growing control subjects.

SP89 RELATIONSHIP BETWEEN THE ASYMMETRIC POSITION OF PORION AND MANDIBULAR ASYMMETRY
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AIMS: To evaluate the relationship between an asymmetric position of porion and mandibular asymmetry using cone beam computed tomography (CBCT).

MATERIALS AND METHOD: The anteroposterior symmetry of porion was investigated on CBCT images from 100 patients. Eighteen patients (6 males, 12 females, mean age 17.6 ± 5.1 years) who had an anteroposteriorly asymmetric position of porion more than 3 mm were selected, and classified into two groups based on the deviation of the mandible (group 1, no deviation of menton; group 2, menton deviation >2 mm). The length of the mandibular body and ramus height were measured.

RESULTS: Thirteen patients (72.2%) showed minimal or no menton deviation (average 0.6 mm), even though the position of porion was anteroposteriorly asymmetric (4.1 mm). Only five subjects (27.8%) out of 18 patients showed transverse deviation of menton (average 3.1 mm). In group 1, mandibular body length and ramus height were longer on the side where porion was positioned more posteriorly. In group 2, however, there was no significant correlation between an asymmetric position of porion and mandibular body length or ramus height.

CONCLUSION: The majority of patients who had an asymmetric position of porion exhibited no transverse deviation of the mandible. The mandibular body and ramus may play a role in compensating for asymmetry in the cranial base.

SP90  INCISOR COMPENSATION AND SKELETAL DISCREPANCY IN CLASS III GROWING PATIENTS
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AIMS: Significant relationships between the amount of both maxillary and mandibular incisor dental compensation and the severity of skeletal Class III malocclusion in adults have been reported. However, such relationship in growing Class III patients has never been assessed. Therefore the aim of this study was to evaluate the relationship between incisor inclination and the amount of skeletal discrepancy among a group of Class III growing patients.

MATERIALS AND METHOD: Lateral cephalometric radiographs of 48 Class III growing patients (ANB <1.5°) were measured (17 boys, 31 girls; mean age 10.04 ± 1.77 years). Maxillary incisor inclination (UINA and UIPP) and mandibular incisor inclination (LINB and LIMP) were measured. Correlation between incisor inclination and degree of skeletal discrepancy was analyzed using Pearson’s correlation tests at the P < 0.05 level of significance.

RESULTS: Significant correlations were found between ANB and LINB (r = 0.371; P < 0.05) and ANB and LIMP (r = 0.434; P < 0.05). Neither UINA nor UIPP were significantly related to ANB (P > 0.05).

CONCLUSION: Mandibular incisor compensation was significantly related to the severity of skeletal discrepancy among these Class III growing patients. Lower incisor inclination may be a useful clinical characteristic for the determination of a Class III skeletal discrepancy in children.

SP91  COMPARISON OF ORAL HEALTH-RELATED QUALITY OF LIFE AMONG PATIENTS RECEIVING CLEAR ALIGNERS VERSUS FIXED ORTHODONTIC APPLIANCE THERAPY
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AIMS: To assess and determine changes in oral health-related quality of life (OHRQoL) during orthodontic treatment, and to compare changes in OHRQoL between those who received clear aligners (Invisalign®) versus fixed orthodontic appliance therapy (FOAT).

SUBJECTS AND METHOD: A total of 95 patients were recruited at a teaching hospital and private orthodontic clinics: 45 Invisalign® and 50 FOAT cases. Assessments of OHRQoL were conducted using the generic short form of the Oral Health Impact Profile (OHIP) 14 and a condition specific measure, OHIP-Aesthetic. Assessments of OHRQoL were conducted at baseline and at 3 months during treatment. Changes in OHRQoL scores was determined over time and comparison made across treatment modalities. The magnitude of statistical differences were calculated (effect sizes).

RESULTS: The response rate was 84 per cent with 40 Invisalign® and 40 FOAT cases. Changes in OHIP-14 scores and OHIP-Aesthetic scores were apparent (P < 0.05), indicating improvements in
OHRQoL during treatment. The OHIP-Aesthetic measure was more sensitive to identifying changes in OHRQoL than the OHIP-14. Among the FOAT group greater improvements in OHRQoL (both in terms of OHIP-14 and OHIP-Aesthetic scores) were observed, compared to those receiving Invisalign® therapy. The magnitude of statistical differences (effect sizes) were larger for the FOAT group compared to the Invisalign® group, albeit for the most part small to moderate.

CONCLUSION: Significant improvements in OHRQoL were apparent during orthodontic treatment among those receiving both FOAT and Invisalign® therapy. The condition specific OHRQoL measure was more sensitive to identifying improvements than the generic OHRQoL measures. Improvements in OHRQoL, and the magnitude of statistical change was greater for those undergoing FOAT compared to Invisalign®.

SP92  ASSOCIATION OF TEMPOROMANDIBULAR JOINT DISC DISPLACEMENTS WITH MANDIBULAR CONDYLE VOLUMES IN ADULT FEMALE PATIENTS
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AIMS: Temporomandibular joint (TMJ) disc displacements (DD) frequently occur with bony changes on the articular surface of the mandibular condyle. The aim of this study was to assess differences in the volumes of the mandibular condyle, and cortical and medular bones using computed tomography (CT) in adult female orthodontic patients according to TMJ DD status.

MATERIALS AND METHOD: Eighty condyles in 40 adult female patients. Each subject consented to magnetic resonance images (MRI) and CT to evaluate their TMJs. They were divided into three groups based on MRI of the TMJs: normal disk position (NR, n = 18), disk displacement with reduction (DDR, n = 25) and disk displacement without reduction (DDNR, n = 37). Condylar volume and volumes of the cortical and medular bones were calculated after segmentation of the condyles from three-dimensional CT images. Differences in volumetric measurements with respect to TMJ DD status were tested with one-way analysis of variance at a significance level of 0.05.

RESULTS: All volumetric measurements were significantly influenced by TMJ DD status. All measurements tended to decrease as TMJ DD progressed to a more severe condition, but there were some differences among the three regions. There were significant differences in condylar and medular bone volumes between NR or DDR and DDNR (NR, DDR > DDNR; P < 0.001, respectively), while cortical bone volumes were significantly different between NR and DDNR (NR > DDNR; P < 0.05).

CONCLUSION: Condylar volume and volumes of the cortical and medular bones are significantly associated with TMJ DD status and condyles with TMJ DD, specifically DDNR, show a smaller size and smaller volumes of cortical and medular bones.

SP93  COMPARATIVE ANALYSIS OF THE RESULTS OF ORTHODONTIC MEASUREMENTS MADE ON THREE-DIMENSIONAL DIGITAL MODELS AND PLASTER DENTAL MODELS
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AIMS: Anthropometry of the dental arches is important in the diagnosis and treatment planning of patients with malocclusions. Traditionally it is undertaken on plaster study models. Modern technologies enable orthodontists to use three-dimensional (3D) digital models. However, their application has to be scientifically proven. The aim of this study was scientific proof of 3D models for orthodontic measurements based on comparison of the results with anthropometric measurements made on plaster study models; the gold standard.

MATERIALS AND METHOD: Twenty one pairs of dental casts were measured using digital callipers. Plaster models were scanned by an optical scanner OpenTechnologies. All measurements on digital models were made using DDP-Ortho software (OrthoLab, Poland). The following measurements were performed: mesiodistal tooth widths (MDTW); Bolton analysis (overall and anterior). The
impact on the results of measurements of mesio-distal tooth widths by different parameters of the dental arches (whether upper or lower), side (right or left), or dental crowding was assessed.

RESULTS: The average MDTW for all data determined by software was $7.40 \pm 0.08$ mm, the same determined manually, $7.39 \pm 0.07$ mm ($P > 0.05$). It was noted that the impact of severe dental crowding on the determination of MDTW was less with traditional measurements ($8.18 \pm 0.21$ mm) compared with 3D ($7.96 \pm 0.20$ mm) ($P < 0.05$). MDTW differed more with respect to the first molars, central and lateral incisors. Pearson correlation coefficients showed that the general average means of Bolton's overall and anterior indices did not vary significantly depending on the method ($P > 0.05$).

CONCLUSION: In general, the differences in measurements of MDTW and Bolton index on digital and plaster models were not considered statistically meaningful. The determination of MDTW depends on the position in the dental arch, the side and the degree of dental crowding irrespective of the method of determination. Thus, orthodontic measurements of teeth and dental arches on 3D models in linear and index measurements provide sufficient accuracy and may be used in diagnosis and research. Digital 3D models are a reliable base for diagnosis and planning of orthodontic treatment.

SP94  EFFECT OF ORTHODONTIC TOOTH MOVEMENT ON GENE EXPRESSION PATTERN IN THE HEALING PROGRESS OF ALVEOLAR DEFECT IN BEAGLES
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AIMS: To investigate the impact of orthodontic tooth movement (OTM) on gene expression in regenerated tissue following alveolar defect surgery in beagles.

MATERIALS AND METHOD: The maxillary first premolars of four male beagles were divided into the following four treatment groups: group C, baseline control group without surgical intervention; group D2, 2 weeks of healing post-surgery; group D6, 6 weeks of healing post-surgery; and group DT6, 6 weeks of healing post-surgery with assisted OTM. In the experimental groups, a critically-sized defect in the extraction socket of the maxillary first premolar was created. In the DT6 group, the maxillary second premolar was protracted into the defect for 6 weeks. Microarray gene profiling was performed and quantitative real-time polymerase chain reaction (qRT-PCR) was undertaken to verify the expression of a subset of target genes selected from the microarray functional annotation.

RESULTS: The gene expression pattern in the regenerated tissue was shown to allow tooth movement over the 6 week time period after alveolar surgery, and this pattern was highly similar to that observed in the woven bone-like tissue at 2 weeks of natural healing. Specific genes participating in the regulatory mechanisms of bone morphogenesis and mineralization were identified in the DT6 group as well as in the D2 group when compared to group D6. These included MMP-13, TNFSF11, SPP1, and DMP1. qRT-PCR verified the differential expression of each target gene, further highlighting the differences between groups DT6 and D6.

CONCLUSION: Activated alveolar remodelling activities induced by OTM could be synchronized with active bone regeneration in order to optimize the matrix necessary for efficient, long-term tooth movement as well as enhanced wound healing.

SP95  ROLE OF PIN1 ON PERIODONTAL CELLS IN VIVO AND IN VITRO
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AIMS: Pin1 is a ubiquitous enzyme that regulates diverse cellular processes, including growth-signal responses, cell-cycle progression, cellular stress responses and immune responses, and aberrant Pin1 function has been implicated in several human diseases. The aim of the present study was to determine the distribution patterns of Pin1 during the development of periodontal tissues in vivo and to examine the role of Pin1 during the differentiation of periodontal ligament (PDL) cells, cementoblasts and osteoblasts in vitro, and its potential mechanism.

MATERIALS AND METHOD: Embryonic and postnatal rat mandibles from 2- and 4-week-old mice were dissected and fixed and expression of Pin 1 was analyzed by immunohistochemistry. Expression...
of Pin1 and differentiation was assessed by RT-polymerase chain reaction, alkaline phosphatase activity, alizarin red staining and Western blotting.

RESULTS: Pin1 protein was strongly expressed in periodontal tissues including PDL cells, pre-cementoblasts and pre-osteoblasts along the developing root surface and alveolar bone at the root formation and PDL alignment stage, and erupted and functional stages of the tooth. Pin1 mRNA and protein was persistently expressed during differentiation of PDL cells, cementoblasts and osteoblasts. Inhibition of Pin1 using juglone dose-dependently stimulated osteoblastic differentiation in PDL cells, cementoblasts and osteoblasts, was confirmed by ALP activity, calcium deposition and mRNAs induction of differentiation markers. In contrast to Pin1 inhibition, the overexpression of Pin1 via adenoviral infection (Ad-Pin1) inhibited differentiation in these cells. Moreover, juglone enhanced the osteogenic medium-induced activation of AMPK, mTOR, Akt, ERK, p38, and NF-κB pathways, which was blocked by Ad-Pin1 infection.

CONCLUSION: The present study shows, for the first time, that Pin1 plays important regulatory roles in the development and differentiation of periodontal tissue, and may have clinical implications for periodontal regeneration.

SP96  DOES INCISOR PROCLINATION INFLUENCE PERCEIVED TOOTH COLOUR?
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AIMS: Social attractiveness is influenced by a variety of different smile-related factors and should reflect a harmonious interplay between the teeth and gums, including the size, shape and visibility of the teeth and gums as well as tooth colour. The aim of this study was to evaluate whether the degree of proclination of the upper central incisors can result in a brighter smile.

SUBJECTS AND METHOD: Forty young adults (20-25 years) in good health with a sound complete dentition. Dental exclusion criteria were: previous restorations on the anterior teeth, active hard and soft tissue disease and inadequate oral hygiene. The subjects were seated on a stool placed in a standardised area in respect to an above directed light source in a room with no windows. Their natural head position was stated as 0. In order to mimic the range of possible anterior torque movements the subjects were asked to tilt their heads upward 15 degrees (+15) and downward 15 degrees (–15). Frontal macro photographs, parallel to the Frankfort plane of the patient’s natural head position without the use of a flash were taken at the three angulations (+15, 0, –15). The photographs were sorted on a computer and analysed for colour differences at the centre of the incisor clinical crowns with specialised software. A paired t-test was used to determine the significance between each value for each inclination.

RESULTS: There was a statistical difference between the Red-Green-Blue (RGB) colour and lightness values between +15-0 degrees (P < 0.0001), –15-0 degrees (P < 0.0001) and –15+15 degrees (P < 0.0001) and between all the values RGB and lightness values (P < 0.0001). As the inclination of the Frankfort horizontal of the subject changed from 0 to –15 degrees the RGB and lightness values decreased indicating a ‘darker’ colour. As the inclination of the Frankfort horizontal of the subject changed from 0 to +15 the RGB and lightness values increased indicating a ‘lighter’ colour.

CONCLUSION: Apart from the functional condition, the correct incisor inclination after orthodontic treatment is necessary for optimal aesthetic results.

SP97  CRANIOFACIAL SHAPE DIFFERS IN SUBJECTS WITH TOOTH AGENESIS: A GEOMETRIC MORPHOMETRIC ANALYSIS
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AIMS: To evaluate the shape of the craniofacial complex in patients with tooth agenesis and compare it to matched controls.

SUBJECTS AND METHOD: The sample comprised 456 patients that were allocated to three groups: the agenesis group of 100 patients (47 males, 53 females) with more than one tooth agenesis (excluding third molars), the third molar agenesis group (one to four missing third molars) of 52 patients (21 males, 31 females), and the control group (304 patients), consisting of two patients
matched by age and gender to each patient of the agenesis groups. The main craniofacial structures depicted on lateral cephalograms were digitized and traced with 15 curves and 127 landmarks, of which 116 were semi-landmarks and 11 were fixed landmarks. These landmarks were subjected to Procrustes superimposition and Principal Component Analysis in order to describe shape variability of the cranial base, maxilla and mandible, as well as of the whole craniofacial complex.

RESULTS: Approximately half of the samples’ variability was described by the first three principal components; the first 12 components accounted for 80 per cent of the variability. Comparisons within the whole sample revealed sexual dimorphism of the craniofacial complex and its structures (permutation test, 10,000 permutations, $P < 0.01$), whereas comparisons within each group revealed sexual dimorphism of the cranial base (permutation test, 10,000 permutations, $P < 0.01$). Differences between the patients of the agenesis group and their controls were found in the shape of all the craniofacial structures except for the cranial base (permutation test, 10,000 permutations, $P < 0.05$). Specifically, the patients in the agenesis group presented with a Class III tendency and a hypodivergent skeletal pattern. Comparison of the third molar agenesis group to its control revealed differences only in the shape of cranial base and maxilla for males (permutation test, 10,000 permutations, $P < 0.05$).

CONCLUSION: The shape of the craniofacial complex differs in patients with tooth agenesis suggesting that common factors are implicated in tooth development and craniofacial morphology.

SP98 COULD CYTOPROTECTIVE SIGNALLING IN AXOLOTLS MEDIATE SCARLESS WOUND REPAIR?
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AIMS: Cleft lip and palate repair requires multiple surgeries that can result in hampered growth of the maxilla and dentition. Minimizing the effects of scar tissue formation could prevent this. In the axolotl no scarring occurs following injury, which is thought to relate to an attenuated inflammatory response. It was postulated that the axolotl mediates this by induction of anti-inflammatory and anti-oxidant genes, such as heme oxygenase (HO-1) and ferritin.

MATERIALS AND METHOD: Axolotls were wounded with a 1.5-mm skin biopsy punch which removed the epidermis, dermis and basement membrane. Using histological staining, HO-1 levels were analyzed. In addition, the upstream target nrf-2 and downstream target ferritin were also tested. Paired sample t-tests were used for statistical analysis.

RESULTS: The anti-inflammatory protein HO-1 and the iron-scavenger ferritin are strongly and constitutively expressed in the unwounded skin of axolotls. Following wounding, HO-1 positive cells are recruited from the central veins to the wound area. The transcriptional factor Nrf2 had translocated to the nucleus of selected cells within the wound area. Also in mice it was demonstrated that HO-1 positive macrophages are recruited to the wound area. Four days after wounding there are almost no HO-1 positive cells in the veins nor in the connective tissue, but HO-1 and ferritin are strongly present in the migrated keratinocytes and Leydig cells that form the new skin in the axolotl.

CONCLUSION: The Nrf2-HO-1-ferritin axis seems to act as a protective layer and is constitutively expressed in the skin of axolotls. Following wounding, this protection is interrupted and HO-1 and ferritin-positive cells swiftly repopulate the wounded area and their activity may contribute to the attenuated inflammatory response. More research into this cytoprotective signalling pathway is warranted to elucidate its possible orchestrating role in protection against scar formation.

SP99 PATIENTS’ PERSPECTIVES OF INFORMATION PROVISION FOR ORTHOGNATHIC SURGERY – A SERVICE EVALUATION
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AIMS: To assess the current information provision for patients on the orthognathic surgery pathway at Whipps Cross Hospital. The objective was to make the information more patient-centred and tailored to individual needs.
MATERIALS AND METHOD: Postal questionnaires were sent to all patients who had undergone orthognathic surgery since 2010, together with invitations to participate in focus group discussions. The results for the questionnaires were analysed using descriptive statistics. A purposive sampling technique was used to select patients for the focus group discussion, which was mediated by two members of the team not involved in the patient’s treatment. The interview was transcribed verbatim and analysed using framework analysis.

RESULTS: Thirty five questionnaires were returned completed. The majority of respondents were satisfied with the information provided to them regarding the pathway. When the results were categorised according to the formats of information provision, verbal information scored the highest whereas written information scored the lowest. Seventy per cent of respondents felt most comfortable obtaining information from their orthodontist. The greatest concern for most patients was the surgery (n = 18, 51%), followed by the duration of treatment (n = 11, 31%). Four patients attended the focus group discussion, each at different post-operative stages. All types of surgical procedures were represented by the group. Three key themes emerged from the framework analysis, which included: an emotional support network for patients; timeframe of treatment stages; suggestions for improvement in information provision for future orthognathic patients.

CONCLUSION: Patients were dissatisfied with the written information provided to them on orthognathic treatment. An individualised patient information pack including ‘top tips’ from patients who had undergone orthognathic surgery and a diagrammatic breakdown of treatment stages was developed. Procedures are in place to develop a mentoring scheme and quarterly group information clinics.

SP100 THE MAXILLA AND MIDDLE PART OF THE FACE IN PATIENTS WITH DIVERGENT AND CONVERGENT FACIAL TYPES OF MANDIBULAR PROGNATHISM
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AIMS: To conduct a cephalometric analysis of the morphology of maxilla, including the whole middle part of the face, in patients with divergent and convergent facial types of mandibular prognathism, as well as to determine differences between them.

MATERIALS AND METHOD: Cephalometric radiographs of 90 patients were analyzed. On the basis of dentoskeletal relationships of the jaws, the patients were divided into three groups: P1 (patients with a divergent facial type of mandibular prognathism), P2 (patients with a convergent facial type of mandibular prognathism) and the group E (control group or eugnathic patients). Nine cephalometric parameters related to the middle face were measured and analyzed.

RESULTS: The effective length of the maxilla, the length of the maxillary corpus and the length of the hard palate were significantly shorter in group P1 compared to group P2 and also in both P1 and P2 compared with group E2. The length of the hard palate was significantly shorter in group P1 compared to group E2, whereas the angle between the soft and hard palate was significantly smaller in group P2 compared to group E2. Additionally, there was a pronounced incisor dentoalveolar compensation of the skeletal discrepancy in both mandibular prognathism groups manifested in the form of significant upper anterior tooth protrusion, but without significant differences among the groups, while maxillary retrognathism was present in most patients in groups P1 and P2. A pronounced U6PP (posterior maxillary hyperplasia) was found only in patients in group P1.

CONCLUSION: The upper jaw is one of the key factors which contributes to diagnosis, but primarily for treatment planning for mandibular prognathism. Accurate assessment of the manifestation of abnormality, localization of skeletal problems and understanding of the biological potential are key factors for the stability of surgical-orthodontic treatment of this abnormality.

SP101 MAPA-CISION: A MINIMALLY INVASIVE PIEZOELECTRIC TECHNIQUE FOR GUIDED BONE REGENERATION IN ORTHODONTIC PATIENTS
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AIMS: Several surgical techniques, with different levels of invasiveness, have been proposed in order to accelerate orthodontic movement and increase alveolar bone volume. The aim of this case series was to test the MaPa-CISION technique, a minimally invasive piezoelectric technique for guided bone regeneration in orthodontic patients, evaluating its efficacy, safety and stability in terms of bone volume endurance and periodontal support integrity of the involved teeth.

SUBJECTS AND METHOD: Eight patients presenting a Class II or Class I malocclusion with narrow dental arches, crowding, thin gingival biotype and multiple gingival recessions, scheduled for multibrackets non-extraction orthodontic treatment with dentoalveolar expansion. They underwent surgical intervention following the MaPa-CISION technique that utilized a 3 x 4 cm collagen membrane (Bio-Gide®) filled with hydroxyapatite particles (Bio-Oss®) of 0.25-1 mm size and sutured with a 5-0 Vicryl® suture in order to create a ‘pillow’ that is positioned through vertical vestibular soft tissues incisions under the periosteum of the zone were volume increase was needed following which vertical interdental corticotomies were performed with a Piezosurgery® handpiece. Edgewise brackets of two different slot dimensions were utilized, according to the bidimensional technique. The first archwire, a 0.016 x 0.022 Sentalloy, was applied immediately after surgery and a stainless steel 0.016 x 0.022 archwire, the working archwire for the bidimensional technique, was applied within 3 months. Cone beam computed tomographic (CBCT) examinations, orthodontic and periodontal measurements were collected before surgery and were compared with the 4 year follow-up records.

RESULTS: No complication occurred either during or after surgery; mean duration of alignment and levelling phase was 4 months; bone augmentation, measured by means of CBCT images, was maintained during the 4 year follow-up period; tooth stability and periodontal health, measured both radiographically and clinically with complete periodontal charting, were good 4 years after bracket removal.

CONCLUSION: The MaPa-CISION technique is safe and effective in order to accelerate orthodontic movement and to increase alveolar bone volume, with no negative effect on the periodontal tissues or tooth stability.

SP102 ATTITUDES TOWARDS TELEMONITORING IN ORTHODONTISTS AND ORTHODONTIC PATIENTS: A CROSS-SECTIONAL STUDY
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AIMS: Telemonitoring systems are progressively gaining more diffusion in medicine and dentistry, together with the improvement of general population skills in new technology utilization. Therefore the aim of this study was to analyse orthodontists’ and patients’ attitude towards the use of Dental Monitoring, an app based system for orthodontic patients’ telemonitoring.

SUBJECTS AND METHOD: Thirty orthodontist and 60 patients seeking orthodontic treatment were enrolled in this university-based cross-sectional study. Inclusion criteria were: age between 14 and 50 years for patients and between 30 and 50 years for orthodontists. After an oral presentation, explaining, through demonstration videos and printed leaflets, the use of the Dental Monitoring system, the participants were asked to complete a questionnaire investigating their attitude towards telemonitoring and their opinion regarding its usefulness. Sociodemographic data were recorded and the Mann-Whitney U test and chi-square contingency tables were utilized to analyse the effect of gender, age and smartphone ownership on telemonitoring attitude. A multiple regression analysis was then used to estimate this effect. When common questions were present in both questionnaires, a comparison was made between patients’ and orthodontists’ attitude.

RESULTS: None of the patients were aware of the possibility of using a smartphone based monitoring system, whereas 70 per cent of orthodontists had used an internet based system at least once to monitor emergency cases and 20 per cent of them regularly telemonitored their patients. Eighty seven per cent of patients reported their availability to take photographs of their teeth every 2 weeks, 93 per cent positively judged the possibility to reduce the number of in-office visits, and 100 per cent considered the use of telemonitoring indicative of high technology and high quality
treatment. Fifty seven per cent of orthodontists positively judged the possibility to reduce the number of in-office visits, 73 per cent considered it useful to periodically measure tooth movements, 90 per cent believed that telemonitoring could be an effective marketing tool, and 63 per cent were concerned about the economic impact of telemonitoring systems on their financial budget. Gender and age did not influence attitudes towards telemonitoring, whereas smartphone ownership was significantly associated with a positive judgement.

CONCLUSION: The patients in this study showed a more positive attitude towards telemonitoring compared with orthodontists.

SP103 DISTRIBUTION OF MALOCCLUSION AMONG ORTHODONTIC PATIENTS WITH SLEEP DISORDERED BREATHING RISK, SNORING AND OBSTRUCTIVE SLEEP APNOEA

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AIMS: To identify the sagittal skeletal and dental malocclusion traits and transverse maxillary configuration of children from an orthodontic population at risk of sleep disordered breathing (SDB) as identified with a questionnaire, and the presence of snoring and obstructive sleep apnoea (OSA).

SUBJECTS AND METHOD: Fifty nine patients were included in this study from an orthodontic consultation clinic. All patients completed a SDB questionnaire. Fifty two patients with a SDB score of 7 or above were referred to a sleep physician. Seven patients were also referred to a sleep physician despite having a score of less than 7; because the orthodontist, the general practitioner or the ear, nose and throat surgeon identified risks for OSA due to other medico-dental reasons. After polysomnography, the patients were classified into no significant OSA or mild-moderate OSA groups. The skeletal and dental classification, overjet and overbite, transverse maxillary configuration were compared among the two groups.

RESULTS: Of the 59 patients, 52 (88.2 %) showed a SDB score of 7 or higher. Thus far 28 of these patients have had an overnight polysomnography. From these, 21 (75%) patients were diagnosed with mild to moderate OSA. The skeletal configuration of these OSA patients were: 15 patients (71.4%) showed Class II, four (19%) a Class I and two (9.5%) a Class III. Only four of the OSA patients had a normal sized maxilla and of these three had a skeletal Class II and one a skeletal Class III. The rest of the OSA patients had either a narrow maxilla (n = 11), a unilateral crossbite (n = 2) or a bilateral crossbite (n = 4), P = 0.668. Dentally there were six Class I, 12 Class II and three Class III patients. The patients with a SDB score of less than 7 exhibited mostly a skeletal Class II and a narrow maxilla. However none of these differences between skeletal and dental configurations and OSA were statistically significant (P = 0.092 and 0.337, respectively).

CONCLUSION: This pilot study investigated the distribution of skeletal and dental sagittal malocclusion and transverse relationships among orthodontic patients with SDB risk, snoring and OSA. There was a trend for a skeletal Class II relationship and a transverse maxillary problem in patients suffering from OSA. Data collection is ongoing.

SP104 CYTOTOXICITY OF AESTHETIC ORTHODONTIC WIRES: AN IN VITRO STUDY

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AIMS: To investigate the cytotoxicity of aesthetic orthodontic archwires with different surface coatings.

MATERIALS AND METHOD: Three fully coated tooth coloured nickel titanium (NiTi) wires (Bio Cosmetic, Titanol Cosmetic, EverWhite), two ion implanted wires (TMA Purple, Sentalloy High Aesthetic), five uncoated NiTi wires (Bio Starter, Bio Torque, Titanol Superalastic, Memory Wire Superalastic and Sentalloy), one β-titanium wire (TMA) and one stainless steel wire were considered for this study. The wire samples were placed at 37°C in airtight test tubes containing Dulbecco’s Modified Eagle’s Medium (0.1 mg/ml) for 1, 7, 14 and 30 days. Cell viability of human gingival fibroblasts (HGFs) cultured with this medium was assessed by the 3-(4,5-dimethylthiazol-2-yl)-2,5-
diphenyltetrazolium bromide (MTT) assay. Data were analyzed by a two-way analysis of variance (ANOVA; α = 0.05).

RESULTS: The highest cytotoxic effect was reached on day 30 for all samples. The archwires exhibited a cytotoxicity on HGFs ranging from none to slight with the exception of Bio Torque, which resulted in moderate cytotoxic on day 30. Significant differences were found between aesthetic archwires and their uncoated pairs only for Bio Cosmetic ($P = 0.001$) and EverWhite ($P < 0.001$).

CONCLUSION: In the experimental conditions, all the aesthetic archwires resulted in slight cytotoxicity as well as the respective uncoated wires. For this reason their clinical use may be considered to have similar risks to the uncoated archwires.

SP105  CEPHALOMETRIC CHARACTERISTICS OF LONG FACE PATIENTS
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AIMS: Achieving an ideal treatment plan for improvement of facial appearance depends on a complete understanding of facial type characteristics. One of the most common groups of skeletal problems are vertical discrepancies, including increased vertical dimension or long face syndrome and decreased vertical dimension or short face syndrome. In the literature, it has been reported that the cephalometric characteristics of long face syndrome are: an increased mandibular plane angle, increased LAFH, decreased PFH, short ramus height, lip incompetence and anterior open bite (AOB), etc. Nevertheless, because of several vertical relapses, it seems that this problem may exhibit various characteristics in addition to those mentioned. Therefore, a simple explanation of such a complex pattern will be inadequate.

MATERIALS AND METHOD: A literature review was carried in Medline and PubMed with the objective to research the cephalometric characteristics of a long face pattern.

RESULTS: Several studies agree with the mentioned characteristics in references. However, in another study, positive and moderate correlation was found between PFH and ATFH but without an accompanying high or low mandibular plane angle with a low or high AFH. Moreover it was found that all long-faced patients do not exhibit an AOB and in another study, a shorter ramus height was reported in long-faced patients with an AOB in comparison to non-open bite subjects.

CONCLUSION: A long face pattern has more clinical and cephalometric characteristics in addition to those known that should be analyzed in subgroups of this pattern in order for an accurate diagnosis.

SP106  DENTAL AND SKELETAL EFFECTS OF A TONGUE CRIB APPLIANCE IN THE TREATMENT OF CLASS III PATIENTS
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AIMS: Evaluation of the dental and skeletal effects of the tongue crib in the treatment of skeletal Class III malocclusions.

SUBJECTS AND METHOD: In this quasi-experimental before-after study 12 patients were treated with a tongue crib. It was a removable appliance used for at least 16 hours a day. The patients were under treatment for approximately one year and at the end of treatment a cephalogram was taken for each patient.

RESULTS: An increase in SNA was seen representing a more anterior position of the maxilla. The anteroposterior growth of the mandible was continued. The mandibular incisors were retruded while the maxillary incisors were protruded. Forward rotation of the maxilla was seen without a significant change in the soft tissue in the nasolabial region.

CONCLUSION: A tongue crib is effective in the treatment of skeletal and dental Class III malocclusions in maxillary deficient patients. It causes maxillary protraction and so improves the sagittal relationship of the jaws.

SP107  PHOTOGRAPHIC DISCREPANCIES IN THE VERTICAL PLANE AND THEIR USE AS A DIAGNOSTIC METHOD
AIMS: To evaluate overbite level with photographic records and to determine if angulation between the object and the camera at a vertical level influences orthodontic diagnosis.

MATERIALS AND METHOD: An observational, descriptive and transverse study. Six intraoral frontal photographs were taken of the same patient, changing the angulation of the camera for each shot(+45°, +30°, +15°, 0°, −15°, −30°). The angulation was 0 when the camera was perpendicular to the frontal plane. These photographs were shown to 131 students enrolled in an undergraduate programme in a dental school from Granada University (62 students) and Rey Juan Carlos University (69 students). They were asked to diagnose the overbite level by looking at the six random photographs with different angulations.

RESULTS: Changes in the angulation of the camera influenced overbite diagnosis. It is difficult to compare this study with others as no related articles could be found.

CONCLUSION: The ideal photograph for an accurate overbite diagnosis must be taken so that the occlusal plane is centred both horizontally and perpendicular to the camera plane. Changes in angulation can lead to diagnostic errors. A 15 degree angle change (−15° in open bite and +15° in deep bite patients) does not affect the diagnosis.

SP108 QUANTIFYING THE OUTCOME OF SURGICAL TREATMENT OF TEMPOROMANDIBULAR JOINT ANKYLOSIS: A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: Temporomandibular joint ankylosis results in restricted mouth opening due to a fibrous or bony (non-neoplastic) union of the mandibular head to the glenoid fossa. Early surgical treatment is recommended, but the ideal surgical technique is debated. The objective of this study was to quantify the effect of the different surgical interventions on maximal (interincisal) mouth opening.

MATERIALS AND METHOD: The systematic literature search (1960-2015) was based on PubMed, Web of Science and Cochrane. Pooled mean differences and 95 per cent confidence intervals between pre- and post-operative maximal mouth opening (in mm) were calculated with random-effects meta-analyses. The surgical interventions were grouped according to increasing complexity: gap arthroplasty, interposition arthroplasty and reconstruction arthroplasty.

RESULTS: Thirty-eight articles were identified (1993-2015), including 1215 operated patients; 84 per cent was caused by trauma, and 8 per cent by infection. Gap arthroplasty (N = 463), interposition arthroplasty (N = 409) and reconstruction arthroplasty (N = 293) resulted in improved maximal mouth opening of 26.2 mm (95%CI 24.1-28.2), 26.7 mm (95%CI 24.6-28.8) and 30.6 mm (95%CI 28.7-32.5), respectively, and overall 28.7 mm (95%CI 26.7-29.2). The mean pooled post-operative maximal mouth opening ranged between 33.0-36.1 mm.

CONCLUSION: Maximal mouth opening improved most after reconstruction arthroplasty, and least after gap arthroplasty. However, the post-operative maximal mouth opening was similar for all techniques.

SP109 IS THERE A CORRELATION BETWEEN SLEEP DISORDERED BREATHING SYMPTOMS BASED ON QUESTIONNAIRES AND MAXILLARY EXPANSION?

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AIMS: To know whether sleep disordered breathing (SDB) symptoms are common in patients who need orthodontic maxillary expansion and if patients treated with a maxillary expansion can benefit from this intervention.
SUBJECTS AND METHOD: Questionnaires were administered at baseline before orthodontic expansion to 62 children and 32 adults who needed orthodontic expansion. If possible a questionnaire at follow-up (3 months after the start retention of expansion) was also completed. Twenty eight children and 21 adults filled in the questionnaires at follow-up. Different questionnaires were used for the children and adults (an adult questionnaire was used if surgical assisted rapid palatal expansion was executed). The questionnaire for children was based on a Dutch translation of the 22-item Pediatric Sleep Questionnaire. Questionnaires for adults were based on the Dutch translation of the Epworth Sleepiness Scale, the Snore Outcomes Survey, the Spouse/Bed Partner Survey and questions used in the sleep laboratory of the University Hospitals Leuven (Belgium).

RESULTS: A big improvement was not seen concerning SDB after maxillary expansion. Possibly this was due to the short follow-up time.

CONCLUSION: Further follow-up is needed to see if orthodontic expansion can help improve SDB.

SP110 ONE IS MENTAL, THE OTHER IS DENTAL...OR HAVE THEY BECOME ONE IN THE ADOLESCENTS FROM THE 21ST CENTURY?!?!?
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AIMS: To examine the psycho-social impact of malocclusion in Macedonian adolescents, their perception of malocclusion and to analyse the adolescent’s need and motivating factors for orthodontic treatment, their experiences of bullying about dental appearance and establishment of their mutual influence.

SUBJECTS AND METHOD: A questionnaire survey of 2916 20 year old students from a public high school in Skopje was conducted. The self-rated Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ) to determine the psycho-social impact of malocclusion and the self-rated (Aesthetic Component of the Index of Orthodontic Treatment Need (AC IOTN) to determine the adolescent’s perception of malocclusion were used.

RESULTS: The desire to have beautiful teeth was the main motivating factor for orthodontic treatment (190 subjects, 64.4%). ‘To have straight teeth’ was the reason given for orthodontic treatment by 48.5 per cent. Forty five per cent believed that they needed treatment. About 12 per cent reported consistent or occasional teasing about the appearance of their teeth, of which 3.4 per cent was by their peers. The majority (84.75%) rated themselves as grade I of AC IOTN - minor degree of malocclusion. The PIDAQ score and of its four factors: dental self-confidence, aesthetic concern, psychological and social impact showed highly significant differences ($P < 0.001$) with the AC IOTN groups, confirming that these variables are independent factors. PIDAQ scores did not differ between the genders, the psycho-social impact of malocclusion was similar across the genders. The total PIDAQ score, and its four factors demonstrated a highly significant correlation ($P < 0.01$) with the adolescent’s perception of malocclusion - AC IOTN. The need for treatment and the motivating factors showed no statistically significant impact on the adolescent’s perception of their dental appearance. There were highly significant differences ($P < 0.01$) depending on the presence of bullying between the level of adolescent’s dental self-confidence, the aesthetic aspects, the psychological and social impact of malocclusion and the subjective need for treatment. A negative, indirect, highly significant correlation($P < 0.01$) was present between the adolescent’s dental self-confidence and their self-perception of malocclusion (AC IOTN), the aesthetic concerns and the psychological and social impact of malocclusion. Adolescents with lower levels of dental self-confidence more frequently than those with higher levels, feel that they have a need for orthodontic treatment.

CONCLUSION: The main reason that adolescents seek orthodontic treatment is to improve the aesthetics and to improve their psycho-social well-being. Malocclusion has a psycho-social impact in adolescents which grows with its increasing severity and the presence of bulling by peers. There is a greater need for treatment in adolescents with lower levels of dental confidence.

SP111 APPLICATION OF ALIGNERS IN PATIENTS WITH COMPROMISED PERIODONTAL HEALTH
Aims: To determine the opportunities for orthodontic treatment with aligners in adult patients with periodontal pathology of different severity for long-term rehabilitation.

Subjects and Method: Two hundred and sixty three patients with compromised periodontal health referred for orthodontic treatment. By random selection, 141 patients (21-60 years of age) were included. All had received active orthodontic treatment in the period from 2002-2012. Treatment was carried out by one specialist orthodontist. The patients were distributed according to the type of treatment appliances (aligners, buccal and lingual braces), and the severity of periodontal pathology (gingivitis, initial and advanced periodontal disease). The periodontal condition of the patients was examined clinically on models and on panoramic radiographs before and after the orthodontic treatment. The patients were followed-up in the retention period from 1 to 10 years. For retention fixed and vacuum retainers were used. Initial periodontal therapy was conducted before orthodontic treatment and maintenance therapy was undertaken during and after the end of treatment. With indications, before orthodontic treatment, periodontal surgery was applied.

Results: Of all patients treated (141), 16.30 per cent were indicated for treatment with aligners. Of these, 52.20 per cent had accompanying gingivitis (13% initial, 34.80% advanced periodontal disease). The comparative analysis of the patients’ periodontal status showed the periodontal condition was stabilized, which was observed also during the period of retention.

Conclusion: Complicated pathology in patients with different severities of periodontal problems requires a complex interdisciplinary treatment approach. Aligners can be successfully used for orthodontic treatment of periodontally compromised adults. The biomechanics of aligners allows controlled loading of the teeth and application of lower forces. This combined with simplified maintenance of oral hygiene enables stable results. Interdisciplinary orthodontic-periodontal therapy provides long-term rehabilitation of the dentition.

SP112 Effects of Specific Orthodontic Treatment Mechanics on Dental Arch Form

Aims: To determine the effects of Myobrace System™ appliances on dental arch form.

Subjects and Method: Thirty one patients (7 to 13 years) who received Myobrace™ treatment in the period from 2008 to 2015. As a first treatment step, a soft trainer for children was used, and if necessary, as a second step, a trainer was used. A protocol for wearing the appliance (10-12 hours daily) was established. At every treatment stage photographic documentation, diagnostic radiology (panoramic radiograph and lateral cephalogram) and plaster models were made. For monitoring the effects of the Myobrace™ on the dental arch form, 124 plaster models were evaluated, demonstrating the beginning and end of treatment of all 31 patients. The dental arch form was differentiated as oval, tapered and square. Such formed stainless steel arches (0.016 × 0.022") for the upper and lower jaw in three sizes (small, medium and large) were used for evaluation. The incisal edges of the anterior teeth and most prominent surfaces of the buccal cusps of the posterior teeth were marked to form a discontinuous occlusal contour. Every arch form (oval, tapered, square) was superimposed over every plaster model. The arch form with the most common points with the occlusal contour was selected. The evaluation was done by two different operators. Due to discrepancies in the results in two cases a third operator was included. The obtained results were statistically processed.

Results: In 83.9 per cent of cases the dental arch form was changed. The oval arch form was maintained in 75 per cent and changed to square in 25 per cent. The square arch form was maintained in 25 per cent and changed to oval in 75 per cent. No change from oval and square to tapered form was observed. The tapered form was changed in 95.6 per cent. In 84.1 per cent the tapered form was reshaped to oval, and in 15.9 per cent to square. In 79 per cent the dental arch form was maintained (9.7%) or changed to oval (69.3%).
CONCLUSION: The Myobrace System™ balances the muscles, stimulates the development of the dental arches and thus the teeth have a tendency for a better position and alignment.

SP113 INTERDISCIPLINARY APPROACH IN PATIENTS WITH ADVANCED PERIODONTAL DISEASE OF THE LOWER ANTERIOR TEETH
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AIMS: To follow up the clinical results of interdisciplinary treatment, incorporating mucogingival surgery and orthodontic treatment in patients with advanced periodontal disease of the lower anterior teeth.
SUBJECTS AND METHOD: Sixteen patients (age 45-60 years) with advanced periodontal disease of the lower anterior teeth. A mandatory requirement for inclusion in the study was at least one lower incisor in a terminal phase of periodontal disease. The treatment protocol included initial periodontal therapy, mucogingival surgery by epithelial-connective tissue graft, full orthodontic treatment with fixed appliances, periodontal maintenance therapy and retention. The 8-year retention was provided with the use of fixed retainer on the lower anterior teeth. Bone level, clinical crown height, gingival biotype, pocket depth, bleeding on probing, tooth mobility, biometric and cephalometric analyses were evaluated before, during and after the end of the treatment. The applied clinical protocol was identical for all patients.
RESULTS: Orthodontic treatment, started three months after mucogingival surgery, included intrusion and lingual movement of the lower anterior teeth. The width of the mucogingival tissues was increased. Migration of the buccal soft tissue margin in a coronal direction was achieved. The length of the clinical crowns was decreased. New approximal contacts were created, which ensured successful splinting.
CONCLUSION: The interdisciplinary orthodontic-periodontal approach which includes mucogingival surgery before orthodontic treatment shows satisfactory results and ensures a favourable prognosis for teeth with advanced periodontal disease.

SP114 PROTOCOL FOR DENTAL AUTOTRANSPANTS WITH ORTHODONTICS
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AIMS: To gather all the actual scientific literature and define a protocol of autotransplantation of teeth with mature and immature apices, compiling the multidisciplinary needs of surgery, endodontics and orthodontics for such treatment.
MATERIALS AND METHOD: This systematic review used the data base of PubMed and the library UB with the keywords: tooth autotransplantation, orthodontics. The total number of publications was 635 and applying the inclusion criteria (systematic reviews, prospective and retrospective studies and follow-up of minimum of 5 years) and exclusion criteria (single clinical cases), the end result was 33 publications for the systematic review.
RESULTS: A protocol for autotransplantation of teeth with mature or immature apices, combined with indications, advantages, disadvantages and guidelines for a successful treatment was established.
CONCLUSION: Autotransplantation has a high success rate which is ideal in growing patients. Patients report low/moderate discomfort during surgery and are satisfied with the result. Post-operative orthodontic forces, within 2-4 weeks, decrease the risk of ankylosis and increase the success rate.

SP115 INCREASED ALPHA SMOOTH MUSCLE AND PERIOSTIN EXPRESSION DURING POST-EMERGENT TOOTH ERUPTION IN GROWING RATS
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AIMS: Tooth eruption is a developmental, physiologic, locally regulated process. It can be divided into two discernible phases, pre- and the post-emergent, when the tooth has penetrated the oral mucosa to reach the occlusal plane. It has been observed that teeth, after antagonist loss, present overeruption of different degrees. The aim of the present study was to explore the expression of alpha smooth muscle actin (α-SM-actin) and periostin (postn) in the periodontal ligament (PDL) during post-emergent tooth eruption in opposed and unopposed teeth of growing rats.

MATERIALS AND METHOD: Twenty three male rats were used in this study. In 14 animals, the right maxillary molars were cut down, the remaining nine rats served as controls. PDL samples were isolated from the first right and left mandibular molars. The expressions of α-SM-actin and postn mRNA were examined by real time-polymerase chain reaction and immunohistochemical staining at 3 and 15 days after the right maxillary molars had been cut down.

RESULTS: The expression of α-SM-actin and postn was up-regulated in unopposed molars relative to molars with antagonists mostly in the 3 day group. Postn is a secreted protein that supports cell adhesion while α-SM-actin mediates fibroblast differentiation to myofibroblast.

CONCLUSION: The absence of occlusal force might have putative roles in α-SM-actin and postn gene expression in the PDL and the changes in their expression level may be linked to post-emergent tooth eruption.

SP116 THE EFFECTS OF ORTHODONTIC TREATMENT WITH EXTRACTIONS ON THE SOFT TISSUE VERTICAL DIMENSION. A SYSTEMATIC REVIEW
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AIMS: To search, in a systematic review, the literature and assess the available evidence for the effects of orthodontic treatment with extractions on the vertical dimension of the soft tissues.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature were performed. The following electronic databases without language and publication date restrictions were searched: Medline (via Ovid and PubMed), Embase (via Ovid), the Cochrane Oral Health Group’s Trials Register and Central. Unpublished literature was searched on ClinicalTrials.gov, the National Research Register, and Pro-Quest Dissertation Abstracts and Thesis database. The reference lists of all eligible studies were checked for additional studies. Two review authors performed data extraction independently and in duplicate using data collection forms. Disagreements were resolved by discussion or the involvement of an arbiter.

RESULTS: Two hundred and ninety nine articles were identified by the searches. Thirteen studies were finally considered eligible for inclusion in this systematic review, after applying the specific inclusion and exclusion criteria. Randomized controlled trials were not identified, most likely due to the nature of the intervention. All studies were evaluated for their methodological quality and reporting. All were generally rated from poor to moderate in their level of provided evidence. Furthermore, the large variation in the study protocols prohibited a valid interpretation of the actual results of the studies through pooled estimates, i.e. a meta-analysis was not feasible. The majority of the studies indicated that an extraction treatment protocol is not significantly associated with changes in the vertical dimension of the soft tissues, when compared to a non-extraction protocol.

CONCLUSION: Although in most cases the level of existing evidence ranged from poor to moderate, there is considerable agreement between studies that orthodontic treatment with extractions is not related to a decrease in the facial vertical dimension. Control or reduction of the soft tissue vertical dimension might not be a justification for selecting an extraction treatment protocol.

SP117 CLINICAL AND BIOMECHANICAL CORRELATIONS BETWEEN THE STOMATOGNATHIC SYSTEM AND POSTURAL MUSCULAR BALANCE
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AIMS: To determine the influence of orthodontic treatment of malocclusions on the parameters of body posture.

SUBJECTS AND METHOD: Thirty adult subjects in whom examination of the spinal profile (contourometry) with assessment of the sagittal and frontal planes of the back and postourometry (rasterstereographic) were used for postural balance assessment before and after orthodontic treatment.

RESULTS: A scoliotic posture was found in 25.5 per cent, grade I scoliosis in 53.3 per cent, and grade II scoliosis in 10.7 per cent. In the sagittal plane the following were observed: round back (15.3%), strengthening of physiologic curvatures (13%), flat back (0.6%), reinforcement of physiologic lordosis and kyphosis (17.1%), kyphosis only (5.6%), hyperlordosis (10.2%), grade I kyphosis (7.6%). The orthodontic status of the examined subjects was crossbite (57.8%), Class II plus overbite (25%), overjet (9.8%), open bite (1.3%) and mesial occlusion (3.2%).

CONCLUSION: After orthodontic treatment of malocclusions the parameters of body posture significantly improved. In most cases no additional musculoskeletal corrections using kinesiotherapeutic methods, osteopathic correction or physical rehabilitation was needed.

SP118 LONG-TERM EFFECTS OF CLASS II HERBST TREATMENT ON THE PHARYNGEAL AIRWAY WIDTH
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AIMS: To assess the long-term effects of Class II malocclusion treatment with the Herbst appliance on pharyngeal airway (PA) width in comparison to untreated individuals with Class I and Class II malocclusions.

MATERIALS AND METHOD: Lateral cephalometric radiographs of 13 male Class II patients from before (T1, mean age: 12.4 years) and after (T2, mean age: 14.2 years) treatment with the Herbst appliance as well as after the end of growth (T3, mean age: 20.2 years) were analysed and compared to two untreated age- and gender-matched samples with Class I (n = 13) or Class II (n = 13) malocclusions. The PA dimensions were measured using the parameters p (narrowest distance between the soft palate and the posterior pharyngeal wall) and t (narrowest distance between the base of the tongue and the posterior pharyngeal wall). In addition standard cephalometric measurements were performed.

RESULTS: Relevant changes in PA dimensions were only seen for the post-treatment period (T2-T3) during which the distances p and t showed a significant increase in the Herbst group only. During the same period, posterior face height (Ar-Go) showed a significantly higher increase in the Herbst group than in both control groups, whereas anterior face height (NL-Me) showed a similar development in all groups.

CONCLUSION: In the long term, Herbst treatment results in a significant post-treatment increase of PA width, possibly due to more pronounced lower posterior facial height development compared to untreated individuals.

SP119 TWO- VERSUS THREE-DIMENSIONAL MEASUREMENT OF THE POSITION OF PALATALLY IMPACTED CANINES
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AIMS: To find the reliability of three different radiographic methods used for palatally impacted canine position measurements.
MATERIALS AND METHOD: This retrospective study was based on the records of patients treated at Palacký University. Two hundred and forty patients with palatally impacted maxillary canines were identified among those seeking orthodontic treatment. Cone beam computered tomographs (CBCT) were obtained for 43 patients, so 51 palatally impacted canines were measured. Impacted canine inclination and distance to the vertical and occlusal plane were measured on panoramic radiographs, CBCT and panoramic radiographs generated from CBCT. For determining measurement reliability, repeatability and reproducibility the three different imaging methods were used. Repeatability was measured by technical error of measurement by Dahlberg’s method and coefficient of variation. Reproducibility was quantified by coefficient of repeatability according to Bland and Altman and by Bland-Altman plots.

RESULTS: Good and clinically acceptable repeatability was found for panoramic radiographs, CBCT and generated panoramic radiographs in all linear and angular impacted canine position measurements to the reference planes. The results proved good with clinically acceptable reproducibility for all radiographs in linear measurements but with poor and clinically non-acceptable reproducibility in angular measurements of impacted canine position to the reference planes. Large and clinically significant bias in angular impacted canine position measurements was proven between three-dimensional (3D) CBCT and two-dimensional (2D) panoramic radiographs and generated panoramic radiographs scans.

CONCLUSION: In consequence of different results from 2D and 3D imaging methods for impacted canine position measurements they are not interchangeable and older findings obtained from 2D methods cannot be automatically applied to CBCT.

SP120 THE PROGNOSTIC VALUE OF VISUALLY ASSESSING ENAMEL MICROCRACKS: THE CORRELATION BETWEEN IN VITRO AND IN VIVO RESULTS

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AIMS: To find a correlation between the severity of enamel microcracks (EMCs), their increase during debonding in vitro, and the possible changes in teeth sensitivity after removal of metal brackets (MB) in vivo.

SUBJECTS AND METHOD: In vitro study: following their examination with scanning electron microscopy (SEM), the teeth were divided into two groups of 15: group 1, teeth having pronounced EMCs (visible with a naked eye under normal room illumination); group 2, teeth showing weak EMCs (not apparent under normal room illumination but visible by SEM). The location, length, and width of the longest EMC were measured using SEM before and after removal of the MB. In vivo study: after debonding, 15 young patients possessing teeth with pronounced EMCs and 15 subjects whose teeth were visible EMCs free were enrolled in the investigation. The assessment of tooth sensitivity was performed just before debonding (JBD), immediately after debonding (IAD), and 1, 3, and 7 days following removal of MB. Discomfort was recorded on a visual analogue scale (VAS). For all experimental groups controls were formed.

RESULTS: In vitro study: visible EMCs showed higher mean overall width (Woverall) and length values. After removal of brackets the increase in Woverall of pronounced EMCs was 0.57 μm (P ≤ 0.05); for weak EMCs, 0.32 μm. In vivo study: for patients with visible EMC free teeth (PFVEMCs) and those possessing teeth with visible EMCs (PVEMCs), sensitivity intensity peaked IAD, started to decrease on day 1, and 1 week following debonding VAS scores were lower than JBD (P ≤ 0.05; for the PVEMCs) and IAD (P ≤ 0.05). PVEMCs showed higher VAS values at each time interval with air and cold (P ≤ 0.05) testing.

CONCLUSION: Although the teeth having pronounced EMCs showed higher width and length values, this did not predispose to a significant EMCs increase after removal of MB. Debonding led to a short-term increase in tooth sensitivity. Higher absolute discomfort values were noticed for the PVEMCs, however, the same pattern of sensitivity dynamics was inherent for all subjects. Thus, this work combines the qualitative EMCs characteristics examined in vitro with their impact on teeth sensitivity in vivo in relation to debonding.
TREATMENT PLANNING FOR CHILDREN HAVING FIRST PERMANENT MOLARS REMOVED UNDER DAY STAY GENERAL ANAESTHESIA

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AIMS: The first permanent molars (FPMs) are prone to caries due to their early eruption and exposure into the oral cavity. Their developmental timing makes them susceptible to chronological enamel defects e.g. hypo-mineralisation. The Royal College of Surgeons of England (RCS) guidelines highlight the importance of: timing of FPM extractions, developing occlusion and quality radiographs to show the developing dentition. The aim of this study was to assess the quality of treatment planning and compliance with the revised 2009 RCS guidelines for extraction of FPMs under general anaesthesia at Birmingham Dental Hospital. The objectives were that a minimum 95 per cent of children who undergo extraction of FPMs should include a dental pantomographic examination and orthodontic opinion as part of treatment planning.

MATERIALS AND METHOD: This was a retrospective case note audit utilising the RCS guidelines as the gold standard practice for treatment planning. Over a 2 year period 41 children aged between 7 and 15 years had 1-4 FPMs extracted under general anaesthesia. Data collected included patient’s age, teeth to be extracted, which radiographs were taken and if an orthodontic opinion was sought. To determine if the teeth were extracted at an optimal time to achieve a good spontaneous result, a consultant orthodontist reviewed the radiographs retrospectively.

RESULTS: Dental pantomographs were taken for 82 per cent and orthodontic opinions sort in 41 per cent of cases. Seventy three per cent of FPMs were extracted past the optimal time to achieve a good spontaneous result as verified by a consultant orthodontist.

CONCLUSION: Timely management of children with poor prognosis FPMs is imperative to avoid unfavourable changes in occlusion caused by early loss of the FPMs. This relies on early referral, adequate assessment, radiographs and, where appropriate, seeking an orthodontic opinion. There is a need to understand why orthodontic opinions were not sought and to develop a care pathway. Distribution of guidance to all clinicians and development of a local protocol to support treatment planning is required.

DENTOFACIAL AND FUNCTIONAL CHANGES IN GROWING PATIENTS WITH DUCHENNE MUSCULAR DYSTROPHY

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AIMS: To determine the impact of Duchenne Muscular Dystrophy (DMD) on the changes in facial morphology, dental arch alterations and oral function in growing DMD patients.

SUBJECTS AND METHOD: Twelve DMD patients (6-20 years of age) and 12 matched controls were screened on two different occasions (T1 and T2), two years apart. Dental casts, lateral cephalometric radiographs, maximal posterior bite force and lip force were measured to determine functional and morphological changes. Furthermore the thickness and echogeneity of the masseter muscle were measured. Paired Student’s t-tests were performed to evaluate the differences between the DMD patients and their healthy matched controls as well as the changes that occurred in the two groups between T1 and T2.

RESULTS: Between T1 and T2 the following changes were observed: widening of the lower arch for the DMD patients of 2.6 mm (±0.9 mm) compared to a slight reduction of –0.1 mm (±0.8 mm) for the control group (P < 0.001). The posterior widening of the upper arch was not statistically significant (P = 0.14). A statistically significant reduction of ANB-angle of 2.0 degrees (±2.0°) was found in the DMD group (P = 0.02). At T1 and T2 the maximal posterior bite force was statistically lower for the DMD patients compared to the control group (P = 0.001), whereas there was no significant difference of masseter muscle thickness, possibly due to replacement of muscle tissue by connective and adipose tissue.

CONCLUSION: DMD seems to have an effect on facial morphology, dental arch dimensions and oral function. During the observation period, all measured parameters deteriorated adding to the pre-
existing aberrations. In all patients a remarkable transverse increase of the posterior arches was found, more in the lower than in the upper, resulting in posterior crossbites, and a tendency toward a skeletal Class III relationship. Furthermore a reduced posterior bite force was detected.

**SP123 STABILITY OF PERIODONTALLY ACCELERATED OSTEOGENIC ORTHODONTIC TREATMENT: A LONG-TERM FOLLOW-UP STUDY**

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AIMS: To evaluate the stability of periodontally accelerated osteogenic orthodontic (PAOO) treatment followed by bone grafting in Class I patients with moderate anterior crowding.

MATERIALS AND METHOD: The dental casts of 11 Angle Class I malocclusion patients with moderate crowding treated with PAOO by performing vertical corticotomy cuts on the buccal sides of the maxillary and mandibular anterior regions were collected. The bone graft was spread over the partially decorticated bone in all patients. Patient records were analyzed at three time intervals: pre-treatment, post-treatment (mean: 11.27 ± 2.63 months) and post-retention (mean: 30.59 ± 3.60 months). The following parameters were digitally measured: incisor irregularity index, anterior arch perimeters, arch lengths, intercanine and intermolar widths for both arches, and overjet and overbite. Multiple comparisons of all measurements were analyzed using one-way analysis of variance and post-hoc Tukey tests at the $P < 0.05$ significance level.

RESULTS: Although a net improvement was noted in comparison to the initial state after periodontal-surgical intervention, there was significant relapse in lower incisor crowding ($P < 0.01$). No statistically significant differences were found for overjet, overbite, and arch length of mandibular measurements during treatment and control. Arch perimeter, intercanine and intermolar widths were stable in the follow-up period. Upper incisor irregularity showed no significant differences after the retention period. Maxillary intercanine width increased approximately 3 mm after orthodontic treatment ($P < 0.05$) and was stable during the retention period.

CONCLUSION: PAOO treatment followed by bone grafting had no effect on the stability of the lower incisors in the long-term. Although the long-term response of mandibular incisor alignment was unpredictable, the upper incisors were stable.

**SP124 NON-SURGICAL ADJUNCTIVE INTERVENTIONS FOR ACCELERATING ORTHODONTIC TOOTH MOVEMENT: A SYSTEMATIC REVIEW**

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AIMS: A systematic review to assess the effect of non-surgical adjunctive interventions on the rate of orthodontic tooth movement.

MATERIALS AND METHOD: Randomised controlled trials of patients receiving orthodontic treatment using fixed appliances along with non-surgical adjunctive interventions to accelerate tooth movement were included. Non-parallel design studies (e.g. split-mouth) were excluded.

RESULTS: The search strategy designed and conducted according to the Cochrane Oral Health group strategies (to 25 November 2014) yielded 324 studies. Two randomised control studies were eligible for inclusion with both of these assessed as being at high risk of bias. The two studies, involving a total of 111 participants, compared the use of vibrational appliances (Tooth Masseuse or OrthoAccel) with conventional treatment mechanics during orthodontic alignment and canine retraction phases. Both studies included objective assessment of the amount or rate of tooth movement, but it was not possible to meta-analyse this data as the two studies used different outcome measurements at different stages of the orthodontic treatment process. The studies did not directly report either the duration of orthodontic treatment or the number of visits during active treatment. The data from the included studies indicated that the use of the vibrational appliances
resulted in a minimal difference in the rate of tooth movement. Although these differences were reported as statistically significant in one of the studies; it was deemed clinically insignificant and did not represent the full duration of routine orthodontic treatment. One study measured subjective evaluation of pain and discomfort and the other evaluated adverse effects. No statically significant difference was found between the study groups in any of the studies. Overall, the quality of the evidence was very low and therefore we cannot rely on the findings.

CONCLUSION: There is limited sound clinical research concerning the effectiveness of non-surgical interventions to accelerate orthodontic treatment. The available evidence is of low quality given the high risk of bias in the included studies. This indicates that there is insufficient evidence to determine if there is a positive effect of non-surgical adjunctive interventions to accelerate tooth movement.

SP125 EFFECT OF THERAPEUTIC ULTRASOUND ON ORTHODONTICALLY INDUCED ROOT RESORPTION AND RATE OF TOOTH MOVEMENT
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AIMS: To study the effect of low intensity pulsed ultrasound (LIPUS) on root resorption and tooth movement.

SUBJECTS AND METHOD: Thirty-one orthodontic patients with severe crowding that required extraction of their first premolars. For the root resorption part, 12 patients had buccal root torque of their first premolars and ultrasound treatment for 20 minutes per day. For the enhancing tooth movement trial, 19 patients had their first premolars removed and were then fitted with segmented arch T loops for canine retraction. LIPUS was randomly applied to one side of the mouth for each patient while the other side served as the control. Both patients and clinician were blinded to which side was active and which side was placebo.

RESULTS: For the root resorption treatment trial, there was significant decrease in root resorption of all premolars treated with LIPUS compared to the control. For the enhancing tooth movement clinical trial, there was a significant difference between the treatment and placebo sides.

CONCLUSION: LIPUS application for 20 minutes per day minimizes root resorption and enhances tooth movement at the same time.

SP126 MECHANICAL PROPERTIES OF AESTHETIC AND NICKEL TITANIUM ARCHWIRES WITH AESTHETIC AND CONVENTIONAL BRACKETS DURING INITIAL ORTHODONTIC TREATMENT
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AIMS: To compare the force level at the initial phase of orthodontic treatment as well as force loss due to friction in simulated canine retraction of aesthetic wires [fibre-glass reinforced composite (FGRC)] compared with nickel titanium (NiTi) archwires with aesthetic and metal brackets.

MATERIALS AND METHOD: The following materials were tested: three types of brackets (0.022” slot size): metal (Discovery®), FGRC (Elegance®) and ceramic (Fascination®); two archwires (0.018”): fibre glass reinforced plastic (translucent Ideal arch pearl) and a reference conventional NiTi arch (Rematitan®, all brackets Dentaurum, Germany). Three measurements were performed with the Orthodontic Measurement and Simulation System: I) levelling test: force measurement for a simulated malocclusion of the maxillary central incisor displaced 2 mm gingivally (x-axis) and 2 mm labially (z-axis); II) three-point bending test according to DIN/ISO 15841 for measurement of the force in vertical and horizontal displacement and III) measurement of force loss due to friction during simulated canine retraction.

RESULTS: I) Levelling test: translucent wires showed significantly lower forces than NiTi arches independent of bracket type. For example, at labial displacement (z-axis) measured with ceramic brackets, force for the translucent wires was 3 N compared to 7 N for the NiTi arches. Similarly, for metal brackets forces were 4 and 6 N and with composite brackets 4 and 9 N for the translucent wires and NiTi, respectively. II) Bending test: both ceramic and composite brackets, when combined
with translucent wires, produced almost the same forces (about 1 N horizontally and 0.4 N vertically). Higher forces were measured with NiTi arches from 1 to 3 N. (III) Friction test: the force loss due to friction was lower with metal brackets (about 30% for translucent wires and 54% for NiTi arches) compared to composite brackets (51% and 47%, respectively) and with ceramic brackets significantly increased friction losses (85% and 89%, respectively).

CONCLUSION: The translucent wires showed lower forces both in levelling as well as in the bending test. However, the force loss due to friction was highest with ceramic brackets either with translucent or NiTi wires.

SP127 LIGHT EMITTING DIODE MEDIATED PHOTOBIOMODULATION THERAPY STIMULATES ORTHODONTIC TOOTH MOVEMENT AND MINISCREW STABILITY
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AIMS: To evaluate the effects of light-emitting diode mediated-photobiomodulation therapy (LPT) on the stability of miniscrews, rate of orthodontic tooth movement and interleukin-1β (IL-1β) levels in gingival and peri-implant crevicular fluid.

SUBJECTS AND METHOD: This study was a double blind, randomized placebo/control matched pairs clinical trial to test the efficacy of LPT. This split-mouth design study consisted of 20 patients (13 girls, 7 boys). The eligibility criteria included patients who required extraction of the maxillary first premolars. Miniscrews were placed between the maxillary first molars and second premolars on both sides as anchorage units. LPT was applied with an energy density of 20 mW/cm² over a period of 21 successive days (20 minutes per day) over the movement of canine teeth on the test side and using a pseudo application on the placebo side. Randomization was accomplished by the toss of a coin. Blinding of the clinicians was applicable by measuring the data of a clinician who was unaware of the treatment delivered. Blinding of the patients was achieved using the same LPT device on both sides but irradiation only one side. For statistical comparison, a paired samples t-test and one-way analysis of variance were used at the P < 0.05 level.

RESULTS: Miniscrew stability was similar between the control and LPT groups at baseline (T0) and the first month (T1). However, miniscrew stability was significantly increased in the LPT group in the second (T2) and third (T3) months. Comparison of tooth movement during the three different time intervals (T1-T0, T2-T1 and T3-T2) revealed a statistically significantly increase at all time intervals after LPT. No statistically significant change was detected in IL-1β levels between groups.

CONCLUSION: LPT has the potential of accelerating orthodontic tooth movement with a positive effect on miniscrew stability.

SP128 DEBONDING CHARACTERISTICS OF A POLYMER MESH BASE CERAMIC BRACKET CURED WITH TWO DIFFERENT CURING UNITS
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AIMS: To record the remnants and base fractures of a polymer mesh base ceramic bracket after debonding.

SUBJECTS AND METHOD: Thirty non-extraction patients (9 males, 21 females; mean age 14.25 ± 1.41 years). Six hundred brackets were bonded and light cured by one operator using a split-mouth design, with either a quartz tungsten halogen (QTH) or light emitting diode (LED) units. The adhesive resin was polymerized through the labial surface of the ceramic bracket (InVu, TP Orthodontics Inc., La Porte, Indiana, USA) for 20 seconds with the QTH unit and for 5 seconds with the LED unit. Initial aligning archwires, 0.014 inch superelastic nickel titanium, were fitted in the upper and lower arches immediately after completion of the bonding procedure. Treatment was completed with 0.019 × 0.025 inch stainless steel archwires in all cases. After debonding, bond failure characteristics were
recorded with a modified remnant index (MRI): 0, no adhesive left on the tooth; 1, less than half of the adhesive left on the tooth; 2, more than half of the adhesive left on the tooth; 3, all adhesive left on the tooth, with a distinct impression of the bracket mesh; 4, all adhesive including part of the polymer mesh base left on the tooth; all adhesive including all of the polymer mesh base left on the tooth.

RESULTS: The mean treatment time was 1.32 ± 0.12 years. No significant difference was observed for MRI scores between QTH and LED units ($P > 0.05$). Furthermore, no significant difference was observed for base fractures between QTH and LED units ($P > 0.05$). When MRI scores were compared among the incisor, canine and premolar teeth, incisor teeth showed higher remnant scores than canine and premolar teeth ($P < 0.001$).

CONCLUSION: The InVu ceramic bracket, designed with a flexible polymer mesh base makes a safe debonding process possible independently of the light curing source.

SP129 A STUDY OF CHRONOLOGICAL AGE, SKELETAL MATURATION OF THE CERVICAL VERTEBRAE AND HAND-WRIST
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AIMS: To identify the relationship between chronological age, skeletal maturation of the hand and vertebral maturation.

MATERIALS AND METHOD: Seventy three radiographs (cephalogram and hand-wrist) were analysed of 73 patients (41 females, 32 males). Skeletal maturation of the cervical vertebrae was evaluated using the method of Baccetti et al. and skeletal maturation of the hand-wrist using the method of Björk et al. The chi-square test was used to determine the relationship between chronological age, cervical vertebral maturation stages, and hand-wrist maturation stages. The Student’s t-test and ANOVA were used to calculate the average chronological age at the pubertal growth spurt for the vertebral and wrist stages.

RESULTS: The chi-square test correlation between chronological age, cervical vertebral and wrist maturation stages was significant at $P < 0.001$. The pubertal growth spurt for wrist stages occurs at an average age of 11.88 years for girls and 12.44 years for boys. The Student’s t-test showed that this was not significant ($P = 0.454$). The pubertal growth spurt according to the stage of the vertebrae occurs at an average age of 11.19 years for girls and 12.39 years for boys, which was statistically significant ($P = 0.014$).

CONCLUSION: 1. There is a high correlation between chronological age and vertebral skeletal maturation. 2. There is a high correlation between the skeletal maturation of the hand and that of the vertebrae. 3. The pubertal growth spurt occurs at vertebral stage 4 and corresponds with wrist stage 5. 4. Vertebral stages are sufficient to determine skeletal maturation.

SP130 INFLUENCE OF DIAMETER AND LOAD OF SCREW TYPE DEVICES ON STATIC AND DYNAMIC BONE-IMPLANT CONTACT: AN ANIMAL STUDY
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AIMS: To compare static versus dynamic bone-implant interface histology of screw type devices and to further evaluate its relation to diameter and load.

MATERIALS AND METHOD: Custom-machined, titanium alloy (Ti6Al4V) screw type devices of 1.6, 2.0, 3.0 and 3.75 mm diameter (Ø) were placed in five skeletally mature beagle dogs. In a split mouth design, screws were placed bilaterally among implants. No load (NL) was applied to one side while a 2 N load (L) was applied by calibrated coil springs on the other side, with a total of 59 screws being analyzed (8 NL and 6 L 1.6 mm Ø, 8 NL Ø and 10 L 2.0 mm Ø, 9 NL and 5 L 3.0 mm Ø and 9 NL and 5 L 3.75 mm Ø screw). Intravital bone labels were administered intravenously, and the dogs were euthanized 90 days after screw placement. Undecalcified sections of ~70 μm were prepared and analyzed under polarized and epifluorescent light. The region of interest (ROI) was defined as
the bone within the threads of the screws. The following parameters were quantified: 1. Static-bone volume/tissue volume (BV/TV, %), bone-implant contact (BIC, %); 2. Dynamic-labelled bone/bone volume (LB/BV, %), and dynamic BIC (DBIC, %). Linear mixed effects models, with a random effect for dog, were used to analyze relationships between diameter, load, and BIC. All tests were two-sided, and statistical significance was defined as $P < 0.05$.

RESULTS: BIC varied approximately from 45.7 to 55.4 per cent of the screw surface, and was not affected by diameter ($P = 0.66$). For all diameters, the L ($P = 0.61$) and NL ($P = 0.66$) screws showed no significant difference in their respective BIC values. Although the percentage of DBIC did not vary with the applied load ($P = 0.41$), it correlated significantly with the diameter of the screw ($P = 0.001$). Specifically, a 1 mm increase in diameter was estimated to be associated with a 4.3 per cent [95% CI: (2.1, 6.5)] mean increase in DBIC.

CONCLUSION: The percentage of BIC that is actively remodelling increases with increasing diameter of the screw. Dynamic histomorphometry is more sensitive in detecting changes in BIC histology when compared to static measurements.

SP131 THE ROLE OF ORTHODONTICS IN THE MULTIDISCIPLINARY APPROACH TO MILD AND MODERATE OBSTRUCTIVE SLEEP APNEA IN CHILDREN

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AIMS: To describe the importance of orthodontic evaluation in the diagnosis of mild and moderate sleep obstructive apnoea (OSA) in children.

SUBJECTS AND METHOD: Patients referred with suspected OSA were enrolled in the study from January 2014 to March 2014. From 1403 patients who attended, 115 patients were selected for an oxygen saturation sleep study. Twelve patients with a McGill Oximetry Score of 4 were selected for adenotonsillectomy. Twenty one children with a McGill Oximetry Score 1 (inconclusive for OSA) underwent a complete polysomnographic examination. Eighty two children with a McGill Oximetry Score of 2 and 3 were included in this sample. Exclusion criteria were genetic syndromes, previous orthodontic treatment, previous adenoidectomy and/or tonsillectomy. The final sample included 67 patients (2-15 years old). Each patient underwent clinical evaluation. On the basis of data collected, a multidisciplinary team (ear, nose and throat specialist, a bronchopneumologist and an orthodontic specialist) assessed the therapeutic strategy for each patients. A statistical descriptive analysis was performed to study the prevalence of collected variables and a control group was collected to compare data.

RESULTS: The sample included 67 patients (mean age ± SD = 5.25 ± 2.06; males = 39, females = 28) with mild or moderate OSA (85.1% mild, 14.9% moderate). The orthodontic examination showed 43.3 per cent were Class I, 40.3 per cent Class II and 16.4 per cent Class III. Palatal constriction with a posterior monolateral or bilateral crossbite was present in 44.7 per cent of patients. The prevalence of malocclusion in OSA children was higher than in the controls. After multidisciplinary consultation, 52.2 per cent of patients were referred for orthodontic treatment, 32.8 per cent for adenotonsillectomy while 15 per cent were prescribed other therapies (drug therapy and/or diet).

CONCLUSION: The presence of craniofacial anomalies in children suffering from mild and moderate OSA is relevant. The role of the orthodontist in the multidisciplinary team results in improvement of the success of the diagnostic and therapeutic protocol.

SP132 THIRD MOLAR DEVELOPMENT IN RELATION TO CHRONOLOGICAL AGE IN SERBIAN CHILDREN

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AIMS: Predicting chronological age in children and young adults can be crucial in forensic odontology. The third molar is important because it is the last tooth to form and it is the only tooth to complete formation after puberty. Previous studies undertaken in different populations to explore the usefulness of the third molar as a reliable age indicator show that dental development varies slightly between different populations, making population-specific studies necessary. The
Purpose of this study was to estimate chronological age based on the stages of mandibular third-molar development following the eight stages (A–H) method of Demirjian in Serbian children.

MATERIALS AND METHOD: Dental pantomograms of 570 young Serbian subjects of known chronologic age (range 8-25 years) and gender (247 males, 323 females). Tooth calcification was rated according to the method described by Demirjian et al., assigned to the third molar tooth. Statistical analyses were performed using Mann-Whitney U and Wilcoxon tests between gender and age.

RESULTS: Third-molar genesis was attained earlier in males than in females. Statistically significant differences ($P < 0.01$) in third molar development between genders were revealed regarding development stages C and E. Statistical analysis showed a strong correlation between age and third molar development for males ($r^2 = 0.89$) and females ($r^2 = 0.79$).

CONCLUSION: There is a strong correlation between age and third molar development for both genders. The use of mandibular third molar development stages using Demirjian’s method can be a valuable chronological age indicator in children and young adults.

SP133 IMMUNOLOGY STRETCH: NK CELLS IN SERVICE FOR ORTHODONTIC TOOTH MOVEMENT
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AIMS: Orthodontic-tooth-movement (OTM) is a sterile-inflammation based process in which immune-cells are involved, however, little is known about their type and function. Activated NK cells (NKs) are major secretors of TNFα and IFNγ-cytokines, which were shown to be involved in OTM by promoting differentiation and activation of osteoclasts which enable OTM through bone resorption. The main activating-receptors of the NKs of mice are Ncr1 and NKG2D. It was hypothesized that NKs participate in the inflammatory-process of OTM and therefore, the aim was to investigate the direct in vivo role of NKs, their Ncr1 and NKG2D-receptors and secreted-cytokines in OTM.

MATERIALS AND METHOD: Nickel titanium closed-coil-springs were set between the upper left first molar (ULM1) and upper incisors of C57BL/6-mice in a wild-type (WT) control group and seven experimental groups for 12 days: NKs-depleted, Ncr1-KO (KnockOut-both copies of Ncr1-gene replaced with GFP), Ncr1-het (heterozygous-one copy of Ncr1-gene replaced with GFP), NKG2D-blocked in WT-mice (WT/NKG2D-bi), NKG2D-blocked in Ncr1-KO-mice (Ncr1-KO/NKG2D-bi), TNFα-KO and IFNγ-KO. A split-mouth-technique was used, in which the diastema between ULM1–ULM2 was measured using a microcomputed tomographic scanner. The mice’s maxillae were prepared for histology. The in vivo accumulation of NKs in the periodontal ligament (PDL) could be evaluated with the GFP-presence in Ncr1-het mice. NK and osteoclast numbers and locations were evaluated using immunofluorescence and tartrate resistant phosphatase staining. The presence of ligands for Ncr1 and NKG2D receptors on the surface of the mice’s-fibroblasts were checked by FACS-analysis.

RESULTS: The number of GFP-labelled NKs significantly increased in the PDL of treated teeth in comparison to the contralateral side (3.44, $P < 0.05$). OTM was significantly reduced in the NKs-depleted, Ncr1-KO, Ncr1-KO/NKG2D-bi, TNFα-KO and IFNγ-KO groups (1.49; 1.22; 4.31; 3.30; 2.25 fold change, respectively, $P < 0.05$), compared to WT. Osteoclast numbers correlated with the ULM1–ULM2 distance in all groups ($P < 0.05$). FACS-analysis revealed ligands for Ncr1 and NKG2D-receptors on the surface of mice fibroblasts.

CONCLUSION: NKs accumulate in the PDL in response to orthodontic force and participate in the OTM process in mice through their Ncr1 and NKG2D activating receptors. Absence of NKs, Ncr1 and NKG2D-receptors, TNFα and IFNγ significantly reduced OTM rate. Mice fibroblasts express ligands for Ncr1 and NKG2D-receptors. Understanding the immune mechanisms involved in OTM will contribute to develop novel biological therapeutic means for clinical control.

SP134 IMPLEMENTATION OF AN ANALYTICAL MODEL FOR ORTHODONTIC TOOTH MOVEMENT AND PERIRADICULAR BONE MORPHOMETRY IN MICE
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AIMS: To implement a unifying protocol for orthodontic tooth movement (OTM) analysis and associated bone microarchitectural changes in mice.

MATERIALS AND METHOD: Twenty-nine C57BL/6 12-week-old male mice were divided into three groups: untreated-WT (n = 10), WT-OTM (n = 10) and TNFα−/−-OTM (n = 9) in which nickel titanium closed-coil springs pulled the upper left first molar (ULM1) towards the upper incisors for 12 days. The maxillae were scanned using microcomputed tomography (μCT). The amount of mesial displacement of ULM1 was measured by five different methods based on dental or skeletal landmarks. The upper right first molar (URM1) served as the control. An algorithm was developed to define standardized regions of interest (ROIs) at both the pressure and tension sides of ULM1 and URM1 and a series of three-dimensional morphometric parameters were calculated.

RESULTS: Among the five different methods to assess OTM, the ULM1-ULM2 diastema measurement showed the lowest standard deviation in all experimental groups (0.0 ± 0.0 µm; 252.1 ± 72.3 µm and 61.4 ± 36.3 µm, respectively). The new algorithm defined reproducible ROIs with minimal operator bias. Using this method, statistically significant differences were found for all selected morphometric parameters between the OTM and control sides (P < 0.05) in the two OTM groups (at both the tension and pressure sides) with no differences between the OTM and control sides in the untreated group. Moreover, a significant correlation was found between these parameters and the amount of OTM.

CONCLUSION: The ULM1-ULM2 diastema measurement, based on μCT, was the most reliable method for OTM measurement. Furthermore, the algorithm was able to detect significant morphometric differences associated with distinct OTM rates. This protocol is therefore proposed as a standardized method for OTM analyses in mice.

SP135 CEPHALOMETRIC ANALYSIS OF UNILATERAL CLEFT LIP AND PALATE PATIENTS DURING THE EARLY MIXED DENTITION TREATED WITH NASOALVEOLAR MOULDING

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AIMS: To elucidate the facial skeletal growth pattern of patients in the early mixed dentition stage with a unilateral cleft lip and palate (UCLP) treated with a nasoalveolar moulding device before lip closure surgery.

MATERIALS AND METHOD: Lateral cephalograms of 10 patients in the early mixed dentition stage were traced. Sagittal measurements were obtained and analyzed to assess the growth pattern.

RESULTS: Mesofacial and brachyfacial biotypes were found; normal sagittal maxillary growth was present; no Class III malocclusion had developed. This protocol avoids retrusive profiles.

CONCLUSION: Pre-surgical maxillary orthopaedics is associated with normal mid-face growth in UCLP patients.

SP136 A NEW FLASH-FREE ORTHODONTIC ADHESIVE SYSTEM – FIRST CLINICAL AND STEREOMICROSCOPIC INVESTIGATIONS

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AIMS: To analyse the clinical and laboratory properties of the recently introduced APC Flash-Free orthodontic adhesive.

MATERIALS AND METHOD: After bonding of 80 brackets on human teeth (group A: APC Flash-Free adhesive n = 40, group B: APC Plus adhesive n = 40), the following measurements were recorded: time for bonding, stereomicroscopic evaluation of excess adhesive, colour penetration (methylene blue, 0.5%/24 hours) and Adhesive Remnant Index (ARI) score after debonding.

RESULTS: The time needed for bonding of the individual bracket differed significantly between the two groups (A: 19.5 seconds/tooth versus B: 33.8 seconds/tooth). The adhesive excess, which was metrically measured from the bracket edge, ranged from 166.27 to 81.66 µm (group A) and from 988.53 to 690.81 µm (group B). After methylene colouration in group A, 52 of 80 measurements
showed discolouration on the bracket/adhesive and/or adhesive/enamel interface while for group B, 78 of 80 were colouration positive. The ARI scores did not differ significantly with an average ARI score of 2.0 for group A and 2.8 for group B.

CONCLUSION: The flash free adhesive significantly reduced the time needed for the bonding process. The excess resin expanded 0.16 to 0.08 mm over the bracket margin. The new technology seems to facilitate a smooth and sufficient marginal surface of the adhesive, which clinically might improve reduction of plaque accumulation. Both clinical performance and bonding efficiency thus might be enhanced.

SP137 COMPARISON OF PAIN RELIEF BETWEEN THE USE OF CHEWING GUM OR INTAKE OF ACETAMINOPHEN AFTER ORTHODONTIC SEPARATOR PLACEMENT
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AIMS: To compare pain relief with the use of chewing gum or intake of acetaminophen after separator insertion.
SUBJECTS AND METHOD: This randomized controlled clinical study comprised 52 students, 20-40 years of age, assigned either to use chewing gum or to take acetaminophen (1.000 mg) on three occasions prior to their self-assessment of pain sensation. To initiate pain, four rubber separators were installed on either the right or left side mesial and distal to the upper and lower first molars. Pain assessment was performed utilizing the visual analogue scale (VAS) at 3 hours, 4 hours, at bedtime and after 27 hours with teeth unoccluded and while biting on a piece of plastic tube. Bite force was recorded at the moment of initial pain sensation at 3 hours and after 27 hours.
RESULTS: A statistically significant difference in the VAS score was observed 27 hours after separator installation when recorded with teeth unoccluded (P < 0.05; t-test for independent samples). A regression model adjusted for VAS score at baseline, gender and loss of separators revealed that the VAS score on average was 1.4 units higher for the chewing gum group (P < 0.05; multiple regression analysis). Since no correlation between bite force at initial pain sensation and VAS score was observed, bite force measurement was excluded from further data analyses.
CONCLUSION: Acetaminophen intake is superior to the use of chewing gum in relieving orthodontic pain. The bite force measurement is not appropriate for orthodontic pain assessment.

SP138 DENTOSKELETAL EFFECTS OF THE HERBST APPLIANCE: A RETROSPECTIVE CASE-CONTROL STUDY
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AIMS: To evaluate the dental and skeletal effects produced by the Herbst (HB) appliance in Class II patients.
SUBJECTS AND METHOD: Eighteen subjects (7 boys, 11 girls; mean age ± SD = 11.8 ± 1.1 years, HB group) with an Angle Class II malocclusion due to mandibular retrusion, with cervical maturation stage (CVMS) C2-C3 and good quality lateral cephalogram at T0 (baseline) and at T1 (immediately after treatment) treated using the HB appliance, was compared to an untreated control group that included 23 subjects (11 boys, 12 girls; mean age ± SD = 10.5 ± 1.2 years, CTR group) matched by gender and CVMS. Data were annualized over a 15 month period. The cephalometric measurements were performed by one blinded operator using a modified Panzer's analysis. Between group differences were assessed by means of an independent sample t-test. Statistical significance was set at P < 0.05.
RESULTS: The HB group showed statistically significant dentoalveolar T1-T0 changes (overjet reduction: −3.3 ± 2.3 versus 0.3 ± 1.2 mm, P < 0.001; molar relation improvement: −4.9 ± 2.4 versus 0.1 ± 1.1 mm; P < 0.001; lower incisor proclination ii/OLp-Pg/OLp: 1.2 ± 1.1 versus −0.5 ± 1.2; P < 0.001) and skeletal maxillary growth control (SS point to OLp: 0.7 ± 1.3 versus 2.5 ± 2.5; P < 0.05) as
compared to the CTR group. The appliance did not result in a significant advancement of the lower jaw and did not affect jaw divergence.

CONCLUSION: The HB appliance is able to correct Class II malocclusions by producing significant dentoalveolar changes, which comprise overjet reduction and molar relationship improvement, and by controlling maxillary growth.

SP139 AN INVESTIGATION ON THE RELATIONSHIP BETWEEN TONGUE PRESSURES DURING DEGLUTITION AND ANTERO-POSTERIOR SKELETAL DISCREPANCY IN MANDIBULAR PROGNATHISM
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AIMS: To investigate the difference in tongue pressure during swallowing between individuals with normal occlusion and those with mandibular prognathism.

SUBJECTS AND METHOD: Ten volunteers with individual normal occlusion and 10 patients with mandibular prognathism diagnosed as requiring surgical-orthodontic treatment. A sensor sheet for measuring tongue pressure was secured to the palatal vault and used to measure the tongue pressure waveform during swallowing test food. The onset time, peak time, offset time, maximum value and duration of tongue pressure were evaluated from the tongue pressure waveforms.

RESULTS: The waveforms in individuals with a normal occlusion were characterized by a sudden rise and a comparatively gentle fall. The order of tongue pressure production in normal occlusion was anterior median, followed by bilateral parts, middle median, and finally posterior median. The maximum value was higher at the anterior median than the other channels. In contrast, the tongue pressures in patients with mandibular prognathism were comparatively low on all channels compared with those in normal occlusion. The cases showing maximum value at the anterior median part were similar to the order of tongue pressure production in individuals with normal occlusion. On the other hand, the other cases exhibiting maximum value at bilateral parts showed a tendency to a longer duration of bilateral sides. The duration of swallowing time was significantly longer in patients with mandibular prognathism than normal occlusion. Differences in the characteristics of tongue pressure waveforms were found depending on the extent of the ANB angle; subjects within the range of $0 > \text{ANB} > -2.5$ degrees had partial characteristics of the waveform in normal occlusion, while the others displaying less than $-2.5$ degrees of ANB did not show characteristics of the waveform in normal occlusion.

CONCLUSION: These findings suggest the possibility that the transitional zone for the tongue pressure waveforms during deglutition may exist around an ANB of $-2.5$ degrees in mandibular prognathism.

SP140 THREE-DIMENSIONAL ANALYSIS OF A DENTO-SKELETAL MODEL IN FACIAL ASYMMETRY CASES
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AIMS: To examine jaw deformities in facial asymmetry cases and dental compensation for the jaw deformities in three-dimensions.

MATERIALS AND METHOD: A three-dimensional (3D) skeletal model was reconstructed from 3D computed tomographic data, obtained from 16 patients with facial asymmetry (9 females, 6 males; mean age: 27.1 years) at the initial examination for orthognathic surgery. 3D images of the upper and lower dentition were scanned from the dental casts and integrated with the skeletal model by means of the iterative closest point algorithm. Cranial coordinates were set up by referring to the orbita area and defined as the global coordinates. Dento-skeletal asymmetry was evaluated in the cranial global coordinates. On the other hand, mandibular coordinates were set up by referring to the inferior border of the mandible and defined as the local coordinates. Asymmetry in the ramus and lower dental arch were evaluated in the mandibular local coordinates.
RESULTS: 3D scanned images of dental casts were integrated with the skeletal model accurately. In facial asymmetry cases, lateral displacement of the chin was 7.2 mm on average, ranging from 2.0 to 14.2 mm and was accompanied by rotational displacement of the mandible in the frontal and horizontal planes. Mandibular asymmetry was significantly related to the right-left difference of ramus height with an average of 6.3 mm (from 1.6 to 12.1 mm). When the dental arches on the displaced chin side were compared with those on the opposite side, the arch width was significantly larger in the upper and smaller in the lower, accompanied by more buccal and lingual inclination of the molars, respectively. The occlusal plane in the frontal plane was ascended toward the chin displaced side.

CONCLUSION: It was demonstrated that facial asymmetry was characterized by the mandibular asymmetry due to asymmetrical growth of the ramus. Asymmetry of bucco-lingual inclination of the molars appears to be the dental compensation for the mandibular asymmetry and should be corrected by means of orthodontics.

SP141 MONITORING OF TOOTH MOVEMENT IN PATIENTS WITH PERIODONTITIS: MASS SPECTROMETRY WITH EFFICIENT REMOVAL OF SERUM ALBUMIN FROM GINGIVAL CREVICULAR FLUID
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AIMS: To find a method to deplete high abundant serum albumin in gingival crevicular fluid (GCF) to increase the detection of otherwise undetectable components by mass spectrometry (MS). The mediators released sequentially at multiple stages during orchestration of tooth movement can be detected in GCF (Kapoor et al., 2014). Using MS for GCF-protein identification or quantification is limited due to the presence of highly abundant serum proteins especially in patients with periodontits (Carneiro et al., 2014).

MATERIALS AND METHOD: GCF was collected with commercially available periopaper strips (Oraflow, New York, USA). The periopapers were eluted with 50 mM NH4HCO3, pH 8.0 and the sample was collected with Pierce Spin Columns (Thermo Scientific). Protein concentration was measured with Pierce BCA Protein Assay Kit and Nano Drop 1000 (Thermo Scientific). The sample was aliquoted in two portions of 15 µl. One portion was precipitated with Trichloroacetic acid (TCA) - Acetone (10% v/v) (Precipitate I). The supernatant was collected and precipitated with 100 per cent Acetone (Precipitate II). The supernatant was again collected and dried down with Speedvac (Precipitate III). Gelelectrophoresis (Invitrogen) was performed, followed by in-gel trypsin digestion and peptide extraction (Schmidt and Urlaub, 2009). MS analysis was performed using LTQ Orbitrap Velos mass spectrometer (LC-MS/MS).

RESULTS: Gelelectrophoresis confirmed a high concentration of serum albumin in the GCF of patients with periodontitis. The high concentration could be depleted by extraction with 10 per cent TCA in Acetone. TCA builds a complex with albumin. This complex is soluble in organic solvents such as acetone. Using TCA-acetone for sample preparation a number of low abundant proteins were detected that were not identified in the unconditioned sample.

CONCLUSION: Gelelectrophoresis and MS analysis show that precipitation with TCA-acetone is an efficient method to reduce serum albumin and to increase protein identifications in GCF. This new approach can be used to effectively monitor the molecular signals of orthodontic tooth movement especially in adult patients with periodontitis leading to a better understanding of the molecular signals and pathways that result in this movement.

SP142 ACTIVATOR APPLICATION IN THE TREATMENT OF CLASS II MALOCCLUSION PATIENTS AT DIFFERENT AGES
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AIMS: To investigate the clinical findings of patients with Class II malocclusion, treated with an activator or a combination of an activator and an extra oral appliance (EOA), and to specify age-related treatment characteristics depending on the period of growth.

SUBJECTS AND METHOD: One hundred and four patients (40 boys, 64 girls) aged 8-10, 11-13 and 14-15 years. A dental distal bite was present in 13 subjects and a skeletal distal bite in 91 cases. The skeletal changes were traced on profile radiographs taken before and after treatment. An activator (Pfeiffer and Grobety) as well as a combination of the activator and EOA were used. Cephalometric measurements, cited by different authors, were used before and after treatment in order to determine the skeletal structure and soft tissue changes. The cervical vertebral maturation stage (CVMS, Baccetti) was used to determine skeletal growth. Eleven statistical analyses were used to process the study data.

RESULTS: Significant differences among the age groups were found in \( \angle \) Spp/M, \( \angle \) ML-G, \( \angle \) LU-G, \( \angle \) Go-Me, \( \angle \) Co-Gn, \( \angle \) SNA-SNP and \( \angle \) Co-B.

CONCLUSION: It is recommended that the functional treatment with an activator is carried out during the middle and late mixed dentition stages (10-13 years) corresponding to the period between CVMS II and SVMS III. The average duration of treatment with the activator was 10.46 months for the 8-10-year-olds, 11.23 months for the 11-13-year-olds and 11.48 months for the 10-15-year-old patients. The extension of treatment is determined by the necessary pre-treatment preparation or the need for precise alignment of the dental arches with fixed appliances.

SP143 MAXILLARY ANTERIOR AESTHETIC TOOTH PROPORTIONS IN AN ORTHODONTICALLY TREATED POPULATION: VARIABILITY OF THE GOLDEN RULE

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AIMS: To analyse the most prevalent aesthetic proportion of maxillary tooth widths in the anterior region and the percentage of each apparent individual tooth width in the total anterior segment, in a group of subjects treated with fixed appliances; and to investigate the occurrence of the ‘Golden Proportion’ and ‘Golden Percentage’.

SUBJECTS AND METHOD: Forty-five patients (16 males, 29 females; mean age 17.96 ± 7.56 years) treated with fixed orthodontic appliances. The inclusion criteria were: Caucasians, complete alignment, molar and canine Class I, 1/3 overbite, 1-3 mm of overjet, absence of posterior crossbite, flat curve of Spee, intact morphology of the upper anterior maxillary teeth, centred midlines, no missing teeth. Patients dissatisfied with their treatment were rejected. The plaster casts, obtained from an alginate impression, scanned with the Reveng Dental® 3D scanner. Nemocast 3D®, were used to perform the measurements of the three-dimensional virtual models. All measurements were recorded as linear lengths in tenths of a millimetre. Descriptive statistics and the Student’s t-test were applied. A paired t-test was used to determine if significant differences occurred in contralateral measurements in the same patient.

RESULTS: The relative width of the central incisor, lateral incisor and canine was respectively 1.42:1:0.80 for the right side and 1.43:1:0.81 for the left side. No statistically significant findings were observed regarding gender and contralateral hemi-arches. The golden proportion for the central incisor to lateral incisor was found to be 40.0 to 56 per cent and for the lateral incisor to canine 6.7 to 8.9 per cent. The percentages of the apparent individual tooth width of the anterior segment from right to left canine were: 12.5, 16, 22.2, 21.9, 13 and 12.4 per cent. The prevalence of golden percentage was: 11.1, 82.2, 37.8, 28.3, 97.8 and 8.9 per cent.

CONCLUSION: The golden proportion was not found to exist between perceived maxillary anterior tooth widths in most of the subjects analysed. The golden percentage occurred in a high proportion of lateral incisors. The results suggest that the rule of golden proportion should not be used as a guideline in orthodontics without considering individual modifying factors.

SP144 THREE-DIMENSIONAL ASSESSMENT OF MUSCULOSKELETAL FEATURES IN CLASS I, II AND III SUBJECTS

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AIMS: 1. To evaluate volumetric parameters of mandibular muscles and linear mandibular skeletal parameters in subjects with skeletal Class I, II and III malocclusions; 2. To compare muscular and mandibular skeletal parameters between study groups and 3. To assess the correlations between skeletal and muscular parameters

SUBJECTS AND METHOD: Seventy eight patients (mean age 20.8 years), 31 skeletal Class III and 26 skeletal Class II patients prior to the start of combined orthodontic treatment and orthognathic surgery and 21 Class I patients before orthodontic treatment (control group). Magnetic resonance imaging was performed for the masseter (MAS) and medial pterygoid muscles (MPM) and volumetric and cross-sectional area (CSA) measurements were undertaken. Cone beam computed tomography (iCAT) was performed for assessment of mandibular skeletal parameters: height of ramus, length of mandibular corpus, overall mandibular length, inter-gonial width, inter-condylar width. Data were analyzed using descriptive statistics, one-way ANOVA analysis with Bonferroni correction and Pearson correlation coefficients. The means, standard deviations and ranges for muscular and mandibular variables were calculated for all study groups. Differences between the left and right sides for all muscular and mandibular variables were calculated.

RESULTS: There was a statistically significant ($P = 0.038$) difference between the Class I, II and III groups when assessing MPM volume, with the highest values in the Class III group and the lowest in the Class II group. There was no statistically significant difference for MAS volume and CSA between the study groups, but there was a tendency for all muscular measurements to be lower in the Class II group. There was a significant difference between Class I, II and III for mandibular skeletal overall length ($P < 0.0001$), ramus height ($P < 0.0006$) and corpus length (0.0001), with highest values in the Class III and lowest variables in the Class II groups. There were several significant positive correlations between muscular and mandibular parameters in all study groups.

CONCLUSION: The results suggest that possibly the performance of MPM is more strongly associated with the etiology of dentofacial deformities than MAS. A relationship between muscular and skeletal parameters exists but this is inconsistent.

SP145 THE RELATIONSHIP BETWEEN ORTHODONTIC TREATMENT NEED AND ORAL HEALTH RELATED QUALITY OF LIFE OF SCHOOL CHILDREN

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AIMS: Malocclusion has a significant physical, social, and psychological impact on the individual and society. Quality of life has been defined by the World Health Organization as ‘people’s perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards, and concerns’. Oral health-related quality of life (OHRQoL) is the extent to which oral and paraoral conditions impact one’s life. The use of OHRQoL measures in addition to professional indices offers a potentially useful combination in clinical practice. The aim of this study was to assess the effect of different orthodontic treatment needs on the OHRQoL of young people.

SUBJECTS AND METHOD: Six hundred and eighty four (343 boys, 341 girls) school children aged 15 to 17 years (mean: 16 ± 0.8 years) were randomly selected from 12 schools representing the four main areas of Tehran. The malocclusion of each subject was determined with the Dental Health Component of Index of Orthodontic Treatment Need. Participants also completed the shortened version Oral Health Impact Profile questionnaire. A chi-Square test was used to analyze the data.

RESULTS: Forty one of the subjects had previous orthodontic treatment or were being treated at the time of the study. Four hundred and thirteen, 172, and 58 of the subjects had little or no, borderline, and actual need for orthodontic treatment, respectively. Orthodontic treatment need significantly affected all daily activities in both male and female subjects.
CONCLUSION: Malocclusion has a negative impact on both physical and psychological aspects of the daily life of subjects who are in ‘definite need for orthodontic treatment’. These impacts are similar for both male and female subjects.

SP146 PATTERNS OF NON-SYNDROMIC PERMANENT TOOTH AGENESIS IN A LARGE HUMAN SAMPLE
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AIMS: To thoroughly explore patterns of non-syndromic permanent tooth agenesis in a large human sample.

MATERIALS AND METHOD: A record review was performed in various orthodontic clinics in order to identify Caucasian patients with non-syndromic permanent tooth agenesis, excluding third molars. Two hundred sixty-two subjects fulfilled the inclusion criteria.

RESULTS: In the 262 Caucasian subjects, approximately 70 per cent presented 1-2 missing teeth. In 83.8 per cent of cases a symmetric agenesis pattern was observed (by jaw, by side, or crossed quadrants). From the large number of different possible tooth agenesis patterns a very small percentage was observed in the sample. In the maxilla, one or both lateral incisors or second premolars were missing in approximately 65 per cent of patients with agenesis in this jaw. In the mandible, one or both central incisors or second premolars were missing in approximately 68 per cent of patients with agenesis in this jaw. These patterns accounted for approximately 62 per cent of the variation observed in the entire dentition.

CONCLUSION: The most prevalent patterns involved premolar/incisor agenesis. The findings indicate the involvement of specific genetic and/or environmental factors in the formation of the entire dentition, which lead to a few specific tooth agenesis phenotypes in cases where this process is disrupted. The present study facilitates the assessment of current treatment needs for patients with non-syndromic tooth agenesis, and can assist clinicians to develop improved interdisciplinary treatment protocols. Furthermore, these data can serve as the basis for planning targeted future genetic studies.

SP147 AUTOMATED ORTHODONTIC OUTPATIENT APPOINTMENT REMINDERS: A PATIENT CENTRED DESIGN
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AIMS: To maximise the impact of automated orthodontic outpatient appointment reminders according to patient preference.

MATERIALS AND METHOD: A 13-item survey was developed and distributed to patients attending orthodontic outpatient clinics over a four-week period.

RESULTS: In total, 533 surveys were analysed, of which 98 per cent (n = 523) favoured receiving an automated appointment reminder, 96 per cent of whom favoured SMS text reminders. Only 1 per cent of patients who had previously experienced SMS text reminders had experienced problems with the service. In comparison, 8 per cent of those who had previously experienced automated voicemail reminders had experienced problems. Thirty nine per cent (207) of patients preferred the reminder to be sent 2 days prior to their appointment, with 45 per cent (241) preferring the reminder to be sent in the morning.

CONCLUSION: Patient non-attendance presents financial and logistical challenges to health-care providers and can influence the final outcome of orthodontic treatment. Non-attendees frequently list forgotten appointment dates as their reason for not attending. This study has served to generate a template for automated orthodontic outpatient appointment reminders and shows that patients prefer to receive a SMS text reminder to be sent 2 days prior to their appointments in the morning.
SP148 MORPHOLOGICAL STUDY OF THE PALATAL RUGAE IN KOREANS AND ASSESSMENT OF THREE-DIMENSIONAL SUPERIMPOSITION IN EXTRACTION CASES
Kyeong min Go, Jin Yi Park, Changbum Park, Jung-yul Cha, Yonsei University, Seoul, Korea, South

AIMS: To improve the accuracy of superimposing digital models for orthodontic patients, the anatomical characteristics of palatal ruga of Korean adults were analyzed. Furthermore, the accuracy of superimposing digital models with third or fourth palatal rugae and the palatal vault in moderate and maximum retraction cases during orthodontic treatment was measured.

MATERIALS AND METHOD: The anatomical features of the palatal ruga using 343 pre-treatment digital model samples based on the position, the number, and the arrangement of the palatal ruga were analyzed. In addition, 40 orthodontic patients who had completed treatment with extraction of upper and lower premolars were divided into a moderate (<7.0 mm) and a maximum (>7.0 mm) retraction group. The superimposition of digital models with third or fourth primary rugae and palatal vault were analyzed. After measuring the amount of retraction on the digital models, the data was compared with the retraction amount measured on the cephalometric radiograph and whether there was a significant difference between the two methods was determined.

RESULTS: 1. About 80 per cent of samples had 3 or 4 primary ruga. 2. Seventy and 78 per cent of left and right palate had additional ruga posterior to the third primary rugae, and in this case, the anterior and posterior limit of third primary rugae were more anterior compared to the case with no ruga posterior to third primary rugae (P < 0.05). 3. In the maximum retraction group, both superimposition methods for the third and fourth primary rugae in digital models showed a significant difference of anterior teeth movements with the superimposition of cephalometric radiographs (P < 0.05). 5. Between the third and fourth rugae, superimposition of the fourth primary rugae showed a higher linear regression coefficient value (R2 = 0.988) with the superimposition method of cephalometric radiograph compared to the superimposition method of the third primary rugae (R2 = 0.931).

CONCLUSION: To perform superimposition of digital models, the third primary rugae or medial 1/2 portion of the fourth primary rugae is an acceptable reference point for moderate retraction cases. However, for maximum retraction cases, the third primary ruga is not appropriate for superimposition. Instead, orthodontists should use the most suitable rugae lying posterior to the mesial portion of the maxillary second premolar based on the number and position of existing palatal rugae.

SP149 NASAL SEPTAL DEVIATION AND FACIAL FORM DURING ONTOGENY
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AIMS: To examine the relationship between nasal septal deviation and the shape of the facial skeleton during ontogeny.

MATERIALS AND METHOD: Nasal septal size was retrospectively measured on existing cone-beam computed tomograms (CBCT) in 66 mixed-sex orthodontic patients of European ancestry aged 6-18 years. First, the septum was manually segmented using three-dimensional (3D) CBCT reconstructions and the volume of the structure calculated. Next, a midsagittal volume that followed the borders of the septum was constructed, which served as a model for a non-deviated septum. Nasal septal deviation was then calculated for each individual as a percentage of nasal septal volume relative to the modelled non-deviated septal volume. Facial form was quantified using a series of coordinate landmarks of the facial skeleton and the cranial base. Using geometric morphometric techniques, size and shape information was distilled from the landmark data. Multivariate regression analyses were conducted to assess the interactions between the septum and the facial skeleton.

RESULTS: The amount of nasal septal deviation was similar across all ages and did not increase with growth and development. There was no significant correlation between nasal septal deviation and age or facial size. Both septal volume and modelled non-deviated volume increased with age and demonstrated similar scaling relationships relative to facial size. Facial shape changes correlated with septal deviation followed a different pattern than allometric shape changes. In individuals with
a deviated septum, the sphenoid body was anteriorly displaced, reducing the size of the nasal cavity. This pattern of morphological variation was independent of the stage of development.

CONCLUSION: Normal developmental changes in nasal cavity and cranial base form are not related to an increase in nasal septum deviation. Rather, a facial skeletal configuration with anterior displacement of the sphenoid may place spatial constraints on the growth of the septum, resulting in deviation.

SP150 WHERE DOES THE DISC PLACE IN ASYMPOMATIC CLASS II AND III MALOCCLUSIONS? A RETROSPECTIVE MAGNETIC RESONANCE IMAGING STUDY
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AIMS: To test the null hypothesis that pre-orthodontic children with Class II and Class III malocclusions have disc displacements before orthodontic treatment.

MATERIALS AND METHOD: Forty-six sagittal unilateral temporomandibular joint (TMJ) magnetic resonance images (MRI) obtained from clinically symptom-free and orthodontically untreated subjects, 26 Class II malocclusion (10 girls, 16 boys) and 20 Class III malocclusion (5 girls, 15 boys) patients in maximum intercuspal position. The mean ages of the Class II and Class III malocclusion groups were 11.71 ± 0.31 and 8.98 ± 1.80 years, respectively. Unilateral TMJ MRIs and lateral cephalometric radiographs were obtained. Measurements were performed to calculate the means, maximum and minimum values. The study groups were compared with a Student’s t-test.

RESULTS: The Class III group exhibited a more anteriorly positioned disc and increased eminence steepness than the Class II group (P < 0.05). The condyle position of both groups was nearly concentric into the glenoid fossa; however, the condyles of the Class II malocclusion group were positioned more anteriorly than in the Class III malocclusion group (P < 0.05).

CONCLUSION: The null hypothesis was confirmed in this study. Pre-orthodontic children with Class II and III malocclusions have a tendency to disc displacement disorders.

SP151 WHICH ONE IS MORE EFFICIENT ON THE MAXILLA: DOUBLE HINGED APPLIANCE WITH RATE AND RHYTHM BY LIOU OR A MCNAMARA TYPE APPLIANCE WITH A MODIFIED RATE AND RHYTHM?
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AIMS: To compare two different maxillary expansion appliances applied with two dissimilar expansion rates and rhythms.

SUBJECTS AND METHOD: This prospective clinical study was conducted on two groups that included 30 patients. Group 1 comprised 15 patients (6 females, 9 males) with a mean age of 13.1 ± 1.33 years treated by means of a double hinged maxillary expansion appliance (DHMEA) and group 2 consisted of 15 patients (9 females, 6 males) with a mean age of 10.71 ± 1.9 years treated with the McNamara maxillary expansion appliance (MMEA). Skeletal age was assigned by the cervical vertabral maturation (CVM) method. The growth stage was CVS3 and CVS2 in groups 1 and 2, respectively. The expansion rate and rhythm was scheduled as four times daily (1 mm) for one week and four times daily (1 mm) closed during the subsequent week for 9 weeks with the DHMEA. It was scheduled as twice daily (0.5 mm) opened for one week and twice daily (0.5 mm) closed subsequent week of screw for 7 weeks with the MMEA. After completion of expansion, the appliances were kept for consolidation. The material consisted of lateral and postero-anterior (PA) cephalometric radiographs taken before (T1) and after (T2) maxillary expansion. Sagittal and transversal measurements were made on the radiographs. The data obtained at T1 and T2 were compared using paired t-tests. The groups were compared by using Mann Whitney U test.

RESULTS: On the lateral cephalograms, statistically significant changes were observed for maxillary position, sagittal dimension, mandibular position, vertical dimension of the face and overjet/overbite in both groups. On the PA cephalograms, statistically significant changes were obtained for the transverse dimension of the maxilla/maxillary dentoalveolar structures in both groups Comparing the difference between the groups on the lateral cephalograms, maxilla/maxillary
SP152 EVALUATION OF NASAL AND PHARYNGEAL AIRWAY CHANGES AFTER ALTERNATE RAPID MAXILLARY EXPANSION AND CONSTRICTION PROTOCOL
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AIMS: To evaluate nasal and pharyngeal airway dimensions after alternate rapid maxillary expansion and constriction protocol (Alt-RAMEC) in patients with a skeletal Class III malocclusion related to maxillary retrognathia.

SUBJECTS AND METHOD: The Alt-RAMEC protocol was applied to 21 patients (10 males, 11 females) for 7 weeks. The mean age of the patients was 10 years 11 months. Lateral cephalometric and postero-anterior (PA) radiographs were taken of each patient at the pre- (T0) and post- (T1) treatment phases to evaluate the nasopharyngeal airway dimensions (NAW1 = PNS-ad1 and NAW2 = PNS-ad2), oropharyngeal airway dimension (OAW = O1-O2), nasal width (the distance between right and left aperture piriformis border) and the maxillary structures. The T1 radiographs were taken immediately after the end of the expansion protocol at the end of the 7th week. The paired t-test was used to determine the statistical significances of differences between T0 and T1 measurements.

RESULTS: The increase in nasal width and nasopharyngeal airway dimensions were statistically significant. No significant increase in oropharyngeal airway dimension was observed. The increase in the width of the maxilla and the maxillary molar teeth was found to be statistically significant.

CONCLUSION: The Alt-RAMEC protocol leads to an increase in nasal, nasopharyngeal airway dimensions and the width of the maxillary structures.

SP153 PREDICTION OF UPPER THIRD MOLAR ERUPTION OR IMPACTION USING LATERAL CEPHALOGRAMS
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AIMS: Upper third molar prediction of eruption or impaction should be part of orthodontic treatment planning. The aim of the study was to assess the reliability of lateral cephalometric measurements regarding the risk of upper third molar impaction in adolescents who underwent orthodontic treatment, and to examine changes in third molar space and angulation following upper first premolar extractions.

SUBJECTS AND METHOD: One hundred and seventy eight adolescent orthodontic patients, aged between 14 and 16 years at the beginning of orthodontic treatment divided into non-extraction treatment group (108) and upper first premolar extraction treatment group (70). Standardized lateral cephalometric radiographs were taken for each patient before (T1) and after (T2) orthodontic treatment. On the lateral cephalometric films the following were measured: Dptv distance from the distal face of the upper first molar to the vertical pterygoid plane (PTV) and Ψ angle formed by the tangent to the upper third molar occlusal face and the palatal plane. Pearson’s Chi-square test was applied for statistical evaluation.

RESULTS: The number of upper third molars with a good chance for eruption increased after orthodontic treatment from 23 to 50 per cent, especially in the extraction group. The number of upper third molars with a high risk of impaction decreased from 11.9 to 7.4 per cent after treatment. Statistically significant correlations (P = 0.030) were found between Dptv values before and after treatment. The angle between the tangent to the occlusal face of the upper third molar and the palatal plane decreased by 3 per cent in the extraction group and by 8 per cent in the non-extraction
group. Statistical analysis showed a very low correlation between T1 and T2 values. There was no relevant correlation between upper third molar prediction of eruption and Class of malocclusion. 

CONCLUSION: Lateral cephalometric films can be used for upper third molar prediction of eruption or impaction. The chances of eruption of the upper third molars improved slightly during orthodontic treatment with or without upper first premolar extractions.

SP154  A RETROSPECTIVE STUDY OF DIFFERENT FIXED RETENTION TYPES
Clara Gonzalez, Josep Maria Ustrell, Universitat de Barcelona, Spain

AIMS: To retrospectively compare different types of fixed retainers used for stabilization of the lower anterior segment. In addition, different types of composite used by several authors were compared, in terms of efficiency, relapse, debonding rate and periodontal problems.

MATERIALS AND METHOD: Systematic review of scientific papers from last 20 years, as indexed by Medline, using the PubMed search engine. The MeSh terms used were: bonded orthodontic, orthodontic retainer, lingual retainer.

RESULTS: The most recommended composite is Concise®. The most efficient fixed wire used as a lower retainer is co-axial wire bonded from canine to canine.

CONCLUSION: Lingual fixed retainers are compulsory after orthodontic treatment for stabilization of the results, as it is an effective and easy method of maintaining fixed orthodontic results.

SP155  BOLTON ANALYSIS: INITIAL VERSUS FINAL DISCREPANCIES AFTER DIFFERENT PREMOLAR EXTRACTIONS
Deisy González Pérez, Susana De la Cruz, Sabino Ochandiano, Master de ortodoncia avanzada, Universidad Europea de Madrid, Spain

AIMS: To investigate whether the extraction of four premolars as a requirement of orthodontic therapy is a factor in the creation of tooth size discrepancies and whether any tooth extraction combination creates more severe discrepancies.

MATERIALS AND METHOD: Pre-treatment dental casts of 119 patients with malocclusions. The dental casts were selected according to the following criteria: no tooth size discrepancy between the mandibular and maxillary dental arches should exist before treatment. Pre-treatment mesiodistal dimensions of the mandibular and maxillary teeth were measured and subjected to Bolton analysis. Hypothetical tooth extractions were performed for each patient with the following combinations: all first premolars, all second premolars, upper first and lower second premolars, and upper second and lower first premolars. The resultant measurements were again subjected to Bolton analysis to determine whether a tooth size discrepancy had been created. The results were evaluated statistically with the statistical package, SPSS version 21.0 for Windows, to obtain a frequency histogram in different samples.

RESULTS: First premolar extractions created the same tooth size discrepancies as upper first and lower second premolars with the same Bolton analysis (to an average of 90%). To equal a Bolton analysis for both, the extraction of second premolars as upper second and lower first premolars resulted in an average of 89 per cent.

CONCLUSION: The findings of this study indicate a new point of view to the question as to which teeth to extract when evaluated for tooth size aspect only.

SP156  AUDIT OF THE DIAGNOSTIC VALUE OF CONE BEAM COMPUTED TOMOGRAPHIC SCANS TAKEN FOR THE ASSESSMENT OF IMPACTED MAXILLARY CANINES
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AIMS: To assess if cone beam computed tomographs (CBCT) taken for impacted canines yielded useful information that affected diagnosis or treatment planning. The diagnostic quality of the CBCT was also assessed. The audit gold standard was that 100 per cent of CBCT should be of diagnostic
quality, and provide additional information compared with plain film radiographs that aid in diagnosis and treatment.

MATERIALS AND METHOD: All CBCT were reported on by a consultant. Forty six cases were identified retrospectively as having a CBCT for orthodontic treatment in relation to impaction and ectopic eruption of the maxillary canines between September 2013 and September 2014. The notes of the patients were assessed for the following: 1. Reason the CBCT was requested; 2. Main findings as recorded in the notes from the CBCT; 3. Affect/influence on treatment plan again as documented in the notes. All CBCTs were assessed for diagnostic quality and coincidental findings not directly related to the reason for the scan were noted.

RESULTS: One hundred per cent of the CBCT audited were deemed of diagnostic quality; therefore this aspect of the audit standard was met. The results of this audit show that in nearly 70 per cent of cases taking a CBCT influenced or changed the surgical and orthodontic management of patients with maxillary impacted canines. This contradicts the findings of several retrospective studies that found that only a minority of cases would have changes to treatment plans when a CBCT was used compared to conventional plain films. However the confidence and accuracy a CBCT gives a clinician, especially in regards to location and mechanical eruption of unerupted teeth, also needs to be appreciated.

CONCLUSION: It is not possible from this audit to ascertain whether the use of CBCT led to better patient outcomes. This would require a prospective randomised clinical trial.

SP157 INTRAORAL SCANNER VERSUS TRADITIONAL POLYVINYL SILOXANE IMPRESSION: PATIENTS’ POINT OF VIEW***
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AIMS: To assess patient acceptance of an intraoral scanner versus traditional polyvinyl siloxane (PVS) impression in everyday orthodontic practice in terms of: injury, discomfort and patient preference.

SUBJECTS AND METHOD: Fifty three consecutive patients with respect to the following inclusion criteria were selected: no dental shape anomalies, no dental number anomalies, age range 25-45 years, no differences in malocclusion or in crowding. All underwent an intaoral scan by means of iTero 2.9 by Cadent and PVS double impression (Acquasil Putty and light). After a few days from these procedures a survey generated on Survio was sent by email to all patients. The survey was based on 10 questions regarding: discomfort, soft tissue injury, nausea, xerostomia, temporomandibular joint (TMJ) activity, mouth obstruction, tongue obstruction, time dedicated, patient preference and technological impact. All answers were assessed by means of descriptive statistics analysis (SAS software, version 9.4 for Windows). A P value less than 0.05 was considered statistically significant.

RESULTS: Seventy nine per cent of patients preferred, as a general method, the intraoral scan while different and significant scores were collected on the question mouth obstruction and TMJ activity where 54 per cent of the patients preferred the traditional PVS impression. For all other points the intraoral scan was significantly preferred to the PVS impression.

CONCLUSION: The intraoral scan can be considered a preferred method when compared to traditional impressions and patient experience was well aligned in stating its efficacy in this sample.

SP158 BONE REGENERATION AFTER TREATMENT WITH COVERING MATERIALS COMPOSED OF FLAX FIBRES AND BIODEGRADABLE PLASTICS – HISTOLOGICAL EXAMINATION
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AIMS: The modification of flax fibres to create biologically active dressings could be of interest for tissue engineering. Flax fibres, derived from transgenic flax expressing three bacterial genes for the synthesis of poly-3-hydroxybutyric acid, have a good in vitro and in vivo biocompatibility, do not show any inflammatory response after subcutaneous insertion and have better mechanical
properties than unmodified flax fibres. The aim of this study was to examine the osteogenic potential of covering materials with and without flax fibres.

**MATERIALS AND METHOD:** Forty adult rats were divided into seven groups. A midline skin incision was performed on the skull and similar bone defects were created. In groups 1 and 2 pieces of pure PLA and PCL were inserted. In groups 3 and 4 (PLA-M50, PCL-M50) bone defects were covered with biocomposites composed of PHB-producing flax fibres in PLA or PCL matrix. In groups 5 and 6 biocomposites composed of genetically unmodified flax fibres and PLA or PCL were inserted (PLA-wt-Nike, PCL-wt-Nike). Group 7 without any treatment served as controls. The animals were sacrificed at four weeks, the skull were harvested and subjected to histological examination.

**RESULTS:** The percentage of bone regeneration when using PLA was non-significantly decreased, while with the use of pure PCL the amount of new bone reached a higher level compared to PLA. After treatment with PCL-transgenic flax composites a large amount of new formed bone could be found which was comparable to that of the controls. In contrast, the composite of PCL and native flax plant (PCL-wt) showed a significant decrease on bone regeneration compared to the other tested groups. In comparison to controls and PLA composites, the bone covers made of pure PLA had substantially less influence on bone regeneration and bone healing proceeded with a lot of connective tissue.

**CONCLUSION:** Comparing the histological data, PCL and its composites contribute to a higher quantity of regenerated bone than PLA composites. However, the histological studies showed comparable bone regeneration, both with the use of the covering materials, as well as in untreated bone lesions.

**SP159 THE CROWN HERBST APPLIANCE: EFFECTS ON THE MAXILLARY POSTERIOR DENTITION EVALUATED BY THREE-DIMENSIONAL SUPERIMPOSITION OF CASTS**

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**AIMS:** To analyze the treatment effects of the crown Herbst appliance on the maxillary posterior dentition.

**MATERIALS AND METHOD:** The scans of 40 sets of pre- and post-treatment casts of consecutively treated Class II patients (mean age 14.1 ± 1.3 years) were superimposed and analyzed using the freeware, Blender 2.67. The changes were compared with those of the control sample comprised of 20 Class II patients (mean age 13.8 ± 1.6 years) treated with fixed appliances and Class II elastics.

**RESULTS:** In the crown Herbst group clinically significant derotation (6.9 ± 8.3°, 95% CI 4.3 to 9.2°) and distalization (2.6 ± 1.4 mm, 95% CI 2.0 to 3.1 mm) of the upper first molars was recorded compared to the control group. Distal movement of the upper first molars was followed by the second and first premolars. The design of the appliance allowed passive extrusion of the premolars facilitating in settling of the occlusion.

**CONCLUSION:** The crown Herbst appliance produces predictable distalizing and derotation movement of the upper first molars, contributing in the correction of a Class II molar relationship and providing space in the upper arch.

**SP160 EFFECTS OF A LOCAL PLATELET RICH PLASMA INJECTION ON THE RATE OF ORTHODONTIC TOOTH MOVEMENT IN A RAT MODEL: A HISTOMORPHOMETRIC STUDY**

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**AIMS:** To determine the effects of different concentrations of a platelet rich plasma (PRP) injection on alveolar bone density and on the rate of orthodontic tooth movement in a rat model.

**MATERIALS AND METHOD:** Seventy six rats were divided into a moderate concentration PRP injection group (mPRP, n = 38) and a high concentration PRP injection group (hPRP, n = 38). In each group, five time points were studied: 3, 7, 14, 21 and 60 days. Before orthodontic mesialisation of
the upper first molars, a PRP injection was performed on the right side molar buccal sulcus (mPRP-E, hPRP-E) while the left side molar served as the control (mPRP-C, hPRP-C). Tooth movements were measured on three-dimensional digital models. Alveolar bone volume density and osteoclastic activity (tartrate resistant acid phosphatase activity) in the first molar intra-radicular area were evaluated by histomorphometric analysis. The data were processed with NCSS software (2007, Utah, USA). The results were expressed as the means and standard deviations. One-way repeated measures ANOVA was used in repeated measurements of multiple groups and independent sample t-tests were used to compare the two groups of variables. Intra-observer reliability of tooth movement measurements was estimated using the intraclass correlation coefficient.

RESULTS: Alveolar bone density was decreased in the experimental groups compared to the control groups ($P = 0.0001$) at 3, 7, 14 and 21 days. On day 3, the osteoclastic activity of the experimental groups was higher than the controls ($P = 0.044$, $P = 0.0001$). On day 21, the amount of tooth movement in the hPRP-E group was 1.7 times more than in the hPRP-C group and 1.4 times more than in the mPRP-E group ($P = 0.001$). On day 60, the alveolar bone density increased to the original levels in all groups.

CONCLUSION: Injection of both moderate and high concentrations of PRP may accelerate orthodontic tooth movement by decreasing alveolar volume density on paradental tissues and enhancing osteoclastic activity in a transient way.

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SP161 THREE-DIMENSIONAL ASSESSMENT OF FORSUS APPLIANCE EFFECTS ON CLASS II MALOCCLUSION CASES: A CONE BEAM COMPUTED TOMOGRAPHIC STUDY***
Onur Gurkaynak, Yener Cam, Cukurova University, Adana, Turkey

AIMS: To compare the dentofacial changes in peak and late adolescent patients with Class II malocclusions treated with the Forsus Fatigue Resistant Device (3M Unitek) appliance using three-dimensional (3D) images of cone-beam computed tomographs (CBCT).

SUBJECTS AND METHOD: Thirty five patients with a Class II division 1 malocclusion. The patients were divided into two groups based on their different growth patterns. Between 13 and 14 years is the peak phase of pubertal growth (peak pubertal group) and that between 15-17 years the late phase of pubertal growth (late pubertal group). CBCT were taken before Forsus treatment and after Forsus appliance removal for 3D cephalometric analysis.

RESULTS: The Forsus appliance had a stimulatory effect on the mandible in both groups; but more in the peak pubertal group. There were no sagittal skeletal effects on the maxilla. There were no vertical ratio changes in either group. The maxillary incisors were retruded and the mandibular incisors were protruded in both groups. The changes were more intense in the late pubertal group. In the late pubertal group, the correction of the Class II malocclusion was more dental than skeletal.

CONCLUSION: The Forsus appliance has positive skeletal effects on Class II division 1 patients, but the skeletal effects were limited in late adolescent patients.

SP162 APPLICABILITY OF MOYER’S METHOD IN A GROUP OF CHILDREN FROM TARGU-MURES, ROMANIA
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AIMS: To assess the applicability of Moyer’s method of mixed dentition analysis to estimate the mesiodistal width of the permanent canines and premolars in a sample from Targu-Mures, Romania.

MATERIALS AND METHOD: The buccal surfaces of the lower incisors, upper and lower canines and premolars were recorded from 44 study models (22 females, 22 males) with a digital camera. The mesiodistal size of each tooth was measured with the Image Pro Insight Software. Having in view Moyer’s recommendations, predicted 50 and 75 per cent values were compared to the measured values using a paired t-test.
RESULTS: The differences were not significant between the real size and the 75 per cent predicted values in the lower arch either for males or females. The 95 per cent prediction value was most common in the upper arch both for females and males, but its frequency did not reach 50 per cent in either case.

CONCLUSION: In spite of its limitations, the Moyer’s method can be applied on this sample. While the 50 per cent prediction cannot be applied at all, the 75 per cent value is valid only in the lower arch. Nevertheless, the 95 per cent index can be used for careful ratings in the upper, for both genders.

SP163 CEPHALOMETRIC EVALUATION OF THE SIZE AND MORPHOLOGY OF SELLA TURCICA IN DIFFERENT TYPES OF MALOCCLUSION AMONG ROMANIAN SUBJECTS
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AIMS: The vertical and sagittal position of the maxilla and mandible is influenced by the size and angulation of the cranial base. The sella turcica is part of the cranial base, located in the middle cranial fossa, the growth and development of this bony structure being influenced by the neural and general skeletal pattern. Even though the pituitary gland has a certain influence on the shape and size of the sella, the development of other bony structures also certainly influences it. Cephalometric analysis is an important part of orthodontic diagnosis and treatment planning. From numerous cephalometric landmarks, the point S (sella) is commonly used to describe the cranial base and to evaluate the position of other bony structures towards it. Sella and its midpoint can be easily identified on lateral cephalograms. The purpose of this study was to evaluate the shape and dimension of the sella turcica in different types of malocclusions.

MATERIALS AND METHOD: One hundred and thirty randomly selected lateral cephalometric radiographs were analysed, on which the skeletal and facial pattern were identified and the shape and sagittal dimensions of the sella were measured.

RESULTS: Statistical analysis showed no significant differences regarding the shape of sellae in different types of malocclusion, although skeletal Class II cases presented the most anarchic sellae shapes. Comparing linear measurements of skeletal length and sella diameter, it was found that the smallest diameter of the sella was in Class III, moreover other skeletal lengths presented the lowest mean values also in this type of malocclusion. Statistically significant differences among maxillary, mandibular and cranial base length and sella diameter were found in Class I patients (P = 0.013).

CONCLUSION: A Class III malocclusion has the most evident effect on the shape and size of sellae turcica.

SP164 ORTHODONTIC FORCES AND THEIR EFFECTS ON PERIODONTAL FIBROBLASTS: AN IN VITRO MODEL STUDY
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AIMS: Mechanical stresses such as compressive forces are loaded in the periodontum during orthodontic movement and remodelling takes place in response to these stresses. The aim of this study was to investigate the influence of mechanical stresses in vitro on the viability and function of fibroblasts of the periodontal ligament (PDL) and to analyze if there are differences between continuous compressive forces (CCF) and intermittent compressive forces (ICF).

MATERIALS AND METHOD: PDL fibroblasts were seeded in a six well plate in a Dulbecco’s Modified Eagle’s Medium and then incubated with 2 mL of culture media for one week. Pressure was applied by placing them in a centrifuge to simulate different types of forces, according to the protocol of Redlich et al. (1998). For CCF the fibroblasts were centrifuged at 1200 rpm for 30 minutes and ICF for three intervals of 10 minutes, compared with untreated controls. Cell viability was analyzed by the MTT test and function with alkaline phosphatase analysis. The study was repeated three times.

RESULTS: The fibroblasts changed with the different types of force. Under both conditions, a statistically significant decrease (P < 0.05) in viability and function was observed. The application of a
CCF in vitro altered viability of the fibroblasts where viability was 14 per cent higher than in the intermittent group (the difference not being statistically significant). ICF showed more cell function than CCF with a statistically significant difference ($P < 0.05$).

CONCLUSION: The application of ICF in fibroblasts appears to stimulate cell function better than CCF. This method is a rapid and easy way to study the effect of CCF and ICF on fibroblasts.

SP165 EVALUATION OF PREVALENCE OF IMPACTION, ECTOPIC ERUPTION, RETENTION AND AGENESIS OF THE PERMANENT SECOND MOLAR IN TURKISH PATIENTS

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AIMS: To determine the prevalence of impaction, ectopic eruption, agenesis and primary and secondary retention of the permanent second molar (M2) among Turkish adolescents.

MATERIALS AND METHOD: This retrospective study consisted of panoramic radiographs (PRs) of 9783 patients. (5389 girls, 4394 boys) referred between 2011 and 2015. The mean and standard deviation age was 13.16 $\pm$ 2.05 years for females and 11.92 $\pm$ 1.27 years for males. Demographic data of all patients, and the prevalence of impaction, ectopic eruption, agenesis and primary and secondary retention of M2 was registered in a standardized manner. The Pearson chi-squared test was performed to compare the statistical significance of differences in prevalence of findings between the genders and between the maxilla and mandible of the patients.

RESULTS: The prevalence of ectopic eruption of M2 was 2.1 per cent, primary retention was 2.5 per cent, secondary retention was 0.7 per cent, impaction was 0.9 per cent and agenesis was 1.2 per cent. The prevalence of agenesis was significantly higher in the mandible but no significant differences were found between the genders. Statistically significant differences were found between the genders and between the maxilla and mandible when the prevalence of impaction was elucidated. There were statistically significant differences between the maxilla and mandible for ectopic eruption of M2 and differences between the right and left sides in the mandible was evident. The prevalence of ectopic eruption was statistically significantly higher in the mandible. Statistically significant differences could be observed for primary retention in males and in the maxilla. The prevalence of secondary retention showed significant differences in females and in the maxilla.

CONCLUSION: In the examined Turkish patient population, the investigated parameters were higher than reported earlier. Orthodontists should apply treatment mechanics by considering the possibility of impaction, ectopic eruption, retention and agenesis of M2 when eruption disturbances related M2 are identified.

SP166 EFFECTS OF METHACRYLOXYDECYL DIHYDROGEN PHOSPHATE PRIMERS ON THE BOND STRENGTH OF ORTHODONTIC BRACKETS ON ZIRCONIA SURFACES

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AIMS: Zirconia crowns have been gaining popularity in restorative dentistry due to their improved strength and aesthetic results. However, it has been shown that the conventional silane coupling agent may not be effective in elevating the bond strength between orthodontic brackets and zirconia surfaces. Therefore, the aim of this study was to evaluate the effects of 10-methacryloyloxydecyl dihydrogen phosphate (MDP) primers on the shear and tensile bond strengths of metal brackets on zirconia surfaces.

MATERIALS AND METHOD: One hundred seventy four cylindrical shaped zirconia platforms were fabricated. The zirconia surface was sandblasted and received one of three surface treatments before being cured with Transbond XT resin primer and light-curing adhesive paste (3M Unitek, Monrovia, California, USA); (A) no additional surface treatment ($n = 57$); (B) Z-Prime™ Plus (Bisco Inc., Schaumburg, Illinois, USA) ($n = 59$); and (C) Clearfil (Kuraray Dental Inc., Okayama, Japan) ($n = 58$). All specimens were stored at 37°C in distilled water for 24 hours prior testing. Shear bond
strength (SBS) was measured on 30 samples in each group and tensile bond strength (TBS) on the remaining samples. All tests were conducted in a universal testing machine (Instron Corp., Massachusetts, USA) with a crosshead speed of 1.0 mm/minute. For statistical analysis, the Kruskal-Wallis test was used with a significance level at 0.05.

RESULTS: The SBS of groups A, B and C was 5.76 ± 3.22 MPa, 21.14 ± 6.00 MPa, and 21.11 ± 4.96 MPa, respectively. There existed a statistically significant difference between groups A and B (P < 0.001) as well as between groups A and C (P < 0.001), but not between B and C. In contrast, the TBS strength of the groups A, B and C was 3.46 ± 2.21 MPa, 3.97 ± 2.09 MPa, and 4.56 ± 2.01 MPa, respectively, with no statistically significant difference among the three groups.

CONCLUSION: The MDP-containing primers significantly enhanced the SBS between the metal brackets and zirconia surfaces. However, the TBS was unaffected by application of MDP-containing primers.

SP167 THE EFFECTS OF SUPPLEMENTAL VIBRATIONAL FORCE ON CYTOKINE LEVELS IN GINGIVAL CREVICULAR FLUID DURING ORTHODONTIC TOOTH MOVEMENT
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AIMS: To investigate the levels of inflammatory and bone metabolism-related cytokines, interleukin-1 beta (IL-1β), tumour necrosis factor-alpha (TNF-α), receptor-activator of nuclear factor kappa beta ligand (RANKL) and osteoprotegerin (OPG) in gingival crevicular fluid (GCF) during the levelling stage of orthodontic tooth movement by mechanical vibration.

SUBJECTS AND METHOD: Twenty one patients (11 males, 10 females) divided into two groups. The experimental group (n = 11) included patients who were to receive orthodontic treatment using mechanical vibration, while the control group (n = 10) included patients who were to receive orthodontic treatment without mechanical vibration. Mechanical vibration (25 g force, 30 Hz frequency, 20 minutes per day) was applied using the Acceledent™ (OrthoAccel Technologies Inc., Houston, Texas, USA).

RESULTS: In the experimental group, the RANKL concentration varied somewhat during this period, but showed an increased tendency. The OPG concentration in the experimental group was higher than that in the control group at all time points except at 6 weeks. The RA

CONCLUSION: 1. The group that had undergone mechanical vibration revealed a different fluctuation pattern, with regard to the GCF cytokines, than the group who had undergone orthodontic appliance therapy only. 2. Higher expressions of RANKL, OPG and TNF-α were observed in the vibration group. 3. The RANKL/OPG concentration ratio remained higher than at baseline throughout the levelling period. This was especially true in the experimental group, in which the ratio peaked at 3 weeks.

SP168 ROMSE- A REGISTER PROJECT FOR RARE DISEASES WITH OROFACIAL INVOLVEMENT
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AIMS: Around 30 million people in Europe are affected by a rare disease. Approximately 80 per cent of all known rare diseases are of genetic origin and around 15 per cent can become manifest in the orofacial region. This may include anomalies of tooth structure, soft tissue and craniofacial dysplasia such as cleft lip and palate (CLP) as well as dysgnathia. In medicine and dentistry there is often little knowledge of clinical manifestations, diagnosis and treatment of a rare disease. This leads to
patients getting the wrong diagnosis and difficulties in patient-centred care in general. The aim of this working group is to establish a ‘register for orofacial manifestations in people with rare diseases’ in order to allow doctors, dentists and orthodontists, as well as patients and their families, to inform themselves more about rare diseases with orofacial manifestations.

MATERIALS AND METHOD: Starting in 2011 material from various databases (Orphanet, e-medicine, Gene Clinics, EMA, OMIM) as well as Medline, medical literature and ‘grayliterature’ was collected and evaluated. Since 2013 the gathered information has been incorporated into the web-based, freely accessible register at http://romse.org. All rare diseases with orofacial manifestations are registered with current subject-specific literature and correctly categorized.

RESULTS: So far 471 rare diseases with orofacial manifestations have been listed in the ROMSE register. One hundred and fifty two of those diseases or syndromes show dysgnathia and 145 of the analyzed rare diseases can potentially occur in combination with a CLP. The register is also connected to other databases and information platforms for rare diseases such as Orphanet, Research for Rare, Seatlas and ZIPSE. Additionally, collaboration is being undertaken with seven university clinics, which serve as a first medical/dental point of contact for those who are affected.

CONCLUSION: Rare diseases and their symptoms come with difficult challenges regarding their therapy. By setting up ROMSE a platform is provided for dentists and orthodontists on interdisciplinary treatment strategies. In the future this register should also serve as a source of information for physicians, patients and their families.

SP169 AESTHETIC IMPACT OF SIMULATED LIP RETRACTION IN TWO- VERSUS THREE-DIMENSIONS IN CAUCASIAN ADULTS
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AIMS: To compare the perceived aesthetic change from simulated lip retraction in two- and three-dimensions to determine if reviewers are less critical of three-dimensional (3D) than two-dimensional (2D) images.

MATERIALS AND METHOD: 3D images (3dMD, Atlanta) of eight Caucasian dental students (4 male, 4 female) were augmented to an ‘aesthetic’ norm (pre-treatment; upper and lower lips: −7 mm and −5 mm to E-line) and 3.5 mm lip retraction (post-treatment). Right-facing profiles of pre- and post-treatment groups were used for 2D evaluation, and 20-second videos of rotating pre- and post-treatment 3dMD images for 3D. A 5th male 3dMD image served as an untreated control. Laypeople were randomly assigned to one of two survey versions and presented with each subject’s pre- and post-treatment pair, either in 2D or 3D, and asked to quantify which image was more aesthetic using a visual analogue scale (VAS), from −100 (image on left) to 100 (right). No pair was shown in both 2D and 3D within each survey and each contained an equal number of 3D and 2D pairs. The absolute value of the VAS was used to quantify how critical a reviewer was of differences between the two images.

RESULTS: One hundred and forty nine responses were considered for analysis after exclusions (based on age and response to a control question). There were no significant differences in age, gender, or average VAS between respondents of the two surveys. There was a significant increase in the average VAS score for the images in 2D compared to those in 3D (difference = 6.06, P < 0.0001). Additionally, the proportion who had a neutral response to a non-control case (i.e. less than 10 units of the VAS scale), was significantly higher for 3D images than 2D (30% versus 21%, P = 0.0007).

CONCLUSION: The results support the hypothesis that reviewers were less critical of 3D images than 2D images. The use of 3D images might be more appropriate for evaluation of treatment results since actual interactions are in three-dimensions.

SP170 COMPLETION OF PATIENT HEALTH RECORDS: ARE STANDARDS MAINTAINED?
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AIMS: Certain medical conditions can influence and affect the type of orthodontic treatment that is provided to patients. The aim of this clinical audit was to investigate if clinicians complete the health records of patients undergoing orthodontic treatment.

MATERIALS AND METHOD: A prospective assessment was undertaken. The health records of 100 patients undergoing orthodontic treatment were reviewed between October 2014-October 2015 at three separate time points (T1, T2 and T3). In accordance with King’s College Hospital Health Records Policy, 100 per cent of patients undergoing orthodontic treatment should have all components of their health records completed. Two investigators assessed the completeness of health records against a checklist with predefined domains. Data was collected using a pre-specified data capture sheet. Following time points T1 and T2, areas of improvement were identified and discussed at a local clinical meeting and guidance reinforced via a departmental handbook prior to data collection at T3.

RESULTS: Three hundred sets of patient records were identified and included. At time points T1, T2 and T3, 100 per cent health records had the correct patient label/name, hospital number, were contemporaneous and legible. At T1, the correct date was recorded in 99 per cent all clinical entries and increased to 100 per cent at T2 and T3. Within the health records the documentation of the department name and health records signed by clinicians improved from 77, 95 and 98 per cent through the respective study time points. The documentation of the treatment plan and the presence of a consent form increased from 96 and 89 per cent at T1 to 99 per cent at T3. Overall, the recording of patient allergy status and highlighting significant medical conditions increased from 97 to 100 per cent throughout the three study time points.

CONCLUSION: Following implementation of departmental guidance, there was an improvement in results suggesting clinicians’ understanding of the importance of medical history and full completion of notes improved with time. Updating and highlighting complex medical histories is important as it may affect the efficiency of orthodontic treatment.

SP171 A RADIOGRAPHIC COMPARISON OF EXTERNAL APICAL ROOT RESORPTION IN MAXILLARY CENTRAIS BETWEEN EXTRACTION AND NON-EXTRACTION PATIENTS DURING ORTHODONTICS
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AIMS: To measure the amount of external apical root resorption (EARR) in maxillary central incisors during active orthodontic treatment in patients with and without extraction of maxillary premolars.

MATERIALS AND METHOD: Forty maxillary incisors in 20 patients (8 males, 12 females) aged 12-19 years, with different malocclusions. Standard periapical radiographs, using the long-cone paralleling technique, were obtained before and 8 months after the start of treatment. Quantitative measurements were performed separately and corrected for image distortion. Root length reduction was calculated in millimeters of the original root length.

RESULTS: The degree of EARR for the maxillary central incisors was 0.72 ± 0.57 mm for the non-extraction group and 0.96 ± 0.68 mm for the extraction group during the 8 month follow-up. Statistically significant resorption was found for 65 per cent of the central incisors.

CONCLUSION: The amount of root resorption after 14 months and after treatment is still under investigation.

SP172 METAL EXPOSURE ASSOCIATED WITH BONDING OF PATIENTS RECEIVING FIXED ORTHODONTIC APPLIANCES
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AIMS: Orthodontic treatment with fixed appliances implies exposure to metals. The aim of this study was: 1) to perform a systematic search on metal exposure from fixed orthodontic appliances, 2) to assess patients exposure to metals by saliva analyses during and after bonding of the appliances.
SUBJECTS/MATERIALS AND METHOD: A systematic search, focusing on metal exposure, from fixed orthodontic appliances was performed with PubMed and Web of Science databases; in addition to hand-searching. Twenty four patients, aged 11-18 years, scheduled for treatment with fixed orthodontic appliances, participated in the clinical study. After rinsing with ultrapure water unstimulated saliva was collected: immediately before bonding (A-samples); after bracket bonding but before arch ligation (B-samples); after 3-6 weeks (C-samples). The appliances used consisted of pre-coated 0.022 slot brackets (3M Unitek), nickel-titanium 0.014 archwires and elastomeric ligatures. The saliva samples were analysed by inductively coupled plasma/mass spectrometry (ICP-MS) for Ni, Cr, Mo, Ti, Co, Fe, Al, Si.

RESULTS: The systematic literature search identified 49 studies, of which two in vivo and five in vitro studies matched the inclusion criteria. The in vivo studies showed an increase in concentration of metals (mainly Ni and Cr) in saliva 10 minutes-1 day after bonding, but lower values after 30 days. The results of the clinical study showed that compared with the A-samples the levels of Ti, Ni, Co, and Al were significantly increased immediately after bracket bonding (B-samples), and approached pre-bonding values after 3-6 weeks (C-samples). Only Ti was significantly increased in both B and C-samples. Al was the element found in the highest concentrations.

CONCLUSION: Release of metals from metal components, i.e. brackets and archwires, seems to be transient, with overall low release of Ni and Cr, elements that have received attention due to the allergenic potential. However, elements present in the bonding material, such as Al, are released in addition to those in the metallic components.

SP173 SYSTEMIC FACTOR EFFECTS ON ORTHODONTICALLY INDUCED INFLAMMATORY ROOT RESORPTION: A SYSTEMATIC LITERATURE REVIEW
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AIMS: Systemic factors are shown to affect the degree of orthodontically induced inflammatory root resorption (OIIIRR). However, a systematic overall assessment of their impact on OIIIRR has not yet been reported. The aim of this study was to systematically assess the risk of any intervention(s) that could induce a systemic effect on OIIIRR in human or animal subjects.

MATERIALS AND METHOD: A comprehensive search strategy was performed for all major electronic databases. Two reviewers independently selected studies, undertook data extraction, and assessed the risk of bias for all included studies according to a pre-specific protocol inspired by Cochrane and PRISMA guidelines. Studies that compared the effect of intervention(s) in an experimental versus a control group were included. Furthermore, studies with less than five subjects or animals per group were excluded.

RESULTS: Five human and 27 animal trials met the inclusion criteria. Fluoride decreased OIIIRR, however one study reported no effect. Most of the included articles stated that low-level laser therapy (LLLT) and ultrasound therapy decreased OIIIRR while two articles reported no effect. Regarding hormones and stress, recombinant human growth hormone (rHGH) and thyroxin (TH) decreased OIIIRR, stress had no effect while ovariectomy (OVX) showed a marked increase. For the medications: lithium chloride (LiCl), calcium (Ca²⁺), steroids (except for methylprednisolone), and especially bisphosphonates showed decreased OIIIRR. Most NSAIDS showed no effect, except for one study that reported decreased OIIIRR with high doses of celecoxib. Another study reported an increased effect with prolonged indomethacin administration. Statins and prostaglandin E₁ analogue showed no affect on OIIIRR while prostaglandin E₂ (PGE₂) increased OIIIRR. Sympathectomy markedly increased OIIIRR while coticision had no effect. In addition, asthma and allergy increased OIIIRR, however two studies found no effect. Not all of the findings were statistically significant.

CONCLUSION: Administration of fluoride, LLLT and ultrasound therapy, TH, rHGH, bisphosphonates, steroids, LiCl and Ca²⁺ decreased OIIIRR while sympathectomy, allergen sensitization, OVX and PGE₂ administration increased OIIIRR. In general, the effect on OIIIRR increased with a higher dosage and/or exposure time. Despite the methodological limitations of the included studies, this
systematic review provides an important overview and recommendations for developing future high quality animal and human trials.

SP174 COMPARISON OF THE SMILE IN CLASS II PATIENTS BEFORE AND AFTER ORTHODONTIC TREATMENT  
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AIMS: To compare smile changes in Class II malocclusion patients treated by extraction of upper premolars.
MATERIALS AND METHOD: Photographs and cephalometric radiographs of 30 mild to moderate Class II patients treated with premolar extraction were evaluated. Photographs and cephalometric radiographs of a control group of 30 students with a normal occlusion were also evaluated. In cephalometric analysis, skeletal, dental and soft tissue angular and linear measurements were considered. For smile evaluation smile line, lip line, symmetry of smile, upper lip curvature and gingival show were measured. Data were analyzed using a Student’s t-test.
RESULTS: There was a reduction in buccal corridor space after treatment but no significant post-treatment changes were seen in lip length increase during smiling. The smile line was increased after treatment. The consonant smile line increased after treatment. The anterior teeth became more upright after treatment compared to pre-treatment and the control group, which caused more gingival display and a higher upper lip line after orthodontic treatment.
CONCLUSION: Changes in the smile of treated Class II patients were due to a change of anterior tooth inclination that lead to more gingival display and a higher lip line. The decrease in negative space/buccal corridor was seen as a positive changes after orthodontic treatment.

SP175 RELATIONSHIP BETWEEN BODY MASS INDEX, SKELETAL MATURATION AND DENTAL DEVELOPMENT  
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AIMS: To determine whether an increased Body Mass Index (BMI) is associated with accelerated skeletal maturation and dental maturation in orthodontic patients.
SUBJECTS AND METHOD: Skeletal maturation and dental development of 95 orthodontic patients (65 females, 30 males), aged 6 to 15 years, were determined. Dental development was assessed using the Demerjian method and skeletal maturation was evaluated by the cervical vertebral method (Baccetti). BMI was determined for each patient. A t-test was applied to compare the mean difference between chronological and dental age among the subjects. A regression model was used to assess the relationship between BMI percentile, skeletal maturation, and dental development.
RESULTS: Of the subjects 18.9 per cent were overweight and obese. The mean differences between dental age and chronological age were 0.73 ± 1.3 for underweight and normal weight children and 1.8 ± 1.08 for overweight and obese children. These results highlighted the correlation between accelerated dental maturity and increasing BMI percentile ($P = 0.002$). A new formula was introduced for this relationship. There was no significant relationship between BMI percentile and skeletal maturation.
CONCLUSION: Children who were overweight or obese had accelerated dental development whereas they did not have significantly accelerated skeletal maturation after adjustment for age and gender.

SP176 COMPARISON OF COMMERCIALLY AVAILABLE ARCHWIRES WITH A NORMAL DENTAL ARCH  
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AIMS: To study the size and shape of the Iranian mandibular dental arch and evaluate the correlation of the average dental arch with commercially available preformed rectangular nickel-titanium (NiTi) archwires.

SUBJECTS AND METHOD: One hundred and forty eight subjects selected from students of Shiraz University of Medical Sciences. The inclusion criteria were Angle Class I molar and canine relationships and a normal growth pattern. Intercanine and intermolar widths were measured after scanning their mandibular dental casts. Three main arch form templates; square, ovoid and tapered (Orthoform TM; 3M, Unitek, California, USA) and 12 commercially available preformed mandibular NiTi archwires were scanned. Intercanine and intermolar widths of the archwires were compared with the dental arch widths of the study samples. Arch width, arch form and the most appropriate archwire were determined for each cast. A Student’s t-test was used to compare arch widths and arch depths of male and female subjects. Coefficient of variance was used to determine the variability of indices in the study samples.

RESULTS: Most preformed archwires were wider than the average width of the normal Iranian dental arch. The most frequent arch form in this Iranian population was tapered. Intermolar width was the only statistically significant variable between males and females.

CONCLUSION: Variation in available preformed archwires does not entirely cover the range of diversity of the normal dental arch of this population. Narrow archwires with a tapered shape are more consistent with the Iranian lower arch.

SP177 RELATIONSHIP BETWEEN CHRONOLOGICAL AGE AND DEVELOPMENTAL STAGES OF THE MANDIBULAR THIRD MOLAR IN 12 TO 20 YEAR OLD ORTHODONTIC PATIENTS

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AIMS: To investigate the relationship between chronological age and developmental stages of the mandibular third molar in a population of Shiraz, south Iran.

MATERIALS AND METHOD: Demirjian’s classification system was used to evaluate the developmental status of the mandibular third molars on 500 panoramic radiographs of orthodontic patients. The age range of the patients was 12 to 20 years. The mean and standard deviations of chronological age for each developmental stages were calculated. One-way ANOVA and post-hoc Tukey HSD test were used to compare the mean age and developmental stages of molar teeth. The age differences in the developmental stages between the genders was assessed. Correlation between calcification stages of the third molars and age was determined.

RESULTS: Crown calcification was completed at a mean age of 13.8 years, and root formation without apex closure was observed at a mean age of 17.5 years. At a mean age of 18.4 years apex closure occurred. Males were advanced in most of stages of calcification. A strong correlation between developmental stages of the lower third molars and chronological age was found in both genders.

CONCLUSION: The present investigation could provide reference data for third molar development in this population. Developmental stages of mandibular third molars showed a strong correlation with age. The lower third molars developed earlier in males than in females.

SP178 AN AUDIT OF THE USE OF FLUORIDE MOUTHWASH AND ORAL HYGIENE PRACTICES IN 100 CONSECUTIVE PATIENTS

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AIMS: To assess brushing frequency in fixed appliance patients, prevalence of interproximal brush use and if instructed on use; to assess if fluoride mouth-washing advice was received; to assess the prevalence, frequency and timing of fluoride mouth-washing.

SUBJECTS AND METHOD: One hundred consecutive patients were given an anonymous questionnaire. The gold standard was: 100 per cent of patients using fluoride mouthwash and 100 per cent advised to use it and 100 per cent of patients using interproximal brushes and brushing at least twice per day.

RESULTS: Eleven per cent of patients brushed once per day, 73 per cent twice per day and 16 per cent more than this. Sixty four per cent of patients used an interproximal brush, 81 per cent were instructed to use them. Seventy nine per cent of patients received advice to use a fluoride mouthwash; 17 per cent said no and 4 per cent could not remember. Sixty eight per cent of patients used a mouthwash, 86 per cent at the same time as brushing their teeth and 14 per cent at a different time.

CONCLUSION: The gold standard was not met. Patient written and verbal instruction on fluoride mouthwash use, benefits and risks should be increased by clinicians. Oral hygiene instruction encouraging the use of interproximal cleaning aids and their benefits should be increased by clinicians and dental nurses and the results of the audit disseminated and reaudited.

SP179 SKELETAL VERSUS CONVENTIONAL ANCHORAGE FOR MAXILLARY ANTERIOR TOOTH RETRACTION: A META-ANALYSIS
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AIMS: To assess the effects of surgical anchorage devices compared to conventional anchorage during maxillary retraction procedures by evaluating dental, skeletal and soft tissue changes in patients with a Class II division 1 malocclusion or with bialveolar dental protrusion undergoing orthodontic treatment.

MATERIALS AND METHOD: Electronic literature searches through the PubMed (Medline), the Cochrane Oral Health Group’s Trials Register and the Cochrane Central Register of Controlled Trials (Central) were conducted to identify all relevant articles published until 16th November 2015. The trial database, ClinicalTrials.gov, was also searched for ongoing and unpublished studies. Eligible studies were selected based on inclusion criteria, and quality assessments were conducted. After data extraction, meta-analyses were performed.

RESULTS: Three randomized clinical trials out of 224 potentially eligible papers were included, all of them considered at high risk of performance bias. All the selected studies showed similar findings in dental changes. The upper molars were significantly distalised in the mini-implant group whereas there was a significant forward displacement of the molars in the control group (MD: −2.68 mm; 95%CI: −3.87 to −1.49; P < 0.001; I²: 89%). Significant molar intrusion was detected in the skeletal anchorage group (MD: −1.28 mm; 95%CI: −2.42 to −0.14; P = 0.03; I²: 87%). The upper incisor edges were significantly retracted in both groups (MD: −1.47 mm; 95%CI: −2.30 to −0.64; P < 0.001; I²: 20%) and were significantly intruded in the mini-implant group though extruded in the conventional anchorage group (MD: −2.52 mm; 95%CI: −3.00 to −2.04; P < 0.001; I²: 0%). No significant differences were detected for most of the skeletal variables. In general, changes in the soft tissues were more prominent in the mini-implant group than in the conventional anchorage group.

CONCLUSION: When retracting anterior teeth in patients with dentoalveolar protrusion, miniscrew implants can provide absolute anchorage giving superior results compared to conventional anchorage. Hence, better dental changes and aesthetic outcomes can be achieved using skeletal anchorage in patients with a Class II division 1 malocclusion or with bialveolar dental protrusion.

SP180 DEALING WITH ASYMMETRIES. THE IMPORTANCE OF THE SIX DEGREES OF FREEDOM
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AIMS: To review the diagnostic methods of craniofacial deformities and emphasize the importance of three-dimensional (3D) imaging and the 6 degrees of freedom to obtain an accurate diagnosis in asymmetric patients.

MATERIALS AND METHOD: A literature review of scientific papers from the last 10 years, as indexed by Medline, using the PubMed search engine and the following Mesh terms: facial asymmetries, diagnosis, reference plane, yaw. No grey literature was included.

RESULTS: For patients with facial asymmetry, accurate and complete diagnosis, treatment planning and follow-up are significant. Conventional diagnostic tools have limitations in asymmetry diagnosis. The advent of 3D images has greatly reduced the magnification and projection errors that are common in two-dimensional radiographs, and has introduced the evaluation on three cartesian axes plus three rotational angles, pitch, roll and yaw. Six degrees of freedom describe the spatial orientation of dentofacial traits. 3D imaging has also facilitated the introduction of 3D cephalometry, but some fundamental problems must be solved, such as reference system reliability and assessment and measurement of symmetry.

CONCLUSION: 3D imaging has become an essential tool for capturing accurate information of the location in space of craniofacial structures in asymmetric patients but there are is still a need to unify criteria and optimize the results.

SP181 DIVERGENCE TEST OF POSTERIOR BONE DENTITION USING CONE BEAM COMPUTED TOMOGRAPHY
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AIMS: To propose a method to test divergence of the posterior bone dentition using cone beam computed tomography (CBCT) and to test the reliability of that method.

MATERIALS AND METHOD: CBCT scans of 34 subjects were chosen on which measurements were made to determine the available and necessary space in the posterior region, the outbreak scale of the third lower molar and the skeletal Class. Measurement results in three dimensions were compared with traditional measurements obtained on dental pantomograms (this last one was only obtained for those who had the DPT and CBCT taken on the same day).

RESULTS: There was a statistically significant connection between bone dentition divergence and lower third molar outbreak scale. However, valuing the connection between bone dentition divergence and skeletal Class (Wits) showed no connection between these two variables.

CONCLUSION: This method for testing the divergence of the posterior bone dentition on CBCT scan was found to be a reliable method. A negative divergence of rear bone dentition was found in 50 per cent of subjects, with heterogeneous values and distribution. There was a statistically and significant connection between bone dentition divergence and lower third molar outbreak scale. However, the opposite was observed with the Wits appraisal.

SP182 CONTROL ABILITY OF VOLUNTARY LIP-CLOSING FORCE USING VISUAL FEEDBACK IN YOUNG ADULTS AND ELDERLY SUBJECTS
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AIMS: Maintenance of oral health in elderly people is important because a healthy oral function is needed to enhance the quality of life. However, the change of oral function along with ageing is not well understood. This study aimed to clarify the difference in ability of the control of voluntary lip-closing force (LCF) between young adults and elderly subjects.

SUBJECTS AND METHOD: Forty healthy young adults and 28 healthy elderly people were recruited. The experimental system consisted of apparatus that could measure directional LCF, and a display that showed the exerted LCF for each direction in real time, along with a target value. The subjects were instructed to control the LCF to maintain the target value using visual-feedback. The target value was set at half of the LCF with maximum effort. The matched time was estimated when the LCF was kept in the range of 8 per cent of the target value. The accuracy rate was calculated by
dividing the matched time by 3 seconds, which was the time between 1 second and 4 seconds after the onset of LCF.

RESULTS: The accuracy rate of the directional LCF differed significantly depending on the direction. The accuracy rate in the lower direction in the elderly was significantly lower than that in young adults. This result suggests that voluntary control of LCF might differ depending on age.

CONCLUSION: The change of lip function along with ageing may not depend on force with maximum effort but on voluntary control of the ability of force.

SP183 PATIENT LOAD IN AN EMERGENCY CLINIC
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AIMS: To assess the incidence of unscheduled emergency visits to an orthodontic department and to identify the causative factors.

MATERIALS AND METHOD: A prospective audit of emergency clinics over four consecutive weeks was undertaken. The data was recorded on a standardized data collection form and included the following information: Patient number per session and type of emergency/reason for the visit.

RESULTS: Two hundred and eighteen patients attended the emergency clinics in Guy’s Hospital over 4 consecutive weeks; an average of 10.9 patients per session. Sixty two per cent of these appointments were for fixed appliance emergencies, including mainly debonded brackets (22%), long wires (19%) and broken wires (13%). Fifteen per cent of these were to fit separators. The remaining 38 per cent were for removable orthodontic appliances, mainly broken retainers (30%) followed by an equal number of lost and ill fitting retainers (11 and 10% respectively). Forty nine per cent of the removable appliance emergencies were for fitting repaired retainers.

CONCLUSION: A high number of patients attend emergency sessions for unscheduled appointments due to broken brackets, long or broken wires and ill fitting, broken, or lost retainers. A large number of these appointments, such as placement of separators and fitting of retainers were not for emergency reasons. However these were pre-arranged appointments and part of the departmental policy. The highest number of patient attendance was on Friday followed by Monday.

SP184 POST-OPERATIVE STABILITY OF THE MAXILLO-MANDIBULAR COMPLEX IN FACIAL ASYMMETRY: A THREE-DIMENSIONAL COMPUTED TOMOGRAPHIC STUDY
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AIMS: To assess aspects of asymmetry post-operative improvement and three-dimensional (3D) directional changes in the maxilla and mandible before surgery and one and four years after surgery for patients with a Class III skeletal malocclusion and to examine stability over a long period after LeFort I maxillary osteotomy and mandibular intraoral vertical ramus osteotomy (IVRO).

SUBJECTS AND METHOD: Sixteen patients with a Class III skeletal malocclusion and facial asymmetry. 3D computed tomographic images were obtained directly before surgery and one and approximately four years after surgery.

RESULTS: With regard to the changes for the period from one to four years after surgery, on the deviated side there were statistically significant increases in the sagittal Mx. occlusal line angle, inferior Go vertical distance; and on the non-deviated side statistically significant increases in the inferior Go vertical distance and U6 vertical distance. As a result of analyzing 3D skeletal changes in the maxilla and mandible one year post-surgery and comparing these with the condition pre-surgery, in the case of the maxilla, there were statistically significant differences in pitch; and in the case of the mandible, in yaw, roll and pitch. However, four years post-surgery, there were no statistically significant differences with regard to yaw, roll and pitch in the maxilla or mandible.

CONCLUSION: It was verified that for a patient with Class III skeletal asymmetry, the asymmetry of the maxilla and mandible was improved after surgery, and the results were maintained for up to four years with minimal change except for bone remodelling in the inferior gonial area.
SP185  CHANGES IN OCCLUSION AFTER PRE-ORTHODONTIC ORTHOGNATHIC SURGERY IN SKELETAL CLASS III ASYMMETRY PATIENTS
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AIMS: To evaluate changes in occlusal contact pattern due to orthognathic surgery alone, without the influence of pre-operative orthodontic treatment.

SUBJECTS AND METHOD: Functional occlusal indicators were observed using a computerized occlusal analysis device, T-scan, in patients with skeletal Class III malocclusions with asymmetry (12 males, 12 females) before surgery, 1 month after surgery, 6 months after the initiation of post-operative orthodontic treatment, 12 months after surgery and 24 months after surgery. Identical analyses were carried out in 20 subjects with normal occlusions who did not receive orthodontic treatment and were compared with the experimental group.

RESULTS: The occlusal contact area and force distribution ratio on the deviated side was significantly larger when compared with the non-deviated side. One month after surgery, there were no significant differences in the occlusal contact area and occlusal force distribution ratio between the deviated and non-deviated sides. Total occlusal contact area 1 month after surgery was significantly less than before surgery. Occlusal time before surgery was longer in the experimental group than in the control group. Twenty four months after surgery, occlusal time remained significantly longer in the experimental group than in the control group. Delta was significantly reduced with the progress of post-operative orthodontic treatment.

CONCLUSION: Patients with skeletal Class III malocclusions with asymmetry exhibit occlusal balance displacement to the deviated side. Also, occlusal contact area was smaller and there were more occlusal interferences when compared with the control group. Occlusal imbalance and interferences were improved with orthognathic surgery alone without the influence of pre-operative orthodontic treatment and further improvement was observed with the progression of post-operative orthodontic treatment.

SP186  BOND STRENGTH OF A NANO-COMPOSITE USED FOR BONDING CERAMIC ORTHODONTIC BRACKETS
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AIMS: The bond strength and location of bond failure in brackets bonded with a nano-composite to tooth enamel were studied and the results were compared with those of a conventional composite adhesive.

MATERIALS AND METHOD: Thirty human premolar teeth were divided into two groups. Composite (Transbond XT, 3M Unitek) and nano-composite (Filtek Z350 XT, 3M Espe) adhesives were used for bonding the orthodontic brackets on the teeth in each group. The brackets were debonded with sharp-edged debonding pliers in a universal testing machine. After debonding the brackets and the tooth surfaces under the brackets were inspected using a stereomicroscope to evaluate the adhesive remnant index (ARI).

RESULTS: Tensile bond strength measured using the modified diametral compression test, decreased when the brackets were bonded to tooth enamel with nano-composite instead of composite adhesive. However, the tensile bond strength for brackets bonded with the nano-composite was more than the minimum tensile bond strength value recommended for successful clinical bonding. The ARI score demonstrated that most of the bond failures in the composite adhesive and nano-composite groups were a combination of cohesive and adhesive failure at the enamel-adhesive and bracket-adhesive interfaces. According to the ARI score, the use of nano-composite would reduce the risk of enamel damage.
CONCLUSION: Nano-composite is acceptable for bonding ceramic brackets and reduces the risk of enamel damage.

SP187 STRESS DISTRIBUTION AND DISPLACEMENT BY MINI-IMPLANT AND TOOTH-IMPLANT SUPPORTED RAPID MAXILLARY EXPANSION – A THREE-DIMENSIONAL FINITE ELEMENT STUDY
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AIMS: To evaluate and compare the biomechanical effects on the craniofacial structures induced by rapid maxillary expansion (RME) orthopaedic forces by four mini-implants and a hybrid two mini-implant with two molar tooth supported rapid palatal expander.

MATERIALS AND METHOD: A finite element (FE) skull model strained to a state of maxillary expansion simulating the clinical situation. A three-dimensional FE analysis of the craniofacial complex was developed from sequential computed tomography scan images of the skull of a 12-year old female for the approximation of the clinical situation. The final mesh of the tooth-implant supported model consisted of 422179 shell elements with 92592 nodes and for the implant supported model (nodes = 94528; elements = 432420). A transverse expansion of 3 and 5 mm was simulated with a force of 100 N for the expansion of the midpalatal suture for both models. The displacement and Von Mises stresses in different planes were studied on different nodes located at various structures of the craniofacial complex.

RESULTS: The magnitude of molar tip displacement was significantly lower in the four mini-implant group both at 3 mm (2.45 mm versus 9.08 mm) and 5 mm (4.09 mm versus 15.32 mm) expansion magnitudes. Von Mises stresses (N/mm²) were also decreased in the four mini-implant group at 3 (90823 versus 118924) and 5 (54494 versus 71354) months. The maximum von Mises stresses were found around the frontomaxillary, zygomaticomaxillary and frontonasal sutures.

CONCLUSION: The hybrid mini implant and tooth supported RME appliance delivered more force to the teeth and caused more displacement than the mini-implant supported appliance. Consequently, the four mini-implant supported RME transmitted forces to the craniofacial structures more efficiently, resulting in skeletal rather than dental expansion when compared to the two mini-implant and tooth supported expansion appliance.

SP188 HARD AND SOFT TISSUE ANALYSIS OF SKELETAL CLASS II MALOCCLUSION
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AIMS: To evaluate horizontal and vertical characteristics according to lateral cephalometry of adult Korean skeletal Class II patients.

SUBJECTS AND METHOD: Sixty males and 60 females (mean age: 21.0 years) consisting of freshman of Yonsei University from 1996 to 1997 and patients with a history of orthognathic surgery and a skeletal Class II profile were compared with 70 males and 70 females (mean age: 21.9 years) with a skeletal Class I normal occlusion. The skeletal Class II group had the following conditions: 1. Profile composed of a retrognathic mandible or protrusive maxilla; 2. Class II molar and canine key; 3. ANB-greater than 4 degrees; 4. Wits appraisal greater than 1.0 mm. Cephalometric analysis consisted of 22 skeletal, 25 soft tissue and 12 dental measurements.

RESULTS: 1. There was no considerable vertical measurement difference between the skeletal Class II malocclusion group and the normal occlusion group in skeletal analysis. Some variations, however, were found between the two groups in soft tissue analysis. 2. The length and antero-posterior position of the maxilla were not different between the Class II malocclusion and the normal occlusion group. 3. Mandibular length of the skeletal Class II malocclusion group had the following conditions: 1. Profile composed of a retrognathic mandible or protrusive maxilla; 2. Class II molar and canine key; 3. ANB-greater than 4 degrees; 4. Wits appraisal greater than 1.0 mm. Cephalometric analysis consisted of 22 skeletal, 25 soft tissue and 12 dental measurements.

CONCLUSION: The hybrid mini implant and tooth supported RME appliance delivered more force to the teeth and caused more displacement than the mini-implant supported appliance. Consequently, the four mini-implant supported RME transmitted forces to the craniofacial structures more efficiently, resulting in skeletal rather than dental expansion when compared to the two mini-implant and tooth supported expansion appliance.
malocclusion group than in the normal group, but those of the molars (U6-HP, L6-MP) showed no significant difference between the two groups. 7. Classifying the skeletal Class II malocclusion group according to the antero-posterior position of both jaws, a normally positioned maxilla and retruded mandible was observed in 43.3 per cent, both a normally positioned maxilla and mandible in 28.3 per cent and both a retruded maxilla and mandible in 20.0 per cent.

CONCLUSION: A skeletal Class II is mostly characterized by the length and antero-posterior position of the mandible.

SP189 AN IN VITRO STUDY OF FRICTIONAL RESISTANCE VARIABLES OF CONVENTIONAL ORTHODONTIC APPLIANCES. EFFECTIVENESS OF A FRICTION REDUCING AGENT
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AIMS: To evaluate the influence of the type of ligature, arch section and a friction reducing agent on resistance to sliding in orthodontics.

MATERIALS AND METHOD: Using a stereolitographic model of a perfectly aligned hemi-arch, canine, first premolar and second premolar brackets and a molar tube were bonded. Using a universal test machine, static and dynamic friction were measured combining conventional section and hybrid section 0.019 × 0.025 inch stainless steel archwires, metallic and elastomeric ligatures and under three environmental conditions (saliva, dry and with the addition of a friction reducing agent). Data was analyzed using the Statgraphics plus 5.1 system.

RESULTS: The friction reducing agent showed a statistically significant decrease in friction when compared to the saliva and dry group. The hybrid section archwire presented lower friction rates than the conventional section wire. The metallic ligature presented lower friction than the elastomeric ligature. When hybrid section wires were combined with elastomeric ligatures, it did not present lower friction than the conventional section wire.

CONCLUSION: The type of ligature used could be one of the most important factors when friction is measured in orthodontics. The archwire can play an important role, and the hybrid section wire can present advantages when compared to a conventional section in sliding, but this will happen only when metallic ligatures are used. The friction reducing agent showed a statistically significant decrease in friction, so it is necessary to study if it behaves in the same way intraorally.

SP190 EFFECT OF NICOTINE ON PERIODONTAL LIGAMENT CELLS WITH MECHANICAL STRESS
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AIMS: The acceptance of the fact that nicotine acts on cellular and tissue metabolism is widespread, but there are few reports in the literature demonstrating the action of nicotine on orthodontic movement. Thus, the aim of this study was to investigate the effects of nicotine on periodontal ligament (PDL) cells with mechanical stress.

MATERIALS AND METHOD: PDL cells were obtained from the upper incisors of male Sprague-Dawley rats, 4 weeks of age, 100 g body weight. Fifth passages were used for this experiment. The experimental group had PDL cells subjected to mechanical stress and nicotine. The controls consisted of three groups: PDL cells without mechanical stress and nicotine, PDL cells with nicotine added, and PDL cells treated with mechanical stress. Nicotine concentration was 20 ng/ml solution. A centrifugal force of 2000 rpm was used as mechanical stress for 20 minutes every day. mRNA levels of receptor-activator of nuclear factor kappa beta ligand (RANKL), osteoprotegerin (OPG), interleukin-6 (IL-6), tumour necrosis factor alpha (TNF-α) and vascular endothelial growth factor (VEGF) were analyzed by means of quantitative real-time polymerase chain reaction at 1, 3 and 5 days. Data was analyzed using statistical analysis and performed by non-repeated measures ANOVA and Tukey’s test. A value of P < 0.05 was considered to be statistically significant.

RESULTS: The levels of RANKL and OPG were highly expressed only in the nicotine administration group at day 3 and but high expression was not observed in the experimental group. Expression level of IL-6 was high in the mechanical stress group and the experimental group at day but no significant
difference was observed in the two groups. Expression level of TNF-α was highly expressed in the nicotine administered group at day 5 but not in the mechanical stress group or in the experimental group. No significant difference was observed in the expression level of VEGF.

CONCLUSION: Nicotine administration will promote the release of cytokines that affect bone resorption, but mechanical stress has been suggested to reduce the influence.

SP191 APPLICATION OF CYCLIC AND STATIC TENSILE MECHANICAL LOADING PROVOKES SIMILAR RESPONSES OF HUMAN PERIODONTAL LIGAMENT FIBROBLASTS
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AIMS: To compare the biochemical responses of human periodontal ligament fibroblasts (hPDLF) triggered by the application of cyclic and static tensile mechanical forces simulating masticatory and tooth movement stress.

MATERIALS AND METHOD: Human PDL tissue explants were used to develop primary cultures of hPDLF. Cyclic and static tensile strain was applied to hPDLF of the same donor using specifically designed devices. Western blot analysis was employed to study the expression of MAPK kinases (p38MAPK, JNK/SAPK, ERK), while gene expression of c-Fos, Runx2, osterix (Osx), alkaline phosphatase (ALP) and osteopontin was monitored by qRT-polymerase chain reaction analysis.

RESULTS: Both cyclic and static mechanical loading activate within 15-30 minutes all three MAPK kinase signalling pathways (ERK, p38 and JNK). Furthermore, both types of deformation lead to rapid phosphorylation of c-Jun, one of the components of the activator protein-1 (AP-1) transcription factor. Interestingly, it seems that cyclic mechanical loading induces a more intense and sustained activation up to 3 hours of application. Moreover, the expression of c-fos and c-jun genes, two key role cellular responses to mechanical stress, is also upregulated. An approximate 6.7 ± 2.3 and 4.3 ± 1.7 fold increase in c-fos and c-jun gene expression, respectively, was observed during the application of both types of mechanical force. However, the expression of the Osx gene, encoding for a transcription factor related to osteoblastic differentiation, was upregulated (1.5 ± 3.7-fold activation) only when hPDLF were subjected to static mechanical forces up to 6 hours after mechanical stimulation. On the other hand, the long-term exposure of these cells to both cyclic and static mechanical strain (from 12 to 24 hours) increased the expression of the transcription factor Runx2 and ALP (approximately 1.5-fold in both cases), two classical markers of osteoblastic differentiation.

CONCLUSION: Both cyclic and static mechanical deformation applied to hPDLF activate similar signalling pathways and lead to the upregulation of effectors of osteoblastic differentiation.

SP192 DEGREE OF CURE OF ORTHODONTIC ADHESIVES UNDER METALLIC AND CERAMIC BRACKETS
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AIMS: To evaluate the degree of cure (%DC) of light-cured adhesives bonded to ceramic and stainless steel brackets.

MATERIALS AND METHOD: Thirty metallic and ceramic brackets (Forestadent) were bonded to adhesives Transond XT (3M Unitek), Connect (GC), Enlight (Reliance) (n = 5) by firmly pressing the complex bracket/adhesive onto a cellulose strip on a background surface of standard reflectance (80%). The %DC of adhesives, which were irradiated from the incisal and cervical edges with a light emitting diode curing light (Radiplus) of 1.5 W/cm\(^2\) output, was measured by micro-MIR FTIR and data were analysed with two-way ANOVA with bracket (metallic versus. ceramic) and adhesive serving as discriminating variables (alpha = 0.05).

RESULTS: Ceramic brackets were associated with a higher %DC with the exception of Connect adhesive. %DC ranged from 48 per cent (Transbond XT-metallic bracket) to 73 per cent (Connect with ceramic or metallic bracket).
CONCLUSION: The interference of brackets seems to cause a 20 per cent reduction in the polymerization efficiency with the exception of one group of adhesive which does not contain a bonding agent (Connect) where the %DC remained unaffected.

SP193 EVALUATION OF POSITIONAL CHANGES OF THE MANDIBLE FOUND A SHORT TIME AFTER SAGITTAL SPLIT RAMUS OSTEOTOMY
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AIMS: Due to positional changes of the mandible a short time after sagittal split ramus osteotomy (SSRO), post-operative orthodontic treatment may be prolonged. The present study aimed to investigate the positional shift of the mandible and mandibular condyle a short time after SSRO.

MATERIALS AND METHOD: Cephalometric and axial cephalometric radiographs were obtained for 40 patients (16 males, 24 females, average age 26.8 ± 5.3 years) diagnosed with mandibular prognathism and treated by SSRO, pre-operatively and at 6 months post-operatively. All radiographs were obtained in the intercuspal position, and displacements of the jaw and ossicles were evaluated. Also, to examine positional changes of the mandible in 10 patients who had undergone SSRO (4 males, 6 females, average age 28.3 ± 3.5 years), a computed tomographic (CT) image and cephalometric radiograph were used. The shortest distance between the mandibular condyle and mandibular fossa was measured in three directions, i.e., in the frontal plane, sagittal plane and horizontal plane, and positional changes of the mandible were evaluated.

RESULTS: In 40 patients on whom cephalometric analysis was performed, positional and axial shifts of the mandibular condyle were observed. From the CT, in the frontal plane there was a displacement of 1.0 mm (~1.0 mm ~ 1.0 mm) outwards left, and 0.5 mm (~1.0 mm ~ 1.0 mm) outwards right. In the horizontal plane, there was a displacement of 1.0 mm (~1.0 mm ~ 1.5 mm) outwards left, and 0.5 mm (~1.0 mm ~ 1.5 mm) outwards right. In the sagittal plane, there was a displacement of 1.0 mm (0.5 mm ~ 1.0 mm) forwards. In four of the 10 cases evaluated, no changes in the ossicles or mandibular condyle were seen. In four other cases, a displacement of the mandibular condyle was observed, and in two subjects, displacements of both ossicles and the mandibular condyle were observed.

CONCLUSION: In a short period of time following SSRO, there is no positional shift of the distal and proximal ossicles, but a displacement of the mandible is seen. This is due to positional change of the mandibular condyle.

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AIMS: Odontoma are considered to be the most common odontogenic tumour of the oral cavity. The exact aetiology of odontomes is still not known. Most odontomes are asymptomatic and are discovered during routine radiographic investigations and can cause disturbances in the eruption of the teeth, most commonly delayed eruption or deflection.

MATERIALS AND METHOD: By a retrospective study design, demographic and clinical data regarding patients that presented odontomas from 1995 to 2015 were obtained and the influence of active therapy on the dentition and on the treatment of impacted teeth was analyzed. In order to compare the examined groups with reference to numerical variables, the Kruskal Wallis test was applied. For the only variables that resulted in statistical significance, two-by-two comparisons were performed applying the Mann Whitney test. The Spearman correlation test was used in order to assess the existence of any significant interdependence between the presence of odontoma versus the presence of tooth structured material.
RESULTS: Forty-five patients (mean age 14.2 years) with 19 complex and 26 compound odontomes were included. Initial symptoms were delayed eruption of permanent teeth (n = 25), pain (n = 6), swellings (n = 4), and no symptoms (n = 10). Thirty-one cases were discovered by incidence, all of them via panoramic radiographs. The mandible/maxilla ratio was about 2:1 (31/15). Thirty-two out of 45 odontomes were in close proximity to at least one tooth (n = 21 in the incisal region). A total of 12 teeth were extracted (complex: n = 8; compound: n = 4). Of the non-extracted teeth, 33 were displaced and retained. Of those, 29 teeth were aligned through an orthodontic-surgical approach and four teeth erupted spontaneously after surgery during the follow-up period.

CONCLUSION: Early detection of an odontoma is more likely an accidental radiological finding, hence the need for routine radiographic analysis should be emphasized. Early diagnosis of odontomas in the primary dentition is crucial in order to prevent later complications, such as impaction or failure of eruption of teeth.

SP195 FUNCTIONAL ANALYSIS OF PARATHYROID HORMONE 1 RECEPTOR MUTANTS FOUND IN PRIMARY FAILURE OF TOOTH ERUPTION

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AIMS: Permanent tooth eruption is important not only for chewing but also for development of the jaws. Primary failure of tooth eruption (PFE) is a rare growth disorder characterized by a severe posterior open bite. Several reports have indicated that mutations in the gene encoding parathyroid hormone 1 receptor (PTH1R), the receptor for parathyroid hormone and PTH-related peptide were associated with the development of PFE. Among them, missense mutations (356C>T, 395C>T, 439C>T, and 1148G>A) in PTH1R gene in four PFE patients were identified. Functional analysis of the mutations in PTH1R gene, however, has not yet been performed. In this study, the functions of PTH1R mutants identified in the PFE patients were investigated.

MATERIALS AND METHOD: Lentiviral vectors harbouring cDNAs for wild-type and the mutated PTH1R genes were prepared. HeLa cells, known not to express PTH1R, were infected with the viral vectors for wild-type or each mutated PTH1R gene. Western blotting and immunostaining were used to test the expression of the PTH1R proteins. An enzyme-linked immunosorbent assay was employed for determination of intracellular accumulation of cAMP after exposure to PTH.

RESULTS: While accumulation of cAMP was not seen in HeLa cells introduced with the gene for green fluorescence protein instead of that of PTH1R, cells introduced with wild-type PTH1R gene responded to PTH and produced cAMP. On the other hand, PTH-induced production of cAMP in cells expressing the mutated PTH1R genes especially those having 356C>T and 395C>T substitutions which was lower than that obtained in the cells introduced with the wild-type gene.

CONCLUSION: Amino acid substitutions of P119L, P132L, R147C, R383Q in PTH1R protein were deduced from the mutations of 356C>T, 395C>T, 439C>T, and 1148G>A in the gene. Observations indicate that Pro-119 and Pro-132, both of which reside in the PTH-binding domain, were critical for the function of PTH1R. Considering the importance of the PTH/PTH1R system in bone metabolism, it is plausible that the retarded function of PTH1R is one of the causes of the development of PFE.

SP196 COMPARISON OF CHEWING CYCLES ON THE DEVIATED AND NON-DEVIATED SIDES IN PATIENTS WITH SKELETAL ASYMMETRY

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AIMS: To compare the chewing cycles on the deviated and non-deviated sides in patients with skeletal asymmetry and unilateral posterior crossbite.

MATERIALS AND METHOD: The chewing records of 13 patients (3 males, 10 females, mean age 22.0 ± 8.2 years) who had more than 3 mm of menton deviation and an ipsilateral posterior crossbite. Chewing cycles were classified into eight types and the frequency of each type on the deviated and
non-deviated sides was compared. The opening time, occlusal time, closing time, and location of the turning point were also evaluated.

RESULTS: A normal chewing pattern was observed more frequently on the non-deviated side than on the deviated side. Concave closing, concave opening, reverse, and superimposition types showed higher frequencies on the deviated side, whereas both a positive and reverse crossing type had lower frequencies. The mean cycle time indicating the sum of opening time, occlusal time, and closing time, was shorter and the coefficient of variation was higher on the deviated side than on the non-deviated side. The location of the turning point was more medial and anterior on the deviated side than on the non-deviated side.

CONCLUSION: Patients with skeletal asymmetry and an ipsilateral posterior crossbite showed higher frequencies of a normal chewing pattern on the non-deviated side. On the other hand, various abnormal chewing patterns were found more prevalent on the deviated side. Chewing time was slightly shorter on the deviated side and the turning point was located more medially and anteriorly on the deviated side.

SP197 THREE-DIMENSIONAL ANALYSIS OF LIP MORPHOLOGY FOLLOWING THE CORRECTION OF PSEUDO-CLASS III MALOCCLUSIONS
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AIMS: To investigate three-dimensional (3D) lip morphology following the correction of pseudo-Class III malocclusions.

SUBJECTS AND METHOD: Eighteen Japanese patients (male, n = 5; female, n = 13; mean age: 8 years 2 months) diagnosed with a pseudo-Class III malocclusion. All patients showed a negative overjet on at least two incisors, including the bilateral central incisors, and functional mandibular prognathism due to premature contact of the anterior teeth. The anterior crossbite was corrected by labial movement of the upper anterior teeth within 6 months of the diagnosis. 3D images of the face at rest were recorded for each patient using a 3D surface imaging device (3dMDcranial System, 3dMD, USA) before and after treatment. The images were superimposed at the forehead, and the mid-sagittal, axial, and frontal planes were defined based on several reference points using an image processing software program (3D-Rugle, Medic Engineering, Japan). The subnasale (sn) and labiomentale (labm) were identified. The plane through the sn and labm, perpendicular to the mid-sagittal plane, was defined as the lip base plane. The lip protrusion surface area and volume anterior to the lip base plane were calculated. Significant differences in the pre- and post-treatment values were identified using the paired t-test.

RESULTS: The upper lip protrusion surface area and volume significantly increased after treatment (P < 0.001). Meanwhile, there was no significant difference in the pre- and post-treatment lower lip protrusion surface area.

CONCLUSION: 3D images of the face of patients with a pseudo-Class III malocclusion showed anterior protrusion of the upper lip but no significant protrusion of the lower lip after correction of an anterior crossbite.

SP198 CEPHALOMETRIC CHANGES AFTER EARLY OR LATE CERVICAL HEADGEAR TREATMENT – A RANDOMIZED CLINICAL TRIAL
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AIMS: To evaluate craniofacial structure changes in children with a Class II occlusion treated with cervical headgear and randomized into early and late treatment groups.

SUBJECTS AND METHOD: Sixty seven children (28 girls, 39 boys) with a Class II occlusion. The children were randomly divided into two groups. In the first group headgear treatment was started immediately or after eruption of first maxillary molars (mean age 8.0 years, SD 0.62). In the second group headgear treatment was started later (mean age 9.6 years, SD 0.71). The active headgear treatment was continued in both groups until a normal Class I occlusion on first molars was
achieved. Lateral cephalometric radiographs were taken of both groups at the beginning of follow-up (T0, mean age 7.3 years, SD 0.53), at the beginning of treatment of the second group (T1, mean age 9 years, SD 0.56) and at the end of treatment of the second group (T2, mean age 11.5 years, SD 0.57). Conventional cephalometric landmarks and reference lines were used for skeletal structures. The cephalometric values were compared between the early and late treatment groups at different time points. An independent samples t-test was used to compare the means of the values of the groups.

RESULTS: Significant differences in linear (overjet, U1-facial plane, convexity of point A) and angular (SNA, ANB, angle of convexity) parameters of the early group at T1 showed the cervical headgear treatment moving the maxilla posteriorly. At T2 the linear distance between condylion and point A was shorter for the early group indicating a more retrusive position of the maxilla. The distance between nasion and anterior nasal spine was longer for the late group indicating rotation of the maxilla downward.

CONCLUSION: There were minor changes between the early and late treatment groups at T2 at the age of 11.5 years.

SP199  EFFECTS OF ORTHODONTIC FORCES ON PERI-MINISCREW CREVICULAR FLUID COMPOSITION: A SYSTEMATIC REVIEW
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AIMS: Peri-implant crevicular fluid (PMICF) analysis has been suggested to provide a non-invasive way to detect early metabolic and biochemical changes not readily discernible, as well as help in monitoring the response to force loading. Information regarding crevicular fluid around orthodontic miniscrews is lacking, thus the aim of this study was to investigate PMICF profile changes under the effect of orthodontic forces.

MATERIALS AND METHOD: A search was made, without restrictions, for published and unpublished literature in Medline via PubMed, the Cochrane Central Register of Controlled Trials, the Cochrane Database of Systematic Reviews, Scopus, Web of Science, Lilacs, IndMed, Scielo, Arab World Research Source, ClinicalTrials.gov, International Standard Randomised Controlled Trial Number registry and OpenGrey databases. In addition hand searching was performed. Data from prospective human trials on PMICF profile changes under the effect of orthodontic forces were reviewed. Data was classified according to the substance investigated.

RESULTS: Two hundred and seventy one references were initially identified and finally included data from five studies involving 64 patients and analyzing PMICF from 148 miniscrews that were followed for a period up to 300 days. Compared to baseline values, PMICF levels of Interleukin 1β, 2 and 6 did not change significantly during loading in the long-term. Osteoprotegerin and receptor activator of nuclear factor kappa-B ligand levels ratio also remained unchanged and, finally, no significant difference was found between chondroitin sulphate (WF6 epitope) levels during force application. Only for Interleukin 8 levels was an increase observed at isolated time points during loading.

CONCLUSION: In general, PMICF profile did not demonstrate significant changes during loading, suggesting that miniscrews can be used effectively for anchorage when physiological forces are applied.

SP200  DETERMINATION OF MAXILLARY AND MANDIBULAR ALVEOLAR STRUCTURES IN UNTREATED ORTHODONTIC PATIENTS IN DIFFERENT AGE GROUPS
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AIMS: To determine the maxillary and mandibular alveolar structures of untreated patients in different age groups on standardized lateral cephalometric radiographs.
MATERIALS AND METHOD: One hundred and fifty five archived lateral cephalometric films were randomly selected from the records of pre-treatment patients. Forty of the patients were under the age of 12 years (<12 age group), 55 were between the ages of 12-16 (12-16 age group) and 60 were over the age of 16 (>16 age group). The inclusion criteria were good quality lateral cephalograms and absence of congenital craniofacial anomalies or syndromes. Exclusion criteria were the presence of congenital craniofacial abnormalities or syndromes, patients with missing teeth. Upper incisor alveolar heights (UIAH), upper molar alveolar heights (UMAH), lower incisor alveolar heights (LIAH), lower molar alveolar heights (LMAH), the thinnest width of symposys values (B-B'), mandibular alveolar width (Id-Id') and maxillary palatal width were measured. Data analysis was performed with SPSS 16.0 software using the one-way ANOVA and Tukey test.

RESULTS: Despite the increase in all measurements as age increased, there were no significant differences among the three age groups for any measurements. However, there were significant positive correlations between age groups and LIAH and LMAH (P < 0.05).

CONCLUSION: The alveolar structures should be examined in detail before applying implant and orthodontic mechanics, and appropriate treatment mechanics should be chosen.

SP201 COMPARISON OF LOWER INCISOR INCLINATION BETWEEN ADULTS AND CHILDREN WITH SKELETAL CLASS II MALOCCLUSION AND MANDIBULAR RETROGNATHIA IN A THAI POPULATION
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AIMS: To compare the amount of dental compensation in terms of lower incisor inclination between adults and children from cephalometric values in untreated skeletal Class II patients with a retrogнатhic mandible.

MATERIALS AND METHOD: One-hundred and fourteen lateral cephalograms of untreated skeletal Class II patients with a retrogнатhic mandible according to the value of A-N-B (Subspinale-Nasion-Supramentale) and S-N-B (Sella-Nasion-Supramentale) were divided into two groups based on chronological age. The LI-NB angle was selected to compare the mean between 54 children aged 10-17 years and 60 adults over 18 years old. The normality test was performed using the Kolmogorov-Smirnov test. The means between groups were compared with an independent t-test.

RESULTS: Cephalometric values revealed that the inclination of lower incisors for both groups was within normal range. Statistically significant differences were found between the two groups (P < 0.05). The mean LI-NB angle for adults was 35.35 degrees [standard deviation (SD) 5.87]. The mean LI-NB for children was 32.11 degrees (SD 6.18). The mean difference between the two groups was 3.24 degrees. The older age group showed a higher degree of proclination reaching a high normal range for the Thai population.

CONCLUSION: Dental compensation for skeletal Class II patients with a retrogнатhic mandible tended to increase with age as the lower incisor inclination became greater with age.

SP202 INTRUSION OF MAXILLARY POSTERIOR TEETH WITH ZYGOMATIC ANCHORAGE IN OPEN BITE CASES
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AIMS: To evaluate the dentofacial effects of intrusion of maxillary posterior teeth with zygomatic anchorage in open bite cases.

SUBJECTS AND METHOD: Fifteen female and 5 male subjects (average chronological age 19.28 ± 2.65 years). In all subjects a Hyrax appliance, banded to first and second premolars and molars, was used as the anchorage unit for intrusion of the posterior teeth. Titanium miniplates were fixed to the zygomatic process of the maxilla. An intrusion force of 200 g/side with active tie-backs was applied to the posterior teeth from the zygomatic plates. Dentofacial changes were evaluated on lateral cephalometric films obtained at the beginning and at end of intrusion of the maxillary posterior teeth.
RESULTS: The average intrusion of the maxillary first molars was 3.37 mm. An increase of overbite of 3.6 mm was obtained. A decrease of lower anterior face height of 2.05 mm with a decrease of the mandibular plane angle (SN/GoGn) of 2.22 degrees were observed.

CONCLUSION: The anterior open bite was corrected with anterior rotation of the mandible as a result of intrusion of the maxillary posterior teeth using zygomatic anchorage.

SP203 THREE-DIMENSIONAL ASSESSMENT OF OCCLUSAL CONTACT CHANGES AFTER NON-EXTRACTION TREATMENT

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AIMS: The occlusion that is re-established by orthodontic treatment might be one of the keys for stable orthodontic results. The aim of this study was to evaluate the pre- and post-treatment posterior occlusal contacts in non-extraction treated patients using the three-dimensional (3D) model cast system.

SUBJECTS AND METHOD: Occlusal contacts in maximum intercuspation were examined in a sample of 10 patients before and at the end of active orthodontic treatment. All patients had mild to moderate crowding with a Class I relationship. The model casts were scanned, the occlusal maps were gained via a 3Shape R900 scanner and the perimeter of the posterior occlusal contacts was measured. Wilcoxon signed-rank test was used to assess differences between groups. The level of significance for measurements was set at $P < 0.05$.

RESULTS: The mean perimeters of total occlusion contacts were 13.71 mm pre-treatment whereas the perimeter was 12.21 mm post-treatment ($P > 0.05$). For the molar region, occlusal contacts were decreased significantly ($P < 0.05$). Although occlusal contacts in the premolar region were increased, this was not statistically significant.

CONCLUSION: Based on the results of this pilot study, after orthodontic treatment occlusal contacts may decrease but long-term evaluations of contacts are continuing with different treatment protocols to check whether the contacts are increased or not.

SP204 EVALUATION OF ANOMALY IMPROVEMENT AND COMPLEXITY GRADES AND OUTCOMES OF PATIENTS WHO UNDERWENT ORTHODONTIC TREATMENT

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AIMS: To evaluate the anomaly improvement and complexity grades and outcomes of orthodontic problems and to detect the differences between genders on improvement and complexity grades and outcomes.

MATERIALS AND METHOD: Pre- and post-treatment orthodontic models and cephalometric radiographs of 387 subjects (150 extractions, 237 non-extractions) whose orthodontic treatment had been completed. Before and after treatment orthodontic models were carefully examined and occlusal features were scored using the Index of Complexity Outcome and Need (ICON).

RESULTS: According to the improvement grade, the numbers of greatly improved, substantially improved, and moderately improved cases were 224 (57.8%), 113 (29.1%) and 48 (11.5%), respectively. The number of minimally improved and no improvement or worse cases was two (1.6%). These improvement grades were similar to those in other clinics in Turkey and higher than grades obtained in the other countries. Although the improvement grades of females were better than those of males, the difference was not statistically significant ($P > 0.05$). According to complexity grade, the number of very difficult, difficult, and moderate cases were 157 (40.5%), 102 (26.3%) and 61 (11.5%), respectively. The number of mild and easy cases were 34 (8.7%) and 36 (9.3%). According to treatment outcome, all treatment scores were acceptable

CONCLUSION: Use of the ICON can be recommended to evaluate treatment results and achieve better outcomes for future treatments.
SP205 DETERMINATION OF ORTHODONTIC TREATMENT NEED OF ADOLESCENTS AND EFFECTS OF DIFFERENT VARIABLES ON TREATMENT NEED USING THE INDEX OF COMPLEXITY, OUTCOME AND NEED
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AIMS: To evaluate orthodontic treatment need for adolescents using the Index of Complexity, Outcome and Need (ICON) and to determine whether treatment need changes according to gender, dental, sagittal and vertical skeletal malocclusions.

MATERIALS AND METHOD: Pre-treatment orthodontic casts and panoramic films of 387 patients who applied for orthodontic treatment (250 males, 137 females; mean age 15.75 ± 2.97 years for males and 12.81 ± 1.50 years for females) were investigated using the ICON.

RESULTS: Two hundred and seventy five patients (71.1%) were found to need orthodontic treatment. Although not statistically significant, males (69.3%), a Class II dental molar relationship (66.6%), and Class II and Class III in sagittal skeletal anomalies were found to be higher than the others. Also, in vertical skeletal malocclusions, the orthodontic treatment needs of hyperdivergent patients (75.3%) were statistically higher than the others. The majority of individuals who were in the pubertal growth period were male (55.1%), dental Class II (72.3%), skeletal Class II malocclusion (55.8%) and normo-divergent (48.4%).

CONCLUSION: When vertical direction growth increased, the need for orthodontic treatment increased. ICON should be used to determine orthodontic treatment rather than Angle classifications.

SP206 ION RELEASE FROM NICKEL-TITANIUM ARCH WIRES – INFLUENCE OF WIRE COATING AND ACIDITY OF SALIVA
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AIMS: To analyse the influence of wire coating and acidity of saliva on the pattern of ion release from nickel-titanium (NiTi) archwires.

MATERIALS AND METHOD: Uncoated NiTi and rhodium-coated nickel-titanium (RhNiTi) wires were immersed in artificial saliva solutions (1.5 g/L KCl, 1.5 g/L NaHCO₃, 0.5 g/L NaH₂PO₄–H₂O, 0.5 g/L KSCN, 0.9 g/L lactic acid). The pH values were adjusted to 5.5 and 6.6 with the use of lactic acid and NaOH. Specimens were incubated at 37°C for 28 days. Released Ni and Ti ions were measured by means of inductively coupled plasma-optical emission spectroscopy. Data was analysed with two-way ANOVA and Student-Newman-Keuls post-hoc test and the effect size was assessed by η².

RESULTS: The release of Ni was associated with wire type (P = 0.025; η² = 0.263), but not with the pH value. The NiTi wire released significantly less Ni at pH value 6.6 (P = 0.018; η² = 0.698). The release of Ti was associated with both the wire type (P < 0.001; η²=0.801) and the pH value (P < 0.001; η² = 0.633). The RhNiTi wire released significantly less Ti at pH value 6.6 (P = 0.004; η² = 0.798).

CONCLUSION: Coating on the wire surface modifies the release of ions from NiTi wires in artificial saliva of various acidity. The release of Ti depends on the acidity levels of artificial saliva.

SP207 TOOTH REGENERATION BY RATE-CONTROLLED FREEZING AND CRYOPRESERVATION USING A MAGNETIC FIELD FOR ORTHODONTIA
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AIMS: Regenerative medicine is one of the most promising fields of the 21st century. In the present study, immediate autogenous tooth transplantation was performed. Rate-controlled freezing of an extracted incisor tooth from a rat was performed utilizing a magnetic microfield. The tooth was
frozen, thawed, and replanted, and the influence of this procedure on the periodontal tissue was investigated.

MATERIALS AND METHOD: The extracted tooth was immediately frozen in a CAS system, stored in a deep freezer (−150°C) for 3 days, and transplanted. The periodontal membrane is often damaged during tooth extraction; in cases of significant damage, regeneration of the membrane is facilitated by cell cultivation prior to tooth transplantation.

RESULTS: It was confirmed that the culture floor became usable by β-calcium phosphate block. Scaffolding was facilitated by addition of 0.1-0.3 mm β-calcium phosphate powder. β-calcium phosphate powder (+): 0.25 ± 0.05* β-calcium phosphate powder (−): 0.19 ± 0.04  *P < 0.05 The periodontal membrane regeneration speed in serum-free culture medium was 1 mm per 3 days, suggesting a slight increase in speed.

CONCLUSION: Unless the condition of the donor tooth is extremely poor, immediate autogenous tooth transplantation is achievable; the treatment success rate increases with an increased amount of undamaged periodontal membrane of the extracted donor tooth. Therefore, periodontal membrane regeneration of the extracted tooth in vitro may lead to an improved treatment success rate. Because tissue and cell destruction during the freezing and thawing of the extracted tooth has a great influence on transplantation results, improvement in cryopreservation techniques, such as reducing freezing and ice-associated damage, is important for increasing the transplantation success rate. It is believed that storage banks aimed at tissue and cell cryopreservation will rapidly develop, along with the popularization of regenerative medicine.

SP208 EVALUATION OF GINGIVAL BIOTYPE IN THE MANDIBULAR ANTERIOR REGION IN INDIVIDUALS WITH DIFFERENT DENTAL MALOCCLUSIONS AND AMOUNTS OF CROWDING
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AIMS: To evaluate the relationship of gingival thickness (GT) and the width of keratinized gingiva (WKG), which is considered to be a significant risk factor for gingival recession that can be seen in the mandibular anterior region due to orthodontic tooth movements, with different malocclusion groups and the amount of crowding.

SUBJECTS AND METHOD: One hundred and eighty seven periodontally healthy subjects (121 females, 66 males) were enrolled in the study and divided into three groups: Angle Class I, Angle Class II and Angle Class III malocclusion. Each group was classified as mild, moderate or severe according to the amount of existing crowding. The WKG was determined as the distance measured between the mucogingival junction and the free gingival margin; whereas GT was determined by the transgingival probing technique. Factorial variance analysis and Duncan multiple comparison test were used to identify whether there was a difference according to Angle classification and the amount of crowding in terms of these parameters.

RESULTS: It was found that teeth in the mandibular anterior region had a thin biotype. WKG and GT were highest for the mandibular incisor teeth in the severe crowding group and at the mandibular canine teeth in the mild crowding group. The relationship of WKG and mean GT of the mandibular anterior region with Angle classification was not found to be statistically significant. The GT of teeth 41 and 42 were found to be lower in the Angle Class III group.

CONCLUSION: When the amount of crowding increased it was observed that the WKG and GT of the central and lateral incisors were increased while the WKD and GT of the canines were decreased.

SP209 VERTICAL CHANGES OF THE LIP AND PERIORAL SOFT TISSUE RESULTING FROM INCISOR RETRACTION
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AIMS: To evaluate vertical lip and perioral soft tissue changes with respect to incisor retraction in an effort to analyze which factors might be responsible for their vertical changes, using multiple regression analysis.

SUBJECTS AND METHOD: Sixty one skeletal Class I and Class II adults with lip protrusion treated by anterior retraction after four premolar extractions. Changes of philtrum length, vermilion height and lip length were measured on lateral cephalograms before and after treatment.

RESULTS: 1. Upper and lower lip philtrum lengths (SnLs, LiB') were increased after retraction of the anterior teeth, whereas upper and lower vermilion heights (LsStms, StmiLi), and vermilion lengths (LsLi) were decreased. 2. Upper and lower lip lengths (SnStms, StmiB'), and soft tissue lower anterior facial heights (SnMe') did not show any significant difference after treatment. 3. The increase of upper lip philtrum length was mainly influenced by extrusion of the upper anterior teeth (△U1V), and the increase of lower lip philtrum length was mainly influenced by the initial overjet before treatment. 4. The decrease of upper and lower lip vermilion height was mainly influenced by the decrease of upper lip thickness.

CONCLUSION: The vertical changes of the lip and perioral soft tissue was mainly influenced by the extrusion of the upper anterior teeth, the initial overjet before treatment and the decrease of upper lip thickness.

SP210 EFFECTS OF CONVENTIONAL AND SELF-LIGATING BRACKETS ON PLAQUE ACCUMULATION AND PERIODONTAL STATUS
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AIMS: To evaluate the amounts of plaque accumulation of two different bracket types.

SUBJECTS AND METHOD: Forty healthy patients randomly divided into two equal groups according to bracket type: self-ligating bracket and conventional edgewise twin bracket. Prior to the start of orthodontic treatment all patients received oral hygiene instruction, i.e. use of orthodontic and interdental brushes three times a day with fluoridated toothpaste. Gingival Index (GI), Bleeding on Probing (BOP), Orthodontic Plaque Index (OPI) and Stained Tooth Surface Index (STSI) were used for evaluation of plaque accumulation and periodontal effects. Clinical measurements were performed at 1, 2 and 3 months after bracket placement. For statistical evaluation the mean value of these three measurements were calculated for each variable.

RESULTS: GI and STSI showed significant differences between mandibular and maxillary arches for self-ligating brackets. GI, OPI and STSI showed significant differences between mandibular and maxillary arches for conventional brackets. Due to these differences between the two arches, bracket types were compared separately with each other for each jaw. These comparisons did not demonstrate any significant differences between bracket types.

CONCLUSION: Self-ligating brackets do not present an advantage concerning plaque accumulation when compared to conventional edgewise twin brackets.

SP211 INCREASE OF ORTHODONTICALLY INDUCED ROOT RESORPTIONS, TOOTH MOVEMENT VELOCITY AND PERIODONTAL BONE LOSS BY EXPERIMENTAL PERIODONTITIS IN RATS
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AIMS: Many adult orthodontic patients suffer from chronic periodontitis with recurring phases of active periodontal inflammation. Although various studies have indicated a destructive effect of orthodontic forces on periodontal attachment during active periodontitis, there is only little or conflicting data about the effects on orthodontically induced root resorptions (OIRR) or on the velocity of orthodontic tooth movement. These were investigated in a rat model.

MATERIALS AND METHOD: Sixty three male inbred Fischer344-rats were randomly assigned to three consecutive experiments of 21 animals each [cone beam computed tomography (CBCT) and
AIMS: Nicotine is known to induce periodontitis. In a previous study (Kirschneck et al., 2015) it was shown that orthodontic forces can add to nicotine-induced periodontal bone loss. However, there is little or conflicting information about the effects of nicotine on undesired, orthodontically induced root resorptions (OIRR) or tooth movement velocity, particularly in doses corresponding to the average European smoker. Since the prevalence of smokers among adult (26%) and juvenile (12%) patients is rather high, the aim was to investigate the effects of nicotine on OIRR, tooth movement velocity and osteoclast activity in a rat model.

MATERIALS AND METHOD: Sixty three male, inbred Fischer344-rats were randomly assigned to three consecutive experiments of 21 animals each [cone beam computed tomography (CBCT)/histology and IL-6 serology/reverse transcription quantitative polymerase chain reaction (RT-qPCR) analyses and cotinine serology] and three different experimental groups: (1) control, (2) orthodontic tooth movement (OTM) of the upper left first/second rat molars (NiTi coil spring; 0.25 N), (3) OTM with experimentally induced periodontitis (cervical silk ligature). A split-mouth design was used (contralateral side as no-force-control). Periodontal bone loss and OTM were quantified by CBCT after 14 and 28 days of OTM, whereas only after 14 days leukocyte counts, OIRR/osteoclast activity and gene expression of known inflammatory and osteoclast markers were assessed in blood serum, histological slices of the alveolar process or by RT-qPCR in defined dental-periodontal tissue samples, respectively.

RESULTS: As expected, the experimental periodontitis caused a distinct bone loss, which was significantly increased when orthodontic forces were applied concurrently. A similar effect was found for OIRR, which, in conjunction with osteo-/odontoclast activity, were significantly more pronounced during active periodontitis. Contrary to previous reports about an inhibition or no effects on OTM, a significant acceleration of OTM was found during active periodontitis. Gene expression analyses as well as serum leukocyte counts indicated a synergistically increased inflammatory and osteoclastogenic reaction as the most likely cause for the observed phenomena.

CONCLUSION: Although an increased velocity of tooth movement would be favourable for orthodontic treatment purposes, the results indicate that force application during active periodontitis should be strictly avoided due to the distinct detrimental effects on dental and periodontal health, which were observed in a rat model. Orthodontic treatment should thus only be started after successful treatment of active inflammatory processes and paused in case of recurring active pockets during OTM.
interventions should therefore only be started after cessation of smoking and patients advised about the risks involved, particularly if continuing or restarting their smoking habit.

SP213 DEVELOPMENT OF A HUMAN PHANTOM HEAD FOR DIGITAL DATA ACQUISITION OF COMPUTED TOMOGRAPHY AND DENTAL MODELS
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AIMS: To devise a human phantom head for digital data acquisition of computed tomography (CT) and dental models.

MATERIALS AND METHOD: The phantom comprised parts of a ready-made phantom for radiographic examination training (Kyoto Kagaku, Co. Ltd., Japan). The dental arch of the phantom was not covered so that dental impression taking could be performed. The phantom was radiographed using a CT scanner (Somatom Emotion6, Siemens AG, Germany). The Hounsfield units (HU) of various tissues were measured on the phantom. The phantom had dental impressions taken. A dental model, made from the dental impressions, was scanned using a three-dimensional (3D) surface imaging device (3Shape R700 Scanner, 3shape, Denmark). The CT and dental model digital data were transferred to a personal computer and integrated using a 3D imaging software program (Body-Rugle, Medic Engineering, Japan).

RESULTS: A simulated or human phantom head for radiographic examination and dental impression taking was developed. Typical soft and hard tissues were appropriately rendered using the CT data. The mean HU values of the enamel, dentine, cortical bone, and palatal soft tissue obtained from the phantom were 2816, 1761, 1563, and 3, respectively. The X-ray absorption rates of those tissues appeared to be approximately equal to those of the human body. The CT and dental model digital data were integrated with a high accuracy.

CONCLUSION: The devised human phantom head can acquire digital data of CT and dental models. This phantom may be used for integration between various types of radiographic images and dental model digital data.

SP214 CORRELATION BETWEEN ORTHODONTIC TREATMENT WITH EXTRACTIONS AND TEMPOROMANDIBULAR JOINT DISORDERS
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AIMS: To improve diagnostic methods after orthodontic treatment with extractions. Evident changes in soft tissues and dentoalveolar characteristics appear with tooth extractions.

SUBJECTS AND METHOD: Eighty seven patients, 16-32 years of age, were examined. Five groups of patients were selected according to the site of the tooth extractions.

RESULTS: As a result of the site of the extractions there were different blocks and restrictions on mandibular movements, dysfunctions of the temporomandibular joints and a decrease of the muscle contraction speed, etc., in all five groups.

CONCLUSION: All methods for orthodontic research can be considered as a background for making a decision for a further treatment approach and precise assessment of the consequences. The more initial scientific research is carried out, the more an effective scheme of treatment can be formed and accomplished.

SP215 LONG-TERM STABILITY OF THE PALATAL REGION OF INTEREST IN ADULT ORTHODONTIC PATIENTS
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AIMS: To examine the long-term stability of the palatal region of interest (PRI) for the assessment of orthodontic tooth movements in three-dimensions.
MATERIALS AND METHOD: Three-dimensional (3D) digital information of dental casts were obtained from 14 adult orthodontic patients (mean age 31.2 years, range 27 to 39.9 years) using a 3D scanner. To assess long-term stability of palatal morphology, 3D images of the palate were scanned from the upper dental casts, which were obtained at the initial examination (T1) for orthodontic diagnosis and at the examination (T2) more than five years after active treatment. PRI was defined as the region including the third palatal rugae and the hard palate. PRI of T1 was superimposed on the corresponding PRI of T2 by means of the iterative closest point (ICP) algorithm and their differences were assessed to evaluate stability.

RESULTS: The average difference in the PRI between T1 and T2 was 0.25 mm (0.19–0.39 mm) with a standard deviation of 0.116 mm (0.08–0.22 mm).

CONCLUSION: It was demonstrated that the configuration of PRI was longitudinally stable and not affected by orthodontic treatment. PRI appears to be suitable for a clinical reference area to assess orthodontic tooth movements in three dimensions.

SP216 DOES VERY PREMATURE BIRTH EXPOSE CHILDREN TO A PARTICULAR FACIAL DEVELOPMENT?
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AIMS: Very preterm babies, born between 8 to 18 weeks before term, survive nowadays due to advances in neonatal medicine. Despite these progresses, neonatal morbidity remains significant and frequent handicaps affect these infants. The orofacial sphere might also be impaired to the image of other structures. Considering the role of functions/dysfunctions and environmental factors in orofacial development, this study explored possible deviations of cephalometric characteristics in a group of very preterm children, at 5 years of age.

SUBJECTS AND METHOD: The very preterm sample comprised infants prematurely born in 1997 between gestational week # 22 to 32, who took part in a French epidemiological study (EPIPAGE, 2003). A lateral cephalogram was taken of 60 very preterm 5 year-old children from Alsace, France, showing no syndrome or palatal cleft. This sample was compared with two control groups of the same age: one derived from the Iowa facial growth study (84 full-term children), the other taken from the Manual of Facial Growth, Bhatia (94 infants). A Bayesian statistical analysis was conducted on skeletal cephalometric variables and comparisons were performed 2 by 2 between groups, using a suitable regression model and applying a principal component analysis.

RESULTS: The two control groups displayed a great variability illustrating the difficulty of sampling a representative group of the overall population. A virtual super-sample merging the two control groups was therefore assembled. Compared to full term infants, preterm children displayed: no difference in the basi-cranium linear dimensions; a significant increase of the cranial base angle; no difference in facial divergency; a closure of the gonial angle; an anteriorly positioned maxilla and mandible; no difference in mandibular length; no difference in ANB angle and a negative Wits value.

CONCLUSION: The Bayesian analysis showed that a very preterm child had an increase in the cranial base angle, a closure of the gonial angle, facial prognathism and a Wits revealing a Class III tendency. The obligation to survive and feed in the preterm group, associated with strong early orofacial functional activities may explain the robust development of the mandible. The opening of the skull base remains however elusive.

SP217 SHORT-TERM CRANIOFACIAL GROWTH CHANGES IN TURKISH SUBJECTS WITH DIFFERENT SAGITTAL MALOCCUSIONS: PART I†††
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AIMS: To investigate the short-term craniofacial growth changes in an untreated Turkish sample.

SUBJECTS AND METHOD: Ninety-four subjects (51 females, 11.6 ± 1.3 years; 43 males, 12.04 ± 1.42 years) who had at least two cephalometric radiographs obtained at different time-points. The mean observation period was 2.2 years. The sample was divided into three groups in response to sagittal
the jaws, vertical growth treatment and for retention stability assessment after treatment. The cephalometric radiographs were analyzed in Dolphin Imaging 11.5. Several angular and linear parameters, representing the anteroposterior dimensions and positions of the jaws, vertical growth pattern and the positions and inclinations of the teeth were measured to reveal the growth changes in all groups. The data was analyzed by paired-samples t-test.

RESULTS: In Class I male subjects, significant growth changes were observed in the parameters of CoA, CoGn and CoGo between the two time intervals ($P < 0.05$). In Class I female subjects, some parameters (A/Na perp., Pg-Na perp., FMA, PP/OP, upper lip anterior to TVL, SN/GoGn, PP/GoGn, CoA, CoANS, CoGn, CoGo) were found to be significantly changed during the observation period ($P < 0.05$). In Class II subjects, several parameters demonstrated significant changes in both genders (females: PP/GoGn, PP/OP, U1APog, U1PP, CoA, CoANS, CoGn, CoGo; males: SNB, ANB, FMA, SN/GoGn, PP/OP, PP/GoGn, soft tissue points A and B to TVL, CoA, CoANS, CoGn, CoGo)($P < 0.05$). The significant growth changes in Class III female subjects were only in CoGn and CoGo parameters ($P < 0.05$); while the significant changes were in the parameters of PP/OP, U1/PP, soft tissue point B to TVL, CoGn, CoGo in Class III male subjects ($P < 0.05$).

CONCLUSION: The findings of this study reveal some significant dental and craniofacial growth changes in Class I, II and III subjects during the observation period of 2.2 years.

**SP218** THREE-DIMENSIONAL EVALUATION OF TOOTH MOVEMENTS: A NEW CONCEPT USING BEST-FIT MATCHING SOFTWARE AND INTRAORAL SCANNING
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Aims: Objective measurement of orthodontic tooth movement is important both for clinical procedure assessment during treatment and for retention stability assessment after treatment. However, this measurement is often performed imprecisely using two-dimensional evaluation methods on plaster models. A new concept for three-dimensional (3D) evaluation of tooth movements using best fit matching software and intraoral scanning is presented.

Materials and Method: A special software matching tool (OraCheck, Cyfex) has been developed ensuring highly accurate 3D analysis of different data sets. Superimposing of data sets is automatically performed using a special best-fit algorithm. For difference analysis each point of the virtual baseline is related to the closest corresponding point on the follow-up model surface. The respective area can be selected manually and be adapted to the respective focus of interest. Special analyzing tools permit exact analysis for each tooth regarding angle of rotation, direction of the axis of rotation and translation in all directions. Furthermore changes in arch width dimension and arch shape over time can easily be analyzed using virtual measurement tools. Superimposition reference points must be suitable for analyzing tooth movements.

Results: Matching accuracy for the OraCheck software was found to be $< 1 \mu m$ ($n = 10$, quadrant scans, Cerec Omnicam). Several different orthodontic clinical follow-up situations were analyzed and the first clinical examples using this concept are presented. (I) Fixed retainer maxillary anterior, 3 months after retainer fracture (Cerec Omnicam, in vivo scan); (II) Settling of occlusion following orthodontic treatment; end-of-treatment and end-of-retention period, 12 months after retainer placement (inEosX in vitro scan); (III) orthodontic maxillary anterior space closure using Aligner therapy (Cerec Omnicam, in vivo scan).

Conclusion: 3D analysis of tooth movement in the context of follow-up monitoring using intraoral scanning is highly promising. For tooth movements one has to be certain that superimposition points are suitable or make sure that the results of the analysis are interpreted as relative within the jaw.

**SP219** A PROSPECTIVE RANDOMIZED CLINICAL TRIAL OF ORTHODONTIC BONDING AGENTS
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AIMS: In vitro evaluation has revealed that resin-modified light cured glass ionomer cement (LCGIC) shows lower bond strength than resin adhesives. There has been limited information on the clinical performance of LCGIC. The objectives of this study was to evaluate the performance of orthodontic bonding systems in a prospective randomized clinical trial.

MATERIALS AND METHOD: Following ethical approval, 75 consecutive patients undergoing both upper and lower fixed appliance therapy were randomly recruited. A split mouth design was adopted with quadrants randomly assigned to four orthodontic adhesives, liquid/powder LCGIC, two-paste LCGIC, hydrophilic composite resin and hydrophobic composite resin. Over a 12-month period, the survival rates of the brackets were estimated with the Kaplan-Meier method. The survival distributions for the adhesives, type of teeth, and patient gender were compared with the log-rank test.

RESULTS: The overall failure rate was 7.8 per cent: liquid/powder LCGIC 1.1 per cent, hydrophobic composite resin 1.7 per cent, hydrophilic composite resin 1.7 per cent and two-paste LCGIC 3.3 per cent. The log-rank test showed that the liquid/powder LCGIC had a significantly lower failure rate ($P < 0.05$). The lower molar showed a significantly higher failure rate than other types of teeth. There was no significant difference between the genders.

CONCLUSION: Liquid/powder LCGIC showed significantly lower failure rate in spite of lower bond strength in the laboratory evaluation. There was no significant difference in failure rate between hydrophilic and hydrophobic composite resins.

SP220  AN INVESTIGATION OF THE CORRELATION OF DNA FRAGMENT SIZE TO OROFACIAL MUSCLES IN PATIENTS PRESENTING WITH FACIOSCAPULOHUMERAL MUSCULAR DYSTROPHY

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AIMS: To correlate DNA fragment size to orofacial muscle weakening in a group of patients with a genetically supported diagnosis of facioscapulohumeral muscular dystrophy (FSHD).

SUBJECTS AND METHOD: Molecular genetic analysis was performed in 48 patients (24 females, 24 males) from 32 autosomal dominant pedigrees and 16 sporadic or with an unidentified family history. The patients were tested using the Southern blotting technique, using EcoRI/Avrl double digestion and fragments were detected by p13E-11 telomeric probe. Pearson’s correlation was used to compare fragment size with the degree of muscle weakening as far as the forehead, the periorcular and the perioral muscles were concerned. Furthermore, 20 of the patients received orthodontic screening and in nine of them panoramic and lateral cephalometric radiographs, intraoral and portrait photographs were obtained and analyzed.

RESULTS: The correlation between DNA fragment size and the severity of muscle weakness was found to be significant for the forehead ($r = 0.36; P = 0.012$), the periorcular ($r = 0.31; P = 0.035$) and the left and right perioral ($r = 0.36; P = 0.014; r = 0.32; P = 0.029$) muscles. In patients with late onset of the disease the dentofacial features of the clinical screening as well as the measurements of the cephalometric analysis ranged within the limits of usual malocclusions. Nevertheless, the clinical records and cephalometric analysis of a FSHD patient with documented early onset and genetic testing showing a substantial fragment revealed a long ovoid face with increased lower face height, anterior open bite and posterior bilateral crossbite. The lips were severely incompetent and protrusive and the tongue was oversized.

CONCLUSION: In FSHD patients the forehead, the perioral and the periorcular muscles show a decrease in their activity, dependent on the size of the DNA fragment. Dentofacial and orthodontic assessment of a FSHD patient with early onset of the disease showed severe dentofacial abnormalities. The results of this research study provide useful information regarding orthodontic treatment planning in FSHD patients with altered orofacial muscle activity.
SP221  PREVALENCE OF TOOTH ANOMALIES IN NON-SYNDROMIC CLEFT LIP AND PALATE PATIENTS IN GREECE
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AIMS: To investigate the prevalence of tooth anomalies among cleft lip and palate (CLP) patients
and their potential association with the type of cleft and gender.

MATERIALS AND METHOD: Records of intraoral screening and radiographs were obtained from the
graduate clinic of the department of orthodontics and pediatric dentistry of the Dental School,
University of Athens, as well as from several private practices in Greece. A total of 154 patients (97
males, 57 females) born between 1977-2006 in Greece were examined for tooth agenesis and other
dental anomalies. Chi-square and Fisher’s exact tests were applied to assess comparisons between
dental anomalies, cleft types and gender. Logistic regression was performed to assess any potential
effects of gender and cleft type on tooth agenesis.

RESULTS: Overall, 64 per cent of the sample had dental anomalies and the main two that occurred
were tooth agenesis (50%) and microdontia (18%). No differences were observed between males
and females apart from the case of bilateral CLP (BCLP) type where the frequency of tooth agenesis
was significantly higher among males (P = 0.047). As non-statistically significant odds ratios for the
association of gender and cleft type with tooth agenesis were obtained, no confounding was
present. The proportion of tooth agenesis was substantially higher in subjects with a unilateral right
CLP and BCLP in quadrant 1 and unilateral left CLP and BCLP in quadrant 2 compared to the rest, and
an isolated cleft palate in quadrants 3 and 4. These results were attributed to teeth 22 (31%) and 12
(21%) in the maxilla and 35 (6%) and 45 (5%) in the mandible.

CONCLUSION: In CLP patients the most frequently affected teeth with dental anomalies were by far
the upper lateral incisors followed by the second left mandibular premolars. The high prevalence of
tooth agenesis that occurred, especially in the maxillary arch, should be further investigated through
more sophisticated approaches such as the use of the tooth agenesis code method.

SP222  ARCH WIDTH CHANGES IN EXTRACTION AND NON-EXTRACTION TREATMENT IN MATCHED
CLASS I BORDERLINE MALOCCLUSIONS
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AIMS: To investigate the transverse dental arch width changes after extraction and non-extraction
treatment in matched Class I malocclusions.

SUBJECTS AND METHOD: Five hundred and sixty Class I patients was subjected to discriminant
analysis and a borderline subsample of 62 patients, with regards to extraction treatment, was
obtained. Of these patients, 31 were treated with extractions and 31 without extractions of four first
premolars. Of the extraction patients 20 were female and 11 male with a mean age of 14.23 (SD
3.27) years. The non-extraction sample consisted of 31 patients (16 females, 15 males) with a mean
age of 15.77 (SD 5.44) years. The patients’ plaster casts were digitally scanned and the maxillary and
mandibular intercanine and intermolar widths were measured.

RESULTS: The extraction group showed an increase in the maxillary and mandibular intercanine
widths (P < 0.001) and a decrease in the mandibular intermolar widths (P < 0.001). The non-
extraction group showed an increase in all four measurements (P ≤ 0.003). The post-treatment
differences between the two groups showed a significant difference in the maxillary (adjusted mean
difference: −3.18; 95% CI: −3.94, −2.42; P < 0.001) and mandibular intermolar widths (adjusted.
mean difference: −3.70; 95% CI: −4.51, −2.9; P < 0.001) while the overall difference was also
significant (P < 0.001).

CONCLUSION: Borderline Class I malocclusion subjects exhibited significant transverse arch changes
after extraction or non-extraction treatment. The extraction cases showed an expansion of the
maxillary and mandibular arch at the anterior part as shown by the intercanine distance increase and
a constriction of the posterior segments as shown by the decrease in intermolar widths. The cases treated non-extraction presented a significant increase in transverse dimensions of both arches shown by the increase in intercanine and intermolar widths. Treatment choice had a different impact on maxillary and mandibular intermolar widths; the extraction cases exhibited a significant transverse arch width decrease with regards to the non-extraction cases.

SP223 SECULAR CHANGES IN OCCLUSAL TRAITS IN CHILDREN 6-8 YEARS OF AGE
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AIMS: To assess possible changes in occlusal traits in young children during the last two decades.

SUBJECTS AND METHOD: The recent study group (Group 2000) comprised 235 girls and 248 boys from a population sample of children, whose ages ranged from 6.4 to 8.5 years at the time of examination. The earlier study group (Group 1980) consisted of 155 girls and 157 boys extracted from another population sample of 1579 children and matched by age. The following occlusal variables were recorded according to the modified method of Björk et al. (1964): molar occlusion, overjet, overbite, crossbite, and scissor bite. Chi-square or Fisher’s exact test were used to compare the differences in the prevalence of occlusal traits between the groups.

RESULTS: Regarding sagittal occlusion, the mean overjet for group 1980 was 3.8 mm (SD 1.7) and for group 2000 2.8 mm (SD 1.6). Children in group 1980 were more likely to have an increased overjet (>5 mm) and scissor bite than the children in group 2000 (P < 0.001 and P = 0.050, respectively). On the other hand, a crossbite was more common among children in group 2000 than among children in group 1980 (P = 0.050).

CONCLUSION: The present findings show some changes in occlusion during the last 20 years, possible referring to a smaller mandible in children 6-8 years of age 20 years ago than today.

SP224 DENTOFACIAL PARAMETERS ASSOCIATED WITH A UNILATERAL PALATALLY IMPACTED CANINE
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AIMS: To investigate the relationship between a unilateral palatally impacted canine (PIC) and specific dentofacial parameters.

MATERIALS AND METHOD: A sample of 108 retrospective subjects were recruited. This consisted of 54 consecutive pre-treatment study models of subjects with a unilateral PIC matched with controls for age, gender and malocclusion. The position of the PIC was identified from the relevant clinical notes and was confirmed radiographically using the parallax technique. Digital study models were produced for all subjects to assess the following dental parameters: intercanine and intermolar width; palatal depth and palatal area; anterior Bolton tooth-size discrepancy (TSD); maxillary arch shape and ratio and maxillary central and lateral incisor shape and ratio. Numeric and categorical parameters were compared between groups using general linear models and Fisher’s exact test, respectively. The level of significance was 5 per cent.

RESULTS: Intercanine width was significantly smaller in the test group compared to the control group (P = 0.0002). No significant difference was recorded in intermolar width, palatal depth, palatal area and anterior Bolton TSD. Arch ratio was significantly smaller in the test group than in the control group (P = 0.0029), and arch shape distribution was significantly different between the test and control groups (P = 0.0090), with a tapered arch shape being the most common among the test group (48%). Tooth shape distribution was significantly different between test and control groups for the maxillary right central incisor (P = 0.030), with more square/round tooth shapes in the test group (17%) compared to the control group (2%). Tooth ratio showed no significant difference between test and control group.

CONCLUSION: Intercanine width was significantly smaller in unilateral PIC subjects compared to controls, whereas intermolar width was not. Palatal depth and palatal area did not differ significantly
between subjects with or without a unilateral PIC. No significant difference was found in anterior Bolton TSD. Maxillary arch ratio was significantly smaller, with a tapered arch shape being the most common among the test group. A square/tapered tooth shape was significantly more common in the test group.

**SP225 VALIDATION OF DISCRIMINANT ANALYSIS BY GEOMETRIC MORPHOMETRIC**

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**Aims:** Discriminant analysis (DA), applied to orthodontic diagnostic records, identifies factors that might drive treatment planning towards one of two alternatives, such as the decision to extract or not. DA, based on conventional cephalometric measurements and dental cast data, indicates that the extraction decision is largely based on morphological features. The aim of this study was to evaluate the validity of DA using geometric morphometric methods.

**Materials and Method:** A sample of 560 Class I patients treated either with extraction of four premolars or non-extraction. DA based on 27 cephalometric measurements, six dental cast measurements and the variables of age and gender was used to identify the factors that separated the two groups. Based on the results, the cases most similar between the groups were selected, leading to 60 borderline cases. The borderline sample consisted of 23 extraction cases (14 females, 9 males, mean age 15.3, range 10.6-38.9 years), and 37 non-extraction cases (18 females, 19 males, mean age 13.1, range 10.4-16.4 years). The sample was analysed using methods of geometric morphometrics. The main craniofacial skeletal structures on the pre-treatment lateral cephalogram were digitized and traced with 15 curves and 126 landmarks (116 sliding semi-landmarks and 10 fixed landmarks) and the soft tissues were traced with two curves and 37 sliding semi-landmarks. Procrustes alignment and Principal Component Analysis were applied to assess shape variability of the whole craniofacial complex and the soft tissues.

**Results:** Concerning the hard tissue, the first five principal components accounted for 50 per cent of shape variability, whereas approximately 80 per cent of the variability was described by the first 14 components. Regarding the soft tissues, the first four principal components accounted for 80 per cent of shape variability. Permutation tests showed no statistically significant difference between the two groups, either for the skeletal craniofacial structures as a whole (permutation test, 10,000 permutations, $P = 0.16$) or for the soft tissues (permutation test, 10,000 permutations, $P = 0.25$).

**Conclusion:** DA was successful in identifying morphologically similar patients.

**SP226 OBJECTIVE ASSESSMENT OF SUBJECTS' COMPLIANCE WITH THERMOPLASTIC VACUUM-FORMED RETAINERS FOLLOWING FIXED APPLIANCES: A PROSPECTIVE TWO-CENTRE STUDY**

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**Aims:** To assess objectively the number of hours subjects wore their vacuum-formed retainer (VFR) in the short-term following fixed appliances, to compare them to self-reports and to investigate possible effects of age, gender, treatment duration and setting.

**Subjects and Method:** Fifty-one patients from two clinics (26 males, 25 females) necessitating retention with VFR at least in the upper dental arch were followed for 12 weeks after appliance removal. The patients were advised to wear their appliances everyday, as much as they could, except during eating and brushing. The total period per day that they wore their upper retainer was recorded objectively with the aid of a TheraMon® microsensor. Data was read every 4 weeks and compared to self-completed reports. Analysis of the 41 subjects with complete data was performed with IBM Statistics® SPSS 20.0. Shapiro-Wilk test was used to check the normality assumption. The
mean and standard deviation were used to summarize the data and the analysis was based mainly on non-parametric methods (α = 0.05).

RESULTS: Although a statistically significant reduction was observed in the microsensor readings (hours) divided by the total number of advised wear days (weeks 1-4: 16.9 ± 4.4; weeks 5-8: 16.2 ± 5.3; weeks 9-12: 15.6 ± 5.6; P < 0.01, Friedman’s test), there was no significant difference with respect to recorded hours per actual wear days (weeks 1-4: 17.0 ± 4.2; weeks 5-8: 16.4 ± 4.8; weeks 9-12: 15.8 ± 5.1; Friedman’s test). No difference was observed between week periods 1-4 (68.3%), 5-8 (65.9%) and 9-12 (53.7) regarding the number of days that subjects wore their appliances for over 8 hours (Cochran’s Q test). Microsensor readings were positively statistically correlated with self-completed data (Spearman’s rho from 0.878 to 0.92 P < 0.000). Recordings per advised wear day did not associate either with patient age or treatment duration (Spearman’s rho). Finally, no difference was observed between genders or treatment centres (Mann-Whitney U test).

CONCLUSION: In the present sample, although subjects tended to miss some days, the total period of retainer wear during the others did not change in the first 12 weeks of retention. Microsensor readings were highly statistically correlated with patient reports and did not differ by age, gender, treatment duration or setting.

SP227 EFFECT OF GLASS IONOMER SEALANT ON DEMINERALIZATION ENAMEL ADJACENT TO BRACKETS – MICROHARDNESS ASSESSMENT
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AIMS: To evaluate the effect of the glass ionomer sealant, Clinpro™ XT varnish, on preventing enamel demineralization around orthodontic brackets.

MATERIALS AND METHOD: Forty samples of bovine incisor crowns were divided into two groups; an orthodontic bracket was bonded on the vestibular surface of all samples. The sealant was applied around the orthodontic bracket in group 1 while group 2 received no treatment. The samples were submitted to acid challenge during pH-cycling in a demineralization solution for 6 hours and in a remineralization solution for 18 hours. Microhardness of the samples was then assessed at distances of 1000, 2000 and 3000 µm at the interface, close to the surface of the bracket. For each point at the interface, microhardness readings were performed at depths of 100, 200, 300 and 400 µm. The data obtained were submitted to the ANOVA statistical test and the Tukey test.

RESULTS: All measurements showed statistical differences for the interaction between distance and treatment (P = 0.00) and depth and treatment (P = 0.031). Clinpro™ XT seems to have prevented demineralization up to 2000 µm from the bracket, the same values found at 1000 µm, but at 3000 µm the values began to diminish when compared with 1000 and 2000 µm.

CONCLUSION: The use of glass ionomer sealant, Clinpro™ XT, was shown to be effective in reducing enamel demineralization around orthodontic brackets, but the farther away from the brackets, the less effective it was.

SP228 EFFECT OF SEALANTS ON DEMINERALIZATION OF ENAMEL ADJACENT TO BRACKETS – AN IN VITRO STUDY
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AIMS: To evaluate the effects of glass ionomer sealants, Clinpro™ XT and Fluoroshield, in preventing enamel demineralization in the region circumscribed and localised to orthodontic brackets by microhardness and scanning electron microscopy (SEM).

MATERIALS AND METHOD: The crowns of 60 bovine teeth were divided randomly into three groups: G1 bracket bonding (control), G2 bracket bonding and glass ionomer sealant Clinpro™ XT, G3 bracket bonding and Fluoroshield sealant. The samples were submitted to cariogenic challenge (demineralization and remineralization recycling). Subsequently Knoop hardness (25 g, 10 seconds) was evaluated using a durometer unit (Shimadzu), at distances of 1000, 2000 and 3000 µm in the interface and 100, 200, 300 and 400 µm in depth, to incisal and cervical from the orthodontic
SEM images were obtained from the surface cervical samples. The results were analyzed using ANOVA and Tukey test ($P < 0.05$).

RESULTS: The values showed significant influence on hardness knoop interactions. Treatment/distance and treatment/distance/region ($P = 0.00$) in G2 and G3, revealed the occurrence of greater enamel hardness at the cervical region in the areas closest to orthodontic bracket with the applied sealant; more evident with Clinpro™ XT. However, for samples that did not receive sealant no clear influence of these interactions with hardness was observed. It was concluded that sealants were more effective near to the brackets and less effective in the most remote measurements of dental enamel.

CONCLUSION: Clinpro™ XT sealant had the highest hardness values and greater effectiveness.

SP229 CEPHALOMETRIC HARD TISSUE PROFILE ANALYSIS OF TEENAGE ORTHODONTIC PATIENTS IN SOUTHERN TURKEY: A PILOT STUDY
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AIMS: To evaluate the hard tissue profile of teenage orthodontic patients in Southern Turkey.
MATERIALS AND METHOD: A total of 100 lateral archived cephalometric radiographs were used in this study. All selected patients had normal growth and development without any observable craniofacial abnormalities, no history of previous orthodontic or prosthodontic treatment and no maxillofacial or plastic surgery. The selected patients were 41 males and 59 females aged between 12-18 years from the Hatay region of Turkey. The anteroposterior angular relationship of the maxilla to the mandible and the cranial base was measured by SNA, SNB and ANB angles and the linear relationship of the maxilla to the mandible by Wits appraisal. The position of the maxilla relative to the cranial base was measured by the linear distance from point A to nasion perpendicular. Statistical analyses were made on three groups according to ANB norms. The skeletal Class I group consisted of 46 cases, the skeletal Class II group 44 cases and the skeletal Class III group 10 cases.
RESULTS: According to ANB norms, 46 per cent of the patients were skeletal Class I, 44 per cent skeletal Class II and 10 per cent skeletal Class III. The mean SNA, SNB, ANB, Wits and Npe-A values and standard deviations for the skeletal Class I, II and III groups were: 81.02 ± 4.04°, 78.79 ± 3.66°, 2.23 ± 1.29°, −1.15 ± 2.36 mm and 2.30 ± 3.23 mm; 82.36 ± 3.00°, 76.53 ± 2.96°, 5.83 ± 1.46°, 2.84 ± 2.35 mm and 1.93 ± 3.29 mm; 77.55 ± 5.95°, 79.75 ± 5.72°, −2.12 ± 2.47°, -5.8 ± 3.39 mm and −0.7 ± 3.34 mm, respectively.
CONCLUSION: These lateral cephalometric values are important to understand the hard tissue profile of orthodontic patients from Southern Turkey. These values will also guide treatment planning for these patients.

SP230 FACTORS INFLUENCING LONG-TERM STABILITY OF BONDED RETAINERS
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AIMS: A retrospective longitudinal study to identify factors influencing long-term failure of bonded retainers, hypothesizing an association between variation of tooth morphology and retainer failures.
MATERIALS AND METHOD: Treatment records, regularly taken intraoral photographs and dental pantomograms of 89 patients, 14-60 years of age at debonding, with 4-19 years retention time and bonded retainers on the upper and lower anterior teeth. Two bonding composites, several wire types and retainer designs, such as single wire or segmented, canine to canine or incisors only, were employed. All retainers were fabricated, fitted and repaired by the same orthodontist. Age, gender, pre-treatment Irregularity Index, post-treatment overjet and overbite, bonding composite, retainer wire, retainer design, retainer position on the teeth, size and shape of the teeth, width of the composite bud, composite discoloration and degradation, parafunctions and periodontal condition were assessed. The numbers, time points of and reasons for repairs were recorded. A weighted repair score, based on the time point of retainer failure, was developed giving higher or lower scores
for earlier or later failures, respectively. Reliability tests, descriptive statistics, t-tests and regression analyses were performed to test the significance of differences and assumed relations.

RESULTS: A significant association was found between bone loss more than two-thirds of root length and retainer failures. In the mandible a significantly higher failure rate was found for the 0.025 inch twisted flex gold wire. In the mandible Flow composite performed significantly better than in the maxilla. On the lower canines a wide composite bud showed a significantly lower repair frequency than a narrow one. Only for the canines was repair frequency significantly associated with composite degradation. The size and shape of most teeth was not associated with failure rate. The hypothesis suggesting an association between morphologic variation and failure rate could not be rejected nor fully confirmed as only a small cingulum of the upper canines was associated with more repairs.

CONCLUSION: Most variables studied were not related to failure rate, suggesting that individual variation remains the main factor in long-term bonded retainer success.

SP231 HISTOLOGICAL EXAMINATION OF ANGIogenesis AND OSTEOogenesis WHEN USING SYntHETIC COllAGEN IN HUMANS
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AIMS: After tooth extractions alveolar bone resorption often occurs, which can complicate later implantology. Socket preservation with bone substitute material has shown that resorption of the alveolar ridge can be reduced after tooth extraction. It has been proven that early vascularization and angiogenesis of the material used is essential for bone formation and bone quality. The aim of this randomized study was to evaluate angiogenesis and osteogenesis in extraction alveoli of humans treated with Bio-Oss® collagen (Geistlich Biomaterials) compared with natural bone regeneration.

SUBJECTS AND METHOD: Thirty patients, 17 with a mean age of 57.1 ± 12.2 years, were treated with Bio-Oss® and 13 (mean age 52.6 ± 10.6 years) were used as controls with natural bone regeneration. After 8 weeks, a bone biopsy was obtained from all patients, fixed in formalin, decalcified and embedded in paraffin. Semi-thin bone cross-sections were stained either with hemalaun/eosin or Masson Goldner trichrome and morphometrically analysed. The expression of CD34 and alkaline phosphatase (ALP) were studied using specific antibodies.

RESULTS: After division of the biopsies at different stages of bone regeneration it was noted that in Bio-Oss collagen treated alveoli more samples with immature bone (stage 1; 6/17) were present than in the controls. Samples with already mineralized bones were rarely found (stage 4; 2/17). Histomorphometry of all samples examined independently of stage showed no significant differences between augmented and non-augmented alveoli. Furthermore, the insertion of Bio-Oss collagen resulted in no changes in vascularization of the tissue, whereas the expression of the bone specific protein ALP increased significantly.

CONCLUSION: Bio-Oss is a suitable material for socket preservation. This material produces bone tissue with a greater quantity but lower quality in comparison with untreated controls.

SP232 THE ACCURACY OF TWO- AND THREE-DIMENSIONAL SOFT TISSUE PROFILE PREDICTION METHODS AFTER BIMAXILLARY ORTHOGNATHIC SURGERY IN CLASS III PATIENTS
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AIMS: To evaluate the accuracy and reliability of different soft tissue profile prediction methods after bimaxillary orthognathic surgery in skeletal Class III patients.

SUBJECTS AND METHOD: Twenty skeletal Class III patients (10 females, 10 males) with a mean age of 23.68 ± 7.14 years. Pre- and post-operative cephalometric films were obtained and 48 measurements (38 linear, 6 angular and 4 proportional) were made. Soft tissue prediction was undertaken using three methods; manual method using hand tracings (with template method), a
two-dimensional (2D) soft tissue prediction program (Dolphin Imaging, version 11.5) and a three-
dimensional (3D) program (SimPlant Master, version 16.0). Manual and 2D predictions were made
using cephalometric films and cone beam computerized tomography images were used for 3D soft
tissue prediction. Predicted soft tissue images were compared with cephalometric films taken at
least 6 months after surgery representing the actual outcomes of the bimaxillary surgery. Dependent
two-sample t-test, one-way variance analysis and Bonferroni test were used for statistical analysis.
Method error was determined by the intraclass correlation coefficient (ICC).

RESULTS: ICC determined for all measurements was found to be above 0.981, showing high
reproducibility of measurements. The conventional manual method predicted Pronasale, Pog* (soft
tissue Pogonion) and Gn* points, facial convexity, labiomenttal and nasolabial angle significantly
different (P < 0.05) from the actual surgical outcome and Dolphin Imaging made significantly
different predictions of the nasolabial and labiomenttal angle, Ls point and chin area. The statistically
significant differences were not much more than 3 mm for these two groups, so it can be suggested
that both Dolphin Imaging and manual methods offer a reasonably accurate method of soft tissue
prediction. The SimPlant program predicted the upper lip and A* point with more than a 3 mm
different position when compared with the actual outcome, so the 3D program was insufficient for
prediction of upper lip area.

CONCLUSION: The manual method and Dolphin program can be used for soft tissue prediction in
Class III orthognathic surgery patients within the limits of the methods, but SimPlant software n
eds to be improved for more accurate soft tissue predictions after bimaxillary surgery.

SP233 CHANGES OF CEPHALOMETRIC PHARYNGEAL AIRWAY SPACE AND HYOID BONE POSITION OF
SKELETAL CLASS III PATIENTS AFTER ORTHOGNATHIC SURGERY IN KOREAN WOMEN
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AIMs: To evaluate the changes of cephalometric pharyngeal airway space and hyoid bone
measurements after orthognathic surgery in comparison with a control group.

SUBJECTS AND METHOD: Twenty five Korean women with a skeletal Class III malocclusion who
underwent mandibular setback surgery. The control subjects included 25 females with normal
occlusion. A lateral cephalometric radiograph was taken for each patient at the beginning of pre-
(T1) and post- (T2) surgical treatment. Two pharyngeal airway spaces and four measurements of
hyoid bone were compared among T1, T2 and the control group. Any statistically significant
differences in the cephalometric variables among groups were determined by paired t- and t-tests.
Differences with P values less than 0.05 were considered statistically significant.

RESULTS: The average increase of ANB and amount of setback at point B in the surgery group was
4.9 ± 1.6 degrees and 9.2 ± 3.6 mm. The Class III subjects had significantly larger MAS, HRGN, and
C3H than control subjects. PAS, MAS, HRGN, C3H and H-C3Me of the Class III subjects were
decreased and MP-H was increased significantly after setback surgery. MP-H after setback surgery
was the only significantly different measurement compared with the control group. Both HRGN and
H-C3Me had a moderately negative linear relationship with setback amount.

CONCLUSION: The cephalometric pharyngeal airway spaces were decreased in the Class III group
after mandibular setback surgery. The T2 pharyngeal airway space in Class III corresponded with that
of the control group. Mandibular setback surgery produced significant changes in all hyoid bone
position measurements. These measurements, changes except for HRGN, were related to a
backward and downward position change of the hyoid bone after orthognathic surgery. No linear
relationships were found between the amount of setback and the decrease in pharyngeal airway
space.

SP234 ANTERIOR OPEN BITE IN ASSOCIATION WITH EAR-NOSE-THROAT AND SPEECH DISORDERS –
A THREE-DIMENSIONAL ULTRASOUND EVALUATION OF TONGUE POSTURE
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AIMS: An anterior open bite (AOB) is one of the most difficult problems in growing children and post-treatment stability is considered unpredictable. An AOB is defined as a vertical gap between the upper and lower incisors with the teeth in centric occlusion. Heredity, multifactorial aetiology and irregular tongue posture play an important role in early diagnosis and interceptive treatment. The assessment of tongue posture in growing children is unreliable due to anatomical limitations. The aim of this study was to evaluate the prevalence of an AOB in a regional kindergarten and to assess tongue posture using three-dimensional ultrasound diagnostics (3D US) in preschool children with and without an open bite.

SUBJECTS AND METHOD: Orthodontic clinical examination, facial and intraoral photographs and study casts were obtained of 444 children (234 boys, 210 girls, aged 3 to 6 years) with an AOB. An ear, nose and throat (ENT) examination was performed to evaluate ENT conditions, a speech therapist examined phonetic and speech disorders. A 3D US of tongue posture was assessed twice by a radiologist and an orthodontist independently using 3D US Voluson 730 Expert with a convex conductor (RAB 2-5 MHz, GEH). The tongue posture data were analysed with 4D View Program, Version 5.0. The SPSS Program 20.0 was used for statistical analysis.

RESULTS: An AOB was present in 25 of the subjects (6%) aged 3-6 years (4.6 years). Orthodontic findings included appropriate facial appearance (72%), improper lip-seal (97%), tongue posture and swallowing (97%). In subjects with an AOB phonetic and speech disorders were found (84%). ENT and breathing disorders together with improper oral habits, thumb sucking, bottle feeding and prolonged pacifier use were the most important aetiological factors in children with an AOB. The 3D US of tongue posture showed the tongue to be on the mouth floor which differed significantly from the referential tongue posture in the non-AOB group.

CONCLUSION: 3D US assessment of tongue posture can be an important tool to identify early tongue irregularities, not only to assess the role of the tongue in the aetiology of an AOB in preschool children, but also to objectively support the effectiveness of treatment planning. The main advantage of the method is that it is a non-invasiveness, relatively simple, quick and repeatable procedure and as such of great value as a patient friendly procedure in small children.

SP235 DETECTING THRESHOLD OF RESISTANCE TO SWITCH INTO ORAL BREATHING
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AIMS: As upper airway obstruction resulting in partly or mainly oral breathing and the increasing risk for allergies, asthma, sleep apnoea and possibly some malocclusion traits, the aim of this study was to assess perception of increased nasal resistance, compensatory mechanisms to it, and to study whether sensitivity changes with age.

SUBJECTS AND METHOD: Forty 11-20-year-old subjects (21 females, 19 males), mean age 17.6 (SD +2.1) years, and 40 59-82-year-old adults (29 females, 11 males), mean age 69.9 (SD +5.9) years, participated voluntarily in the study. Respiratory airflow rate and oral and nasal pressures were measured using the pressure-flow technique (Microtronics Co., Iloa, Kansas, USA ) to calculate nasal resistance: $R = \frac{\Delta P}{V}$, where $R = \text{resistance (cmH}_2\text{O/L/s)}, \Delta P = \text{differential pressure (cmH}_2\text{O)}, \text{and } V = \text{airflow rate (ml/s)}. A device to create resistance loads was modified from a precision iris diaphragm (Model no. N36.624) that was opened and closed in 0.2 mm changes in diameter in random order. Following each change, the subjects reported whether they detected a change in airway resistance.

RESULTS: Resistance values for the younger group were in the unloaded condition 1.54, in the loaded condition just before detection of increased resistance 2.10 and in the loaded condition at detection 2.26 cmH$_2$O/L/s. By analyses of covariance, the corresponding values for the older adults were statistically significantly higher ($P < 0.05$) in all conditions. Airflow rate during rest breathing was for adolescents and young adults 318 and for older adults 351 ml/s ($P = 0.037$) but decreased to 300-308 ml/s in both groups just before and at detection of increased resistance.
CONCLUSION: Adolescents and young adults have a lower threshold to detect increased nasal resistance compared to older adults. However, physiologic response to added nasal resistance by decreasing airflow rate occurs well before detection of the load in both age groups.

SP236 COMPARISON OF SELF-ESTEEM SCORES OF PATIENTS WITH PLANNED EXTRACTION AND NON-EXTRACTION ORTHODONTIC TREATMENT‡‡‡
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AIMS: To compare self-esteem scores of extraction and non-extraction orthodontic treatment planned patients.
SUBJECTS AND METHOD: The Rosenberg self-esteem scale was assessed in 132 patients (87 females, 45 males; average age 17.13 ± 1.91 years) after providing information about their orthodontic treatment plans. Sixty-six (42 females, 24 males; average age 16.98 ± 1.50 years) of these patients comprised the extraction group and 66 patients (45 females, 21 males; average age 17.28 ± 2.32 years) the non-extraction group. Comparison between self-esteem scores of extraction and non-extraction groups was carried out using an independent samples t-test.
RESULTS: Both extraction (1.02 ± 0.86; P < 0.05) and non-extraction (0.83 ± 0.54; P < 0.05) groups had high (0-2) self-esteem scores but the non-extraction group had a statistically significant (P < 0.05) higher self-esteem score than extraction group.
CONCLUSION: High self-esteem scores were found in both groups at the beginning of orthodontic treatment, although non-extraction orthodontic treatment planned patients had higher self-esteem scores than the extraction cases. The adoption of orthodontic treatment with extractions may be more difficult for patients.

SP237 A NOVEL TREATMENT APPROACH TO CORRECT SEVERE MAXILLARY HYPOPLASIA IN ADULT PATIENTS WITH A CLEFT LIP AND PALATE
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AIMS: To assess the effect of distraction osteogenesis (DO) combined with the rigid external distractor (RED) to correct a hypoplastic maxilla in patients with a cleft lip and palate (CLP).
MATERIALS AND METHOD: Pre- and post-treatment clinical and radiological records including: dental casts, (panoramic radiographs, lateral cephalographs, craniobial computed tomography), intra- and extra-oral photographs of four patients who underwent maxillary DO using a RED were compared. All patients were adults (aged 19-22 years) and had a CLP. Due to the severity of the cleft the maxillary hypoplasia was very pronounced, both vertically and horizontally. All patients refused orthognathic surgery to correct the skeletal malocclusion. The mean reverse overjet after orthodontic decompensation among patients was 10 mm. The patients were operated on in childhood for the cleft and all had secondary bone grafts. The distraction procedure was performed after orthodontic decompensation with fixed appliances.
RESULTS: In all patients DO combined with RED resulted in favourable skeletal changes, improvement of facial aesthetics and correction of their malocclusion. The average distraction time was 15 days and the latency period was 3.5 months. Cephalometric changes revealed forward movement of the maxilla, and small increases of anterior face heights with clockwise rotations of the mandible. Craniofacial computed tomography showed new bone formation at the distraction regions. Augmentation of suborbital and cheek areas, improved convexity of the profile together with correction of the nasolabial angles was also recorded. The orthodontic and surgical protocol was well accepted by all patients and they did not report any severe pain. No bone grafts or rigid plate fixations were performed.
CONCLUSION: DO combined with RED provides a new opportunity in adult patients with clefts to improve the skeletal relationships which provide a better frame for the soft tissues. It is an attractive
alternative to a conventional LeFort I osteotomy and it may reduce the failure risk due to post-operative scars or relapse.

**SP238 LOWER INCISOR INCLINATION DURING CLASS II MALOCCLUSION TREATMENT WITH THE XBOW APPLIANCE FOLLOWED BY FIXED APPLIANCES***
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Aims: Increased lower incisor inclination is a common side effect of Class II division 1 malocclusion treatment. The goal of this study was to predict lower incisor inclination changes from initial cephalometric variables in Class II division 1 malocclusion patients following full orthodontic treatment including use of only a Xbow appliance at an initial treatment stage.

Subjects and Method: One hundred and seventy two consecutively treated patients with mild to moderate Class II division 1 malocclusions were considered. Patients were in the late mixed or early permanent dentition; with mean ages of 12.3 years before treatment (T1), 13.5 years after Xbow (T2), and 15.2 years after full treatment (T3). Commonly used cephalometric variables at T1 were used to predict the change in lower incisor inclination from T1 to T3 as well as the final inclination at T3 for those patient whose final inclination was greater than 100 degrees. Measurements for each variable at T1 were considered in the statistical analysis to determine if they were predictive in influencing lower incisor inclination changes as a result of treatment. Therefore lower incisor inclination changes were considered as the response/outcome variable. The remaining cephalometric variables at T1 were considered as predictor variables. An ANOVA, several stepwise regression analyses, and correlation analyses were completed.

Results: All measurement errors were less than 0.8 mm or 1.2 degrees and therefore considered not clinically meaningful. The average lower incisor angulation changed significantly at each time point (99.1° at T1, 102.2° at T2 and 103.6° at T3). Six initial cephalometric variables were found to be statistically significant (P < 0.05) predictors. These variables were associated with factors such as open bite tendency and an anteroposterior maxilla-mandibular position. Three different prediction equations were generated including these initial variables (R2 values of 0.13 0.323, and 0.401).

Conclusion: The best prediction model could account for 40.1 per cent of the variability in the final lower incisor inclination. Potential indicators of increased final lower incisor inclination include a deeper initial overbite, vertical growth tendency, protruded maxilla, retruded mandible or shorter mandibular ramus.

**SP239 CORRELATION OF VOLUMETRIC AND CROSS-SECTIONAL MEASUREMENTS USING CONE BEAM COMPUTED TOMOGRAPHY AUTOMATIC RECONSTRUCTION WITH OTOLARYNGOLOGIST-GENERATED ADENOID HYPTERTROPHY DIAGNOSIS**
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Aims: To test the reliability of cone beam computed tomographic (CBCT) volumetric and minimal cross-sectional area (MCA) measurements of the nasopharynx using Dolphin® imaging and to determine the correlation of CBCT volumetric and cross-sectional area measurements of the nasopharynx, using Dolphin® imaging, with a definitive nasoendoscopy (NE) supported adenoid hypertrophy diagnosis.

Materials and Method: CBCT scans of 38 patients with a history of upper airway obstructive problems were analyzed. No CBCT was taken for this specific study, following the ALARA principle and the standard of care of European guidelines. The chief complaint and reason for referral to a highly specialized multidisciplinary clinic was based on significant upper airway concerns. An ear, nose, and throat specialist analyzed the NE of each patient and the adenoid size was classified on a four-point scale based on its obstruction. Two calibrated evaluators applied a previously validated method to quantify MCA and volume of the nasopharynx. Dolphin® imaging was the selected software due to its popularity to execute these functions. The Spearman’s rank correlation coefficient (Spearman’s rho = $\rho$) measured the statistical dependence of the non-parametric variables, representing the association of volume and MCA with NE – the gold standard.
RESULTS: The reliability between the two assessments, by the same evaluator, on Dolphin automatic segmentation function for volume (ICC = 0.975 CI 0.951,0.987) and MCA (ICC = 0.840 CI 0.693,0.917) was excellent. Inter-operator reliability for volume was also excellent (ICC = 0.975 CI 0.90.98), but only good (ICC = 0.701 CI 0.44,0.85) for MCA. Spearman’s rank correlation (p) demonstrated a weak association between the values presented by the automatic measurement for both volume (4.9%; p = -0.222) and MCA (3.7%; p = 0.192).

CONCLUSION: The evaluators were consistent on manipulating the selected software, but volumetric and MCA measurements did not correlate well with the gold standard adenoid size assessment – NE. Volume and cross-sectional areas of the upper airway to assess localized constriction using CBCT imaging based on Dolphin® imaging automatic reconstruction may not be sufficiently accurate for clinical purposes.

SP240 EVALUATION OF SOFT TISSUE CHANGES AROUND THE LIPS AFTER MANDIBULAR SETBACK SURGERY WITH MINIMAL ORTHODONTICS USING THREE-DIMENSIONAL STEREOPHOTOGRAMMETRY

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AIMS: To evaluate the soft tissue changes around the lips over time after mandibular setback surgery (MS) with minimal orthodontics (MO) using three-dimensional (3D) stereophotogrammetry.

SUBJECTS AND METHOD: This was a retrospective study of 15 patients (7 males, 8 females) with mandibular prognathism who underwent MS-MO. Lateral cephalograms and 3D photographs were taken before (T0), 1 month (T1) and 6 months (T2) after surgery and were superimposed. A paired t-test, independent t-test and simple linear regression analysis were used to evaluate the hard and soft tissue changes and their correlation.

RESULTS: The soft tissue landmarks on the X (left-right) axis showed no significant positional changes. The landmarks of the lips and oral commissure on the Y (vertical) axis moved downward up to T2 but most of these changes did not differ significantly over time (T1-T0 versus T2-T0). The landmarks of the lower lip, oral commissure and soft tissue chin on the Z (anterior-posterior) axis showed posterior movement at T1 and T2. On the other hand, the lower lip (Li, 1.67 mm) and soft tissue chin (B', 1.28 mm; Pog', 1.61 mm) moved significantly forward from T1 to T2, which had no correlation with anterior relapse of the mandible.

CONCLUSION: Protrusion of the lower lip and soft tissue chin with a forward and upward relapse of the mandible during post-surgical orthodontics was observed. This findings suggest that 3D stereophotogrammetry can be useful for evaluating perioral soft tissue changes over time in orthognathic surgery patients.

SP241 A CONTEMPORARY VIEW ON THE PHYSIOLOGIC GROWTH DIRECTION OF THE CRANIOFACIAL SKELETON

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AIMS: The directional growth pattern of the craniofacial skeleton differs depending on whether an anterior or posterior cranial base superimposition method is used. Posterior cranial base superimposition suggests that the vertical relationship between basion and the hard palate exhibits minimal change with growth. The purpose of the study was to assess the growth change in the vertical relationship between basion and the hard palate.

SUBJECTS AND METHOD: Fifty untreated Northern European Caucasian subjects (26 males, 24 females) were selected from the Denver Growth Study. Serial lateral cephalograms of each subject at 8 (T1), 12 (T2) and 15 (T3) years were hand traced and 14 variables were measured. Method error was assessed with paired t-tests and Dahlberg’s formula. The growth changes for each variable from T1 to T2, T2 to T3 and T1 to T3 were calculated and the significance of the changes across time were assessed with repeated measures ANOVA.

RESULTS: From the ages of 8-15 years, the vertical relationship between basion and the palate, as represented by three palatal planes (ANS-PNS, PNSmax, visP) exhibited minimal change. This lends
support to an upward and forward growth of the anterior cranial base and maxilla away from the foramen magnum and the vertebral column as suggested by posterior cranial base superimposition methods.

CONCLUSION: Posterior cranial base superimposition methods should be used to assess growth and treatment changes as they provide a more biological representation of the directional pattern of facial growth.

SP242 OCLUSAL CHANGES IN 54 OBSTRUCTIVE SLEEP APNOEA PATIENTS TREATED WITH A BI-BLOC MANDIBULAR ADVANCEMENT DEVICE
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AIMS: To determine the amount of occlusal changes in patients with obstructive sleep apnoea (OSA) treated with a bi-bloc mandibular advancement device (MAD).

SUBJECTS AND METHOD: Fifty four patients diagnosed with snoring, mild, moderate or severe apnoea [apnoea-hypopnoea index (AHI), baseline mean 23.70 ± 15.83] by complete polysomnography received treatment with an adjustable appliance at 60 per cent of maximum protrusion; the device used was a bi-bloc, the Silensor® (Erkodent®, Germany). The protrusion was progressively increased until the minimum AHI possible was achieved. AHI measurements were made with Apnealink®. The final mean protrusion was 63.02 ± 11.3 per cent and the final AHI, 45 ± 62. Plaster models were taken before and 3.5 years, 42 months after the MAD treatment. Overjet, overbite, midline deviation, maxillary and mandibular intercanine and intermolar distance were measured by the same clinician on the pre- and post-treatment plaster models with a dental calliper (Leone® dental calliper with double tips). To evaluate the method error, 20 plaster models were measured again two weeks after the first measurements; the Pearson correlation test showed a significant correlation between repeated measurements ($P < 0.05$). The Kolmogorov-Smirnov normality test was applied to the data. As overbite, intercanine and intermolar maxillary and mandibular distances showed normality ($P > 0.05$), they were analyzed with the $t$-test for paired samples. As overbite and midline deviation did not show normality; they were analyzed with the Wilcoxon test ($P > 0.05$).

RESULTS: No significant differences ($P > 0.05$) were observed in dental midlines, intercanine maxillary distance and intermolar maxillary and mandibular distances pre- or post-treatment. Significant differences ($P < 0.05$) were observed in overjet, overbite and intercanine mandibular distances pre- and post-treatment.

CONCLUSION: The continuous use of bi-bloc protrusion devices for OSA treatment will cause changes in the occlusion, decreasing significantly both overbite and overjet and increasing the intercanine mandibular distance. Treatment did not affect the intermolar, intercanine maxillary distances, intermolar mandibular distance or midline deviation.

SP243 - WITHDRAWN AND UPGRADED TO ORAL PRESENTATION OP06 EVALUATION OF STABILITY OF SURGICAL CORRECTION BY MEANS OF COUNTERCLOCKWISE ROTATION OF THE OCCLUSAL PLANE IN CLASS II HIGH-ANGLE FACIAL TYPES***
Daniela Lupini, University of Ferrara, Italy

AIMS: To examine the long-term stability of surgical counter-clockwise rotation of the maxillo-mandibular complex (CCWRMC) to reduce the mandibular plane angle in a group of patients, each classified as a Class II high-angle facial type.

SUBJECTS AND METHOD: Twelve adult patients (5 males, 7 females) each exhibiting a high mandibular plane angle (SN^GoGn average 41°), mandibular hypoplasia, obtuse gonial angle and no signs or symptoms of temporomandibular joint (TMJ) disorders. Superimposition of anatomic landmarks were used to compare lateral cephalograms taken before surgery, immediately after surgery, and at a post-surgical follow-up.
RESULTS: The change in the angle of the occlusal plane proved to be statistically significant as well as other post-surgical changes. The mean relapse was calculated to be 1.2 degrees, that is 18 per cent of the whole counterclockwise rotation.

CONCLUSION: CWRMC for Class II subjects with high angle facial deformities and healthy TMJs can be a stable procedure if the surgical technique used respects the vertical length of the masseter and medial pterygoid muscles and if careful treatment planning and coordination of both orthodontic and surgical procedures are provided.

SP244  A SURVEY OF GENERAL DENTAL PRACTITIONERS IN EAST SUSSEX, UK TO INVESTIGATE THEIR EXPERIENCE OF PROVIDING SHORT-TERM ORTHODONTICS
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AIMS: Short-term orthodontics (STO) is a cosmetic dental treatment that aims to enhance a patient’s smile by aligning their anterior teeth. The aim of this research was to investigate what experience general dental practitioners (GDPs) in East Sussex, UK have had of providing this treatment.

MATERIALS AND METHOD: Following an initial pilot study, an online questionnaire was distributed by email to all GDPs registered in East Sussex, UK. Questions related to orthodontic systems used, number of completed cases, retention methods, postgraduate training, and strategies employed for marketing and obtaining valid consent. The responses were analysed statistically with chi-square, Fisher’s exact and Kruskal-Wallis tests at a confidence interval of 0.05.

RESULTS: Fifty three out of 376 dentists (14%) responded to the survey. Ten (19%) were providing STO, with the most popular system being the Inman Aligner. The number of cases completed by individual practitioners ranged from 0 to 175. The largest group of providers (n = 4, 40%) had graduated more than 30 years ago, but none had postgraduate qualifications in orthodontics. Neither the time since graduation nor the time since completion of STO training had any effect on dentists’ confidence with STO (P > 0.05). Six providers (60%) expressed an interest in additional clinical support from their local orthodontist in the form of seminars, study groups and one-to-one advice. All respondents prescribed lifelong retention and obtained consent in writing. None messaged patients directly with advertisements or offered time-limited discounts on treatments.

CONCLUSION: The response rate to this survey was very low despite a three-stage telephone follow-up. A possible explanation may be that the target group was reluctant to participate due to the current controversy about STO. Nevertheless, this study has identified a need for specialist orthodontists to provide teaching and support for general dentists performing cosmetic orthodontics. It has also highlighted a need for orthodontic professional bodies to issue guidelines on case selection for STO to help general dentists recognise which malocclusions are beyond their scope of practice. Further research is needed to establish the most effective methods of delivering orthodontic education to GDPs.

SP245  CHANGES OF ENAMEL LAYER THICKNESS AFTER TREATMENT WITH METAL AND CERAMIC BRACKETS. IN VITRO STUDIES
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AIMS: To investigate optical coherence tomography (OCT) as a new tool to evaluate enamel. A further aim was to assess changes of the enamel layer thickness after using metal or ceramic brackets and two types of bonding system.

MATERIALS AND METHOD: Eighty teeth, extracted for orthodontic or periodontic reasons, were divided into four groups. Metallic and ceramic brackets were bonded using conventional or self-etching bonding systems. The specimens were stored at 37°C for 24 hours and then debonded. Clean-up was carried out with two procedures: carbide bur or polisher with alumina. The enamel surface was captured by two- and three-dimensional scans before bonding, after debonding and after clean-up. The given results were analysed with Mann-Whitney U and Tukey test.
RESULTS: There was no significant influence of bonding systems and no significant importance of clean-up procedures on enamel depiction ($P > 0.249$). The only significantly influential factor was the bracket used ($P < 0.018$). Enamel thickness changes were at the lowest estimate when using the metallic brackets in comparison to ceramic brackets ($P < 0.018$).

CONCLUSION: The thickness of enamel after debonding and clean-up depends neither on the type of bonding nor on the clean-up. It depends purely on the type of the bracket material. OCT has been shown to be an efficient method to evaluate enamel structure.

SP246 ACCURACY OF CHAIR-SIDE SCANNERS FOR SURFACE MEASUREMENTS ALONG A CURVED LINE

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AIMS: Chair-side scanners offer the advantage of obtaining digital dental models directly from the patient without the need for dental impressions. To date, no study has evaluated their accuracy in obtaining surface measurements along a curved line (curvilinear). The aim of this study was to evaluate and compare digital dental models generated from two commercial intraoral scanners with manual measurements when performing curvilinear measurements.

MATERIALS AND METHOD: Sixty one dry mandibles with an intact dentition chosen from a unique collection. Each skull had the mandibular arch scanned with Cadent iTero scanner (Align Technology, San Jose, California, USA) and Lythos™ Digital Impression system scanner (Ormco Corporations, Anaheim, California, USA). Surface measurements along a curved line were performed digitally in three different directions (anteroposterior, mesiodistal, and buccolingual) on the digital models and manually on the dry skulls. One-sample $t$-test and linear regression analyses were performed. To further graphically examine the accuracy between the different methods, Bland-Altman plots were computed. The level of significance was set at $P < 0.05$.

RESULTS: There were no significant differences between any of the paired methods, which indicated a certain level of agreement between the methods tested ($P > 0.05$). Bland-Altman analysis showed no fixed bias of one approach versus the other, and random errors were detected in all comparisons. Although the mean bias of iTero and Lythos scanner measurements when compared to direct measurements were very low, minimum mean bias occurred for comparison of the two intraoral scanners. However, Lythos scanner and direct measurement comparison had the largest confidence interval (agreement level, 0.85 to $–1.11$) range. None of the comparisons displayed statistical significance for the $t$-scores, which indicated the absence of proportional bias in these comparisons.

CONCLUSION: The intraoral scanners tested in this study produced digital dental models that were highly accurate when performing direct surface measurements along a curved line in three dimensions of space.

SP247 DO YOUNG HYPERACTIVE PATIENTS DISPLAY A SPECIFIC CRANIOFACIAL MORPHOLOGY?

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AIMS: Attention deficit hyperactivity disorders (ADHD) have been shown to be associated in children with sleep-disordered breathing such as snoring and/or sleep apnoea. Since this latter was shown to be linked to specific craniofacial traits (Bacon, 1988; 1990), it was hypothesized that ADHD patients might also display a distinct craniofacial morphology. The aim of this study was to compare lateral cephalograms of a group of young individuals ADHD with the lateral radiographs of a control group of young Class I subjects.

SUBJECTS AND METHOD: Fifty patients (40 males, 10 females, mean age = 10 years) diagnosed with ADHD were registered in 2008 in a research project initiated by the university hospital, whereas the control group included 47 Class I subjects. Eighteen hard and soft tissues cephalometric measurements (SN length, BaN length, SBA length, BaSN angle, SN/MP angle, PNS-ANS/MP angle, lower face height/total face height, gonial angle, SNA, SNB, ANB, Wits, PNS-ANS length, Ar-Gn
length, soft tissue palate length, pharyngeal minimal cross-section, Ba-PNS length, hyoid bone-MP distance) were recorded on lateral cephalograms. Bayesian statistics and a multiple component analysis were used to differentiate the two groups. The Bayesian method of statistical inference was preferred to the classical/frequentist method. A crucial element of the Bayesian reasoning is the choice of a prior distribution of values, that is to say the probability of each parameter value (mean or proportion) before observing the data, summarizing what is already known on the matter. Thus to compare two means, the Bayesian statistical analysis provides the probability that the difference between the two means will lie below a value defined by the investigator as clinically relevant (hence the notion of threshold values).

RESULTS: Bayesian statistical analysis showed no difference between the two groups for most of the variables considered. The sole exception concerned the length of the soft tissue palate which was significantly increased in hyperactive subjects. The results of the principal component analysis demonstrated no morphological difference between the two groups.

CONCLUSION: This cephalometric approach did not allow determination of a specific craniofacial morphology among young hyperactive subjects.

SP248 THE EFFECT OF MOUTHRINSES ON THE MATERIAL COMPOSITION OF ORTHODONTIC ARCH WIRES
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AIMS: During orthodontic treatment not only mechanical tooth cleaning but also use of mouthrinses can help to maintain the oral hygiene of the patient in order to prevent caries and gingivitis. In saliva galvanic corrosion occurs on the surface of orthodontic brackets and archwires. Scientific research has reported that mouthwashes increase this corrosion, which causes physical changes of the wires which can affect the friction and power delivery curves. In previous research it was proven that surface morphology changes occurred on archwires immersed for 3 months in different mouthwashes. The aim of this study was to detect further physical changes to archwires caused by mouthwashes, i.e. the effect on the material composition of the wires.

MATERIALS AND METHOD: Different bracket-archwires combinations were examined after 3 months immersion in mouthrinses. The material composition of the samples (nickel-titanium and titanium-molybdenum archwires) was determined with scanning electron microscopy equipped with energy dispersive X-ray spectroscopy.

RESULTS: Due to an electrochemical reaction between the metals (brackets-archwires) and the electrolyte (mouthwash) the titanium and zirconium content of the archwires increased, while molybdenum and stannum content decreased.

CONCLUSION: Material composition changes may affect the mechanical properties of archwires, which can influence their power delivery curve and so the success of tooth movement. These results can help to find the optimal mouthrinse during orthodontic treatment, which not only reduces the risk of caries, but also ensures successful treatment.

SP249 A NEW MEDICAL DEVICE BASED ON THERAPEUTIC ULTRASOUND FOR INCREASING THE EFFICIENCY OF ORTHODONTIC TREATMENT
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AIMS: For more than two decades, therapeutic ultrasound devices have been proven to accelerate the repair of fresh fractures and non-union fractures of long bones. The availability of this therapy was limited to long bones, but in 2015 a specially designed therapeutic ultrasound product for orthodontic applications was developed. The new orthodontic medical device targets applications for accelerating orthodontic tooth movement, preventing root resorption and providing differential anchorage (selective tooth treatment).
MATERIALS AND METHOD: A split mouth design where one side of the mouth (dental arch) received ultrasonic treatment from the Aevo System in addition to treatment from orthodontic appliances, while the other side of the mouth was treated with orthodontic appliances alone (no ultrasonic treatment).

RESULTS: For the past 5 years, the safety and efficacy of the product has been evaluated in double blinded, split mouth, animal trials and clinical trials. Most recently, a multi-site double blinded, split mouth design clinical study was completed, and the preliminary data available at this time shows promising results for acceleration of bodily tooth movement (on average in the order of 20-25%) and reduction of tooth root resorption (in the order of 25-33% on average).

CONCLUSION: Preliminary clinical trials data and clinic cases show promising results. While the underlining ultrasound therapy is decades old, this new orthodontic product is new and more scientific evidence is required to support its efficacy and safety on a much wider variety of clinical cases and treatment plans.

SP250 TREATMENT OF POST-ORTHODONTIC WHITE SPOT LESIONS BY RESIN INFILTRATION COMPARED TO ACID-MICROABRASION
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AIMS: To evaluate and compare the effectiveness of resin infiltration to the acid-microabrasion in the treatment of post-orthodontic white spot lesions (WSL).
MATERIALS AND METHOD: Ninety multiple WSLs on the incisors and premolars were included in the study. Ninety post-orthodontic WSLs rating as 1 or 2 on the international caries detection and assessment system (ICDAS) II scale, in 36 quadrants, were divided into two groups. Group I; 44 lesions were treated by resin infiltration and group II; 46 lesions with acid-microabrasion. ICDAS II scores were assessed before treatment (T0), immediately after treatment (T1), after 3 months (T2) and after 6 months (T3)
RESULTS: At T0, there was no statistically significant difference between the lesions in the two groups. While at T1, resin infiltration showed statistically significantly lower ICDAS scores than acid-microabrasion. At T2 as well as T3, there was no statistically significant difference between the two groups.
CONCLUSION: Both resin infiltration and acid-microabrasion improved the aesthetics of demineralized lesions. Resin infiltration improved the aesthetic appearance of demineralized teeth significantly more than acid microabrasion immediately after application. Aesthetic outcomes of resin infiltration and acid-microabrasion showed adequate stability for 6 months.

SP251 THE ASSOCIATION OF MEASUREMENTS USED IN ORTHODONTIC PRACTICE WITH FACIAL AESTHETICS BASED ON THE PRINCIPLE OF PERCEPTUAL UNITY
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AIMS: To investigate the association between the sense of aesthetics of orthodontists and laypersons, and the measurements used in orthodontic practice, taking into consideration the principle of perceptual unity.
SUBJECTS AND METHOD: Sixty patients (30 males, 30 females) with an age range of 9 to 17 years. To assess facial aesthetics, pre-treatment extra-oral images were used. Two separate panels consisting of 50 laypersons and 50 orthodontists were established to score the patient images. A visual analogue scale (VAS) was used for scoring. Regression analysis was used to measure the correlation between the model values, the cephalometric values and the intra-oral photograph indices [Aesthetic Component of the Index of Orthodontic Treatment Need (AC/IOTN)] of each patient, and the mean VAS scores obtained from the orthodontists and the laypersons separately.
RESULTS: While orthodontists found the dental aesthetics indicative of the AC/IOTN value and the horizontal sum (the sum of the overjet and ANB angle) significant, the laypersons only found the...
AC/IOTN value significant. The AC/IOTN accounted for 40 per cent of the VAS score of the laypersons and 28 per cent of the VAS score of the orthodontists.

CONCLUSION: The dental aesthetics and the horizontal sum represent a significant guide for orthodontists; only dental aesthetics is an important guide for facial aesthetics. According to orthodontists, laypersons pay more attention to the appearance of teeth when assessing aesthetics.

SP252  THE DIFFERENCE IN SAGITTAL LIP POSITION AND SOFT TISSUE CONVEXITY BETWEEN CLASS II DIVISION 1 AND DIVISION 2 PATIENTS: CEPHALOMETRIC ANALYSIS
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AIMS: To evaluate the influence of upper and lower incisor inclination to sagittal lip position and to compare the soft tissue profile between divisions using Worms soft tissue analysis.

SUBJECTS AND METHOD: The records of 120 randomly selected patients. All included patients were skeletal Class II (ANB >4°) and had finished the adolescent growth peak, which was evaluated according to an improved version of the cervical vertebral maturation (CVM) method. The inclination of the upper and lower incisors was assessed using the Steiner method and sagittal lip position was evaluated using Worms method by measuring the distance from the upper and lower lip to the reference line (Sn'-Pog'). Worms method was also used to estimate soft tissue convexity. Cephalometric analysis was performed with the Dolphin Imaging 11 program. In order to conduct statistical analysis, SPSS Statistics 17.0 software was used. Significance of the average difference between independent samples was evaluated using the Mann Whitney U test. Correlation between samples was determined by Pearson correlation coefficient. To evaluate the dependence between the samples, the least squares method was applied. The level of significance for the analysis was set at \( P < 0.05 \).

RESULTS: Both the upper and lower lips showed a significant difference between the Class II divisions: the value of upper lip was 3.6 ± 2.03 mm in division 1 and 2.28 ± 1.22 mm in division 2, while the lower lip was 2.14 ± 2.87 mm and 0.81 ± 1.78 mm, respectively. A strong correlation and significant dependence were found between the upper and lower incisors and sagittal lip position. A significant difference of soft tissue convexity occurred between the divisions, the value being 21.77 ± 38 degrees in division 1 and 18.09 ± 4.02 degrees in division 2.

CONCLUSION: Class II division 1 patients have more protrusive upper and lower lips in comparison to Class II division 2 subjects. The sagittal lip position highly depends on the inclination of upper and lower incisors. Patients with more protruded incisors have a more convex soft tissue profile.

SP253  HERITABILITY OF MANDIBULAR CEPHALOMETRIC VARIABLES IN TWINS
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AIMS: To determine the genetic and environmental impact on mandibular morphology using lateral cephalometric analysis of twins with completed mandibular growth and DNA based zygosity determination.

MATERIALS AND METHOD: Thirty nine cephalometric variables of 141 same sex adult pairs of twins were analysed. Zygosity was determined using 15 specific DNA markers and the cervical vertebral maturation method was used to assess completion of mandibular growth. A genetic analysis was performed using maximum likelihood genetic structural equation modelling.

RESULTS: The heritability estimates of angular variables describing horizontal mandibular position in relation to cranial base and maxilla were considerably higher than those describing vertical position. The mandibular skeletal cephalometric variables also showed high heritability estimates with angular measurements being considerably higher than linear ones. The findings indicate that angular measurements representing mandibular skeletal morphology (mandibular form) have greater genetic determination than linear measurements (mandibular size).

CONCLUSION: The shape and sagittal position of the mandible is under stronger genetic control, than is its size and vertical relationship to cranial base.
Aims: To determine the influence of temporomandibular disorders (TMD) on mental stress in patients with a mandibular midline shift.

Subjects and method: Twenty-five patients with TMD with an age range of 12 to 35 years. Lateral and frontal cephalograms, electromyography (EMG), magnetic resonance imaging (MRI) of the temporomandibular joint, questionnaire of the State-Trait Anxiety Inventory (Spielberger, 1968, 1977) and assessment of mental stress according to Nemchin were studied.

Results: TMD was observed in all subjects. There was asymmetry of the facial lines on the frontal cephalograms. According to MRI data, total ventral dislocation without repositioning on the left was observed in 42 (86%); partial dislocation of the ventral full reposition on the left was 57.14 per cent and on the right 100 per cent. According to EMG data, the difference of biopotential indicators was observed in 100 per cent. Situational and personal anxiety were assessed using the method of Spilberger-Hanin. A moderate degree of situational anxiety was found in 71.43 per cent and a high degree in 28.57 per cent. There was a high degree of personal anxiety in 57.14 per cent and a moderate degree in 42.86 per cent. In assessing the scale of personality manifestations of anxiety, moderate with a tendency to low level of anxiety was observed in 71.43 per cent, moderate with a tendency to a high level of anxiety in 14.29 per cent and a high level in 14.29 per cent. In assessing mental stress (Nemchin) a weak mental stress was found in 71.43 per cent, moderate in 14.29 per cent and high in 14.29 per cent.

Conclusion: Emotional burden and anxiety have a strong relationship with TMD and muscular dysfunction. Patients with more severe disorders of the articular disc (full ventral dislocation without repositioning) and of an older age have a higher level of personal anxiety. Comprehensive treatment of patients with TMD by an osteopath and psychotherapist is recommended.

Aims: To assess the prevalence and occurrence of 11 periodontopathogens in subgingival biofilm of banded and bonded molars during the first period of fixed orthodontic treatment.

Subjects and method: The subjects, selected from patients referred for orthodontic treatment, were divided in two groups: group A comprised 15 patients (14.4 ± 2.45 years of age) who received orthodontic bands on the first permanent molars and group B, 10 patients (15.7 ± 1.87 years of age) with directly bonded tubes on the labial surface of the same teeth. Subgingival sample collection was performed before band and tube application and 4-5 weeks after placement. The DNA-strip technique was used to assess the presence of 11 putative periodontopathogens at each time point.

Results: Fusobacterium nucleatum, Eikenella corroden and Capnocytophaga spp. were found in a large number of the samples; other periodontopathogens were present at a smaller rate. At 4-5 weeks after attachment placement a slight increase of putative species was observed in both groups.

Conclusion: The presence of orthodontic tubes and bands influences the accumulation and composition of subgingival microbiota. Higher level of oral hygiene should be achieved before and during orthodontic treatment in order to prevent any side effects on periodontal tissues.
AIMS: To evaluate the presence and behaviour of putative periodontopathogens in patients with a healthy periodontium in the early phases of fixed orthodontic treatment.

SUBJECTS AND METHOD: Nineteen orthodontic patients were selected and two subgingival samples were collected: before bonding (T1) and 4-7 weeks after bracket placement (T2). Genomic DNA was extracted from these samples and bacterial detection was performed by DNA-strips using the polymerase chain reaction technique (micro-Ident®plus11, Hain Lifescience Gmbh, Germany).

RESULTS: *Fusobacterium nucleatum* was present in 94.73 per cent of the T1 samples and *Eikenella corrodens* and *Capnocytophaga spp.* were present in around 74 per cent of the T1 samples. *Treponema denticola, Tannella forsythia* and *Campylobacter rectus* were found in one-fourth of T1 samples; other bacteria were found randomly. An increased number of putative periodontopathogens were found in overall T2 samples, the number of *Parvimonas micra* increased the most in T2 samples. *Fusobacterium nucleatum, Eikenella corrodens* and *Capnocytophaga spp.* were found in almost every T2 sample as well.

CONCLUSION: Some periodontal pathogens are present under healthy periodontal conditions, so their presence is not evident clinically.

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**SP257  MOTIVATION REGARDING ORTHODONTIC TREATMENT**

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AIMS: To compare motivation levels regarding orthodontic treatment between patients and their parents.

SUBJECTS AND METHOD: A patient motivation questionnaire was conducted of 93 patients from 8 and 18 years of age, and their parents with ages comprehended to be between 31 and 54 years of age. A randomly chosen review of 46 patients and 47 parents, was evaluated. The questionnaire consisted of 10 questions with five possible answers each. Five of the questions were positively orientated and five negatively orientated. Answers were scored from 1 to 5 points, a score of 5 a very positive response and 1 a very negative response, obtaining therefore, a maximum total score of 50 points or a minimum total score of 10 points. Good motivation: 39-50 points; regular motivation: 27-38 points; poor motivation: 10-26 points. After conducting the surveys, all data were entered into SPSS (version 20) for calculation of the results.

RESULTS: Patient’s motivation was mostly intermediate, being greater in parents compared with children, and higher in males compared to females

CONCLUSION: There were no statistically significant differences between the motivation levels of parents and their children. There were no differences in the degree of motivation between females and males. No differences were found between patients of different age groups. The most valued aspect reported by the patients was a slow, continuous and organized treatment as the one proposed by the orthodontist. The most valued aspects of the parents were those related to the amount of information received about their children’s treatment.

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**SP258  THREE-DIMENSIONAL DIAGNOSIS IN ORTHODONTICS: IMPACTED CANINES**

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AIMS: The introduction of three-dimensional (3D) images in dentistry has generated interest in several areas of orthodontics as the correction of a malocclusion includes the three planes of space. The aim of this systematic literature review was to determine the following: 1. Advantages and limitations of computed tomography (CT) versus cone beam computed tomography (CBCT) in orthodontics; 2. Diagnostic value of CBCT for a clinical entity of interest in orthodontics, i.e. impacted canines.

MATERIALS AND METHOD: Observational and retrospective research designs of the literature, summarizing the results of primary research, in order to analyse the working hypothesis. The articles
selected were classified into two groups: those comparing CT versus CBCT for 3D diagnosis in orthodontics and studies that included canines with the use of CBCT as a diagnostic tool.

RESULTS: CBCT differed from conventional CT in several aspects. It identified the resolution, the image quality, precision and accuracy, the radioactive dose, the time of scanning and processing, and the comprehensive diagnosis of structures of different natures. In this way, the diagnosis of unerupted canines by CBCT provides precision in the localization and proximity to contiguous structures, image quality, as well as eliminating the main drawbacks of 2D radiographs. These include: distortion, overlapping and magnification, for easy diagnosis and surgical-orthodontic approach of the included tooth. However, the radioactive dose and the cost, represent its main limitations.

CONCLUSION: CBCT can be considered as the diagnostic tool of the future in orthodontics and, it is particularly indicated for included teeth. However, nowadays, the system is still far from replacing traditional imaging techniques, since there are several factors that limit their use and a lack of scientific evidence.

SP259 ROOT RESORPTION IN ORTHODONTICS
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AIMS: Whilst root resorption in orthodontics is a phenomenon that has been debated in the literature, its nature and effects are still controversial. This review of the literature focused on the aetiology and predictability of this pathological clinical entity, usually associated with orthodontic movement. From a systematic review of the literature, the following assumptions will be considered: 1. All orthodontic treatment involves a shortening of the initial root length?; 2. What factors influence the development of this clinical entity?; 3. Is it predictable?

MATERIALS AND METHOD: This was a retrospective observational study to review the results of primary research. Documentary research was performed in specialized databases on the subject. Review articles were classified according to their relationship with possible factors that increase the risk of root loss: Primary factors, or dependent on the individual variations; and secondary factors, resulting from orthodontic practice.

RESULTS: Radicular structure loss, secondary to orthodontic movement, is conditioned by individual factors such as gender, patient age, hereditary pattern, associated parafunctions, systemic diseases, prior dentoalveolar trauma, root morphological alterations, type of malocclusion and tooth type. Orthodontic factors that further compromise root integrity are: long-term treatments, dental intrusion movements, intense and continuous loading (>20-26 g/cm²), orthodontic extractions, intermaxillary elastics and/or particular techniques. Both, fixed and removable devices, can result in iatrogenic forces to periodontum and tooth.

CONCLUSION: Root resorption is a further complication to orthodontic treatment. More research is needed to predict the appearance of resorption associated with a particular treatment, given the different and individual susceptibility to develop apical lesions, although these cannot be minimised.

SP260 MOST FREQUENT COMPLICATIONS IN ORTHOGNATHIC SURGERY
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AIMS: To determine the incidence of intra- and post-operative complications in orthognathic surgery patients.

SUBJECTS AND METHOD: A retrospective review of 50 patients (29 females, 21 males, mean age 26.1 years) undergoing orthognathic surgery from 2008 to 2015 was conducted. Data was analyzed using SPSS statistics (IBM SPSS statistics, version 22). The frequency and percentage for qualitative variables and the average, minimum, maximum and standard deviation for quantitative variables were analyzed.
RESULTS: Of the 50 patients, 38 did not suffer intra- or post-surgical complications. The remaining subjects suffered complications of different types: chin hypoesthesia (2), infraorbital hypoesthesia (2), infraorbital paresthesia (1), lip paresis (1), premaxillary non-union (1), 21 root resorption (1), osteosynthesis material sensitivity (1), suture material sensitivity (1), nasal deformity and infraorbital hypoesthesia (1) and chin hypoesthesia and nasal deformity (1).

CONCLUSION: Orthognathic surgery has a low incidence of complications. A proper study of the patient, a good surgical technique and post-operative follow-up make it a safe procedure. Orthognathic surgery is a procedure that requires a learning curve for its realization.

SP261 RELATIONSHIP BETWEEN CLOSURE OF THE SPHENO-OCCIPITAL SYNCHONDROSIS AND CERVICAL VERTEBRAL MATURATION
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AIMS: Synchondroses at the cranial base represent important growth centres for the craniofacial skeleton. The sphenoid-occipital synchondrosis (SOS) is particularly important, given its late ossification and contribution to postnatal cranial base growth. Growth at the SOS carries the maxilla upward and forward relative to the mandible, increasing facial height and depth. The reported age of complete closure of the SOS has varied. The posterior cranial fossa indicates the somatic growth pattern, and SOS fusion is reportedly related to maturation events occurring in adolescence. Several human growth studies have shown that the timing of pubertal growth of the craniofacial region is closely related to the stage of cervical vertebral maturation (CVM). The aim of this study was thus to examine the timings of closure of the SOS and CVM using cone beam computed tomography (CBCT) and to evaluate the relationship between these events.

MATERIALS AND METHOD: CBCT images (field of view, 20 × 18 cm) were obtained from 121 Japanese girls between 8 and 15 years of age before orthodontic treatment. The fusion status of the SOS was divided into four stages using CBCT images: stage 1, completely open; stage 2, partially closed; stage 3, not open, but ossification remains incomplete; and stage 4, completely closed. CVM was evaluated using the CVM method (CVM index; 1-6) on CBCT images.

RESULTS: The earliest complete closure of the SOS occurred in an 11-year-old girl. In approximately half of the patients from 12 to 12½ years, the SOS was closed. In all cases, the SOS was fused completely by 15 years of age. Furthermore, the fusion status of the SOS correlated strongly with CVM. CVM was ≤4 in patients with fusion status of the SOS as stage 1 or 2 and ≥4 in patients with fusion status stage 3 or 4.

CONCLUSION: Timing of closure of the SOS correlated with skeletal maturation. In addition, the SOS was completely closed by the time the pubertal growth spurt had almost ended. The COS can thus be considered to play some role in pubertal maxillofacial growth.

SP262 ADULT ORTHODONTICS: WHAT’S ON THE INTERNET?
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AIMS: To evaluate the quality, reliability and readability of information on the Internet on adult orthodontics.

MATERIALS AND METHOD: An Internet search of three search engines (Google, Yahoo and Bing) was conducted using two search terms (‘adult orthodontics’ and ‘adult braces’). The first 50 websites from each engine and under each search term were screened and exclusion criteria applied. The country of origin and authorship of the included websites was recorded. They were also assessed for quality using four methods: the HON seal, JAMA benchmarks, the DISCERN instrument and the LIDA tool. Readability of included websites was assessed using the Flesch Reading Ease Score (FRES).

RESULTS: Only 13 websites met the inclusion criteria. Most were of US origin (61%). The authors of the websites were dentists (39%), professional organisations (15%), past patients (15%) and unspecified (31%). Only one website displayed the HON seal and three websites contained all JAMA benchmarks. The mean overall score (Q16) for DISCERN was 3.9/5 and the mean total LIDA score was 115/144. The average FRES score was 63.1/100.
CONCLUSION: The number of informative websites on adult orthodontics is low and these are of moderate quality. More accurate, high quality Internet resources are required on adult orthodontics.

SP263 EARLY RESULT OF ORTHODONTIC TREATMENT SATISFACTION SCALE IS A RISK FACTOR OF DECREASED FINAL SATISFACTION RATE

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AIMS: Success of orthodontic treatment depends not only on perfect clinical treatment but also on the patient’s satisfaction and beauty perception. Therefore, the aim of this study was to evaluate risk factors of dissatisfaction with final treatment despite appropriate clinical results.

SUBJECTS AND METHOD: The study included consecutive patients requiring orthodontic treatment. A validated treatment satisfaction scale was used 3 months after the start of treatment and at the end of treatment. The questionnaire contained 18 questions: seven concerning dentofacial aesthetics, six concerning oral function, and five regarding psychosocial benefits of orthodontic treatment. Each question was evaluated by the patient on the 5-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied). Univariate and multivariate analysis was conducted investigating the association between the different variables with post-treatment satisfaction.

RESULTS: One hundred and thirty five consecutive patients (59 males, 76 females) with median age of 23 years (range 13-39 years) were enrolled in the study. There were 76 patients with a Class I, 36 patients with a Class II and 26 with a Class III malocclusion. The average time of treatment was 18.1 (range 10-22) months. The average time of follow-up was 24.3 months. In one patient a so-called standard occlusal contact was not achieved. Most patients were very satisfied and satisfied with their facial appearance (95%), final aesthetic profile (96%) and perceptions of psychosocial benefits (82%). Malocclusion type, and decreased treatment satisfaction score after 3 months were identified as risk factors in the univariate regression analysis. Only the result of the orthodontic treatment satisfaction scale after 3-months was the only risk factor predicting decreased final satisfaction rate in the multivariate regression analysis.

CONCLUSION: Most of the patients were satisfied with the final result of orthodontic treatment. An early orthodontic treatment satisfaction scale may help to identify patients with a decreased final satisfaction rate. This may contribute to a better understanding of their needs at the early stage of treatment.

SP264 CLINICAL SURVEY ON DENTOFACIAL CHARACTERISTICS OF JAPANESE ADULT PATIENTS WITH A CLASS II MALOCCLUSION

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AIMS: There has been significant controversy about the factors that cause a Class II malocclusion. The aim of this study was to evaluate the morphological characteristics of Japanese adult patients with a skeletal Class II malocclusion compared with a Class I.

SUBJECTS AND METHOD: Ninety one Japanese adult patients without history of orthodontic treatment participated in this study. These included 42 patients with an ANB angle of at least 5 degrees, an Angle Class II from half to full cusp, and an overjet of at least +4 mm (13 males, 29 females, mean age: 27.1 years), and 49 with a Class I occlusion (17 males, 32 females, mean age: 26.5 years). Lateral cephalograms were used and the Mann-Whitney U test was carried out for statistical evaluation (P < 0.05).

RESULTS: Skeletal indices revealed that the maxilla was significantly smaller in the Class I group than in the Class II group. However, no overgrowth of the maxilla was seen in the Class II group. The mandible was significantly smaller in females in the Class II group. The mean pogonion to nasion perpendicular value was −7.5 mm (males: −6.0 mm, females: −8.9 mm) in the Class I group, and
−12.8 mm (males: −11.8 mm, females: −13.7 mm) in the Class II group, indicating a significant
difference of the pogonion in both males and females in the Class II group. Anterior face height was
significantly shorter perpendicularly in females of the Class II group, but no significant difference was
noted in males of the same group.
CONCLUSION: Retrusion of pogonion was characteristic in both male and female Class II patients,
although mandibular body length and ramus height were not significantly different between Class II
and Class I.

SP265  THE DISPLACEMENT PATTERN OF MAXILLARY ANTERIOR TEETH
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AIMS: As en masse retraction in sliding mechanics with miniscrews becomes more common in
contemporary orthodontic treatment of extraction cases, controlling torque and the vertical
dimensions of the anterior teeth during space closure is an important concern for orthodontists. This
finite element (FE) study aimed to compare and analyze the correlation between the length of a
retraction hook and the displacement pattern of maxillary anterior teeth in en masse retraction to
find the most effective loading condition for orthodontic treatment.
MATERIALS AND METHOD: Three types of FE models were constructed: one immediately after
extraction of the first premolar (M1); the second with 1 mm extraction space remaining (M2); and
the third with the extraction space tightly closed (M3). Six identical models were constructed for
each M1, M2, M3 in differentiating experimental conditions. In half of them, a miniscrew was used
as anchorage, and in the rest the first molar was used as anchorage. The miniscrew was placed
between the maxillary second premolar and first molar, 8 mm apical to the archwire. The length of a
retraction hook was varied: −1 mm, +3 mm and +6 mm and the retraction hook was attached
between the upper lateral incisor and canine on the archwire. A retraction force of 200 g was
applied on each side in all models.
RESULTS: In the first molar group, the amount of anteroposterior and vertical displacement of the
maxillary anterior teeth was the least in the model with a 6 mm retraction hook. On the contrary, in
the miniscrew group, the amount of displacement was least in the model with a −1 mm retraction
hook. Compared to the first molar group, the displacement of anterior teeth in the miniscrew group
was less. In the miniscrew group, the anterior teeth of M3 were displaced least among the three
types of models, which were M1, M2 and M3.
CONCLUSION: The shorter the length of the retraction hook, the less uncontrolled tipping
movement appeared in the miniscrew group and vice versa, the longer the length of the retraction
hook, the less uncontrolled tipping movement appeared in the first molar group.

SP266  EFFECT OF ORTHODONTIC ALVEOLAR CLEFT CLOSURE FOR ORAL HYGIENE
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Maxillofacial Surgery, Faculty of Medicine, University of Tsukuba and 2Sweden Orthodontic Center,
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AIMS: As management of children with a cleft lip, palate and alveolus (CLPA), orthodontic treatment
combined with secondary bone grafting (SBG) has been carried out to guide canines and/or incisors
into the cleft area in the mixed dentition. However because of the complex anatomical morphology
around the alveolar cleft defect and malposition of teeth in the cleft area, oral hygiene control
seems to be difficult inspite of frequent oral hygiene instruction. The aim of the present
investigation was to evaluate the longitudinal change of oral hygienic condition of CLPA patients
before and after the first phase of active orthodontic treatment.
SUBJECTS AND METHOD: Eleven patients (an average pre-treatment age of 8.4 years) with a
unilateral cleft lip and palate (UCLP group). Seven hard or soft palate cleft patients without alveolar
cleft (CP group, 9.3 years) and 10 non-cleft orthodontic patients (N-group, 7.8 years) formed the
control groups. Plaque control records (PCR; O’Leary, 1975) were taken and compared amongst
groups before and after the first phase of orthodontic treatment. In the UCLP group, PCR were also
compared between cleft and contralateral sides. The calibration accuracy was checked by one dental
hygienist using the original PCR and oral photographs taken with disclosing solution. Statistically significant differences were analyzed with Mann-Whitney U or the Steel-Dwass test.

RESULTS: In spite of oral hygiene instructions to all patients on several occasions, no statistically significant improvement of PCR was detected after active orthodontic treatment in any group. However, there was a tendency for PCR score to decrease in the UCLP group from 73.2 to 56.5 per cent ($P = 0.07$). Furthermore, PCR of the alveolar cleft side showed significant improvement compared to the contralateral side in the UCLP group ($P = 0.04$).

CONCLUSION: Although sufficiently conscious oral hygiene instruction was performed in the mixed dentition, an equable change of PCR was not shown after orthodontic treatment. Therefore improvement of oral hygiene for the young patient was considered difficult. However, significant improvement of oral hygiene was shown in the alveolar cleft region of UCLP subjects after the first phase of orthodontic alveolar cleft closure treatment.

SP267 - WITHDRAWN AN AUDIT ON THE QUALITY OF STUDY MODELS AT AN NATIONAL HEALTH SERVICE HOSPITAL IN THE UNITED KINGDOM
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AIMS: To assess the quality of study models supplied by a commercial laboratory for orthodontic registrars in training at a district general hospital in England between November 2014 and July 2015. MATERIALS AND METHOD: Two hundred consecutive study models (100 upper, 100 lower casts) from patients treated by the specialist registrars at the Orthodontic Department at Kingston Hospital were examined by two assessors scoring for the following 11 parameters: 1. All erupted teeth clearly shown; 2. Labial sulcus clearly shown; 3. Palate (upper cast) or lingual sulcus (lower cast) clearly shown; 4. Absence of air blows; 5. Free from plaster debris; 6. Correct base thickness; 7. Heels of models cleared for occlusion; 8. Models trimmed to the standard angles; 9. No teeth damaged or broken on the model; 10. Absence of plaster defects; 11. Correct labelling of study models. Items 1 to 4 are deemed factors affecting study models due to clinical technique, whilst items 5 to 11 are deemed factors due to laboratory technique. A gold standard for quality of study models was defined as achieving 100 per cent of the categories listed. This is probably unattainable for every cast on every occasion but it helped to focus critical attention.

RESULTS: Only 32 per cent of the models examined achieved the set gold standard. Thirty eight per cent of models showed errors due clinical technique, the most common error being the presence of air blows within the cast. Sixty eight per cent of models showed errors due to laboratory technique, the most common error being the presence of plaster debris.

CONCLUSION: It is suggested that: 1. an alginate machine should be used for mixing every impression; 2. clinicians should carefully assess the impressions in order to reduce the number of clinical errors; 3. Guidelines should be issued to laboratory staff; 4. study models should be stored safely and securely along with bite registration; 5. study models should be labelled with patient name and unit number. A re-audit is planned for July 2016.

SP268 FACTORS RELATED TO TEMPOROMANDIBULAR DISORDERS IN ORTHODONTIC PATIENTS. A RETROSPECTIVE STUDY
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AIMS: To retrospectively assess the associated risk factors: age, anxiety, hyperlaxity, trauma and Angle malocclusion between males and females with temporomandibular disorders (TMD).

SUBJECTS AND METHOD: Data was collected retrospectively from the Temporomandibular Joint Department (TMJD) and the Orthodontic Department (OD) of the Hospital Odontològic Universitat de Barcelona, over a 2 year period (from October 2013 to October 2015). Among 104 patients reporting signs and symptoms of TMD at the TMJD, 29 were sent from the OD. Five patients were excluded for lacking information from the history. The 24 adult patients (17 females, 7 males), were from 14 to 62 years of age. Patients were classified into two groups according to gender. Trauma and anxiety were evaluated using a questionnaire. Occlusion was evaluated according Angle
malocclusion and hyperlaxity with the Beighton classification. Data was analyzed using Student’s t- and χ2 tests to determine differences between the factors studied among both groups.

**RESULTS:** Females had a higher TMD prevalence than males, 2:1 relationship. There were no significant differences between the age of males and females (t = 0.495, P < 0.05). There were no significant differences comparing male and female patients with trauma (χ2 = 1.63, P < 0.05), hyperlaxity (χ2 = 1.62, P < 0.05), anxiety (χ2 = 2.61, P < 0.05) and Angle malocclusion (χ2 = 0.25, P < 0.05).

**CONCLUSION:** The proportion of TMD in patients was higher in females than males. For both genders, age, Angle malocclusion, trauma, anxiety and hyperlaxity were not found to be risk factors for TMD. For these results to be more conclusive, a larger sample is required.

SP269 INVESTIGATION INTO CEPHALOMETRIC PREDICTOR VARIABLES DETERMINING SURGERY OR NON-SURGERY IN SKELETAL CLASS III CASES

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**AIMS:** To treat Class III malocclusions, there are several treatment options depending on the cases. Surgical orthodontic treatment is often performed for severe skeletal mandibular prognathism to establish a normal anterior overjet with correct incisor inclination. On the other hand, patients with a moderate skeletal disorder and dentoalveolar compensation can be treated by non-surgical Class III camouflage orthodontics. It is still controversial to determine the treatment plans of these cases either surgical orthodontics or camouflage orthodontics. The purpose of this study was to investigate Class III orthodontic treatment using cephalograms and to find the border between surgery and orthodontics.

**SUBJECTS AND METHOD:** Thirty-one patients with a Class III malocclusion who had been orthodontically treated in 2014 were examined. Mandibular set back surgery was performed in 15 patients (seven sagittal split ramus osteotomy, eight intraoral vertical ramus osteotomy), bimaxillary osteotomy (LeFort I osteotomy and sagittal split ramus osteotomy) was performed in nine patients. The other seven patients were treated non-surgically. Using lateral cephalograms taken before treatment, SNA, SNB, ANB and Wits appraisal were measured and compared among each group.

**RESULTS:** The mean values of surgical group were SNA: 82.5°, SNB: 85.4°, ANB: –2.9°, Wits appraisal –10.2 mm and for the non-surgical group: SNA: 82.6°, SNB: 82.7°, ANB: –0.1°, Wits appraisal –7.8 mm. Between the surgical and non-surgical group, the values of ANB, SNB and Wits appraisal were significantly different (P < 0.05: ANB, P < 0.1: SNB, Wits appraisal). On the other hand, the measurements were not significantly different between the mandibular set back group and the bimaxillary osteotomy group.

**CONCLUSION:** Comparison of the mean values between surgical and orthodontic groups showed that ANB, SNB and Wits appraisal were significantly different. These measurements are possibly references to diagnose the Class III cases as surgery or not.

SP270 CORTICISION INCREASED ALVEOLAR BONE RESORPTION IN PROPORTION TO THE AMOUNT OF CUT VOLUME, BUT DID NOT HAVE ANY EFFECT ON ORTHODONTIC TOOTH MOVEMENT

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**AIMS:** To evaluate the relationship among the cut bone volume of corticision, the amount of tooth movement and the resultant alveolar bone resorption after tooth movement.

**MATERIALS AND METHOD:** Ten-week-old female Wistar rats were divided into corticotomy groups and a control group that underwent sham corticotomy (n >6). Two experiments using two different orthodontic forces (10 or 25 g) were performed. The volume of bone cut by corticotomy was 0.1 mm³, 1.0 mm³, and 1.7 mm³ in the 25 g groups, and 1.0 mm³ and 1.7 mm³ in the 10 g groups. Nickel-titanium closed-coil springs were set on the maxillary left first molars to induce mesial movement.
Before and after orthodontic tooth movement, micro-computed tomographs were taken. The amount of tooth movement and the alveolar bone resorption were measured using the images.

RESULTS: Although the volume of bone cut was distinguishable between the corticotomy groups, the amount of tooth movement was not significantly different between the control group and any of the corticotomy groups. However, increased volume of cut bone was significantly related to decreased alveolar bone; in particular, reduced height of the alveolar bone crest after tooth movement.

CONCLUSION: The volume of alveolar bone cut by corticotomy does not affect tooth movement in 10-week-old female Wistar rats; however, it may increase alveolar bone loss after tooth movement.

SP271 RISK FACTORS AND APICAL ROOT RESORPTION DURING ORTHODONTIC TREATMENT – A RETROSPECTIVE COHORT STUDY
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AIMS: Orthodontically induced inflammatory root resorption (OIIRR) is an iatrogenic consequence of force application during orthodontic treatment, although it may also occur unexpectedly. It is characterized by the reduction of the length of the dental root jeopardizing the success of the treatment. The purpose of this study was to investigate the association between OIIRR and potential risk factors.

SUBJECTS AND METHOD: From 604 patients treated during 1994-2004, 33 patients (19♀, 14♂) presented with radiographically diagnosed OIIRR at the end of the treatment. One hundred patients (64♀, 36♂), randomly selected with clear medical history, comprised the control group. Pre- and post-treatment panoramic and cephalometric radiographs were used. The following risk factors were investigated: gender, duration of treatment, type of dentition, Angle classification, frontal face type, lower face height (LFH), premolar extractions, incisor inclination relative to their osseous base, allergy and asthma, mechanotherapy. STATA 8 was used for logistic regression analysis.

RESULTS: OIIRR was radiographically diagnosed at a rate of 5.4 per cent with the incisors being the most frequently involved teeth. The use of a retraction arch posed a four times higher risk for OIIRR, while when combined with prolonged treatment time by 1 month it increased the risk from 17 to 46 per cent. Patients in the permanent dentition ran a 1.24-42 times greater risk than those in the mixed dentition. Class II elastics and upper second premolar extractions worsened the incidence of OIIRR, while gender, allergy, asthma and incisor inclination did not. Although not statistically significant, there was a tendency for OIIRR in patients with a long face, increased LFH and Class II or III malocclusion. Interestingly, there was a greater incidence of OIIRR in Class III patients with an anterior open bite and normal/increased LFH.

CONCLUSION: The aforementioned results indicate factors that should be taken into account in order to avoid the undesirable occurrence of OIIRR. Further research with more randomised controlled trials, prospective clinical studies and greater sample sizes needs to be conducted to draw reliable conclusions.

SP272 EFFECTS OF HEAD POSITIONING IN THREE-DIMENSIONAL AND CONVENTIONAL DENTAL PANORAMIC RADIOGRAPHY ON MEASUREMENTS OF ANTERIOR TOOTH LENGTH
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AIMS: To investigate the effects of head positioning in three-dimensions and conventional dental panoramic radiography on measurements of anterior tooth length.

MATERIALS AND METHOD: A simulated or phantom human head was radiographed at standard and various alternative head positions using three-dimensional (3D) and conventional panoramic radiographic equipment. The phantom head was displaced 4, 8 and 12 mm in the forward, backward, right, and left directions, and tilted 5, 10 and 15 degrees in the upward and downward directions from the standard head position. The phantom was also radiographed using cone-beam computed tomography (CBCT). The lengths of the anterior teeth were measured on the panoramic
and CBCT images. The value in the standard head position was defined as the standard value. Measurement error was defined as the standard value minus the CBCT value on each panoramic radiograph. Significant differences between measurement errors using 3D and conventional panoramic radiographs were evaluated. Magnification ratio of the standard value to the CBCT value for each panoramic radiograph was calculated as the actual ratio. Magnification ratio of the measurement value to the standard value for each head position was also calculated as the head position ratio.

RESULTS: Measurement errors were small and actual ratios were almost 100 per cent for all anterior teeth evaluated using the 3D panoramic radiograph. Measurement errors for the 3D panoramic radiographs were significantly smaller than those for the conventional panoramic radiographs. For the 3D panoramic radiograph measurements at the 4, 8 and 12 mm displaced head positions, and at the 5-degree tilted head positions in all directions, the head position ratios were within ±5 per cent of 100 per cent.

CONCLUSION: Using 3D panoramic radiographic equipment, measurement errors in tooth lengths were small for all anterior teeth. At 12 mm of displacement and 5 degrees of head tilt, no head positioning effects were noted on the measurements of anterior tooth lengths.

SP273 AN ATTEMPT TO IDENTIFY NOVEL MUTATIONS RESPONSIBLE FOR TOOTH AGENESIS BY WHOLE EXOME SEQUENCING

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AIMS: To identify mutations responsible for a case of familial tooth agenesis.

SUBJECTS AND METHOD: A patient with odontogenesis and three asymptomatic family members. Five teeth were missing in the patient. Genomic DNA was extracted from whole blood samples and subjected to a library construction followed by whole exome sequencing. Variance was identified for all samples using a genome analysis toolkit and the patient’s specific mutations were identified assuming dominant inheritance that is common in other known pathogenic variants for tooth agenesis. Candidate variants were further narrowed using reported mapping information, gene ontology (GO) and/or predicted mutational impact (Polyphen2).

RESULTS: The total variant number for this one affected patient from a single family was 91,214. By removing synonymous, non-coding and frequent (>1%) variants, the number of the candidates to could be reduced to 276. A variant with high predicted mutational impact was found to coincide with chromosomal region 10q11.2-q21 where causative mutations for tooth agenesis have been previously mapped, yet no responsible genes have been identified. Four variants with high mutational impacts for which GO analysis suggests a possible connection with tooth morphogenesis were identified.

CONCLUSION: By whole exome sequencing analysis of a family with tooth agenesis patients, several variants responsible for the symptom were identified. Candidates include variants at NCOA4, ITGA6 and LRP4.

SP274 ORTHODONTIC TREATMENT OUTCOME IN 12-YEAR-OLD ADOLESCENTS AFTER ONE YEAR’S TREATMENT WITH THE ERUPTION GUIDANCE APPLIANCE IN THE EARLY MIXED DENTITION

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AIMS: To explore long-term treatment outcome in patients treated with the eruption guidance appliance (EGA) in the early mixed dentition

SUBJECTS AND METHOD: In this prospective study, 7- to 8-year-old children (n = 48) were recruited after screening. Eligibility criteria for participants were: early mixed dentition, Class I or Class II occlusion with one or more of the following characteristics: deep bite (≥2/3 overlapping of the incisors), increased overjet ≥5 mm, moderate anterior crowding in combination with an overjet ≥4 mm. The participants were randomly divided into two groups. Group 1 started treatment with an
EGA immediately and group 2 one year later. The patients were instructed to wear the appliance every night for 2 hours/day. Active treatment continued for one year. Thereafter, the same appliance served as a retainer every other night. The age of the participants at the follow-up examination was 12.4 years (±0.6). Thirty-five untreated matched controls, with mean age of 12.1 years (±0.9), were selected from patients waiting for orthodontic treatment in the Public Dental Service Competence Centre of Northern Norway. Occlusal assessments were performed on dental casts obtained from all participants at start of the study (T0), after one year of treatment (T1) and at follow-up (T2). Differences between groups were analyzed with the independent t- and chi-square tests.

RESULTS: At T2, the number of participants had decreased from 48 to 35. From T0 to T2, the mean overjet decreased from 5 mm (±1.3) to 3.3 mm (±1.2), overbite decreased from 3.7 mm (±1.3) to 3.0 mm (±1.1). At age 12, the participants had significantly smaller overjet and overbite values as compared to corresponding figures of the controls, 6.9 mm (±2.1) and 4.4 mm (±1.3). From T0 to T2, the number of participants with a distal molar relationship decreased from 23 to 15. Initially, molar relationships did not differ between the participants and controls. At T2, distal molar relationship was significantly less frequent among the participants than the controls. Patient compliance showed great variation.

CONCLUSION: Early correction of an increased overjet, overbite and distal occlusion using the EGA can also be effective in the long-term, provided patient compliance is sufficient.

SP275 EVALUATION OF IDEAL FACIAL PROPORTIONS OF CAUCASIANS FROM CENTRAL EUROPE USING VIRTUAL AND CLINICAL THREE-DIMENSIONAL EXAMINATION

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AIMS: To determine the ideal proportion of the soft tissues of subjects with a Caucasian facial type living in central Europe using three-dimensional (3D) analysis (virtual and clinical analysis) to focus on the parts most influenced by orthodontic treatment – lower third of the face.

SUBJECTS AND METHOD: Fifty six respondents (54 females, 11 males) in the age range of 18-35 years with a Caucasian type of face, living in Slovakia. Analyses were realized by clinical and virtual analysis. The uniformity of clinical and virtual analysis were compared means of the median test. The results were similar (P > 0.05). The measurements were performed according Farkas and the combined measurements, which focussed on the lower third of the face. The lips and surrounding structures were evaluated. The median was identified and considered as typical (norm). Non-parametric statistical methods (Excel) were used to calculate the median and standard deviation. Data were divided into Gauss distribution. Statistical significances were tested by median test.

RESULTS: The proportion of people living in Slovakia were similar to those of Farkas. Moderate deviations from Farkas were found for the height of the lower third of the face. The values were smaller in both genders (62 mm, males, 57 mm females. Norm was defined according median in proportion of height of the upper lip 11 mm (females), 12 mm (males), high upper lip 8 mm (females), 9 mm (males), distance between nasolabial crease 48 mm (females), 55 mm (males), width of wings of nose 32.50 mm (females), 37 mm (males), distance stomion to pogonion 36 mm (females), 42 mm (males), distance stomion to gnathion of chin 39 mm (females), 43 mm (males) and finally distance between width of gonion 109 mm (females), 119 mm (males).

CONCLUSION: The findings confirm the validity of Farkas’ study, except for value of lower third of the face, which was smaller in both genders. The norm of the lower third of the face was defined. It was confirmed that virtual and clinical measurements of the lower facial third had no significant differences in measured parameters. Both are valuable methods for craniofacial analysis.

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EVALUATION OF EFFECT OF DENTAL CARIES IN THE MIXED DENTITION ON LACK OF SPACE AS A REASON FOR ORTHODONTIC ANOMALIES

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AIMS: Evaluation of the lack of space due to caries or loss of primary teeth in intact teeth in children. The side with approximal caries of the teeth was compared with the side with maintained intact teeth. As a control, casts with a maintained support zone on both sides were analysed.

MATERIALS AND METHOD: Thirty dental casts of children aged 7-8 years were evaluated. Casts should have a support zone and the first permanent molar present. The casts were divided into two groups: group 1 contained 14 dental casts with no significant approximal caries and group 2 dental casts where approximal caries (11 casts) or missing tooth/teeth (5 casts) of the support zone occurred. The following were considered: symmetry of dental arches on both sides of the casts for groups 1 and 2 as well as the difference in lack of space between casts with approximal caries or missing teeth and casts with an impaired mesiodistal width of the support zone. A t-test was used to determine the average.

RESULTS: Dental caries in the primary teeth of the support zone influence space in the lateral part of the arch and therefore formation of orthodontic anomalies. A discrepancy between the sides of the dental arches without missing teeth and sides with missing mesiodistal width were: maxilla 2.73 mm and mandible 1.04 mm. For casts where the mesiodistal width of the support zone on both sides was maintained, the discrepancy was 0.5 mm in the maxilla and 0.15 mm in the mandible. Mesial movement of the maxillary first permanent molar after loss of mesiodistal width was on average 2.23 mm, and in the mandible 0.89 mm. Mesial movement in the maxilla was more noticeable than in the mandible (38%).

CONCLUSION: Orthodontic treatment need in children is almost 50 per cent. Many cases are due to caries and its consequences.

COMPARATIVE EVALUATION OF TREATMENT OUTCOMES BETWEEN TEMPORARY ANCHORAGE DEVICES AND CLASS III ELASTICS IN CLASS III MALOCCLUSION

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AIMS: To investigate the difference in treatment strategies between temporary anchorage devices (TADs) and Class III elastics in Class III malocclusion patients.

SUBJECTS AND METHOD: Twenty three subjects (11 patients in the TAD group and 12 patients in the Class III elastic group) with an Angle Class III malocclusion treated with non-extraction comprehensive orthodontic treatment. Lateral cephalograms obtained pre- (T1) and post- (T2) treatment were used for evaluation of the treatment outcomes. The paired t- and Student’s t-tests were used for statistical analysis.

RESULTS: In both groups, a correct overjet and Class I molar relationship was achieved and the occlusal plane was rotated counterclockwise at T2. In the elastic group, distal tipping of the lower molars, extrusion of the lower incisor and upper molars, clockwise rotation of the mandibular plane angle and an increased ANB angle were observed. In the TAD group, distal tipping and intrusion of the lower molars, bodily movement of the lower incisors and a maintained mandibular plane angle were observed.

CONCLUSION: In non-extraction treatment for Class III malocclusion, the mandibular plane angle was increased in the elastic group and maintained in the TAD group. Therefore, it appears that the use of Class III elastics is preferable in low angle short face cases, and that TADs are suitable for high angle long face.

CHANGES OF THE LIPS AND PERIORAL SOFT TISSUE ACCORDING TO BRACKET REMOVAL
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AIMS: To evaluate the changes of the lips and perioral soft tissue after bracket removal.

SUBJECTS AND METHOD: Nineteen males and 33 females (mean age: 18.8 years) who had undergone orthodontic treatment. Thirteen hard and 17 soft tissue landmarks were analyzed for 10 linear and two angular measurements on cephalometric radiographs at three stages: before debonding (T1), just after debonding (T2), and 1.5 months after debonding (T3). The vertical reference plane (sG-perpendicular) and a line from the middle of the S-shaped curve between the tip of the nose and subnasale to the soft tissue pogonion (S line) were used for linear measurements.

RESULTS: 1. The mean amount of retrusion in both genders 1.5 months after debonding (T3-T1) was approximately 0.38 mm for the upper lip and 0.88 mm for the lower lip from the vertical reference plane (sG perpendicular line). There was no significant difference between males and females during this period. 2. Immediately after debonding (T2-T1), the lower lip retrusion of females was about 0.52 mm and that of males was 0.2 mm from the S line, which revealed a significant difference. 3. During the post-debonding period (T3-T2), the lower lip of males was retruded about 0.38 mm more than that of females from the S line.

CONCLUSION: Lips are retruded after bracket removal (T3-T2, T2-T1), but there was no gender difference 1.5 months after debonding (T3-T1).

SP279 EVALUATION OF THE EFFECTS OF MODIFIED CLASS II ACTIVATORS ON THE MAXILLA AND MANDIBLE
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AIMS: Distal malocclusions are the most common type of anomaly. Skeletal malocclusions cause the emergence of different face types. These anomalies can be prevented or treated by elimination or reduction of abnormal function. Both maxillary protrusion and mandibular retrusion are evident in the development of skeletal Class II, but commonly seen is mandibular retrusion. Functional appliances are widely used for treatment of these anomalies. These appliances conduct the strength of certain muscle groups through the dentition to the basal bone by changing the function and position of the mandible. Although there are many studies on the mechanism of action of functional appliances, the results are still controversial. In this study, the effect of two different activators used in the treatment of Class II division 1 anomalies on sagittal development of the maxilla and mandible were compared.

MATERIALS AND METHOD: Hand-wrist radiographs, together with lateral cephalometric radiographs at the beginning and at end of treatment of 18 individuals treated with a modified Twin-Block appliance and 15 Class II individuals (control group) treated with a Herbst appliance. It was possible to evaluate differences among the groups.

RESULTS: The modified Twin-Block restricted maxillary development more than the Herbst appliance. However, the provocation of mandibular development was not inspired by the activator design.

CONCLUSION: The development of the mandible correlates with the amount of activation and the daily use of the device.

SP280 A NEW SYSTEM FOR ANALYZING THE COORDINATION OF DENTOALVEOLAR MORPHOLOGIES
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AIMS: To develop a new system for the quantitative evaluation of coordination between upper and lower dentoalveolar morphologies as well as for displaying the images of coordination.

MATERIALS AND METHOD: An analyzing system was developed to implement the following requirements: 1) a coordinate system and a reference plane were defined using several anatomic
landmarks on each upper and lower model; 2) the roll, yaw, and rotation centre were calculated between reference planes; 3) the virtual occlusal plane was defined as the middle of the above reference planes; 4) outlines of sections parallel to each reference plane were projected onto the virtual occlusal plane and those images displayed. To verify this system, 20 initial digital models of subjects treated with (n = 10) and without (n = 10) orthognathic surgery were analyzed for clinical application.

RESULTS: Both visual and quantitative evaluations concerning the coordination of dentoalveolar morphologies were achieved by this new system. Furthermore, the parameters computed by this system suggest some differences between those cases undergoing surgery and those not.

CONCLUSION: The new system developed in this study attained quantitative evaluations of the coordination of dentoalveolar morphologies using only digital models. This system can enhance clinical efficiency for more accurate diagnoses of borderline cases.

SP281 EVALUATION OF THE FAILURE RATE BETWEEN STAINLESS STEEL AND CERAMIC BRACKETS – A PRELIMINARY STUDY
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AIMS: To evaluate the difference in bracket failure rate between stainless steel and ceramic brackets.

SUBJECTS AND METHOD: A total of 10 consecutive patients treated with stainless steel brackets (Abzil Agile, 3M Unitek; group 1) and 10 consecutive patients treated with ceramic brackets (Radiance, American Orthodontics; group 2) participated in the study. Only individuals treated with fixed functional appliances were excluded from the survey due to reports of frequent bracket failures. All incisors, canines and premolars were included within the survey. A total of 381 brackets were bonded, of which 195 were stainless steel and 186 were ceramic. All brackets were bonded with the same protocol (Transbond Plus Self Etching Primer followed by Transbond XT adhesive) by the same operator. Patients attended at monthly intervals for 6 months during which every loose attachment was noted. The collected data were inserted in a spreadsheet and statistically analyzed. Statistical significance between the two groups was estimated using two-tailed Fisher’s exact test ($P < 0.05$).

RESULTS: During the study two out of 186 (1.1%) bonded ceramic brackets and 12 out of 195 (6.2%) bonded metal brackets failed. Data analysis showed significant differences ($P = 0.0117$) between the failure rates of the groups.

CONCLUSION: Ceramic brackets tend to fail statistically less often in comparison with their metal counterparts. The difference between failure rates (4.8%) is also of clinical importance because it represents almost one additional loose bracket.

SP282 A RETROSPECTIVE INVESTIGATION OF THE PREVALENCE OF IMPACTED TEETH IN THE AEGEAN REGION OF TURKEY
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AIMS: To examine the frequency of impacted permanent teeth, excluding third molars, in the Aegean region of Turkey.

MATERIALS AND METHOD: Archived panoramic films of 1403 patients (912 females, 491 males) referred between January 2014 and September 2015 were examined. Data including age, gender and localization were evaluated by statistical tests.

RESULTS: In 198 patients, 293 impacted teeth were detected. Of these, 138 were maxillary canines, 81 mandibular second premolars, and 34 maxillary second premolars. Of these 293 impacted teeth, 182 were detected in the maxilla and 111 in the mandible. One hundred and thirty six patients had one impacted tooth, 43 two impacted teeth and 19 three or more impacted teeth. Of the impacted teeth that were detected bilaterally, 23 were maxillary canines, 14 were mandibular second premolars, five were maxillary second premolars and four were mandibular canines.
CONCLUSION: Impacted teeth may cause cyst formation, root resorption at adjacent teeth, temporomandibular joint disorders, and focal infections. Therefore, early diagnosis with careful examination is important to prevent associated complications.

SP283  PREVALENCE OF HYPODONTIA IN THE AEGEAN REGION OF TURKEY
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AIMS: To determine the prevalence of hypodontia in the permanent dentition in the Aegean region of Turkey.
MATERIALS AND METHOD: Orthodontic files, including panoramic radiographs of 1403 patients (912 females, 491 males) who were referred from January 2014 to September 2015, were investigated. Data including the age, gender, localization were evaluated by statistical tests.
RESULTS: Except for third molars, the prevalence of hypodontia in the present sample was 9.19 percent. A total of 245 congenitally missing teeth were observed in 129 patients. Two cases of oligodontia were observed. The most frequently missing teeth for the males and females respectively were the lateral incisors (n = 91, 37%), mandibular second premolar (n = 74, 30%), maxillary second premolars (n = 38, 15%), and the mandibular incisors (n = 13, 5%). Symmetrical hypodontia was predominant, and the most commonly symmetrical hypodontia was maxillary lateral incisors (n = 34, 26%), and mandibular second premolars (n = 22, 17%). Congenitally missing permanent teeth were observed more often in the maxilla than in the mandible.
CONCLUSION: Hypodontia may lead to some clinical problems including malocclusions, aesthetic and functional complaints, and psychological problems. All patients should be evaluated by an interdisciplinary approach for appropriate treatment choice.

SP284  SELLA TURCICA BRIDGE IN SUBJECTS WITH A SKELETAL CLASS III MALOCCLUSION
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AIMS: A sella turcica bridge is a morphologic variation caused by excessive ossification of the dura mater between the anterior and posterior clinoid processes of the sphenoid bone, or abnormal embryologic development. The aim of this study was to evaluate the presence of a complete sella turcica bridge in subjects with a skeletal Class III malocclusion compared to subjects with a skeletal Class I occlusion.
SUBJECTS AND METHOD: Thirty subjects with a skeletal Class III malocclusion (mean age 22.3 years) and 120 subjects (control group) with a skeletal Class I occlusion (mean age 18.1 years) were included in the retrospective study. The skeletal Class was defined by ANB angle and Wits appraisal using lateral cephalograms. The presence of a complete sella turcica bridge between the anterior and posterior clinoid processes of the sphenoid bone was also evaluated using the lateral cephalogram. A chi-square test was used to analyze the occurrence of a sella turcica bridge in skeletal Class III subjects compared to the control group.
RESULTS: The frequency of a complete sella turcica bridge was significantly higher (P < 0.0 P = 1.49E-16) in the skeletal Class III group (5 bridges, 16.6%) than in the control group (10 bridges, 8.3%).
CONCLUSION: The presence of a complete sella turcica bridge is significantly greater in subjects with a skeletal Class III malocclusion. Craniofacial deviation in the sagittal plane such as in skeletal Class III is associated with morphological variation of the middle cranial fossa.

SP285  EFFECT OF LOCAL ANAESTHESIA ON TRIGEMINAL SOMATOSENSORY-EVOKED MAGNETIC FIELDS
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AIMS: Inferior alveolar nerve (IAN: third branch of the trigeminal nerve) injuries occasionally occur after orthognathic surgery. Patients may experience symptoms including hypoesthesia of the lower
teeth, chin and lower lip with biting injuries, and problems with speech, mastication and swallowing. For objective neurophysiological evaluation of the function of the trigeminal system, magnetoencephalography-based trigeminal somatosensory-evoked field (TSEF) assessment would be valuable in providing spatial and temporal profiles of cortical responses. However, this necessitates knowledge of how TSEF varies with trigeminal nerve dysfunctions.

**SUBJECTS AND METHOD:** Ten right-handed healthy adults signed informed consents and participated. A conduction block of the trigeminal nerve was introduced using local anaesthesia (lidocaine) to temporally mimic nerve dysfunctions, and TSEF changes were monitored.

**RESULTS:** Following electrical stimulation of the lower lip, a magnetic response with a peak latency of approximately 20 ms was identified in all participants. Dipole for the peak was estimated on the post-central gyrus in the participant’s own magnetic resonance image.

**CONCLUSION:** It was verified that a 20 ms latency cortical response of TSEF components localized at the primary sensory cortex can serve as a robust neurofunctional marker of experimental trigeminal nerve dysfunction.

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**SP286** THE EFFECT OF DIFFERENT ARCHWIRES ON THE LOCATION OF THE CENTRE OF RESISTANCE OF THE UPPER ANTERIOR TEETH: FINITE ELEMENT ANALYSIS

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**AIMS:** To define the centre of resistance (CRe) of the upper anterior teeth after engaging different archwires.

**MATERIALS AND METHOD:** A three-dimensional finite element model of six maxillary anterior teeth was constructed. Brackets, 0.022 × 0.028 inches, were placed passive on all six anterior teeth, set at the centre of the buccal surface in the mesio-distal dimension and 3 mm from the cusp tip of the canine to the bracket slot in the vertical direction. The power arms were set mesial of the canine brackets and mini-implants were placed between the roots of the upper second premolar and upper first molar bilaterally. The model was connected with different type of archwires including stainless steel, nickel titanium and titanium molybdenum which was the same size as the bracket slot. The point of force application was varied to be able to locate the CRe from where bodily movement of the teeth was produced. The power arm length and position of the mini-implant were changed by 0.2 mm intervals beginning at 1 mm from the alveolar crest level of the upper second premolar and upper first molar bilaterally. The direction of force was varied parallel to the occlusal plane to simulate tooth movement. The power arm length and position of the mini-implant were changed by 0.25 mm intervals from 1 mm from the alveolar crest level of the upper second premolar and upper first molar according to the occlusal plane. The direction of force was varied apically from the occlusal plane to simulate tooth movement.

**RESULTS:** The CRe was located 10.8, 11.6 and 12.2 mm apically from the bracket slot when using stainless steel, titanium molybdenum and nickel titanium wire, respectively.

**CONCLUSION:** The property of archwire material was associated with the location of the CRe. The location of the CRe will be more incisally placed when using nickel titanium, titanium molybdenum and stainless steel wire, respectively.

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**SP287** EVALUATION OF BUCCOLINGUAL BONE AROUND TITANIUM USING PHOTON COUNTING PANORAMIC RADIOLOGY

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**AIMS:** Quantum radiography (QR) technology has developed in recent years. This QR X-ray system can count the number of X-ray photons. The hypothesis was that buccolingual bone around titanium can be evaluated using photon counting panoramic radiography. The aim of this study was to evaluate buccolingual bony defects using titanium and phantom.
MATERIALS AND METHOD: The panoramic X-ray system, QRmaster-P (Tele-systems, Osaka, Japan) with a current of 4 mA and a voltage of 80 kV was used [Analysis soft :QRMC (Tele-systems/Osaka). Metal: φ 4 x 50 mm pure titanium (Tokyo titanium/Saitama); Phantom: three types of 10 mm thick bony material (compact bone: 900 HU, cortical bone: 700 HU, trabecular bone: 250 HU) (Kyoto Kagaku/Kyoto). All phantoms were made as a defective form (without bone defect, one side loss, loss of both sides). (1) Inserted metal into bone phantom; (2) Placed on median portion and radiographed five times. (3) ROI were set for every bone defect form according to the titanium and these were then analyzed using QRMC. The chart axis was: X axis: Spectrum Deformation Index (SDI): The amount of X-ray energy change which penetrates through an unknown substance. Y axis: Relative Attenuation Index (RAI) based on the energy distribution of the X-ray which penetrates through an unknown substance.

RESULTS: (1) SDI became larger depending on the bone; the cortical bone and the compact bone. The RAI tended to be smaller. (2) RAI could separate a colony at SDI and RAI according to the bony defect form, and SDI increased in trabecular bone, the cortical bone and then the compact bone, being smaller.

CONCLUSION: Buccolingual bone could be analysed using a 10 mm thick bony phantom and 4 mm φ pure titanium by photon counting X-ray.

SP288 COMPARISON OF THE SKELETAL AND DENTAL EFFECTS OF TWO DIFFERENT STRAIGHTWIRE TECHNIQUES IN CLASS I ANTERIOR CROWDING CASES
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AIMS: Self-ligating brackets systems were introduced as one of the greatest advances in orthodontic bracket technology. The growing popularity of these systems in clinical use in recent years has lead the bracket manufacturers releasing new designs and even new prescriptions to be used with them. The orthodontic effects of these new systems are still questionable. The aim of this study was to evaluate the skeletal and dental effects of two of these new systems; Damon System and F1000 System, which are passive self-ligating bracket systems.

SUBJECTS AND METHOD: Thirty two patients (10 males, 22 females) with skeletal and dental Class I anterior crowding. The chronological age of the patients ranged between 12.5 and 18.0 years with a mean of 14.7 years. Group A was treated with the Damon Q brackets and group B with F1000 brackets. In Group A, archwires were employed according to the treatment protocol in the Damon Workbook. The same wire sizes and treatment protocols were also used in group B. Transverse intertooth distances were measured on pre- and post-treatment orthodontic models. Lateral and antero-posterior cephalometric measurements and inter-tooth distances were analyzed.

RESULTS: The transverse widths were significantly increased in both groups while the highest increase was seen for the premolars in both the upper and lower arches. No significant differences between the groups in the upper arch were seen. Significant differences between the groups were observed in the lower arch. Changes in cephalometric values were in accordance with the model measurements. Measurements on antero-posterior radiographs showed that although there were no differences in molar inclinations, the inter-molar width was increased significantly more in group A.

CONCLUSION: Both appliances lead to similar expansion at the posterior region and similar proclination of the incisors. The only significant difference was greater molar expansion achieved by the Damon Q system.

SP289 LONG-TERM EFFECTS OF MANDIBULAR SYMPHYSEAL DISTRACTION OSTEOGENESIS
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AIMS: Treatment of mandibular transverse deficiency with mandibular symphyseal distraction osteogenesis (MSDO) has been shown to be a reliable treatment option. However, the long-term
effects of this procedure on the dental arches is still questionable. The purpose of this study was to evaluate the long-term effects of the MSDO procedure achieved with the use of tooth- and bone-borne distractors.

MATERIALS AND METHOD: Pre-treatment (T0), post-treatment (T1) and long-term follow-up (T2) (6 years 8 months after completion of orthodontic treatment) orthodontic models were collected and analyzed for 14 patients (8 tooth-borne, 6 bone-borne distractors) with a mean age of 14 years 3 months. Changes in inter-tooth distances for canines, premolars, first and second molars and the irregularity index (LII) through T0, T1 and T2 were statistically analyzed.

RESULTS: All measured inter-tooth distances were significantly increased at T1. The largest expansion during treatment was seen in the first and second premolars area (2.8 and 3.5 mm, respectively). Although relapse was seen for all measured variables at T2, the inter-molar distance at T2 was still significantly higher than at T0. The inter-canine width at T2 was not significantly different either from T0 or T1, while the widths between the first and second premolars at T2 were statistically higher than T0 and lower than T1 (P < 0.05). The greatest mean relapse was seen for the first and second premolars (1 and 1.8 mm, respectively). LII at T1 and T2 were statistically lower than at T0 (P < 0.001) but there were no significant differences between LII at T1 and T2.

CONCLUSION: The follow-up results show that although significant dental relapse was seen in the premolar area, MSDO increased the arch width and is a reliable procedure in the long-term. The greater amount of expansion and relapse in the premolar area was explained by greater dental than skeletal expansion during the orthodontic treatment phase.

SP290 EFFECTS OF ORTHOPAEDIC RAPID MAXILLARY EXPANSION ON NASAL SEPTUM DEVIATION
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AIMS: To investigate and evaluate the effects of orthopaedic rapid maxillary expansion (RME) on the nasomaxillary complex and nasal septum deviation.

SUBJECTS AND METHOD: Nine adolescent patients with skeletal maxillary transverse constriction, presenting a septal deviation of more than 1 mm. All patients were treated with a bonded type RME device for a period of 15 days. The protocol consisted of activation of the transverse screw one-quarter turn twice a day. The appliance was then left in place for five months for passive retention. Posteroanterior cephalometric radiographs taken before treatment (T1) and after the retention period (T2) were analyzed. A total of 13 transversal and vertical cephalometric variables, including maxillo-mandibular dentoalveolar structures, skeletal bases and nasal structures were examined.

RESULTS: Significant transverse measurement increases were found at the skeletal base of the maxilla, maxillary and mandibular dentoalveolar structures and at the base of the nose between T1-T2. Nasal septum deviation showed no significant changes, even if the base of the nose enlarged significantly.

CONCLUSION: Nasal breathing is required for normal growth and development of the craniofacial complex and nasal airway obstructions such as nasal septum deviation can affect craniofacial development. Within the limitations of this study it can be concluded that even though the bonded type RME device created expansion at the skeletal base of the maxilla and the nose, no positional changes of the nasal septum were found.

SP291 PHOTOGRAPHIC ANALYSIS OF FACIAL SOFT TISSUE CHANGES ASSOCIATED WITH RAPID MAXILLARY EXPANSION
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AIMS: To evaluate the effects of rapid maxillary expansion (RME) treatment on facial soft tissues.

SUBJECTS AND METHOD: Twenty two consecutive patients (6 males, 16 females) with a mean age of 12 years 3 months at the beginning of treatment, presenting maxillary skeletal transverse constriction and requiring RME. Frontal and profile view photographs of patients taken pre- (T1) and post- (T2) RME were examined. The average time period between T1 and T2 was 7.3 months. Twelve
linear measurements on the frontal view and two angular and two linear measurements on profile view photographs were performed using a pixel ruler and protractor applications. Upper and lower lip positions were also determined according to the analyses of Steiner, Ricketts and Legan-Burstone.

RESULTS: Frontal view measurements showed statistically significant increases at the nose width and intercomissure distances, while only the dorsum of the nose showed an increase on the profile view assessment. No differences were found in other frontal or profile parameters or upper and lower lip positions.

CONCLUSION: The patients’ awareness and satisfaction with treatment results resulted from soft tissue changes instead of the underlying structures. Although there are many studies describing the skeletal, dental and soft tissue effects of RME from cephalometric radiographs, few have been performed on standardized frontal and profile view photographs. Even nose width, the dorsum of the nose and intercomissure distances increased in accordance to the expansion of the skeletal base and dental structures of the maxilla. Facial analyses demonstrate that RME has minimal potential to alter facial soft tissue morphology in the short term. Long-term follow-ups are necessary with an aged matched control group to determine if these changes are stable with growth and development and have no side effects on facial and profile ratios.

SP292 THREE-DIMENSIONAL EVALUATION OF CHANGES IN THE PHARYNGEAL AIRWAY AFTER BIMAXILLARY ORTHOGNATHIC SURGERY
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AIMS: To compare dimensional and volumetric changes in the pharyngeal airway of skeletal Class III adult patients after maxillary advancement/impaction and mandibular set back surgery.
SUBJECTS AND METHOD: Thirteen patients (7 males, 6 females) who underwent maxillary advancement-impaction and mandibular set back surgery. Mimics 10.01 software was used for upper airway volumetric and dimensional measurements on cone beam computerized tomographs (CBCT) of patients. Twenty five landmarks and four planes were determined for measuring the dimensions of the airway. After segmentation of the hypopharyngeal, oropharyngeal and nasopharyngeal airways, nasal cavity and maxillary sinuses, volumetric measurements were performed. A paired t-test was used to compare changes between before and after surgery.
RESULTS: Some reduction was observed in lower airway measurements, while middle and upper airway structures showed dimensional and volumetric increases. No statistically significant change was found except the increase at PNS-UPW distance (P < 0.05). In axial sections, the area between PNS and cervical vertebra 2 (Cv2) increased and set back surgery reduced the area at the Cv3 level. Minimum non-significant changes were found in nasal cavity volume after maxillary impaction.
CONCLUSION: Mandibular set back surgery resulted in a decrease in the volume of the lower pharyngeal airway. Although maxillary advancement and impaction surgery compensated total volume of the pharyngeal airway, patients with insufficient lower pharyngeal airway volume need great attention during orthognathic surgery planning including mandibular set back.

SP293 GENETIC DIAGNOSIS OF PRIMARY FAILURE OF ERUPTION
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AIMS: To research and analyse the bibliography about primary failure of eruption (PFE) and its genetic causes in non-syndromic patients, in order to provide efficient tools for early diagnosis.
MATERIALS AND METHOD: Publications were selected electronically initially in the PubMed database (from 2008 to 2015), using the keywords ‘Primary failure of eruption’ and ‘PTH1R’.
RESULTS: Eleven publications were found. They showed evidence of direct causality between the loss of function of PTHR1 and PFE development. Moreover, in non-syndromic patients, PTHR1 malfunction does not affect peripheric skeletal functions, suggesting a case of haploinsufficiency, as well as a possible contribution of other genes in the disorder.

CONCLUSION: It is important to carry out a genetic analysis in patients with unerupted teeth by unknown causes, given that conventional orthodontic treatment with a continuous archwire in patients with PTHR1 mutations will worsen the malocclusion.

SP294 DISCREPANCIES IN OUTCOME REPORTING EXIST BETWEEN PROTOCOLS AND PUBLISHED ORAL HEALTH COCHRANE SYSTEMATIC REVIEWS

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AIMS: Selective reporting in systematic reviews (SRs) may develop for a variety of reasons, for example, due to the use of multiple measurement scales, outcomes or time points and selective inclusion of specific outcomes. Arbitrary inclusion of outcomes based on post hoc results-driven decisions may bias the conclusions from subsequent syntheses. The aim of this study was to assess discrepancies in the analyzed outcomes between protocols and published reviews within Cochrane Oral Health Systematic Reviews (COHG SRs).

MATERIALS AND METHOD: All COHG SRs on the Cochrane database and the corresponding protocols were retrieved in November 2014 and information on the reported outcomes was recorded. Data was collected at the systematic review level by two reviewers independently.

RESULTS: One hundred and fifty two reviews were included. In relation to primary outcomes, 11.2 per cent were downgraded to secondary outcomes, 9.9 per cent were omitted altogether in the final publication and new primary outcomes were identified in 18.4 per cent of publications. For secondary outcomes, 2 per cent were upgraded to primary, 12.5 per cent were omitted and 30.9 per cent were newly introduced in the publication. Overall, 45.4 per cent of reviews had at least one discrepancy when compared to the protocol; these were reported in 14.5 per cent of reviews. The number of review updates appears to be associated with discrepancies between final review and protocol (OR: 3.18, 95% CI: 1.77, 5.74, P < 0.001). The risk of reporting significant results was lower for both downgraded outcomes [RR: 0.52, 95% CI: 0.17, 1.58, P = 0.24] and upgraded or newly introduced outcomes [RR: 0.77, 95% CI: 0.36, 1.64, P = 0.50] compared to outcomes with no discrepancies. The risk of reporting significant results was higher for upgraded or newly introduced outcomes compared to downgraded outcomes (RR = 1.19, 95% CI: 0.6 2.16, P = 0.57). None of the comparisons reached statistical significance.

CONCLUSION: While no evidence of selective outcome reporting was found in this study, based on the present analysis of SRs published within COHG SRs, discrepancies between outcomes in pre-published protocols and final reviews continue to be common. Solutions such as the use of standardized outcomes to reduce the prevalence of this issue may need to be explored.

SP295 LONG-TERM SATISFACTION AFTER ORTHOGNATHIC SURGERY – A QUESTIONNAIRE STUDY OF 58 PATIENTS

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AIMS: To evaluate patients’ long-term satisfaction with treatment outcome after bilateral sagittal split osteotomy (BSSO) surgery in relation to their treatment motivations and changes in their facial appearance, orofacial pain and chewing ability.
SUBJECTS AND METHOD: Thirty nine females and 19 males who had BSSO surgery between 1998 and 2004. The mean age of the patients was 49.2 years (SD 10.2; range 29-67 years). Forty six patients had mandibular advancements, and 12 had setbacks of the mandible. Patients were surveyed with a questionnaire about their marital status, education, persistent numbness in the lips or jaws after surgery, and their long-term satisfaction with the treatment outcome. In the multiple logistic regression analyses patients’ treatment motivations, and their post-operative recordings on the influence of treatment on their masticatory function and temporomandibular dysfunction, as well as on their facial appearance and self-confidence, were also considered.

RESULTS: Although 73 per cent of the patients had been very satisfied with the outcome of surgical-orthodontic treatment post-operatively (Pahkala and Kellokoski, 2007), still two-thirds of them expressed high satisfaction with the treatment outcomes 10 to 15 years later. None expressed dissatisfaction. Multiple logistic regression analyses showed that older patients, and those with a low educational level and no regular headaches at baseline, and those without persistent neurosensory deficits, expressed high satisfaction with the treatment outcomes. In addition, patients with mandibular setback were more pleased with the outcome than those with mandibular advancement.

CONCLUSION: The effectiveness of surgical-orthodontic treatment seems to be long-lasting. Generally young people and subjects with higher education proved to be more critical of the treatment outcome. Patients who gained an harmonious facial appearance expressed higher satisfaction with treatment outcome than those with improved oral functions. Furthermore, it seems that the treatment had not fulfilled the treatment motives of those with regular headaches. Also persistent numbness in the lips or jaws reduced treatment satisfaction.

SP296 A REGIONAL AUDIT OF THE STANDARDS OF CLINICAL PHOTOGRAPHY IN ORTHODONTICS
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AIMS: This audit was conducted as it was noted that the same photographic errors were repeatedly occurring in orthodontic departments across the Mersey region, regardless of the performing clinician. The aims were to assess the quality of clinical photography and compare these to gold standards, identify common errors in photography techniques, and implement changes if necessary.

MATERIALS AND METHOD: Samples of clinical photographs were retrospectively chosen at random, selecting five patients per clinician, including 11 specialist registrars (Strs), three fixed term training appointments (FTTAs) and 11 consultants. Each sample included a set of 10 photographs: a patient identification photograph, four extra-oral views and five intra-oral views. The data was collected between September 2014 and January 2015 from seven hospitals in the Mersey region. A total of 1250 photographs were analysed from 125 patients. Each image was scored against a range of ‘gold standard’ criteria and given a score of ‘0’ if the image met the all the standards, and a score of ‘1’ if it did not. MS Excel was used for all data collection and analysis.

RESULTS: None of the views met the recommended standard of 95 per cent compliance and consultants out-performed both Strs and FTTAs in nearly every view. The worst views were found to be the extra-oral three-quarter and both left and right intra-oral buccal views. In the extra-oral three-quarter view only 27 per cent of photographs achieved the correct camera angle. In the intra-oral buccal views, only 50 per cent of the images exhibited correctly retracted buccal mucosa, adequately demonstrating the entire first molar. Other common faults were: magnification errors, flash reflections, noise and inadequate retraction of the patient’s hair.

CONCLUSION: The quality of clinical photography in the region was found to be below the recommended standard of 95 per cent compliance. The most common errors where found to be camera angulation and inadequate retraction of buccal mucosa. Recommendations were made to provide consultant led training to clinicians and nurses, with updates on current guidelines and gold standards. Camera settings will now be displayed in surgeries. A re-audit will be completed in 12 months’ time.

SP297 COMPARATIVE CHARACTERISTICS OF THIRD MOLAR POSITION IN DISTAL AND MESIAL OCCLUSIONS
AIMS: To compare the position of the third molars in patients with sagittal occlusal anomalies.

MATERIALS AND METHOD: Dental pantomograms of 110 patients aged 12-15 years with distal (54 cases) and mesial (56 cases) occlusions caused by a mesial or distal position of the mandible. The position of the third molars was evaluated by the value of the internal angles formed by a perpendicular from a line connecting the top of the mesial and distal swelling of the third molars: for the upper to suborbital lines (angles 1 and 2), for the lower to the bottom plane of the jaw base (corners 3 and 4). The material was statistically examined.

RESULTS: In patients with distal occlusion the value of the angles characterizing the position of the upper third molar was increased from 116 to 129 degrees and for the lower third molars from 64 to 71 degrees, which was graphically shown by the trend lines. For patients with mesial occlusion the value of the angles characterizing the position of the upper third molar was increased from 112 to 136 degrees and for the lower third molars from 67 to 82 degrees. When looking at the line trend, (the position of the upper and lower third molars) the distance between them was more in the 12 year olds and significantly less in the 15 year olds. In patients from 12 to 15 years, the increase in the angles of the upper molars was 6.5-8.2 per cent, and for the lower molars the decrease was 3.3-4.0 per cent.

CONCLUSION: 1. The value of the angles characterizing the position of the third molars changes with age, and more in patients with mesial occlusion. 2. The older the patient the less the value of the angles characterizing the position of the upper molars, while the angles of the lower molars, on the contrary, increase. 3. Changes in the angles characterizing the vertical position of the third molars, vertical meet their correct position.

SP298 PALATAL SURFACE AND VOLUME IN MOUTH-BREATHING SUBJECTS EVALUATED WITH THREE-DIMENSIONAL ANALYSIS OF DIGITAL DENTAL CASTS – A CONTROLLED STUDY

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AIMS: To compare the anatomical characteristics of the maxillary arch, identified as palatal surface area and volume, between mouth- and nose-breathing subjects using a three-dimensional (3D) analysis of digital dental casts.

SUBJECTS AND METHOD: Twenty-one Caucasian subjects (14 females, 7 males) with a mean age of 8.5 years [standard deviation (SD) 1.6 years] selected according to the following criteria: mouth-breathing pattern due to allergic rhinitis, early mixed dentition, skeletal Class I relationship, and pre-pubertal stage of cervical vertebral maturation. This study group (SG) was compared with a control group (CG) of 17 nose-breathing subjects (9 females, 8 males, mean age: 8.5 years; SD: 1.7 years). For each subject, initial dental casts were taken and the upper arch was scanned using a 3D laser scanner. On each digital model, 3D measurements were performed to analyse maxillary arch morphology. Between-group differences were tested with the independent sample Student’s t-test \((P < 0.05)\).

RESULTS: In mouth-breathing subjects, changes in physiological function of the upper respiratory tract resulted in skeletal adaptations of the maxillary arch. In the SG, both palatal surface area and volume were significantly smaller when compared with values of the CG. In particular, the palatal surface area and palatal volume were, respectively, 13.5 and 27 .1 per cent smaller in the SG when compared to the CG.

CONCLUSION: Subjects with prolonged mouth breathing showed a significant reduction of palatal surface area and volume leading to a different development of palatal morphology when compared with subjects with a normal breathing pattern.

SP299 ORTHODONTIC TREATMENT WITH LINGUAL VERSUS LABIAL FIXED APPLIANCES: ARE THERE ANY DIFFERENCES? A SYSTEMATIC REVIEW AND META-ANALYSIS
AIMS: To compare, in a systematic review, the therapeutic and adverse effects of lingual and labial orthodontic fixed appliances from clinical trials on human patients in an evidence-based manner.

MATERIALS AND METHOD: Six electronic databases were searched from inception to July 2015 without year, language, or publication type limitations for randomized and prospective non-randomized controlled clinical trials comparing lingual and labial fixed appliances, followed by manual searches. After duplicate study selection and data extraction, risk of bias within and across studies was assessed in duplicate with the Cochrane risk of bias tool and the GRADE approach, respectively. Random-effects meta-analyses of reported aggregate and provided raw data were conducted, followed by mixed-effects subgroup and sensitivity analyses.

RESULTS: A total of 13 papers pertaining to 11 clinical trials were included with a total of 407 (119 male/228 female) patients. Lingual appliances were associated with increased overall oral discomfort compared to labial appliances, increased speech impediment (measured with auditory analysis), worse speech performance assessed by laypersons, increased eating difficulty, and decreased intermolar width. On the other hand, lingual appliances were associated with increased intercanine width and significantly decreased anchorage loss of the maxillary first molar during space closure. Finally, significant signs of bias were identified in non-randomized trials comparing lingual and labial appliances.

CONCLUSION: Based on existing trials, there is insufficient evidence to make robust recommendations for lingual fixed orthodontic appliances regarding their therapeutic or adverse effects, as the quality of evidence was low. Future clinical recommendations should be based on evidence arising from well-conducted randomized clinical trials on lingual appliances.

Registration: Prospero (CRD42015024596)

SP300 HISTORICAL CONTROL GROUPS USED IN ORTHODONTIC RESEARCH ARE ASSOCIATED WITH BIAS

AIMS: The validity of meta-analysis is dependent upon the quality of included studies. The aim of this research was to investigate whether the type of untreated control groups (i.e. source and timing of data collection) influences the results of clinical trials in orthodontic research.

MATERIALS AND METHOD: This meta-epidemiological study used unrestricted literature searching for meta-analyses of clinical interventional trials with untreated control groups in orthodontics. Differences in standardized mean differences (effect size) and their 95 per cent confidence intervals (CIs) were calculated according to the untreated control group through univariable or multivariable random-effects meta-regression, the latter also accounting for the design of the experimental group. The effect of the control group type on the results was then pooled with random-effects synthesis across meta-analyses, followed by mixed-effect subgroup and sensitivity analyses.

RESULTS: After adjusting through multivariable regression for the nature of the interventional group (i.e. prospective or retrospective) and total sample size of the included trials, studies with concurrent control groups reported inflated treatment effects compared to those with historical control groups (effect size = 0.34; 95% CI = –0.22, 0.47; P < 0.001). This bias-introducing effect from historical control groups was of moderate to very large magnitude and was independent of the intervention group’s nature and the trial’s sample size. Finally, these findings were independent of research field (Class II, Class III or transversal discrepancies; P = 0.771) and was robust to publication bias and sensitivity analyses.
CONCLUSION: If historical control groups are included, caution is warranted when interpreting systematic reviews of clinical interventions in orthodontics. In case the inclusion of trials with different control groups is judged appropriate in a meta-analysis, a sensitivity analysis based on their design is justified. Explicit reporting of the control group’s design, preferably in the title or abstract of the report, is essential for its appraisal.

Registration: Prospero (CRD42015024179)

SP301 EFFECTS OF AN OSTEOTOMY OF THE ALVEOLAR PROCESS WITH A PIEZOTOME ON ROOT RESORPTION AND THE ALVEOLAR PROCESS
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AIMS: Corticotomie has been proposed to be an effective and safe method to accelerate orthodontic tooth movement. However, little is known about the impact of the procedure on the osseous tissue and on the periodontium. The aim of this study was to investigate the effect of a corticotomie by means of a piezotome on osseous remodelling at the site of the intervention and on the integrity of the dental roots in combination with orthodontic tooth movement.

MATERIALS AND METHOD: Twelve male Wistar-rats, aged 10 weeks, underwent a vertical corticotomie of the maxillary alveolar process, 2 mm mesial of the first molar on one side, which was randomly determined before force application. Subsequently, the maxillary molars on both sides were combined and moved mesially by means of a closed coil spring which was fixed to both maxillary incisors, delivering a force of 25 cN on both sides for a period of four weeks. Immediately before placement of the orthodontic appliance and again after removal of the appliance, all animals underwent microcomputed tomography (µCT). After four weeks all animals were killed and the upper jaws investigated histologically. The length of the mesial roots of the first molar on either side was determined on each µCT and a ratio of the pre- and post-orthodontic root length calculated. The healing of the osseous wound was assessed after decalcification and histological staining.

RESULTS: In the region where the corticotomie had been performed, only very discrete signs of an osseous trauma were detectable, indicating an advanced healing process. On both sides, apical and lateral root resorptions were detectable histologically. Irrespective of the method, the mesial roots revealed some apical resorption after four weeks in some animals; there was no statistically significant difference between the sides, either with or without piezotome.

CONCLUSION: An almost complete restitution of the osseous tissue after four weeks of healing in combination with orthodontic tooth movement confirms the atraumatic character of the piezosurgical procedure. No advantage with regard to root resorption could be found.

SP302 PATIENTS' PERSPECTIVES TOWARDS ORTHODONTIC TREATMENT: ASSESSMENT OF THEIR EXPECTATIONS – FINDINGS FROM A QUESTIONNAIRE SURVEY
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AIMS: To analyze the psychological aspects of adolescent and adult patients during orthodontic treatment, evaluating their expectations during treatment and comparing Greeks/Italians.

SUBJECTS AND METHOD: This cross-sectional descriptive study involved a sample of 231 patients (114 Italians, 117 Greeks) undergoing fixed or removable orthodontic treatment. A structured questionnaire comprising six questions was used and patients scored each question on a 0-10 visual analogue scale. The participants completed a validated questionnaire measure of orthodontic expectations which was tested for reliability. Descriptive analysis of the responses was undertaken, and comparisons between males and females, as well as between Greek and Italian patients were made. The expectation score was calculated by summarizing the six items (A1 to A6). Reliability analysis was performed using the item-test, item-rest correlation and Cronbach’s alpha. Items with
Chronbach’s alpha coefficients greater than 0.7 were considered acceptable. To investigate the effect of country and gender on expectation score, an univariate analysis was carried out using Wilcoxon’s rank sum test. Differences, with a P-value less than 0.05 were selected as significant.

RESULTS: Overall expectation Cronbach’s alpha coefficient (internal consistency) was 0.73 (95%CI = 0.65:0.81). The mean of expectation items was 7.8 (SD = 1.8). There was a significant very low correlation between item A1 and item A3 (r = 0.17; P-value 0.0101). There was a significant moderate correlation between item A4 and item A6 (r = 0.59; P-value <0.0001).

CONCLUSION: Males showed a significant higher overall score compared to females, as well as Greek patients compared to Italians.

SP303 MORPHOMETRIC COVARIATION BETWEEN PALATAL SHAPE AND SKELETAL PATTERN IN PREPUBERTAL CHILDREN
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AIMS: The palate is located at the interface between two functional matrices, the nasal and the oral cavity. Its shape is affected by numerous factors and it has been related to specific skeletal patterns. The purpose of this research was to assess the covariation between the shape of the craniofacial complex and the palatal shape in prepubertal children.

MATERIALS AND METHOD: In this cross-sectional study, the records of 100 subjects aged 8-10 years were selected from the orthodontic archives. Exclusion criteria were the following: history of orthodontic treatment, crossbite, syndromes of the craniofacial complex, mouth breathing, tooth agenesis (third molars were excluded), finger sucking, torus palatinus. Lateral cephalometric radiographs and upper casts were digitized for each patient and, with a computer-assisted procedure, the craniofacial and palatal shape was evaluated. Procrustes superimposition, and principal component analysis (PCA) was applied for the calculation of shape variability. The shape covariation between palate and craniofacial complex was assessed with partial least squares analysis (PLS).

RESULTS: The first five PCs explained approximately 79 per cent (palate) and 60 per cent (craniofacial complex) of the total shape variability. The first coefficient (PC1) related to palatal height and vertical dimension (high-low angle) included 36 and 24 per cent of total shape variability, respectively. The second coefficient (PC2) related to palatal width and anteroposterior dimension (Class II-III) explained 26 and 14 per cent of shape variability, respectively. Significant covariation was found between the craniofacial and palatal components (RV coefficient: 0.27). The covariation patterns suggest that variation of the craniofacial complex in the vertical direction is related to variation in the height of the palatal vault.

CONCLUSION: The shape of the palate is related to specific skeletal patterns. High-angle subjects tend to have a high-arched palate and, conversely, low-angle subjects have shallow palates. Further research is required to prospectively examine the relationship of these two components.

SP304 COMPARISON BETWEEN RAPID AND MIXED MAXILLARY EXPANSION THROUGH ASSESSMENT OF DENTO-SKELETAL EFFECTS ON POSTEROANTERIOR CEPHALOMETRY
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AIMS: To compare the dento-skeletal effects of rapid maxillary expansion (RME) and mixed maxillary expansion (MME), assessed on posteroanterior (PA) cephalograms.

MATERIALS AND METHOD: The treatment groups consisted of 42 patients, the mean age in RME group (13 females, 8 males) was 8.8 ± 1.37 years at T0 and 9.6 ± 1.45 years at T1, and the mean age in the MME group (12 females, 9 males) was 8.9 ± 2.34 years at T0 and 10.5 ± 2.08 years at T1. Sixteen linear (12 skeletal and 4 dental) and four angular measurements at T0 and T1 were assessed for each patient. Data from the two groups were compared using an independent sample t-test (P < 0.05).
RESULTS: At T0, the groups were similar for all examined variables \((P > 0.05)\). A significant and equal increase of lateronasal and maxillary and upper and lower molar widths \((P < 0.01)\) occurred in both groups at T1. Significant but different increases were observed for maxillary incisal, upper left first molar-latero-orbitale, and maxillary first molar angles \((P < 0.001 \text{ versus } P < 0.05)\). Significant increases were found for upper inter-incisal width apex \((P < 0.001)\) and upper right first molar-latero-orbitale angle \((P < 0.05)\) only in the RME group. At T1, differences in maxillary incisor angle \((P < 0.05)\), upper left first molar-latero-orbitale, and maxillary first molar angles \((P < 0.001)\) were noted.

CONCLUSION: RME and MME were both effective in increasing skeletal transverse dimensions by opening the mid-palatal suture in growing patients, while MME was associated with minor dental side effects compared with RME.

SP305 MODIFICATION OF A MINIMAL INCISION TECHNIQUE REPAIR OF ISOLATED CLEFTS OF THE HARD AND SOFT PALATE – A CEPHALOMETRIC STUDY AT FIVE AND TEN YEARS
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AIMS: To compare the minimal incision (MI) technique with the minimal incision with muscle reconstruction (MMI) technique for repair of isolated clefts of the hard and soft palate regarding cephalometric outcome at 5 and 10 years of age.

SUBJECTS AND METHOD: A consecutive series of 171 Caucasian children born with an isolated cleft palate (ICP) between 1987 and 2005. Individuals with other craniofacial malformations, apart from Pierre Robin Sequence, were excluded. The patients were treated surgically with MI \((N = 86)\) or MMI \((N = 85)\) palatoplasty at a mean age of 13 months, and divided further into two subgroups: clefts within the soft palate only and a notch less than 3 mm in the posterior border of the hard palate (small cleft, \(N = 51\)) and clefts within the hard and soft palate (big cleft, \(N = 120\)). A retrospective evaluation at 5 (mean age 5.4 years) and at 10 (mean age 10.3 years) years of age was performed using lateral cephalograms. Eleven skeletal and one soft tissue measurements were evaluated. Ninety five per cent confidence intervals were calculated and two-way analysis of variance (ANOVA) and three-way ANOVA with repeated measurements on one factor were performed.

RESULTS: Only minor differences in morphology were found between the MI technique groups and the modified MI technique groups, as well as among small and big cleft lengths when lateral cephalograms were evaluated. At 5 years there was an increased inclination of the palatal plane in the big cleft group. There was also decreased hard tissue convexity in the MMI big cleft group and a longer mandibular length in the small cleft group. At 10 years there was an increased inclination of the palatal plane, longer palatal length and increased upper facial height ratio in the MMI group.

CONCLUSION: The craniofacial cephalometric morphology at 5 and 10 years of age in patients with an ICP did not differ between the original and the modified MI technique (MI, MMI) or extension of the cleft.

SP306 AN ATOMIC FORCE MICROSCOPY INVESTIGATION OF SURFACE ROUGHNESS CHANGES OF WHITE-COATED NICKEL TITANIUM WIRES BY THE SLIDING TEST
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AIMS: Atomic force microscopy (AFM) has been widely accepted in the study of the surface roughness of wires. AFM provides quantitative information about surface roughness and appears to be the most suitable method for investigation of surface topography. The purposes of the present study were to investigate in vitro the changes in surface roughness of white-coated wires before and after sliding movement using AFM.

MATERIALS AND METHOD: The prepared archwires were divided into four experimental groups and combined with two different types of orthodontic brackets including 0.022 × 0.028 inch stainless steel (A company, GAC, New York, USA) and ceramic (Crystalline MB, Tomy, Shinmachi, Japan)
brackets. The four types of 0.014 inch orthodontic wires contained a non-coated nickel titanium (NiTi) archwire (Sentalloy®, Tomy) and three types of coated NiTi archwires; specifically, epoxy resin-coated Ultraesthetic™ (G&H® Wire company, Greenwood, Indiana, USA), Teflon-coated Perfect (Hubit, Seoul, Korea), and Ag and biopolymer-coated Dany aesthetic silver (Dany BMT, Seoul, Korea). Two brackets of the same kind were attached to an acrylic block utilizing a dental adhesive. A self-made tensile strength tester consisting of a 2000 g miniature load cell and a syringe pump pulled the archwires across the brackets at a speed of 15 mm/minute for 15 seconds. The surface roughness of each archwire was determined by AFM.

RESULTS: The roughness of all investigated NiTi wires increased significantly by the sliding tests. Moreover, the surface of the wires that underwent a sliding test on metallic brackets was rougher than that of wires subjected to a sliding test on ceramic brackets. Before the sliding tests, Perfect NiTi showed the lowest surface roughness of the four investigated wire types. After the sliding tests, Ultraesthetic™ NiTi showed the lowest surface roughness when using metallic brackets for the sliding test, and Perfect NiTi showed the lowest surface roughness after the sliding test on ceramic brackets. Furthermore, the surface of white-coated NiTi wires, except for Dany aesthetic silver, was not rougher than that of uncoated NiTi wires.

CONCLUSION: There is no reason not to use white-coated NiTi wires because of the friction between the archwire and the bracket.

SP307 PREDICTION OF THE NEED FOR ORTHOGNATHIC SURGERY IN PATIENTS WITH A CLEFT LIP AND/OR PALATE
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AIMS: To determine the cephalometric variables that can predict the future need for orthognathic surgery or distraction osteogenesis in Korean male patients with non-syndromic cleft lip and alveolus (CLA) and unilateral (UCLP) and bilateral cleft lip and palate (BCLP).

SUBJECTS AND METHOD: One hundred and thirty one patients treated by one surgeon and one orthodontist using identical protocols were divided into a CLA group (n = 35), a UCLP group (n = 56), and a BCLP group (n = 40). Lateral cephalograms were taken before secondary alveolar bone grafting (T0; mean age, 9.3 years) and at a minimum of 15 years of age (T1; mean age, 17.3 years). The cephalometric variables of these cephalograms were measured. At T1, three cephalometric criteria were used to divide the subjects into surgery and non-surgery groups (ANB < = –3 degrees; Wits appraisal < = –5 mm; Harvold unit difference > = 34 mm for the surgery group). The feature wrapping method was used to determine the cephalometric variables at T0 for a prediction model.

RESULTS: At T1, 27 (20.6%) of the 131 subjects required surgical intervention to correct their sagittal skeletal discrepancies. Frequency was significantly different among the CLA, UCLP and BCLP groups [8.5%, 21.4% and 30.0%, respectively; P < 0.05; (CLA, UCLP) < (UCLP, BCLP)]. A total of 10 cephalometric variables at T0 were selected as predictors, and weighted classification accuracy was 77.3 per cent.

CONCLUSION: The frequency of surgical intervention increased with cleft severity. Ten cephalometric variables might be regarded as effective predictors of the future need for surgery to correct sagittal skeletal discrepancies.

SP308 BIOMECHANICAL ANALYSIS OF DISTALIZATION OF MANDIBULAR TEETH WITH MINIPLATE ANCHORAGE USING THE FINITE ELEMENT METHOD
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AIMS: To evaluate distalization movement of mandibular teeth according to different force application positions and levels in each tooth with miniplate anchorage using the finite element (FE) method.

MATERIALS AND METHOD: Three-dimensional computed-tomography images of the patient’s mandible and tooth alignment were used to reconstruct the mesh model for the FE analysis. The mesh model reflected the biomechanical characteristics of the periodontal ligament and alveolar bone. Brackets, the archwire and the miniplate were constructed in the mesh model. The mechanical properties of each part were set in the mesh model. The force for tooth distalization was applied on the mandibular canine and first molar at two different levels of each tooth: the bracket level and the cementoenamel junction level.

RESULTS: A. Force application at the bracket level. The force application on the mandibular canine showed more similar displacement amounts on the mandibular first, second molar and second premolar. Force application on the mandibular first molar caused tipping movement of the mandibular first and second molar. B. Force application at the cementoenamel junction level. Force application on the mandibular canine showed a similar movement tendency on the mandibular first molar and first and second premolar than force application on the mandibular first molar. Movement of mandibular second molar was more bodily in force application on the mandibular canine.

CONCLUSION: Force application on the mandibular canine for mandibular tooth distalization caused a similar root movement tendency than the force on the mandibular first molar at two different force levels. It could be considered that the force application on the mandibular canine was the result of tooth distalization with more bodily movement.

SP309 AN AUDIT ON THE USE OF MOUTHGUARDS IN ORTHODONTIC PATIENTS PRE-TREATMENT
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AIMS: This audit aimed to establish if mouthguards are used during contact sports by children requiring orthodontic treatment, prior to commencing treatment. It also assessed for which sports mouthguards are worn, the type of mouthguards used and any barriers to their use.

SUBJECTS AND METHOD: Patients under the age of 19 years, attending new patient record appointments were included in the audit and data was collected prospectively until 100 patients had been included. Data collection was via a questionnaire comprising 10 questions relating to mouthguard wear and sports participation. The gold standard was that 100 per cent of children should wear a mouthguard whilst playing contact sports.

RESULTS: Of the 100 patients included in the audit 47 were male and 53 were female, with an average age of 13.2 years. Twenty nine patients had previously sustained dental trauma, of which 14 had sustained trauma during sport. Dental trauma was most common in football (4 patients), followed by hockey (2 patients), basketball (2 patients) and gymnastics (2 patients). Eighty four subjects reported playing sport, the most common sports being football, basketball, swimming, netball and rugby. Of these 84 patients always wore a mouthguard (4.8%), 15 sometimes wore a mouthguard (17.8%) and 65 (77.4%) never wore a mouthguard. Of the 19 patients who wore mouthguards 18 used shop bought mouthguards and one used a custom made mouthguard. The most common reason for not using a mouthguard was the patient being unaware that one was needed (95.4%). Other reasons included the mouthguard being lost, uncomfortable or the patient did not feel they could play sport as well with a mouthguard (1.5% each).

CONCLUSION: Mouthguard wear was much lower than the gold standard with the main reason being that patients were unaware that mouthguards were needed. The incidence of trauma in patients who wore mouthguards was lower than in those who did not. Shop bought mouthguards were the most commonly used. It is recommended that clinicians always ask patients about their participation in sports and routinely recommend the use of a mouthguard.

SP310 SOFT TISSUE CHANGES AFTER UPPER INCISOR PROTRUSION IN CLASS II DIVISION 2 MALOCCLUSIONS
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AIMS: Orthodontic treatment influences the soft tissues, however controversy remains concerning the precise soft tissue response to changes in tooth position. The aim of this study was to evaluate the soft tissue changes after incisor protrusion with a utility arch.

SUBJECTS AND METHOD: Twenty patients (12 males, 8 females, mean age 10.29 ± 0.90 years) with a Class II division 2 malocclusion. The mean values of SNA (°), SNB (°), ANB (°) and FMA (°) were 80.80, 74.80, 5.99 and 21.1, respectively. The right and left posterior segments were joined by a transpalatal bar for additional anchorage. A protrusion utility arch (0.016 × 0.022 inch blue elgiloy wire) was constructed and inserted after initial alignment of the upper incisors with a prefabricated utility arch (0.014 inch nickel titanium wire). Lateral cephalograms of each patient were taken at the beginning and end of treatment. Each cephalogram was traced and 1-FH (°), IMPA (°), interincisal angle (°), overjet (mm), overbite (mm) and upper central incisor exposure (mm) were measured. Soft tissue measurements were nasolabial angle (°), upper and lower lip thickness (mm) and lip length (mm). While upper lip length was measured from subnasale to stomion superior, lower lip length was measured from stomion inferior to menton. Upper and lower lip thicknesses were measured from the most prominent point of the lips to the most labial point of the upper incisor and lower lip inside, respectively. Descriptive statistics were calculated. The paired sample t-test was applied for intragroup differences. Statistical significance was set at a level of P < 0.05.

RESULTS: A significant decrease in interincisal angle, overbite, upper lip thickness, lower lip length and nasolabial angle values were observed. The increase in 1-FH, IMPA, overjet and lower lip thickness measurement were found to be statistically significant at the end of treatment. There were no statistically significant differences between upper central incisor exposure and upper lip length measurements.

CONCLUSION: Incisor protrusion significantly affects most of the soft tissue measurements. Clinicians should be aware of the observed soft tissue changes during their treatment planning.

SP311 PATIENTS’ AND PARENTS’ PERCEPTION OF VARIOUS FUNCTIONAL APPLIANCES: A PILOT STUDY
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AIMS: To evaluate patients’ and parents’ perception of rigid, semi-rigid and non-rigid functional appliances and to compare their impact on anxiety and discomfort during treatment in different age groups and genders.

MATERIALS AND METHOD: A self-administered questionnaire was used to quantify patients’ and parents’ perceptions. Three groups were formed regarding the type of functional appliance used: rigid (Functional Mandibular Advance), semi-rigid (Forsus Fatigue Resistant Device) and non-rigid (Twin-Block). Two separate questionnaires were used for the patients and their parents comprising the necessary context. Chi square, Mann Whitney U, Kruskal Wallis and non-parametric correlations were used to analyze the data obtained.

RESULTS: No correlation was found for different genders. Patients needed less time to adapt to the semi-rigid appliance. Eating difficulties were encountered by patients in the rigid group. In the semi-rigid group, a direct correlation was observed between pain level and age. From the psychological aspect, the semi-rigid appliance was found to produce less negative effects. Adolescents who had completed functional orthodontic treatment with a non-rigid appliance had difficulties in controlling their saliva during function. Patients’ and parents’ perceptions were found to be in accordance with each other.

CONCLUSION: Adolescents who had completed functional orthodontic treatment with more rigid appliances had more difficulty in their daily life. Orthodontists should be aware of this impact caused by functional orthodontic treatment and regularly encourage patients with the positive outcomes.
SP312 AN AUDIT TO ASSESS AND IMPROVE THE STANDARDS OF CLINICAL PHOTOGRAPHY IN ORTHOGNATHIC SURGERY
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AIMS: To assess the quality of extra-oral photographs taken for orthognathic planning against the gold standard and implement changes where these standards are not met. This was a two cycle prospective audit looking at 50 sets of extra-oral photographs. The first cycle completed in June and the second cycle following training completed four months later in October. The gold standard was that each extra-oral photograph complied with specific criteria laid out by the researched literature. The aim was that 90 per cent of all photographs should comply with the laid out criteria.

MATERIALS AND METHOD: Fifty sets of consecutive extra-oral photographs were selected from the database. These were marked against a standards sheet by three orthodontic consultants. The results were collated and tabulated and presented to the staff along with appropriate teaching at a departmental clinical governance meeting. The audit was then repeated three months later and the results were presented at a further meeting.

RESULTS: The first cycle yielded generally poor results with only five criteria being fulfilled to the gold standard. Following the implementation of training the second cycle yielded far superior results with all photographs reaching the gold standard.

CONCLUSION: The use of clinical photography as a tool or orthognathic planning is invaluable. However it should be recognized that appropriate training in its use should be given or available for all levels of staff. In doing so the quality and value of photographs obtained can be optimized and not detract from their clinical use.

SP313 AN AUDIT OF THE EFFECTIVENESS OF A MANAGED CLINICAL NETWORK DEVISED AND IMPLEMENTED REFERRAL FORM IN SHROPSHIRE
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AIMS: To assess the appropriateness of orthodontic referrals received from primary care into the orthodontic department at Royal Shrewsbury Hospital (RSH) and to assess the validity of the referral form created and implemented by the orthodontic Managed Clinical Network (MCN). This was a two cycle prospective audit looking at all referrals into the orthodontic department at RSH over a two-year period. The first cycle completed in December 2013 and second cycle following implementation of the MCN referral form completed in December 2014. The gold standard was that all orthodontic referrals made to RSH should be in accordance with local and national guidelines. The target was that 100 per cent of all referrals should be of an appropriate nature.

MATERIALS AND METHOD: Data was collected for referrals received in 2013. This included the source of the referral, reason for referral and whether the referral was accepted or rejected. A referral form was created by the local orthodontic MCN lead by the consultant head of orthodontics at RSH. This was distributed widely to all referring practices. A second set of data was then collected following on from a year after the new referral form had been implemented.

RESULTS: The first cycle showed that from the referrals received 10.2 per cent of the total number were rejected and a significant number of referrals were for treatment planning purposes. A referral form was created by the local orthodontic MCN lead by the consultant head of orthodontics at RSH. This was distributed widely to all referring practices. A second set of data was then collected following on from a year after the new referral form had been implemented.

RESULTS: The first cycle showed that from the referrals received 10.2 per cent of the total number were rejected and a significant number of referrals were for treatment planning purposes. The second cycle revealed a significant reduction in the total number of referrals to the hospital but that a similar proportion were still rejected. There was however a significant reduction in the number of referrals received for treatment planning.

CONCLUSION: The use of a MCN identified a local issue with the referral process within the Shropshire region and effectively implemented a process to help mitigate this problem. Although there was no significant reduction in the percentage of overall referrals being rejected from the hospital, the form did streamline the referral process by reducing the overall number of referrals received to just under 50 per cent and preventing the use of the hospital service as a treatment planning service.
SP314 ACCURACY AND RELIABILITY OF MAXILLARY FIRST MOLAR INCLINATION MEASUREMENT USING THREE-DIMENSIONAL DIGITAL MODELS
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AIMS: The use of cone-beam computerized tomography (CBCT) to determine molar inclination, although accurate and reliable, is costly and requires a machine with a voxel large enough to cover the necessary anatomical references in the maxillary arch leading to unnecessary radiographic exposure. Three methods have been developed to measure molar inclination from a three-dimensional digital model. The aim of this study was to assess the accuracy and reliability of maxillary first molar inclination measurements with these three methods with reference to CBCT.

MATERIALS AND METHOD: Maxillary dental casts and CBCT data from 10 orthodontic patients. Three anatomical reference planes were determined on each CBCT and model. These planes were used to construct a repeatable and symmetrical mid-sagittal line. Right and left maxillary first molar inclination was measured from angles constructed from lines drawn from different first molar anatomical landmarks [buccal cusp-palatal cusp (B-P); buccal cusp-buccal cemento-enamel junction (B-Bcej); central groove-midpoint of bucco-palatal width (CG-BPW) intersecting with the mid-sagittal line]. Pearson’s correlation tests were used to assess the accuracy of three measurements from digital models with reference to those from CBCT, whereas paired t-tests were used to determine the reliability of digital model measurements which were measured twice with a two week interval. The level of significance was set at \( P < 0.05 \).

RESULTS: Molar inclinations measured from B-Bcej to the mid-sagittal plane showed the highest correlation with the same angle measured from the CBCT (\( r = 0.93, P < 0.05 \)). Paired t-tests showed a non-significant difference between measurements indicating good reliability (\( P > 0.05 \)).

CONCLUSION: The angle between the B-Bcej line and the mid-sagittal line measured from digital models can be used to determine first molar inclination from digital models with good accuracy and reliability in reference to CBCT.

SP315 EVALUATION OF AN ORTHODONTIC PROBLEM WITH THE AID OF CONSTRUCTIVE ALIGNMENT
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AIMS: To evaluate a problem with the aid of constructive alignment i.e. the interrelationship between the selected problem, learning objectives, process variables and students’ achievements. The dental undergraduate programme in Malmö has a thematic structure. During course 8, students take care of children and adolescents for the first time. Seminars for the whole class are based on students’ questions formulated in the study groups. Summative assessment during the end of the course is based on clinical cases. It is crucial that problems in Problem Based Learning are effective in helping students to learn and understand a topic thoroughly. Constructive alignment is a system in which different components such as learning objectives, educational methods and assessment procedures should align to each other.

SUBJECTS AND METHOD: The sample consisted of one student cohort. The problem was presented as a text ‘Jens, aged 10, has had an orthodontic appliance for half a year. He notices that his teeth have moved and that the teeth used to hurt a few days after the dentist had activated the appliance. Now, Jens sits in the waiting room and he plans to ask the dentist if the treatment will be quicker if he comes more frequently to have the appliance activated.’ The problem is planned to align to the learning objectives ‘the student should be able to explain how the oral tissue reacts to orthodontic tooth movement and the side effects of this tooth movement’. Hypotheses and seminar questions were written in a data platform by each study group and were analyzed. Students’ answers to examination questions were assessed using the SOLO-taxonomy. Finally, students’ self-reports on their achievement regarding the learning objective were analyzed.

RESULTS: All groups formulated problems to ‘Jens’ that were aligned with the actual learning objective. The hypotheses quality varied and several were not complete. Most groups formulated
hypotheses with a biological and a clinical approach. The seminar questions were mainly focused on cellular events during orthodontic tooth movement. A majority of the students (95%) passed the written examination. About 90 per cent stated that they reached the actual learning objective.

CONCLUSION: Principle constructive alignment worked well to evaluate the relevance and characteristics of a problem.

SP316 EVALUATION OF MAXILLARY ARCH MORPHOLOGY IN CHILDREN WITH UNILATERAL IMPACTED INCISORS VIA THREE-DIMENSIONAL ANALYSIS OF DIGITAL DENTAL CASTS
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AIMS: To analyze variations in maxillary arch dimensions in subjects presenting unilaterally-impacted maxillary permanent central incisors (IIG) compared with a control group of subjects without eruption anomalies.

SUBJECTS AND METHOD: Twenty three Caucasian children (8 females, 15 males, mean age 9.7 years SD 1.6 years) displaying IIG were compared with a control group (CG) of 23 subjects (9 females, 14 males, mean age 8.8 years SD 1.9 years) presenting no eruption disorders. Pre-treatment dental casts were taken from each subject and the upper arch was scanned using a three-dimensional scanner. Linear measurements were taken on each digital model to analyze maxillary arch dimensions. Significant between-group differences were tested with the Student’s t-test (P < 0.05).

RESULTS: The transverse and sagittal upper arch measurements were significantly smaller in the IIG subjects than in the CG. In particular, the IIG’s anterior arch was 1.35 mm shorter, while intercanine width was decreased by 2.51 mm on the impacted side.

CONCLUSION: Children revealing IIG demonstrated a significantly constricted maxillary transverse width and shorter arch on the impacted side compared with subjects with no eruption disorders.

SP317 ENHANCING ORTHODONTIC TREATMENT IN SURGICAL CASES: AN ORTHODONTIC PROTOCOL FOR THE PROCEDURE OF SURGERY FIRST
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AIMS: Surgery first (SF) in orthognathic surgery is, in contrast to a conventional protocol, a procedure where orthodontic alignment and settling of the dental arches are undertaken after surgery is carried out. Advantage is taken of the regional accelerating phenomenon generated by the surgical intervention, selective alveolar corticotomies and particulate bone grafting. This process is stated to enhance tooth movements up to 3 months after surgery resulting in shortening of the total treatment time. The aim of this pilot study was to evaluate an orthodontic protocol appropriate for the SF principle.

SUBJECTS AND METHOD: Eight patients (7 females, 1 male) were planned for SF. Their mean age was 24.5 years (SD = 8.9). The type of surgery varied: four patients having bilateral sagittal split and LeFort 1, three a LeFort 1 and one a bilateral sagittal split. Pre-surgical preparation consisted of bands on the first molars, brackets in both jaws on the remaining teeth, adaptation of 0.014 CuNiTi wires, transpalatal and lingual arches for post-surgical insertion. Treatment planning was carried out as model surgery and virtual planning. Surgical splints were fabricated. The surgical procedure included, besides the osteotomies, corticotomies and bone grafting in one or both jaws depending on the type of surgery and insertion of skeletal anchorage (miniscrews and anterior wires). Surgical splints were used for positioning of the jaws and were left post-surgery or removed after osteosynthesis on an individual basis. Intermaxillary elastics were inserted on the skeletal anchorage. After 2 weeks the orthodontic wires were inserted and elastics were used individually to settle the occlusion, often using the skeletal anchorage.

RESULTS: During the first 3 month post-surgery considerable settling was reached and uprighting of the roots was achieved.

CONCLUSION: Although treatment intensity is high in the following three post-surgery months, treatment time seems to be reduced. Even with planning, the surgical procedure and post-surgical
orthodontics are more complicated. Following the present protocol SF is a safe procedure expecting to shorten treatment time.

SP318 ASSOCIATION OF THE DIMENSIONS OF THE MANDIBULAR SYMPHYSIS ACCORDING TO DIFFERENT FACIAL PATTERNS
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AIMS: To analyze the relationship between mandibular symphysis morphology according to different facial patterns.
MATERIALS AND METHOD: Lateral cephalometric radiographs, from the diagnostic records of 385 patients who required orthodontic treatment were measured. They were divided into three groups depending on their skeletal Class: Class I, II and III according to ANB angle and Wits appraisal, and depending on their facial pattern into dolicofacial, mesofacial and brachyfacial according to Ricketts’ facial axis.
RESULTS: In general, for the angle B1-B-Gn and ID-B-Pg lower values were found in dolicofacial patients. For the angle B-Pg-Me, convexity of the symphysis indicator, the opposite was found: higher values for the group of dolicofacial patterns, followed by mesofacial and brachyfacial. Regarding angle B-Pg-Mb, the value was similar for the three groups, being slightly higher in the group of dolico facial patterns, followed by mesofacial and brachyfacial patterns.
CONCLUSION: Both linear and angular symphysis measurements were related to the patient’s facial pattern separately. Linear measures B-PG, PG-I and PG I- B/Me and angular B-B1-Gn and ID-B-Pg are also related by interactions of the malocclusion Class and skeletal facial pattern of the patient.

SP319 EARLY ORTHODONTIC TREATMENT IN PATIENTS WITH CLEFT LIP AND PALATE: A RETROSPECTIVE STUDY
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AIMS: To describe the effect of both timing and procedure of early orthodontic treatment on development of the dental arches in young patients affected by a cleft lip and palate (CLP).
SUBJECTS AND METHOD: Seventy-six consecutive patients, with several types of orofacial cleft, referred between 2004 and 2015. Data recorded included date of birth, gender, type of cleft, number of dental casts and age at the time of follow-up observations. Patients were subclassified according to the type of cleft: 1) Unilateral CLP (UCLP); 2) Bilateral CLP (BCLP); 3) Cleft palate (CP); 4) Cleft soft palate (CSP). Dental casts were analyzed before orthodontic treatment (T0) and after early orthodontic treatment (T1). Dental cast evaluation was performed with regard to: 1) maxillary arch widths, measured with a millimeter calliper: intermolar arch width, measured as the distance between the mesiobuccal cusp tips of the first molar, and intercanine arch width, measured as the distance between the cusp tips; 2) dental arch relationships, according to the modified Huddart/Bodenham (HB) system. This numerical scoring system requires all maxillary teeth to be scored according to their buccolingual relationship to the corresponding mandibular tooth, except for the lateral incisors, which may be missing or in an abnormal position in CLP subjects. The sum of the scores ranges from to +10 to −30 and it reflects the maxillary arch constriction. Statistical analysis: comparisons between T0 and T1 were made with dependent t-tests for direct measurements ($P < 0.05$) and with Wilcoxon’s test for HB scoring ($P < 0.05$).
RESULTS: A significant statistical difference was observed for all the variables evaluated at T0 and T1. In particular, median HB total score at T0 was −7, median HB total score at T1 was −1 ($P = 0.004$). Patients starting orthodontic treatment before 6 years of age had a better outcome ($P < 0.05$).
CONCLUSION: In this series of patients, early orthodontic treatment strongly improved the dental arch relationship. It would seem advisable to start orthodontic treatment when patients are younger than 6 years.
SP320 LITERARY REVIEW OF THE POSSIBLE RELATIONSHIP BETWEEN SELLA TURCICA BRIDGING AND DENTAL ANOMALIES

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AIMS: To study the literature available about the relationship between the shape and bridging of the sella turcica with malocclusions and dental alterations.

MATERIALS AND METHOD: Medline and Cochrane databases were reviewed to November 2015 using the keywords: sella turcica dental anomalies, impacted canines sella turcica, sella turcica bridging. Of the 68 articles found only 12 were deemed useful. No chronological criteria was applied.

RESULTS: Sella turcica has been used for cephalometric analysis in orthodontics due to its availability within the radiographic registries necessary for diagnosis. It has been reported that more information could be obtained from the study of the shape and size of this anatomical structure. Alterations have been reported to be related to craniofacial anomalies, pituitary gland pathologies and various syndromes. It has also been found to have an association with a skeletal Class III malocclusion. More recently, there have been studies describing a possible relationship between an alteration of shape and the presence of local dental variations such as transpositions, hypodontia and impacted canines.

CONCLUSION: There are insufficient studies for any definitive conclusions but those that have been published indicate a higher incidence of bridging in the sella turcica of patients with a Class III malocclusion, hypodontia, transposition, impacted canines or second mandibular premolar agenesis.

SP321 ELEMENTAL COMPOSITION ANALYSES OF THERMALLY ACTIVATED ORTHODONTIC ARCHWIRES BY LASER-INDUCED PLASMA SPECTROSCOPY

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AIMS: It is known that nickel-titanium (NiTi) alloy can become thermally sensitive when a certain quantity of copper is added. In this new alloy the transition temperature from the martensitic to the austenitic phase is decreased to the temperature in the oral cavity. The purpose of this study was to examine the elemental and quantitative compositions of thermally activated orthodontic archwires by laser-induced plasma spectroscopy (LIPS).

MATERIALS AND METHOD: Three nitinol heat activated archwires (3M Unitek, Monrovia, California, USA) and three copper (Cu) NiTi archwires (Ormco Corp., Glendora, California, USA), with dimensions of 0.016 × 0.022 inches were examined. Each archwire was investigated in the areas of the central incisors, the canines and 20 mm at the end of the archwire. Elemental composition was obtained via LIPS for qualitative and quantitative analysis. This was performed in the following way: a powerful pulsed laser was focused on the surface of the sample, causing laser ablation of the material and formation of plasma. The laser-induced plasma contain excited atoms and ions from the sample. These excited species emit light at wavelengths characteristic of the elements in the sample. The light is registered and analyzed with spectral equipment, which allows determination of the elemental composition of the sample. The registered spectra from the samples of the pure Ti, Ni and Cu were compared with the measured spectra of the analyzed archwires.

RESULTS: LIPS analysis indicated the presence of Cu in the archwires produced by Ormco and an absence of Cu in the archwires produced by 3M Unitek. The amount of Cu in the archwires produced by Ormco corresponded to published data.

CONCLUSION: The common opinion that the lower transition temperature of archwires is due to the addition of Cu is not valid for nitinol heat activated archwires. It is likely that the decrease in transition temperature is a consequence of the special metallurgical treatment of the alloy.

SP322 DIFFERENTIAL SCANNING CALORIMETRIC STUDIES OF USED THERMALLY ACTIVATED ORTHODONTIC WIRES
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**AIMS:** The conditions in the oral cavity are very aggressive and suggest a rapid ageing of metal orthodontic materials, affecting the morphology, structure and their mechanical properties. The purpose of this study was to investigate the influence of the duration in the mouth on phase transition processes of thermally activated orthodontic wires.

**MATERIALS AND METHOD:** Six orthodontic wires: three Nitinol heat activated archwires (3M Unitek, Monrovia, California, USA) and three CuNiTi archwires (Ormco Corp., Glendora, California, USA), with dimensions of 0.016 × 0.022 inches. Two of them were as-received and the others were used for up to 6 weeks and over 8 weeks. Each archwire were sectioned into 5 mm segments and analyzed with differential scanning calorimetry method (DSC).

**RESULTS:** The as-received Nitinol heat activated and CuNiTi archwires did not demonstrate qualitative or quantitative phase transformation behaviour differences. The orthodontic wires showed qualitative thermal curve differences when they had been used for treatment. The DSC method is very useful to determine the degradation of superelastic properties of wires during orthodontic treatment.

**CONCLUSION:** The temperature fluctuations in the oral environment may cause qualitative and quantitative phase transformation changes of thermally activated orthodontic wires.

**SP323 FREQUENCY OF WHITE SPOT DEMINERALIZATION IN PATIENTS TREATED WITH FIXED ORTHODONTIC APPLIANCES**

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**AIMS:** Demineralization of tooth enamel is still one of the main complications of orthodontic treatment. The aim of this study was to determine the incidence and location of white spot lesions (WSL) in patients treated with fixed archwire orthodontic appliances.

**SUBJECTS AND METHOD:** Eighty one fixed orthodontic patients were examined. All fulfilled the following criteria: no previous orthodontic treatment, no systematic diseases, no chronic medication and no dental anomalies. The subjects were divided into four groups. The prevalence of WSL was evaluated using a clinical evaluation index for scoring visible WSL.

**RESULTS:** In most cases demineralization was found on the maxillary incisors and mandibular molars. Females were less frequently affected than males, probably because of better oral hygiene. The duration of orthodontic treatment was correlated to enamel demineralization.

**CONCLUSION:** There is a correlation between oral hygiene status and WSL on tooth enamel surfaces. These lesions often develop in patients treated for longer than 12 months.

**SP324 INVESTIGATION OF THE MAGNETIC PROPERTIES AND CHARACTERIZATION OF TITANIUM–NIOBIUM WIRES USED IN ORTHODONTIC TREATMENT**

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**AIMS:** Titanium-niobium (TiNb) alloys are widely used in biomedicine, such as orthopaedic reconstructive surgery, implantology. The reasons are the materials properties: high biocompatibility, low elastic modulus, large superelasticity range, shape memory effect and corrosion resistance. Recently this material has found application in orthodontics. TiNb shows similar characteristics to titanium molybdenum alloy (TMA), that can make it an alternative. The stiffness of TiNb is 14 per cent higher than TMA and 70 per cent less than stainless steel. This makes them
extremely useful in the finishing stages of treatment. It is known that the TiNb shows superconducting properties. Similar alloys are most widely used for preparation of superconducting wires used as a winding of the coils, which can produce magnetic fields as high as about 10 T at liquid helium temperatures. Such coils are used in most magnetic resonance imaging (MRI) systems. The aim of this study was to characterise TiNb wires used in orthodontic treatment and investigate its magnetic properties.

MATERIALS AND METHOD: In the present work, the elemental composition and structure of the TiNb archwire was investigated. The analyses were carried out using the independent techniques: X-ray diffraction analysis, scanning electronic microscopy, energy-dispersive X-ray analysis. The magnetic properties were tested at extremely low and room temperature. The wire used for the windings of the superconducting coils differs from that used for dental proposes only by applied heat treatment, which introduces α-Ti phase precipitations, which increases the reduced current carrying capacity of the wire.

RESULTS: The composition of the wire was Ti-57.15 wt% and Nb-42.85 wt%. Magnetic studies of the low temperature properties of the archwires showed that the material possessed superconducting properties with transition at about 9 K to zero resistant state. The above superconducting transition, material is paramagnetic with a very low susceptibility value. Because of the lack of α-Ti precipitation, the critical current of archwires is very small which make it impossible to apply as a conductor.

CONCLUSION: At body temperature there are no magnetic properties in the TiNb alloys. This latter technique seems to be very promising for the study of martensitic transition at room temperature, where shape-memory properties are established.

SP325 EVALUATION OF SAGITTAL TOOTH POSITION CHANGES WITH THE USE OF SKELETAL FROG APPLIANCE

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AIMS: Recent trends for non-extraction treatment require more frequent use of appliances for distalization of molars, such as the Pendulum, Distal Jet and First Class. It is known that the use of these devices is associated with a loss of anchorage, which results in mesialization of canines and premolars and proclination of the incisors. The most reliable method for overcoming this problem is the use of skeletal anchorage. The appliance 'skeletal Frog' combines mini-implants, located in the anterior paramedian region of the palate, and distalizing springs fixed for distalizing screw. The aim of the study was to determine sagittal tooth position changes when using this appliance.

SUBJECTS AND METHOD: Thirty one patients with Class II molar relationships. Lateral cephalograms before treatment and at the and of distalization were measured. For this purpose the methods proposed by Kinzinger et al. were modified.

RESULTS: The average distalization of the first permanent molars at the cementoenamel junction (CEJ) was 3.27. The upper second permanent molars distalized an average of 2.69 mm. The first and second premolars moved distally an average of 1.39 and 1.88 mm, respectively at the CEJ. Also, the canines moved distally an average of 1.29 mm. The incisal edge of the central incisor moved palatally an average of 0.99 mm. There was a statistically confirmed decrease of the values of the angles between the axes of the teeth and the SN plane. The second permanent molars tipped distally an average of 11.31 degrees, the first permanent molars an average of 7.92 degrees, the second premolars an average of 6.43 degrees and the first premolars an average of 6.75 degrees. Also, the canines tipped distally an average of 5.84 degrees. The incisors retroclined an average of 2.58 degrees.

CONCLUSION: Due to the use of skeletal anchorage and the fact that the premolars are free from the appliance, distalization of the premolars and canines was observed simultaneously with molar distalization. Retroclination of the incisors makes the skeletal Frog an appropriate appliance for treatment of the patients with protrusion of the upper incisors.
TOOTH AGENESIS AND OROFACIAL CLEFTING: GENETIC BROTHERS IN ARMS? A SYSTEMATIC REVIEW
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AIMS: To search the literature in a systematic way to identify the human genes reported so far to cause (or contribute to) tooth agenesis and combined syndromic or non-syndromic orofacial clefting; to gain insight into the molecular and cellular mechanisms explaining the dual involvement in tooth development and palatogenesis, with the ultimate goal to provide molecular diagnoses, leading to precision genetic therapy and/or preventive strategies for tooth agenesis and orofacial clefting.

MATERIALS AND METHOD: The systematic literature search was performed by using PubMed and EMBASE. In each database, three separate searches were performed based on the terms genetics, orofacial clefts and tooth agenesis. The articles were included when evidence was provided on human genes or genetic loci which disruption lead to tooth agenesis and orofacial clefts, with or without other phenotypes. Based on these criteria, 91 articles could be included.

RESULTS: From the 91 articles, the following 25 genes were found to play a role in the combined phenotype of interest: MSX1, PAX9, IRF6, KMT2D, KDM6A, CHD1, CDH7, FGFR1, FGF8, SATB2, TBX22, TFGA, TGFBR3, TGFBR1, TGFBR2, TP63, AXIN2, WNT3, WNT5A, TWIST1, BCOR, OFD1, PTC1, PITX2, PVRIL1. The majority of the functions and tissue-specific expression of these genes is clustered around six cellular and molecular functions such as patterning, proliferation, differentiation, migration, adhesion and transcription regulation.

CONCLUSION: The findings provide clues on six mechanisms (partially) underlying the overlapping occurrence of tooth agenesis and orofacial clefts. These six clustered functions should be further refined using three-dimensional molecular and cellular modelling in order to better explain their specific role.

COMPARISON OF LOAD-DEFLECTION CHARACTERISTICS BETWEEN BENT NICKEL TITANIUM AND HEAT-ACTIVATED NICKEL TITANIUM WIRES
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AIMS: To compare the natural characteristics of load-deflection rate between nickel titanium (NiTi) with bends and heat-activated NiTi with different amount of deflection.

MATERIALS AND METHOD: The three-brackets bend test was performed with an Intron universal testing machine (Ametek Lloyd Instrument Ltd., Hampshire, UK) at 37°C environment with a 10 N load cell and a crosshead speed of 1 mm/minute. Two brackets were bonded on an acrylic block with an 8 mm span and the central one was bonded on the acrylic crosshead. A 0.012 inch bent superelastic NiTi (SuperElastic Regular Force, Highland Metals) with the placement of bends at 1 and 2 mm were tested and compared with 0.012 inch heat-activated NiTi (Biostarter, Forestadent) at the same amount of deflection at 1, 2 and 3 mm with a tested deactivation distance of 0.5 mm. The specimens consisted of three wires/group (N = 3) and the activation was repeated three times. The normality test was achieved using Shapiro-Wilk test. The mean deactivation forces between groups were compared by ANOVA (P < 0.05).

RESULTS: No hysteresis presented from 1 and 2 mm bent NiTi and heat-activated NiTi at 1 mm deflection. At 2 and 3 mm deflection, all groups expressed the hysteresis characteristics. Mean deactivation forces from all groups were normally distributed. Statistical analysis revealed that 1 and 2 mm bent NiTi produced significantly lower force than heat-activated NiTi at all deflections (P < 0.05).

CONCLUSION: NiTi with the placement of 1 and 2 mm bends generates lighter forces and is recommended to be used as an initial levelling archwire.

THE DENTITION IN PATIENTS AGED 6-12 YEARS BEFORE AND AFTER CLASS III MALOCCLUSION TREATMENT
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AIMS: To compare dentition changes in patients before and after mesial occlusion treatment caused by a minor mesial position of the lower jaw, using a custom made device (patent RU №2307620, 10.10.2007). and a Fränkel Type III appliance.

SUBJECTS AND METHOD: Sixty patients aged 6-12 years with a mesial occlusion of dentoalveolar form divided into two groups: group 1 (n = 30) with mesial occlusion and premature removal of the primary molars and group II (n = 30) with mesial occlusion treated with the Fränkel appliance. Morphometry dentition on plaster models of the upper and lower jaws were defined; the premolar and molar widths and the length of the anterior segment of the dentition. The period of active orthodontic treatment was followed by analysis of the devices and the Fränkel appliance.

RESULTS: Not only the position of individual teeth, but also the ratio of tooth antagonists was normalized when using the custom-made device and the mesial occlusion was eliminated. The active period of orthodontic treatment was from 4 to 10 months (average 7.0 ± 0.7 months) The same morphometric indices were studied after orthodontic treatment and it confirmed that a reduced distance within 1.5 mm was preserved between the upper and lower canines, but these figures showed no significant differences on individual standards (P > 0.05) After normalization of the sagittal and transverse dimensions using the Fränkel appliance the ratio of opposing teeth was normalised and the mesial occlusion was eliminated. The active period of orthodontic treatment was from 6 to 12 months (average 9.1 ± 0.8 months).

CONCLUSION: Guided by a developed algorithm, the advantage of the custom-made device was a reduction in the length of treatment by 1.3 times, which increases the quality of life.

SP329 EFFECTS ON THE NASOLABIAL ANGLE IN PATIENTS UNDERGOING ORTHODONTIC TREATMENT WHO ALSO HAD EXTRACTIONS
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AIMS: To define, locate, and quantify the effect of orthodontic treatment on the nasolabial angles, leading to the acceptance or rejection of the concept that tooth extraction affects the middle third of the face, thus producing a retrusive tendency in the facial profile.

MATERIALS AND METHOD: The records of 200 patients were examined, with only 30 patients fulfilling the criteria required for the trial. The age range was between 13 and 44 years. The variables in category and number were registered by their distribution. Baseline data and final results were compared in order to register the degree of change in the six variables of the trial, using the Student’s t-test for paired samples and Pearson correlation coefficient. Statistical significance was set at P less than or = 0.05

RESULTS: A widening in the angle was found on average of about 4.9 degrees. The average result was 104 degrees before and 104 degrees after the extractions. The length of the upper lip showed random results, highly variable and with no tendency to increase in size. With respect to the number of extractions, the average was clearly greater in patients with four extractions. The average was higher in women with a 5.9 degree angle (opening). No significant differences were found in angular measurements according to age; however the graphs showed higher values in the change in patients around 20 years old.

CONCLUSION: Change can be seen in the nasolabial angle after extractions, as the angle becomes more obtuse. In patients with four extractions, the widening of the angle was more significant, followed by those with two extractions and then by those with one extraction. There were no significant differences in the fullness of the lips. The retrusive facial profile was visible in women approximately 20 years of age.

SP330 TOOTH COLOUR AFTER FIXED ORTHODONTIC TREATMENT – AN IN VIVO SPECTROPHOTOMETRIC STUDY
Aims: To assess in vivo tooth colour in patients treated with fixed orthodontic appliances bonded with light-cured composite resin (CR) or glass ionomer cement (GIC).

Subjects and Method: An observational study was conducted on patients with previous fixed orthodontic appliances bonded with GIC or CR, and subjects without previous orthodontic appliances (WOA). The Vita EasyShade intraoral spectrophotometer was used to determine tooth colour. Maxillary incisors, canines and first premolars were measured at the cervical and middle third of their labial surface. The difference of lightness (ΔL*), Chroma (ΔC*), hue (Δh*), red/green coordinate (Δa*), yellow/blue coordinate (Δb*), and total colour difference (ΔE* equation by CIE, 1986) between the recordings for these two areas were computed.

Results: Thirty-three patients (9 with previous orthodontic appliances bonded with GIC, 13 with previous orthodontic appliances bonded with CR, and 11 WOA) were included, a total of 264 teeth being measured. A greater similarity with natural teeth, without previous orthodontic treatment, was observed when bonding with GIC for ΔL* (GIC: 1.50; CR: 2.05; WOA: 1.44), and when bonding with CR for ΔE* (GIC: 3.93; CR: 5.81; WOA: 5.51). Clinically these results suggest that with use of CR for bracket bonding an increased lightness differentiation between the middle and cervical third of the labial surface of the tooth may occur, but using GIC less differentiation of total colour may be noticed between the two areas, when compared to the appearance of natural teeth. Similar results for bonding with GIC and CR, but rather different from the ones of teeth without orthodontic appliances, were found for ΔC* (GIC: 2.25; CR: 2.38; WOA: 3.43), Δh* (GIC: −1.58; CR: −1.92; WOA: −2.80), Δa* (GIC: 0.78; CR: 0.71; WOA: 1.10) and Δb* (GIC: 2.27; CR: 2.48; WOA: 3.42).

Conclusion: Considering the limitations of this study, it is suggested that by bonding orthodontic appliances, changes in the distribution of the tooth colour may appear, which also seems to be related to some extent to the bonding material used. Even so, a question that arises is to what extent these colour changes are perceptible. Prospective studies need to be conducted in order to enhance knowledge on these aspects.

Severity of orthodontic root resorption in patients with different types of malocclusions, according to Angle classification

Aims: To observe if root resorption severity is different in patients with different types of malocclusion, according to Angle classification.

Subjects and Method: A retrospective study was conducted on patients with fixed orthodontic treatment, with appliances in both jaws for at least 6 months. Measurements were made on existing panoramic radiographs, extracted from patients’ files, made only for treatment purposes. Root resorption was assessed only for the maxillary and mandibular incisors, calculated using the formula of Linge and Linge. Two indices were recorded: mean root resorption (mean value of root resorption registered for the eight measured incisors in each patient, in mm) and the maximum root resorption (maximum value of root resorption from the eight measured incisors in each patient, in mm).

Results: The convenience sample included 55 patients, 14 males and 41 females, mean age 16 years. Eighteen had a Class I malocclusion, 24 a Class II and 13 a Class III. Four hundred and forty maxillary and mandibular incisors were measured, mostly mild or moderate apical root resorption being observed, its mean value being 1.31 mm. By comparatively analyzing mean root resorption (Class I: 1.14 mm; Class II: 1.30 mm; Class III: 1.57 mm) and maximum root resorption (Class I: 2.34 mm; Class II: 2.73 mm; Class III: 3.15 mm), it was suggested that patients with a Class I malocclusion present less severe root resorption compared to patients with Class II or Class III malocclusions. Patients with a Class III malocclusion also had a tendency to register the highest values for both
indicators of root resorption used. Even so, with the Kruskal-Wallis test there was no statistically significant difference in severity of root resorption between the three Classes of malocclusion.

CONCLUSION: Patients with a Class III malocclusion seem to have the highest susceptibility to root resorption during orthodontic treatment. Considering the limitation of this study it is difficult to draw a conclusion on the different susceptibility to root resorption between different Classes of malocclusion; studies on a larger sample size need to be implemented for clarification of these aspects.

SP332 FACIAL SOFT TISSUE CHANGES DURING THE PRE-PUBERTAL AND PUBERTAL GROWTH PHASE: A THREE-DIMENSIONAL 5 YEAR FOLLOW-UP STUDY
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AIMS: Facial soft tissues changes during growth roughly tend to mimic the underlying hard tissues, but not completely. The aim of the study was to assess facial growth among pre-pubertal and pubertal subjects without malocclusion using a non-invasive three-dimensional (3D) laser scanning system.

SUBJECTS AND METHOD: Fifty-nine subjects (30 females, 29 males) aged 5.4-8.9 years with normal occlusion were clustered into younger and older pre-pubertal and pubertal groups according to age and the absence/presence of a standing height growth spurt. 3D facial images were obtained using laser scanners for five consecutive years. Several transversal, sagittal and vertical parameters were assessed for between and within group comparisons.

RESULTS: Significant overall changes of almost all parameters were seen within each group ($P < 0.05$) without any group differences ($P > 0.05$). The younger pre-pubertal group showed greater annual growth rates of lip prominence; both pre-pubertal groups showed greater rates in facial middle third height. The pubertal group showed greater annual rates in facial profile angle changes during the growth peak.

CONCLUSION: Soft tissue facial growth has generally similar amounts and rates irrespective of the pubertal growth spurt. Pre-pubertal subjects show greater annual rates of facial middle third height changes, while pubertal subjects show greater annual rates of chin protrusion.

SP333 COMPARISON BETWEEN THE TOTAL AMOUNT OF PROTEIN IN NORMAL AND COMPROMISED HEALTHY PERIODONTIUM PATIENTS IN ETHNIC THAIS
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AIMS: To compare the difference between the amount of protein in the gingival crevicular fluid (GCF) in subjects with normal and compromised periodontal health.

MATERIALS AND METHOD: GCF sampling was performed for two groups, comprising normal and compromised healthy periodontium groups. GCF was collected onto four filter paper strips from the crevice of the upper left central incisors over a minute collection period. These samples were analyzed for total protein with the Pierce™ BCA protein assay kit. Normality was carried out with the Kolmogorov-Smirnov test. Comparison of the amount of total protein between the two groups was performed by independent t-test.

RESULTS: The total protein amount in GCF were significantly different in the normal and compromised healthy periodontium ($P < 0.05$). The mean of total protein in normal and compromised healthy periodontium was $610 \pm 42$ and $241 \pm 33$ pg/ul, respectively. The means difference in the two groups was $0.09$ pg/ul. The quantity of total protein in compromised healthy periodontium was greater than in the normal healthy compromised periodontium group.

CONCLUSION: There was a greater amount of total protein in the compromised healthy periodontium group, which can imply that the GCF composition may be different, especially, in the level of cytokines which should relate to the periodontium status.
ANOMALIES IN TOOTH NUMBER OF THE PERMANENT DENTITION IN CHINESE AND INDIAN ORTHODONTIC PATIENTS

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AIMS: To assess and compare the proportion and distribution of tooth anomalies in the permanent dentition, excluding third molars, in a sample of Chinese and Indian orthodontic patients in Singapore.

MATERIALS AND METHOD: This cross-sectional study was carried out using panoramic radiographs and clinical records of 415 Chinese and 317 Indian orthodontic patients aged 12 to 16 years. They were examined for evidence of tooth anomalies. The results were analysed with SAS 9.3. Fisher’s Exact test was used to statistically compare incidents of hypodontia and hyperdontia between the races and between the genders.

RESULTS: The prevalence of hypodontia in Chinese and Indian orthodontic patients was 13.7 and 6.0 per cent, respectively. The prevalence of hyperdontia in Chinese and Indian orthodontic patients was 7.0 and 3.8 per cent, respectively. Chinese orthodontic patients had significantly higher odds of developing hypodontia compared to Indian orthodontic patients [Odds Ratio (OR) = 2.50, 95% confidence interval (CI) \( P < 0.001 \)]. Male Indian orthodontic patients had significantly higher odds of developing hyperdontia compared to female Indian orthodontic patients (OR = 3.6 95% CI, \( P = 0.035 \)). The most common missing tooth in the Chinese subjects was the lower second premolar (26.14%), whereas in Indians it was the upper lateral incisor (39.02%).

CONCLUSION: There are significant racial differences in the presentation of tooth anomalies in the permanent dentition of Chinese and Indian orthodontic patients in Singapore.

EVALUATION OF ARCH CHANGES WITH LOW FRICTION AND TRADITIONAL ORTHODONTIC MECHANICS

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AIMS: To compare changes in the transverse width and in arch depth produced by low friction and traditional mechanics during aligning and levelling.

SUBJECTS AND METHOD: Thirty three patients with crowding treated non-extraction: 19 patients with self-ligating brackets (SL) and 14 with traditional brackets (TB) with nickel titanium wires (0.014-inch) for 3 months. Casts were taken before treatment (T0) and after 3 months (T1) for both groups. Measurements were made on casts by two orthodontists using a digital calliper: intercanine, first and second interpmolar and first intermolar widths and arch depth were recorded. Descriptive statistics were calculated at T0 and T1 and for the T1-T0 changes. Wilcoxon test was used to analyze the differences between T0 and T1 values (\( P < 0.05 \)) in the SL group and a paired \( t \)-test in the TB group. A non paired \( t \)-test compared the statistical differences between the two groups.

RESULTS: Intercanine width in the SL group increased from T0 to T1: 0.77 mm in the upper and 0.46 mm in the lower arch; in the TB group there was no increase in the upper arch and a reduction of 0.08 mm for lower intercanine width. The first interpmolar width increased by 1.53 mm in the upper and 0.99 mm in the lower arch for the SL group and 0.29 mm in the upper and no increase in the lower arch in the TB group; the second interpmolar width was 1.27 mm in the upper and 0.83 for the lower in the SL group and 0.19 mm and 0.16 mm in the TB group. The changes in intermolar width were 0.63 mm in the upper and 0.42 in the lower arch for the SL group. There was no increase in the upper and a reduction of 0.08 mm in the lower arch for the TB group. Changes in arch depth were 0.75 mm in the upper and 0.42 mm in the lower arch in the SL group and 0.29 and 0.62 in the TB group.

CONCLUSION: In according with present aesthetic criteria (wider smiles) the results indicate that the SL group had a statistically significant increase in the transverse dentoalveolar width within the first 3 months of therapy compared with the TB group. No statistically significant increase for arch depth was recorded.
AIMS: To assess the severity of malocclusion in the sagittal, vertical and transversal directions in children with special needs compared to normal children with socio-economic problems for effective planning of interceptive orthodontic treatment

SUBJECTS AND METHOD: A cross-sectional study was carried out that included 421 children with special needs and 2156 children with socio-economic problems. Data were collected based on a questionnaire and dental examination. Clinical examination recorded the following: maxillary overjet, mandibular overjet, open bite, deep bite and crossbite. Statistical analyses of data were performed using the chi-square test.

RESULTS: At the end of the study the following was observed: maxillary overjet 1 in 20.43 per cent, overjet 2 in 2.61 per cent, overjet 3 in 1.66 per cent of disabled children compared with children with socio-economic problems (9.46%, 0.97% and 0.37%, respectively). Mandibular overjet 1 occurred in 7.84 per cent but in children with socio-economic problems it was 1.76 per cent, overjet 2 occurred in 0.95 and 0.23 per cent, respectively. An open bite 1 was observed in 19.48 per cent, open bite 2 in 4.04 per cent and open bite 3 in 0.48 per cent. In the healthy group with social-economic problems they were 5.32, 0.28 and 0.32 per cent, respectively. With deep bite 1, 15.2 per cent, deep bite 2, 3.56 per cent and deep bite 3, 0.24 per cent and for the healthy group 9.14, 2.32 and 0.60 per cent, respectively. In the transverse plane a unilateral crossbite was found in 7.36 per cent and a bilateral crossbite in 6.18 per cent than in the social-economic children (4.36% and 1.95%, respectively).

CONCLUSION: In children with special needs the severity of malocclusion is higher than in healthy children with socio-economic problem. Significant differences were found in malocclusion traits between the two groups.

AIMS: Patient consent to treatment is a fundamental aspect of orthodontic care. The aim of this clinical audit was to investigate whether orthodontic clinicians were obtaining consent prior to commencing active orthodontic treatment, including obtaining consent for photographic records.

MATERIALS AND METHOD: A prospective analysis was undertaken. The records and consent forms of 100 patients undergoing orthodontic treatment were reviewed between October 2014-October 2015 at three separate time points (T1, T2 and T3). In accordance with King’s College Hospital Trust Strategy and Policy for Consent to Examination or Treatment; 100 per cent of patients undergoing orthodontic treatment should have all components of the consent form completed. Two investigators assessed the completeness of the consent form against a checklist and collected data using a pre-specified sheet. Following time points T1 and T2, areas of improvement were identified and changes to improve completion of consent forms were implemented prior to data collection at T3.

RESULTS: Three hundred sets of patient records were identified. Overall at time points T1 and T2, consent form completion was below Trust standards. At T1, only 89 per cent had consent forms present, with 5 per cent not signed by the clinician and only 83 per cent had patient labels. This improved at T2, with 98 per cent of consent forms present. Patient labels and clinician signatures were found for 92 and 98 per cent, respectively. At T1, only 48 per cent had consent to clinical photography completed, which increased to 56 per cent at T2. Prior to T3, the results of T1 and T2 were discussed at a local clinical meeting and guidance reinforced via a departmental handbook. At T3, the standard of 100 per cent was achieved. Consent for photographs improved to 98 per cent.
CONCLUSION: Following implementation of departmental guidance, the practice of completing the consent forms by orthodontic clinicians prior to active treatment and photographic records improved substantially.Clinicians within the department are aware of the importance of completed and accurate consent forms.

SP338 INDIVIDUAL AND SOCIAL MOTIVATION OF THE DECISION FOR ORTHODONTIC TREATMENT Joanna Rajewska de Mezer1, Jolanta Twardowska Rajewska2, Marcin de Mezer2, 1Department of Educational Studies, Adam Mickiewicz University Poznan and 2Private Practice, Poznań, Poland

AIMS: To obtain information about patients’ motivation for orthodontic treatment: what type of factors make patients look for treatment and if the decision was motivated by individual or social factors.

MATERIALS AND METHOD: Data was collected based on a questionnaire completed by the patients. The study group comprised 50 subjects undergoing orthodontic treatment with removable and fixed appliances, who were at different stages of treatment.

RESULTS: For the majority of respondents the motivation for orthodontic treatment was aesthetic reasons. For some respondents both aesthetic and functional reasons were important. The smallest group represented patients for whom treatment motivation was only functional. Motivation for treatment was also dependent on the patient’s age and personal perception. The examined patients associated treatment with number of positive effects for themselves in various spheres of their lives. Patients with significant disorders of the masticatory system perceived in treatment the possibility to avoid social exclusion and stigmatization. They saw an opportunity for a positive perception by others.

CONCLUSION: An increasing number of people are choosing orthodontic treatment to improve their image. Patients who come to an orthodontic practice obtain a lot more information about their condition, but if they are self-referred, inner motivation, based on environmental factors is most important.

SP339 PREVALENCE AND EVALUATION OF ORTHODONTIC TREATMENT NEED AND PERCEIVED IMPACT OF MALOCCLUSION IN A UNIVERSITY ADULT POPULATION IN MALAYSIA Sneha Ravindranath1, James Tan2, Allan Pau1, 1Department of Dentistry, 2International Medical University, Kuala Lumpur, Malaysia

AIMS: With the increasing trend of adult patients seeking orthodontic treatment, it is relevant to understand the need for orthodontic treatment from the adult patient’s perspective. The aims of this study were to (1) determine the orthodontic treatment need in a university adult population based on the aesthetic component (AC) of the Index of Orthodontic Treatment Need (IOTN), (2) estimate the self-perceived need for orthodontic treatment and (3) assess the self-reported psychosocial well-being and its association to treatment need.

SUBJECTS AND METHOD: Eighty seven adults (20-70 years of age) comprising academic and corporate staff from the International Medical University. The AC of the IOTN was used to determine orthodontic treatment need and a simple questionnaire was used for data on socio-demographics and self-perceived need. Psychosocial well-being was measured through the self-rated Psychosocial Impact of Dental Aesthetics Questionnaire (PIDAQ). Data was analyzed using non-parametric Kruskal-Wallis tests with statistical significance set as P < 0.05.

RESULTS: Three adults (3.4%) had a definite need and 10 (11.5%) were found to have a borderline need determined by the AC of the IOTN whereas 29 (33.3%) perceived a definite need and 11 (12.6%) adults thought they may need orthodontic treatment. Age, gender, ethnicity or marital status was not associated with treatment need. Occupation was significantly associated with corporate staff indicating a higher self-perceived need than academics (P = 0.014). Those who had no need for treatment as measured by the AC of the IOTN scored significantly higher on the dental self-confidence domain (P = 0.015) when compared to those with treatment need. A self-perceived need was found to be significantly associated with dental self-confidence (P = 0.001), social impact (P = 0.004), psychosocial impact (P = 0.009) as well as the aesthetic concern domains (P = 0.011).
CONCLUSION: The orthodontic treatment need as perceived by the adults in this study was higher and was found to be significantly associated with the psychosocial well-being. Orthodontic treatment for the patient based on assessment of psychosocial impact would be beneficial in addressing patient’s perspectives of treatment need.

SP340 NUMERICAL AND BIOMECHANICAL ANALYSIS OF ORTHODONTIC TOOTH MOVEMENTS AFTER TREATMENT OF PERIODONTITIS USING CLINICAL DATA
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AIMS: For functional and aesthetic reasons, orthodontic treatment of tooth migration is frequently applied after successful periodontal therapy. In this study, the biomechanical behaviour of the periodontal ligament (PDL) of the upper incisors with various malocclusions was investigated using the data of patients’ treatments following periodontitis.

MATERIALS AND METHOD: The study was based on established three-dimensional finite element (FE) models of periodontally damaged maxillae with typical clinical variants of malocclusion. The material parameters for the PDL were taken from a previous study that intraorally measured tooth mobility in patients before and after treatment of periodontitis. Young’s moduli of the PDL were determined in patient’s individual FE models. These were found to be in the range of 10 to 50 per cent of healthy PDL parameters. The parameters were integrated into the maxillary FE models of periodontitis cases and initial orthodontic tooth movements were simulated. The material parameters for bone (homogeneous, isotropic, E = 2 GPa) and tooth (E = 20 GPa) were also adapted from previous research. The calculated results were compared with those of a patient with reduced attachment but unaltered PDL. The segmented arch techniques (after Burstone) with forces of 0.2 N per tooth was applied for space closure of fanned anterior teeth and incisor retraction with various treatment elements.

RESULTS: The strain in the apical region of the PDL increased up to 50 per cent due to the reduced attachment. In patients with particularly ‘soft’ PDL strains up to 80 per cent occurred.

CONCLUSION: In addition to the lack of attachment, the altered tissue structure of the PDL contributes to noticeably higher tooth mobility. This resultant considerably increased strain in the already pre-damaged PDL, increases the risk for periodontal overloading.

SP341 CLINICAL CHARACTERISTICS OF IMPACTED PERMANENT CANINES IN ORTHODONTIC PATIENTS: A REVIEW‡‡‡
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AIMS: To review the clinical findings of impacted canines in orthodontic cases.

SUBJECTS AND METHOD: Fifty eight orthodontic patients (with impacted permanent canines) including 34 females and 24 males, aged 10 to 20 years who attended for treatment over a period of 10 years. This retrospective study used clinical records, study models, radiographs and intraoral photographs. Data included gender, age, location, periodontal support, radiographic findings, orthodontic treatment and prognosis of impacted canines.

RESULTS: Three cases had four impacted canines, two had three impacted canines, 18 had two impacted canines and 54 each had one impacted canine. Three cases were impacted because supernumerary maxillary lateral incisors existed, three cases were impacted because of odontoma, one case was impacted because of transposition with mandibular lateral incisor. In one of the cases with bilaterally maxillary malpositioned teeth the lateral incisor root was resorbed and there was a tendency for ectopic eruption. In the other cases, the aetiology was unknown. Seven impacted teeth were extracted because of the treatment plan. Fifty one impacted canines were surgically exposed and successful traction was applied.
CONCLUSION: After controlled (low forces) orthodontic traction, the impacted canines were incorporated in their normal position in the dental arch, if sufficient space was available. Sometimes periodontal problems occurred during the traction orthodontic procedure, but the final treatment effect was satisfactory.

SP342  GLENOID FOSSA FORWARD RELOCATION AFTER ORTHOPAEDIC-ORTHODONTIC TREATMENT IN CLASS II DIVISION 1 PATIENTS‡‡‡
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AIMS: To document the alteration within the condyle-glenoid fossa complex and positional changes of the glenoid fossa in the cranium after functional and mechanical treatment.

SUBJECTS AND METHOD: Ten patients (5 girls, 5 boys) 9 to 13 years old with a skeletal Class II division 1 malocclusion. The patients were treated with a removable Twin-Block functional appliance followed by fixed appliances. The changes in cranio-glenoid-fossa complex were evaluated using HTM before pre-functional therapy and after functional orthopaedic treatment and at the end of orthodontic treatment

RESULTS: A forward condyle position within the glenoid fossa and articular disc retrusion with respect to the condyle head were statistically significant after functional appliance treatment. Linear measurements from the centre of the external auditory meatus to the post-glenoid spine revealed a 1.3 mm forward relocation of the post-glenoid spine along the Frankfort horizontal plane.

CONCLUSION: Forward relocation of the glenoid-fossa complex seems to be one of the mechanisms of action of functional appliances whereas the internal anatomical arrangements within the temporomandibular joint complex normalizes to its pre-treatment position.

SP343  EFFECTS OF RETINOIC ACID ON WNT SIGNALLING AND OSTEOBLAST DIFFERENTIATION
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AIMS: Wnt signaling plays a key role in craniofacial embryogenesis and is crucial in palate formation and osteogenesis. Retinoic acid (RA), the main vitamin A derivate, is also essential during development and an overdose can induce a cleft lip and/or palate. However, the molecular interactions between Wnt and RA during bone formation are not clearly understood. The objective of this study was to investigate the influence of RA on Wnt signalling during the mineralization and differentiation of osteoblasts.

MATERIALS AND METHOD: Mouse calvaria pre-osteoblasts (MC3T3) were seeded in differentiation medium and cultured with or without (control group) 0.5 µM RA during 4 weeks. Mineralization was monitored by alizarin red staining. Expression of Wnt (LEF1, c-Jun) and osteoblast (OCN, ALP) marker genes was evaluated every 7 days by quantitative polymerase chain reaction. Data was tested by one- or two-way ANOVA followed by Bonferroni test at a significance level of P < 0.05.

RESULTS: RA strongly delayed mineralization by 84 ± 0.03 per cent compared with the controls (P < 0.05). The first mineralized nodules were evident at day 17 whereas in the control group it had already started at day 11. The inhibition of mineralization was reflected by the low expression of osteoblast marker genes. Osteocalcin and alkaline phosphatase gene expression increased in control cultures but were significantly down-regulated (P < 0.05) by RA . The expression of Wnt marker genes c-Jun and LEF1 was up-regulated by RA (P < 0.05) after the first week as compared with the control group. During the last 3 weeks c-Jun expression decreased progressively but remained higher than in the control group, while LEF1 expression was constantly high.

CONCLUSION: RA impairs the differentiation of osteoblasts by disrupting Wnt signaling. This might be an important mechanism in RA-induced clefting.

SP344  INFLUENCE OF REMINDERS ON THE PLAQUE AND GINGIVAL BLEEDING INDEX OF ORTHODONTIC PATIENTS. REVISITED RESULTS
AIMS: To evaluate the Plaque Index (PI) and Gingival Bleeding Index (GBI) of orthodontic patients that received oral hygiene instruction and active reminders.

SUBJECTS AND METHOD: This is a prospective, randomized, clinical trial. At this moment 12 patients have been selected following this inclusion criteria: age between 12 and 18 years, need for treatment in the lower and upper arch with fixed appliances, no medical or dental records related to periodontal disease and living with parents or legal guardian with a cellular mobile phone. The patients were randomly assigned to three groups: group 1. The patients were given oral hygiene instructions; group 2. The patients received oral hygiene instructions and were instructed on how to brush the teeth; group 3. The patients received oral hygiene instructions, were instructed on how to brush the teeth, and received a reminder text message weekly. Each patient was given an oral hygiene kit including toothbrush, toothpaste, interproximal toothpick and mouthwash. Oral hygiene was measured using the PI and GBI. Measurements were taken before bracket bonding and at 1, 2, 3, 4 and 5 months after bracket bonding. All measurements were carried out by one investigator blinded to group allocation. PI and GBI scores were compared within each group with the Friedman test ($P < 0.05$) and between the different groups by the Kruskal-Wallis test ($P < 0.05$).

RESULTS: No significant differences were detected between PI and GBI scores within each group ($P > 0.05$) or between the three groups ($P < 0.05$).

CONCLUSION: For the three groups analyzed, there were no significant changes in the indices carried out independently of the preventive method implemented. Future research will include an increased number of patients in each group.

SP345 CHIN-CUP VERSUS FACEMASK IN THE EARLY TREATMENT OF SKELETAL CLASS III – WHICH IS MORE EFFECTIVE?

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AIMS: To review the contemporary high quality literature on Class III early treatment, comparing the effects of the chin-cup (CC) and the facemask (FM).

MATERIALS AND METHOD: A literature research was performed up to November 2015 on PubMed, Literature in the Health Sciences in Latin America and the Caribbean (LILACS), Scientific Electronic Library Online (SciELO), Cochrane Central Register of Controlled Trials, Scopus, Web of Knowledge, Cambridge Scientific Abstracts. No language restriction was applied. The eligible papers were identified by two authors independently. Records were assessed for eligibility by means of the inclusion and exclusion criteria. Disagreements on selection were resolved through discussion and if necessary consulting a third reviewer. The methodological and quality score process was independently applied by two authors. Data were extracted through a customized form and a meta-analysis was performed.

RESULTS: The search strategy resulted in 2697 records; after the selection process 14 papers were included and qualitatively assessed. Only one study was judged of high quality. All the selected studies reported a skeletal improvement. Meta-analysis showed no statistically significant differences in the standardized mean difference between FM and CC for ANB (FM = 3.31; 2.42-4.19; $I^2 = 90.9%$; CC = 2.59; 1.34-3.85; $I^2 = 84.3%$; $P = 0.363$), SNB (FM = -1.55; -1.94- -1.16; $I^2 = 68.2%$; CC = -2.23; -3.31---1.14; $I^2 = 80.81%$; $P = 0.246$) mandibular length (FM = -0.45; -1.01-0.10; $I^2 = 73.3%$; CC = -1.82; -4.12-0.47; $I^2 = 93.4%$; $P = 0.256$) and mandibular divergence (FM = 1.12; 0.59-1.65; $I^2 = 83.2%$; CC = 1.66; 1.14-2.18; $I^2 = 0; P = 0.157$). On the other hand, a larger increase in SNA angle was found with the FM (2.34; 1.60-3.08; $I^2 = 88.6%$) than with the CC (0.59; 0.11-1.06; $I^2 = 0) (P < 0.001$).

No comparison was possible for maxillary length. The two appliances did not show any differences in the proclination of the upper incisors (FM = 0.5; 0.04-0.97; $I^2 = 77.4%$; CC = 0.87; 0.16-1.59; $I^2 = 0%$; $P = 0.397$), while the CC produced greater retroclination of the lower incisors than the FM (FM = -0.23; -0.77-0.30; $I^2 = 78.6%$; CC = -22.14; -2.95---1.32; $I^2 = 0; P < 0.001$).
CONCLUSION: In Class III early functional treatment the FM was more effective than the CC in increasing the SNA angle and in controlling retroclination of the lower incisors; however some likely unwanted effects such as the increase of mandibular divergence, typical of the CC, cannot be avoided using the FM.

SP346 ARE THERE ANY DIFFERENCES IN THE CRANIOFACIAL GROWTH OF CLASS II INDIVIDUALS FROM DIFFERENT CENTURIES?
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AIMS: To describe secular changes in mandibular growth comparing a historical group (HG) of Class II untreated subjects from the AAOF Craniofacial Growth Legacy Collection, used as control group in many cross-sectional studies on craniofacial skeletal growth, with a contemporary group (CG) of similar subjects.

SUBJECTS AND METHOD: The HG comprised 26 individuals (around 1960) from the AAOF Craniofacial Growth Legacy Collection (15 from Burlington Growth Study, 9 from Oregon Growth Study, 2 from Michigan Growth Study) that were matched for gender, age and race with the 26 individuals of the CG (around 2010). One examiner performed all the cephalometric measurements, according to Pancherz’s method, of the two lateral cephalograms obtained at T0 and T1 (12 months). The normal distribution of the data was confirmed by the Shapiro-Wilk test, differences between mean values were determined by t-test for paired and unpaired data. The level of significance was set at α = 0.05.

RESULTS: Among the analyzed parameters, no statistical differences were found in the growth rate for linear skeletal measurement between the HG and CG. However, point A to Olp, point Pg to Olp, Pg/Olp+Co/Olp and Co-Pg at T0 and T1 were greater in the CG than in the HG showing statistically significant differences. These results highlighted the different dimensions in the craniofacial characteristics between the CG and HG.

CONCLUSION: In this study, no differences were shown between the growth rate of Class II subjects of the 1960s and Class II contemporary subjects. Cephalometric analysis showed larger craniofacial dimensions for the CG than for the HG. Nevertheless, there is still a need for further research to verify secular trends of growth on larger samples.

SP347 PERIODONTAL CONDITIONS AFTER A BONDED RETAINER IN THE MANDIBLE
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AIMS: To determine whether there is any difference in the periodontal health between a group of young adults exposed to orthodontic treatment followed by long term use of a bonded fixed retainer from 3-3 in the lower jaw and a corresponding group without orthodontic treatment.

SUBJECTS AND METHOD: A total of 34 subjects, 10 boys and 24 girls where divided into two groups (group 1 with a fixed mandibular retainer and group 2 without a retainer). Both groups had 17 subjects. The mean age in the retainer group was 24.3 years and in the non-retainer group 24.9 years. The patients with a retainer had been in retention for a mean period of 8.8 years with a range of 2 to 13 years. The periodontal conditions were assessed with regard to the standard for grading periodontal health by the sulcus bleeding index (Mühlemann and Son, 1971) and the calculus and debris index (Greene and Vermilion, 1964). Every participant also completed a questionnaire before the clinical examination.

RESULTS: There was a slight increase in all the periodontal index scores for the participants in the retainer group, but the differences were not significant. Questionnaire data revealed that 23.5 per cent of the participants in the retainer group had, at some point, experienced failures with the bonding of their retainer.

CONCLUSION: A fixed retainer in the lower jaw is not a risk factor for compromised periodontal health, at least not in oral health motivated subjects.
SP348  THIRD MOLAR DEVELOPMENT IN RELATION TO SKELETAL MATURATION AMONG SAGITTAL CRANIOFACIAL PATTERNS
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AIMS: To assess the effects of sagittal skeletal patterns on third molar development controlling for skeletal maturation.

MATERIALS AND METHOD: Archived high quality pre-treatment cephalometric and panoramic radiographs of 570 patients were examined. Skeletal maturity was assessed from cervical vertebrae using the cervical vertebral maturation (CVM) method for all subjects. The patients were divided into three groups (skeletal Class I, II and III) according to ANB angle. Development stages of 964 upper and 1131 lower third molar teeth were determined according to the method introduced by Demirjian et al. ANCOVA analyses were separately conducted for both upper and lower third molars to test the effects of skeletal pattern on the developmental stages of the third molars. Dependent variable and covariate were set as third molar stage and CVM stage, respectively.

RESULTS: Statistically significant positive rank correlations were found between skeletal maturity stages and molar development stages in all groups ($P = 0.0001$). ANCOVA showed that skeletal pattern had no significant effect on molar stages when chronological age was disregarded ($P = 0.475$ and $P = 0.856$ for the upper and lower molars, respectively), Skeletal maturation had a significant effect on both upper and lower molar stages ($P = 0.0001$). No significant effect was observed from the interception of skeletal maturity and sagittal patterns on molar development stages ($P = 0.512$ and $P = 0.493$ for the upper and lower molars, respectively).

CONCLUSION: Sagittal skeletal patterns are not related to the development of third molars according to skeletal maturity.

SP349 VIRTUAL FACIAL THREE-DIMENSIONAL MODEL CONSTRUCTION WITH THE VOLUME RENDERING METHOD USING MULTIDETECTOR COMPUTED TOMOGRAPHY
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AIMS: The goal is to judge birth and parentage from the unidentified body or bleached bones. The judgment distinguishes it from a bloodstain persuaded to stay or a fingerprint. Other identification includes various methods. In the case of the dry skull, the facial reconstruction of facial features to be performed from the skull is an important judging method. The thickness of the soft tissues was measured to enable reconstruction of the soft tissues from the dry skull using the volume rendering method to image the skin surface for three-dimensional digital data image processing of the multidetector computed tomography.

SUBJECTS AND METHOD: Five individuals were chosen from a 40 year to a 20 year old male with a Body Mass Index of a level standard. The thickness of the soft tissues was measured. The measurement point of the skull reached on a midline. The standard measurement point assumed it g,n, rhi, ANS, point A, point B, pg, gn. The measurement reached every upward 1 mm with the maxillary bone on facial midline from rhi to g and every downward 1 mm with the maxillary bone on the frontal midline from ANS. The mandibular measurement was performed in a 1 mm upward distance on the facial midline from gn. The computed tomograph was emotion 6 (Siemens AG). As for the irradiation condition, tube voltage 130 kv, tube current 60 mAs, regions of interest were from the top of the head to a mentum lower soft tissue. The reconstruction function assumed it was H70 s, slice thickness 1 mm. For data handling software (ViewDB of Lexi Co. Ltd.) the three-dimensional reconfiguration software used was Zed ViewDB.

RESULTS: Although the software recognized individual differences, it was the gradient to fall from rhi to the measurement minimum value, gradually increasing to the measurement maximum value. This then decreased from the measured maximum value to greater than the maxillary measurement.

CONCLUSION: Date on the superior portion of the face is similar to the literature showing that accuracy was high.
B1 DENTAL AND ORTHODONTIC MALPOSITION IN PATIENTS WITH CONGENITAL SUPERIOR OBLIQUE PALSY

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AIMS: Asymmetry of the face because of habitual head tilt in patients with congenital superior oblique palsy (CSOP) is well described in the literature. The aim of this study was to examine the effect of the head tilt in the development of the dental occlusion.

SUBJECTS AND METHOD: This was designed as a descriptive cohort study. Ten patients with CSOP treated took part in the research (3 females, 7 males, mean age 51.7 ± 15.8 years SD, ranging from 19 to 69 years). All of them underwent an orthodontic examination. The orthodontic findings were compared to the pre-operative amounts of vertical, torsional and horizontal deviation of the eye using Harms tangent screen and stereopsis using a random dot test. Data were coded in Excel (Microsoft Office Excel 2007, Microsoft Corporation Redmond, United States) and analyzed with SPSS Version 22.0 (PASW/SPSS IBM Corporation, New York, USA). For statistical analysis Spearman’s rho (p) correlation analysis for two continuous variables was used. Results with a P-value ≤ 0.05 were interpreted as statistically significant. A P-value ≤ 0.1 but >0.05 were interpreted as statistical trends.

RESULTS: Two parameters could be found to correlate significantly or at least as a statistical trend to orthoptic parameters. Midline deviation of the upper jaw to the facce showed a statistical trend to the vertical deviation of the eye in the primary position (ρ = 0.623; P = 0.054). The anterior position of the first molar on the sagittal plane correlated significantly with the vertical deviation (ρ = 0.594; P = 0.07) and also overbite and the horizontal deviation of the eye in the primary position (ρ = 0.768; P = 0.016) correlated significant.

CONCLUSION: Even in this small study three dental parameters could be found to correlate significantly with pre-operative orthoptic parameters. Further studies have to show whether this orthodontic parameter could be found more often in patients with CSOP.

B1 SIMULATION OF THREE-DIMENSIONAL SOFT-TISSUE PROFILE AND VOLUMETRIC CHANGES BY THE POSTURED WAX BITE ON THE OUTCOME OF TWIN-BLOCK APPLIANCE TREATMENT

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AIMS: To determine how the three-dimensional (3D) soft-tissue profile and volumetric changes produced by the postured wax bite (PWB) simulate the outcome of twin-block appliance (TBA) treatment.

SUBJECTS AND METHOD: In this prospective cohort study, 58 Caucasian patients were recruited with a Class II division 1 malocclusion and an overjet exceeding 7 mm. Forty-seven subjects (18 females, 29 males) completed TBA treatment. 3D stereophotogrammetric images were captured pre-treatment at rest (T1), with the PWB in place (T2) and at the end of treatment (T3). Twenty-five landmarks were located on each image and 10 per cent of images were re-landmarked one month later. The soft tissue linear and volumetric changes (T1-T2 and T1-T3) were analysed using linear mixed effect models (SAS® Version 9.4, www.sas.com).

RESULTS: Intra-observer reproducibility of landmarking was acceptable (P > 0.05) and mean landmark identification error was 0.562 mm. At the completion of treatment, significant forward changes were found for all lower facial landmarks (4-5 mm; P < 0.001), except for labiale superius. All upper facial landmark changes were non-significant. Treatment with the TBA produced 49 per cent of the advancement of soft tissue pogonion and 60 per cent of the facial volume increase simulated by the postured wax bite (P < 0.0001).

CONCLUSION: The TBA produced an increase in lower facial soft tissue volume and advanced the lower facial soft tissue landmarks by around 4-5 mm. Only 60 per cent of the facial volume change and 49 per cent of the expected advancement of soft-tissue pogonion was delivered by the TBA.
SP352 ACCURACY AND PRECISION OF THE MIXED-REALITY SURGICAL SIMULATION SYSTEM IN THREE-DIMENSIONS

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AIMS: A new orthognathic surgical simulation system, ManMoS, able to predict both occlusal correction and jaw repositioning in three dimensions has been developed. This system uniquely integrates the real motion of the dental cast model with the virtual motion of the reconstructed craniofacial model, generating a mixed-reality simulation. The aim of this study was to examine the accuracy and precision of the dento-skeletal model utilized in ManMoS.

MATERIALS AND METHOD: Six ceramic spheres were fixed on a dry skull. A three-dimensional (3D) skeletal model was reconstructed from 3D computed tomographic data obtained from the dry skull. 3D images of the upper and lower dentitions were scanned from the dental casts of the skull and integrated with the skeletal model by means of the iterative closest point algorithm. A dento-skeletal model was reconstructed and available in ManMoS. Twenty-five landmarks were set up on the dry skull, the skeletal model and the dento-skeletal model. Linear measurements between the landmarks and the ceramic spheres were carried out in the virtual space of the ManMoS and compared with those of actual measurements.

RESULTS: The differences between measurements on the skeletal model and the actual measurements were small without significant difference, with an average of 0.18 mm and standard deviation of 0.97 mm. The measurements on the skeletal model did not show significant differences to the measurements on the dento-skeletal model; average difference 0.29 mm, standard deviation 0.26 mm.

CONCLUSION: High accuracy was demonstrated in ManMoS. The ManMoS appears to be an effective tool for an orthognathic surgical simulation.

SP353 OCCLUSAL CHARACTERISTICS OF ADULTS WITH OPERATED NON-SYNDROMIC TRIGONOCEPHALY

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AIMS: Trigonocephaly is a condition with premature ossification of the metopic suture. The aim of this study was to evaluate the occlusal characteristics and temporomandibular disorders (TMD) of adults with operated non-syndromic trigonocephaly compared to age- and gender-matched controls.

SUBJECTS AND METHOD: The study group consisted of eight patients (5 males, 3 females, mean age 27.0 years, range 18.3-31.7 years) who were operated on at a mean age of 6.3 months. Age and gender matched adults were randomly selected from the population registry centre (control group). Clinical examinations were performed to measure occlusal characteristics (overbite, overjet, crossbite, scissor bite). TMD findings included palpation of muscles and temporomandibular joints, sounds and pain in movement.

RESULTS: Six patients in the trigonocephaly group had a moderately increased overjet (>5 mm) compared to the control group. A history of orthodontic treatment was relatively high among the trigonocephaly group (75%). Prevalence of TMD was higher among the trigonocephalhy group. Sixty three per cent of the trigonocephaly group and 29 per cent of the controls had TMD signs.

CONCLUSION: It seems that patients with operated trigonocephaly have more malocclusions and more TMD signs compared to a control group. The results should be confirmed with a larger group.

SP354 THE USE OF GROWTH FACTORS FGF-1 AND HGF-1 TO IMPROVE SATELLITE CELL PROLIFERATION, NEW PERSPECTIVES FOR CLEFT PALATE REPAIR
Aims: Surgical repair of the soft palate in cleft palate patients is often suboptimal, resulting in hampered speech development. It has been demonstrated that extensive fibrosis occurs after excisional wounding of the soft palate in rats. Transforming growth factor-β1 (TGF-β1) and myostatin, both members of the TGF-β super family can decrease satellite cell (SCs) proliferation and induce fibrosis in skeletal muscle after injury. Since fibroblast growth factor (FGF) 1 and hepatocyte growth factor (HGF) improve SC proliferation in limb muscles; it was postulated that these growth factors would improve proliferation of SCs from head muscles (masseter and levator veli palatini) in vitro.

Materials and Method: SCs were isolated from the masseter and levator veli palatini muscles of 9-week-old Wistar rats by enzymatic digestion and trituration. SC were seeded in Matrigel spots in combination with 10, 50 ng/mL of FGF, and, 10 and 20 ng/mL of HGF or controls. Cell cultures were evaluated at days 7 and 9 using markers of skeletal muscle proliferation and differentiation (Pax7, MyoD, MyoG) and myotube formation (MyHC). Staining was quantified by image analysis, and one-way ANOVA was used for statistical analysis.

Results: The number of proliferating SCs was greater ($P < 0.05$) at all time points after treatment with 10, 50 ng/mL of FGF-1 or 10 and 20 ng/mL of HGF compared with the negative control. In contrast, only a few differentiating SC were evident at all time points. Hence, few myotubes were evident by day 9 compared with the controls.

Conclusion: This study indicates that SC proliferation in fibrotic areas may be improved by the administration of FGF-1 and/or HGF. These growth factors may be considered for the development of tissue engineering-based therapies to improve muscle regeneration after soft palate cleft repair.

SP355 Influence of Enamel Sandblasting on the Shear Bond Strength of the Bracket-Adhesive-Enamel Complex Tested According to the DIN-13990-2 Standard

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Aims: To investigate if enamel sandblasting before bonding brackets on bovine teeth, analog to enamel sandblasting before bonding lingual brackets on human teeth, increases the shear bond strength (SBS) of the bracket-adhesive-enamel complex.

Materials and Method: Upper central incisor brackets with laser structured base (discovery®, Dentaurum J. P. Winkelstroeter KG, Pforzheim, Germany) were bonded using a light-curing adhesive system (Transbond XT™, 3M Unitek, USA) on bovine incisors prepared by four different methods: acid etching with 37.4 per cent phosphoric acid (a), sandblasting-only with 50 µm Al4O3 at 1.2 bar (s) and sandblasting with 50 µm Al4O3 at 1.2 bar (s1a) / 5.7 bar (s2a) followed by acid etching. MicroEtcher CD/MicroEtcher IIA (Danville Materials, San Ramon, California, USA) were used for sandblasting at 1.2 and 5.7 bar respectively. After conducting a sample size calculation, 15 randomly chosen specimens were prepared for each enamel preparation method. The shear strength was tested using a universal testing machine Zmart.Pro® (Zwick GmbH & Co. KG, Ulm, Germany). Specimen preparation and strength testing were conducted according to the DIN-13990-2-standard.

Results: The SBS in the acid etching group (a) was 206 N (± 52 N), in the sandblasting-only group (s) 68 N (± 26 N), in the sandblasting and subsequent acid etching groups (s1a) 221 N (± 52 N) and (s2a) 224 N (± 56 N). ANOVA analysis with Tukey post hoc comparison showed a statistically significant difference only between the sandblasting-only group (s) and all others (a, s1a, s2a). No statistically significant difference was found between the acid etching group (a) and the sandblasting/acid etching groups (s1a, s2a).

Conclusion: Enamel sandblasting before acid etching, regardless of the used air pressure, did not increase the SBS compared to acid etching alone. Enamel sandblasting alone showed reduced SBS by approximately 67 per cent compared to acid etching. Therefore, the use of sandblasting in the lingual technique has to be questioned.
AIMS: To compare two different types of fixed retainers used for stabilization of the mandibular anterior segment, and to compare the long-term outcome, 12 years post-treatment. The null hypothesis was that there would be no differences in mandibular incisor stability between the two different mandibular retainers in a long-term perspective.

SUBJECTS AND METHOD: Sixty-four children who had undergone orthodontic treatment with fixed appliances in both arches were divided into two groups depending on which type of fixed retainer was used. Twenty-eight patients had a canine-to-canine retainer bonded and 36 had a bonded twistflex retainer 3-3, bonded to each tooth. Measurements were done on study models and lateral head radiographs, before and after treatment and 6 and 12 years after treatment. The most important measured variable was Little’s irregularity index (LII). Significant differences in means in groups and between groups were tested by one-way analysis of variance. P-values less than 5 per cent were considered statistically significant. When significant differences were found between groups, Bonferroni correction was used. Bonding failures were obtained from the patients’ files.

RESULTS: There were no significant intergroup differences in LII between the four registrations. The same result was found for the available space. The overjet and overbite were reduced after treatment in both groups and were then fairly stable throughout the observation period. No significant differences were found for any of the variables measured on the lateral head radiographs between the groups, at the four different occasions. Thirty-two per cent of the patients with canine-to-canine retainers experienced bonding failures and 44 per cent in the group with twistflex retainer.

CONCLUSION: There were no significant differences between the two groups at the long-term follow-up regarding LII or available space for the mandibular incisors or in bonding failures between the two retainers. Either retention method can be recommended. Overjet and overbite are stable 12 years after treatment.

AIMS: The primary aim of this audit was to investigate the level of written communication between the orthodontist and general dental practitioner (GDP) from initial patient contact to discharge and to assess if recognized ‘valued information’ was detailed to the GDP following initial patient contact. A secondary aim was to evaluate the information provided to the GDP with specific regard to retention following active treatment.

MATERIALS AND METHOD: In total, 250 sets of medical records were retrospectively audited, 50 patients from each unit who had been debonded between January and December 2013 allowing time for the patient to pass through the retention phase and be discharged. Participating secondary care orthodontic units in the United Kingdom included: Birmingham Dental Hospital; Royal Stoke University Hospital; County Hospital, Stafford; Royal Shrewsbury Hospitals and Solihull Hospital. The study design had been previously approved by the Research and Development departments at participating units.

RESULTS: The gold standards of 100 per cent of GDPs receiving correspondence at the recommended time-points and 100 per cent of GDPs receiving information regarding the patient’s retention strategy were not met. For each letter there was a large range between departments. The initial patient contact letter was sent to GDPs in the majority of cases (92-100%). The letter at the end of active treatment or at the beginning of retention was the worst represented, only being sent in 45 per cent of cases on average (12-84%). Information regarding retention was also poorly
represented with, for example, only 2 per cent of discharge letters from one department containing any laboratory information or re-fabrication instructions.

CONCLUSION: As the gold standards were not achieved several recommendations have been made including the use of letter templates and the results of this audit have been disseminated through clinical governance meetings. A re-audit is planned for 3 years’ time, with the new patient clinic letters and retention information being re-audited in 12 months’ time.

SP358 LOCALISATION OF IMPACTED CANINES WITH HORIZONTAL PARALLAX – IS IT DIAGNOSTIC?
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AIMS: To determine whether periapical radiographs used in the horizontal parallax technique to localise ectopic maxillary canines (ECMs) are of high quality and diagnostic value. A further aim was to evaluate if key reference points used to assess the position of the canine are visible on the radiographs, and to assess if the position of the ECM could be determined from the parallax views available.

MATERIALS AND METHOD: This was a retrospective audit carried out between March and May, 2015. Periapical radiographs of 50 consecutive impacted canines were examined for quality, diagnostic value and localisation of the canine using horizontal parallax. The radiology logbook in Birmingham Dental Hospital was used to obtain the identification number of 50 consecutive ECMs, for which a horizontal parallax had been requested between March and May 2015. Each image was assessed independently by an orthodontic specialist trainee and a senior registrar under standardised viewing conditions in the radiology department. The National Radiology Protection Board (NRPB) guidelines were used to assess image quality. Standards set for diagnostic value of images were based on departmental agreed best practice. This included a number of reference points which were considered necessary for canine localisation.

RESULTS: With respect to image quality, only 32 per cent of images were deemed diagnostically acceptable. This did not meet the NRPB standard of ‘no more than 20 per cent’. Of the 50 canines assessed, 18 per cent (9) had more than the ideal number of two images taken. The gold standard set of two images per canine was therefore not met. Only 62 per cent of images contained the essential reference points of the tip of canine, canine crown and root of the adjacent tooth and in one-third of the cases (32%), it was not possible to localise the canine.

CONCLUSION: Based on the findings of this audit a recommendation has been made that two upper standard occlusal radiographs be taken instead of two periapical radiographs when carrying out horizontal parallax to localise ectopic maxillary canines.

SP359 SHEAR BOND STRENGTHS OF THREE DIFFERENT ADHESIVE SYSTEMS
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AIMS: To evaluate differences in the shear bond strength (SBS) of the following three adhesive systems: a chemical curing adhesive system, a light curing adhesive system as well as a light curing adhesive system with fluoride releasing monomers.

MATERIALS AND METHOD: Thirty bovine maxillary permanent incisors were embedded in a silicone mould with cuboid shaped notches with exposition of the buccal tooth surface using an autopolymerizable self-curing resin. After hardening, the samples were divided into three groups (10 blocks each), according to their luting agent: group A: Opal Bond; group B: Rely-a-Bond; group C: Transbond XT. Two metal brackets were bonded on the buccal surface of each tooth using the particular adhesive system. Afterwards the SBS was recorded. Statistics were based on the Mann-Whitney-U-test.

RESULTS: The highest SBS was recorded in group A; the lowest in group B. Nevertheless, no clinically relevant differences in SBS was found between the groups.

CONCLUSION: All tested adhesive systems can be utilized successfully for clinical use regarding their bond strength.
Aims: The antero-posterior lingual retractor includes posterior tubes to control torque of the anterior teeth during retraction that the C-lingual retractor encountered during treatment. Moreover it was hypothesized that change in posterior tube angulation would generate differences in the amount of anterior intrusion while maintaining torque and angulation of anterior teeth. The aim of this study was to evaluate the clinical outcomes of the antero-posterior lingual retractor in terms of canine tipping and anterior and posterior segment intrusion with posterior tube angulation changes employing lateral cephalograms.

Subjects and Method: Two groups were formed into the C-lingual retractor group of 16 patients (group 1) and the antero-posterior lingual retractor group of 30 patients (group 2 and 3). The antero-posterior lingual retractor group was further divided into two subgroups: group 2 of 15 patients: parallel posterior tube to the occlusal plane and group 3 of 15 patients: distally tipped tube that is close to the gingiva in the distal aspect of the tube. Cephalograms were analyzed comparing the initial status and end of active retraction period.

Results: The central incisors and canines show significant retraction and intrusion in all groups. All three groups showed significant intrusion of the central incisors, and especially group 3 showed more intrusion compared to the other two groups. Additionally, group 3 had a significant reduction of the occlusal plane angle implicating greater amounts of anterior segment intrusion. Group 1 showed a greater amount of central and canine angulation changes after treatment compared with groups 2 and 3 values. With a tube angulation change in the antero-posterior lingual retractor, the intrusive force was significantly stronger in the distally tipped tube of group 3. The central incisors and canines showed approximately a 2-3 fold intrusive movement compared to the other two groups.

Conclusion: Posterior tube angulation (tipping the tube distally) generated meaningful intrusion control in the anterior segment. Therefore, the guidewire and posterior tube that enable sliding of the anterior segment can yield three-dimensional retraction (bodily retraction, intrusion, and torque control) and could become one of the standard treatment modalities for lingual retraction.
CONCLUSION: Compensation of skeletal discrepancy by alveolar adaptation might cause correction of arch width discrepancies. Further studies should be undertaken with increased numbers of each sample groups.

SP362 VALIDITY EVALUATION OF TOOTH SIZE AND BOLTON MEASUREMENTS USING CONVENTIONAL TWO- AND THREE-DIMENSIONAL VIRTUAL ORTHODONTIC MODELS***
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AIMS: To evaluate the validity of computerized two dimensional (Dolphin), three-dimensional (3D) laser scanning and manual methods of dental cast analysis
MATERIALS AND METHOD: Twenty set-ups, simulating various types of malocclusions were constructed. The values of tooth size were calculated from isolated artificial teeth out of set-ups (gold standard). These set-ups were duplicated using alginate, resulting in 20 corresponding dental stone models. The models were analyzed with digital callipers manually. The digital images were scanned and were analyzed with Dolphin software. The analyses included the mesiodistal dimension of isolated teeth and measurement of the Bolton scale. The results of the two methods were compared with the results of another study on these models by means of 3D scanning (the gold standard). Interclass correlation was used to evaluate significance of the differences. The difference of the varying methods were obtained through the Dahlberg formula.
RESULTS: The highest correlation was between the gold standard and the manual methods and the lowest between the gold standard and 3D scanning (P < 0.05)
CONCLUSION: The manual method is the most accurate for cast space analysis but the difference in overall size calculation is only 1.8 mm, which seems clinically acceptable.

SP363 QUANTIFICATION OF PATIENT COMPLIANCE OF REMOVABLE APPLIANCE WEAR USING MICROSENSORS
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AIMS: To quantify the wear time of removable orthodontic appliances and to determine whether compliance level increases after patients are made aware of the presence of a microsensor contained within the appliance.
SUBJECTS AND METHOD: A TheraMon® microsensor was incorporated into the removable appliances of 90 patients aged 9 to 12 years, divided into groups based on age, gender and type of appliance: upper active plate, upper active plate with headgear and Fränkel appliance. The patients were instructed to wear their appliance for 14 hours/day (h/d) and were initially not aware of the sensors. During their first monthly recall, data was obtained from the TheraMon® microsensor via its accompany software. After the first recall, the patients were informed about the presence of the microsensor and were then recalled once a month for a period of six months, in order to quantify wear time.
RESULTS: The combined data collected for all patients showed a median wear time of 7.3 h/day (range 4.24-14.7 h/d) over the observation period, which equated to 52 per cent of the required prescribed wear time. The median wear time increased across all groups of patients after being made aware that wear time was being monitored. For patients wearing active plates the wear time increased from 7.6 to 8.8 h/d. For those wearing headgear, together with the active plate group, wear time increased from 8.2 to 9 h/d. For subjects wearing the Fränkel appliance wear time increased from 3.9 to 4.24 h/d. No significant difference was found in compliance between the genders and age.
CONCLUSION: The success of orthodontic treatment with removable appliances is highly dependent on patient compliance. Compliance increased as patients wore the appliances for a longer period of time after they were made aware that it was being monitored, but did not reach the prescribed period of 14 h/d. Additionally, the study showed that patient using active plates demonstrated the highest compliance.
SP364  LEACHING OF BISPHENOL-A FROM INTRA-ORAL AND ORTHODONTIC MATERIALS
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AIMS: To simulate intense mechanical and thermal conditions that may occur intra-orally in order to investigate whether these conditions could cause bisphenol-A (BPA) to leach from routinely employed orthodontic and intra-oral materials.

MATERIALS AND METHOD: Samples of intra-oral materials, including pacifiers, mouth guards, elastomeric ligatures, and polycarbonate brackets, were subjected to simulated abrasion, immersion in artificial saliva, thermal shock via temperature cycling, and simulated intraoral exposure. Sample aliquots were collected for up to 2 weeks after artificial saliva immersion, derivatized, then analyzed for BPA by gas chromatography/mass spectroscopy. BPA concentrations were quantified by calculating the relative response factors based on the area of the internal standard diacetylated BPA-d14 or by using a standard calibration curve created by a serial dilution of a BPA water solution. BPA leaching data was analyzed by descriptive statistics.

RESULTS: Quantifiable amounts of leached BPA were observed from three of 28 materials tested: a Gerber silicone baby bottle nipple (20 µg), a Biocryl thermoformed retainer (30-38 µg depending on the mass of the retainer) and Transbond XT orthodontic adhesive (2 µg). BPA leaching was only observed after 3 days of artificial saliva immersion with no additional leaching thereafter.

CONCLUSION: Although many parts of the world have banned the use of BPA in baby bottles, BPA content may still be present in some silicone baby bottle nipples. While the leached BPA from this investigation was below the United States Environmental Protection Agency reference dose, it was greater than the tolerable daily intake established by the European Food Safety Authority for the Gerber nipple and the thermoformed Biocryl retainer. Due to the existing high level of BPA exposure in children, and its potential association with adverse health effects, BPA exposure should ideally be minimized. Whenever possible, BPA-free baby bottles and nipples are recommended. Methods to reduce BPA leaching from the orthodontic products investigated may include: soaking retainers in hot water prior to delivery, ensuring that the adhesive is fully cured, having the patient rinse after bonding, and/or using an orthodontic adhesive that does not contain a BPA derivative.

SP365  CURRENT PREFERENCES IN ACCELERATED ORTHODONTIC TOOTH MOVEMENT TECHNIQUES IN ORTHODONTICS
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AIMS: To assess the current trends in preferences and utilization of accelerated orthodontic tooth movement (AOTM) techniques in orthodontic practices in the United States.

MATERIALS AND METHOD: Electronic surveys were sent to 1120 members of the American Association of Orthodontists to evaluate their individual preferences for, utilization of, and willingness for future use of AOTM techniques in their practices.

RESULTS: The survey’s response rate was 7.5 per cent. Of these, 35 per cent currently use AOTM technique(s). Fifty-five per cent of the current users are beginners while 10 per cent are advanced users. The three most preferred AOTM techniques currently used by the respondents include intraoral tooth vibrations (53%), micro-osteoperforation (33%), and corticotomy (10%). The 65 per cent of respondents who do not currently use AOTM technique(s) cited lack of demand (71%), lack of scientific evidence (53%), and lack of training (36%) as the most common reasons for the not using the technique(s). A higher proportion of non-users versus users believe that there is no scientific evidence to support the use of intraoral tooth vibrators, pulse electromagnetic field, low intensity laser radiation, and micro-osteoperforations. Also, 69 per cent of current non-users suggested that they do not anticipate incorporating AOTM technique(s) in their office in next 2 years. The other 31 per cent suggested that they are likely to incorporate intraoral tooth vibrators (65%), micro-osteoperforations (59%) and corticotomy (24%) in their practices in the near future. A
statistically significant difference in the perceived risk for complications for pulse electromagnetic field and dentoalveolar distraction was found between users and non-users of AOTM technique(s).

CONCLUSION: Among survey respondents, the current number of users of AOTM technique(s) is less than that of non-users. The majority of users of AOTM technique(s) are beginners with most preferring intraoral tooth vibrators, micro-osteoperforations and corticotomy to reduce treatment time. Most non-users cited lack of demand among patients for the non-use of these techniques in their practices. Current non-users are likely to use intraoral tooth vibrators, micro-osteoperforations and corticotomy in the future. The non-users felt a higher perceived risk for complications for pulse electromagnetic field and dentoalveolar distraction techniques than the users of AOTM technique(s).

SP366  APPLICATION OF THREE-DIMENSIONAL MODELLING AND COMPUTER-AIDED DESIGNING IN CLEFT LIP AND PALATE
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AIM: To introduce the treatment concept of early maxillary orthopaedics in complete unilateral cleft lip and palate (UCLP) patients and to quantify the maxillary morphological changes after pre-surgical alveolar moulding using three-dimensional computer-assisted technologies.
SUBJECTS AND METHOD: Sixty patients with a mean age 5.53 days with a complete UCLP who underwent two treatment protocols before primary chelioplasty. In the first group, conventional orthopaedic appliance fabrication was used. Physical alveolar moulding appliances in the second group were created from virtual 3D computer designed models. The maxillary morphology was analyzed and differences in maxillary anthropometric measurements were recorded before and after treatment.
RESULTS: The three-dimensionally assisted approach reduced the pre-surgical time by 2.5 weeks simplifying the process of appliance manufacture. Highly significant maxillary arch differences were found ($P < 0.0001$) after early rehabilitation in cleft lip and palate patients in both groups.
CONCLUSION: Current digital technologies appear to be a promising and supportive tool for carrying out diagnostics and treatment in patients with congenital birth defects allowing vivid graphical 3D representation of all individual morphological variability in orofacial clefts.

SP367  THREE-DIMENSIONAL EVALUATION OF ALTERNATIVE RAPID MAXILLARY EXPANSION AND CONSTRICTION FOLLOWED BY FACEMASK PROTOCOL IN CLASS III MALOCCLUSIONS
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AIMS: To retrospectively investigate the effects on skeletal, dental and soft tissue structures in growing patients after treatment with a facemask following the alternate maxillary expansion and constriction (Alt-RAMEC) protocol and to compare the results with an untreated group of patients of the same age and with the skeletal problem.
MATERIALS AND METHOD: Archived records of 20 Class III maxillary retrognathic patients (study group; mean age: 9.74 ± 1.46 years). The expansion and constriction protocol lasted for 9 weeks. Additionally, the patients were treated with a facemask (mean duration 7 months) and a Class III bionator for retention, for 4 months. Cone beam computed tomography (CBCT) images and three-dimensional (3D) photographs taken before (T0) and after (T1) expansion and after retention (T2) were evaluated. This study group was compared with a control group of 16 patients whose records included a pair of cephalometric radiographs and 3D photographs. The IBM Statistical Package for Social Sciences (SPSS Statistics 22, IBM SPSS, Turkey) program was used for statistical analysis. Conformity of the parameters to the normal distribution was assessed by the Shapiro Wilks test. For intergroup comparisons a Student’s $t$-test was used, while a paired sample $t$-test was used for intragroup comparisons. Significance was evaluated at a level of $P < 0.05$. 

RESULTS: A significant forward (3.49 mm) and downward (1.15 mm) displacement of point A was achieved. The upper incisors and molars moved significantly forward and downward while the lower incisors moved significantly upward and the lower molars moved significantly forward. Upper intermolar distances and lower intermolar mesiobuccal cusp distance increased significantly. The treatment protocol affected not only the maxilla, but also neighbouring facial bones. The nasal and zygomatic bones moved significantly forward, while internasal and interzygomatic distances increased significantly. Soft tissue changes followed the skeletal ones, with all the measured points moving forward, apart from B' and Pog' which did not show a significant change.

CONCLUSION: The treatment protocol described was very effective for correcting Class III malocclusions and the results were comparable with skeletally assisted maxillary protraction studies.

SP368 ELECTROMYOGRAPHIC ACTIVITY OF MASTICATORY MUSCLES IN GIRLS WITH REPRODUCTIVE HEALTH DISORDERS AT PUBERTY
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AIMS: Girls with reproductive health disorders (RHD) have problems in the dentofacial region, that may be associated with masticatory muscle activity. The aim of this study was to determine electromyographic (EMG) activity of masticatory muscles in girls with RHD.

SUBJECTS AND METHOD: Thirty two girls with violations of reproductive health, such as delay of sexual development and menstrual disorders were examined. Their average age was 15.6 ± 1.6 years. The comparison group consisted of 25 girls without any somatic problems, aged 15.8 ± 1.4 years. Surface EMG of the masseter and anterior temporal muscles was performed during maximum voluntary contraction, left and right clenching, mouth opening and forward mandibular movement. Average amplitude, maximum amplitude and surface of bioelectrical potential were analyzed. The level of significance was set at $P < 0.05$ for all statistical analyses.

RESULTS: Increased average amplitude and the surface of bioelectrical potentials of the anterior temporal and masseter muscles in girls with RHD was observed in all tests. Also irregular EMG activity and asymmetry of the temporal and masseter muscles on the left and right sides was identified during maximum voluntary contraction, mouth opening and forward mandibular movement. Increased values of bioelectrical activity of the masticatory muscles on the balancing side were found during clenching on one side.

CONCLUSION: Increased EMG activity of temporal and masseter muscles in all tests was observed in girls with RHD, relative to control subjects.

SP369 ASSESSMENT OF APICAL ROOT RESORPTION DURING TREATMENT WITH REMOVABLE ORTHODONTIC APPLIANCES IN THE MIXED DENTITION – A PROSPECTIVE MULTIOBSERVER STUDY
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AIMS: A limited number of prospective investigations on root resorption following orthodontic treatment with removable appliances in patients in the mixed dentition are available. The aims of the present study were: 1) to evaluate the occurrence and severity of root resorption of maxillary incisors during orthodontic treatment with removable appliances in patients in the mixed dentition; 2) to investigate inter- and intra-observer agreement with regard to assessment of apical root resorption.

SUBJECTS AND METHOD: One hundred and ten healthy patients (49 girls, 61 boys) in the mixed dentition with a large objective treatment need. Two or three intra-oral periapical radiographs of the maxillary incisor region were obtained; 1) before the start of treatment; 2) following active treatment of 6 to 12 months. Five observers independently assessed the degree of apical root resorption of the maxillary lateral and central incisors according to a modified index of Levander and Malmgren (1988) from grade 0 (intact root contour) to grade 4 (root resorption > one-third of the root length). In order to calculate intra-observer agreement all observers assessed a random sample
of 20 patients one month after the first observation. Inter- and intra-observer agreement were calculated as the weighted Kappa index.

RESULTS: Before the start of treatment 98.5 per cent of all roots were assessed as grade 0, 1 and 2, 1.5 per cent as grade 3 and no root as grade 4. During active treatment 93.5 per cent of the roots were assessed as grade 0, 1 and 2. Five per cent were assessed as grade 3 and 1.5 per cent as grade 4. Overall observer agreement for grading 0 to 5 expressed as pairwise observer agreement, was low. When a cut-off was made grouping the grades 0-2 in one group and grades 3-4 in another group, the observer agreement was markedly higher.

CONCLUSION: This prospective multiobserver study on patients in the mixed dentition with removable appliances showed that apical root resorption of clinical significance during active treatment in the mixed dentition, was infrequent. Grouping the five grades into two groups (0-2, 3-4) resulted in high inter and intra-observer agreement.

SP370 FLUORIDE RELEASE POTENTIAL OF BIOACTIVE ORTHODONTIC ADHESIVE SYSTEMS
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AIMS: To assess the fluoride release potential of bioactive orthodontic adhesive systems of different chemical composition.

MATERIALS AND METHOD: The test specimens were three commercial bioactive fluoride-containing adhesives: light-cure Transbond Plus (3M Unitek, USA), Light Bond Paste With Fluoride (LBF) (Reliance Orthodontic Products Inc., USA) and the dual-cure Geristore® adhesive with Tenure® primer (DenMat, USA), and one control non-bioactive adhesive Transbond XT (3M Unitek). The Bluephase Style curing unit (Ivoclar Vivadent, Liechtenstein) was used for illuminating 10 specimens of each adhesive system at 1100 mW/cm² for 10 and 20 seconds in a simulation of the clinical bonding procedure under a metal premolar bracket, totaling 80 samples. Microhardness was assessed by the Vickers method on Leica VMHT MOT (Walter Uhl, Germany) before and after four weeks of immersion in artificial saliva of pH 4.8 at 37°C in a simulation of intraoral conditions in the presence of mature dental plaque biofilm. The amount of fluoride release was monitored by a fluoride ion selective electrode on Expandable Ion Analyzer EA 940 (Orion Research, USA). Analysis of variance, the Student-Neuman-Keuls post hoc test and Pearson correlation were used for statistical analysis.

RESULTS: Fluoride release after four weeks was related to both adhesive system type and curing time (P < 0.05) and decreases in the following order: Transbond Plus10 > Transbond Plus20 > Geristore-Tenure*10 > Geristore-Tenure*20 > LBF10. > LBF20. The amount of decrease of microhardness after four-weeks of immersion in artificial saliva was related to increased release of fluorides (r = 0.651; P < 0.001). Transbond Plus had significantly superior white spot lesion preventive potential due to twice greater fluoride ions release in comparison with other bioactive adhesives, Geristore-Tenure® and LBF. Microhardness of bioactive Transbond Plus decreased on average by 40 per cent, while its non-bioactive control adhesive system changed its microhardness for only 5 per cent.

CONCLUSION: Transbond Plus has superior remineralisation potential in comparison with other tested commercially available bioactive orthodontic adhesives, but its high microhardness changes raise concerns of bond strength properties.

SP371 CORROSION PROPERTIES OF ORTHODONTIC MINI-IMPLANTS
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AIMS: To examine to what extent oral hygiene agents affect corrosion of the head of mini-implants thereby increasing roughness. This could allow higher retention of plaque and propagation of mucositis and peri-implatits instead of preventing them.

MATERIALS AND METHOD: Three types of commercially available mini-implants were tested: those made of stainless steel and titanium alloys Ti-6Al-4V, grade 5 and 23. They were immersed in the experimental solution: artificial saliva with a pH 4.8, saliva with probiotic bacteria *Lactobacillus reuteri* and saliva with oral antiseptic chlorhexidine (CHX). Immersion lasted 28 days and the solutions were replaced once a week. In order to simulate intraoral conditions, samples were thermocycled through 2500 cycles from 5-50°C for the first 5 days, after which they were stored in an incubator at a temperature of 37°C until the 28th day. Atomic force microscopy was used to analyse surface topography before and after immersion using parameters: roughness average (Ra), root mean square (Rms) and maximum height (Mh). The measurement of microhardness was conducted by the Vickers method.

RESULTS: Corrosion of mini-implants depends on the type of material and corrosive media, and it is reflected more in the change of the surface roughness of the head than in microhardness. Exposure of titanium implant grade 5 to probiotic bacteria significantly increased roughness in parameters Mh, Ra and Rms compared to CHX, artificial saliva and unexposed implants ($P < 0.005$). Exposure to CHX significantly increased the roughness of steel implants in comparison to other experimental conditions ($P < 0.05$). Exposure of titanium implant grade 23 to media increased roughness only in parameter Mh after exposure to artificial saliva and probiotics, but not after CHX ($P = 0.003$). Exposure of mini-implants to saliva, probiotics and CHX did not significantly change the microhardness of titanium implants. However in steel implants exposure to CHX and probiotics decreased microhardness compared to unexposed implants ($P < 0.031$), but not in comparison to saliva.

CONCLUSION: Probiotics increase the roughness of titanium mini-implants, while CHX of steel mini-implants. Therefore, to prevent mucositis and peri-implatitis in patients undergoing orthodontic treatment with temporary anchorage units the use of CHX could be recommended for titanium, and probiotics for steel mini-implants for oral hygiene.

SP372 CHARACTERIZATION OF RETRIEVED ORTHODONTIC PALATAL IMPLANTS
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AIMS: To characterize the morphological and elemental alterations in used orthodontic palatal implants.

MATERIALS AND METHOD: Palatal implants (Orthosystem, Straumann AG, Basel, Switzerland) were removed from patients due to increased mobility (failed group) or upon termination of their service (retrieved group); as-received implants served as control. The respective SLA surface (sandblasted with large grits of 0.25-0.5 mm and acid etched with HCl/H2SO4) morphology of both implants was imaged by scanning electron microscopy (SEM) and the surface elemental composition was investigated employing X-ray energy dispersive spectroscopy (EDX) analysis.

RESULTS: SEM and EDX analysis showed extended morphological and elemental alterations with integuments formed on the surface of the retrieved implants. The element precipitates on the surface were O, C, Ca and P while traces of Na, K, Al, S, Cl and Mg were also identified. The surface of the control samples were characterized by small pits, while only Ti with traces of Al were identified by EDX analysis. The presence of all the aforementioned elements apart from Ti and Al on the surface of retrieved implants should be attached to the contact of implant with bone and oral fluids.

CONCLUSION: Retrieved palatal implant surfaces have undergone morphological and elemental surface alterations probably associated with the osseointegration process during use.

SP373 MIRROR, MIRROR, ON THE WALL, SELF-PERCEPTION TELLS MOST-OF-ALL: SELF-PERCEPTION IS MORE CORRELATED WITH QUALITY-OF-LIFE THAN CLINICAL MALOCCLUSION
AIMS: To evaluate how people’s perception of their own smile compares to how professionals rate it, and how both measures relate to their quality of life (QoL).

MATERIALS AND METHOD: In this cross-sectional, multi-centre study, data were collected from adolescents (N = 2035) at 13 schools in Mexico and Peru. Self-assessed malocclusion was measured using the Index of Orthodontic Treatment Need (IOTN) Aesthetic Component. Calibrated dentist-examiners measured malocclusion severity using the Index of Complexity, Outcome, and Need (ICON). Oral Health Related Quality of Life (OHLQoL) was measured using the Child Oral Health Impact Profile (COHIP-SF19). The sensitivity and specificity of self-perceived malocclusion (IOTN ≥5) was calculated against gold-standard normatively determined malocclusion (ICON ≥43), and compared total and socio-emotional COHIP scores for those classified as true negative (TN), true positive (TP), false negative (FN), or false positive (FP) for malocclusion (Mann-Whitney U-test).

RESULTS: The mean participant age was 14.1 ± 1.7 years; 51.5% per cent female. Participant and practitioner malocclusion assessments were correlated (Spearman ρ = 0.37), but participants significantly underestimated malocclusion severity (P < 0.001). Few participants self-perceived malocclusion (9.9%), but half of all participants (49.9%) were diagnosed with malocclusion, indicating poor sensitivity of self-assessed IOTN score to identify clinically evident malocclusion (sensitivity = 17.5%, specificity = 96.9%). Total and socio-emotional OHRQoL were significantly lower in participants with malocclusion (P < 0.001). However, participants that self-perceived malocclusion (TP, FP) had lower overall (TP = 51.1, FP = 51.9) and socio-emotional (TP = 28.7, FP = 27.4) OHRQoL, and these scores did not statistically differ by normative assessment (P > 0.05). In contrast, participants that did not self-perceive malocclusion (TN, FN) had higher overall (TN = 57.7, FN = 56.3) and socio-emotional subscale (TN = 31.3, FN = 30.5) OHRQoL, and scores were likewise similar by normative assessment (ICON), although statistical significance was reached (P < 0.01). Relationships were consistent by age, gender, location, and indigenous status.

CONCLUSION: Participants underestimate malocclusion severity, but participants that do self-perceive malocclusion report lower OHRQoL. This suggests that the burden which malocclusion has on the individual is more closely related to self-evaluation than how crooked the teeth actually are. In this setting, self-perception may better indicate QoL than clinical diagnosis and should be considered in treatment planning.

SP374 CHEMOKINE CXCL12 IS INVOLVED IN RECRUITMENT OF CRANIAL NEURAL CREST CELLS TO THE FORMING PALATE IN MICE

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AIMS: Cleft lip and/or palate (CLP) is a common facial congenital malformation. However, the exact biological mechanisms are still not completely understood. During early development of the foetus, cranial neural crest cells (CNCs) migrate from the neural tube to different regions of the craniofacial area. Those CNCs contribute to the formation of the cartilage, bone, and muscles in the palate. When CNCs do not migrate to the craniofacial area congenital abnormalities will occur. It was postulated that expression of chemokine CXCL12 in the epithelial layer of the palatal shelves could direct CXCR4-positive CNCs to the developing palate.

MATERIALS AND METHOD: Day 15 (E15) foetuses of 8-10 week-old pregnant wildtype (wt) mice (n = 10), were used for this study. (Immuno)histochemical stainings of palatal structures was performed using haematoxylin-eosin staining and antibodies against chemokine CXCL12, its receptor CXCR4, and transcription factor SOX-9 (cranial neural crest cell marker).

RESULTS: This is the first study, demonstrating an overexpression of CXCL12 in the epithelial cells of the disintegrating midline epithelial seam (MES) during palatal fusion, while CXCR4 was present in both the MES and mesenchyme of the palatal shelves. It was demonstrated that at E15 cranial neural crest cells are present in the palatal shelves and positive for the receptor CXCR4.
CONCLUSION: The striking overexpression of CXCL12 in the disintegrating MES during palatal fusion and presence of CXCR4 positive cranial neural crest cells in the palatal shelves suggest that the chemokine CXCL12 is involved in the recruitment of CNCs to the forming palate.

SP375 THE RELATIONSHIP BETWEEN MASTICATORY MOVEMENTS AND MOLAR OCCLUSION IN LATERAL DEVIATION OF THE MANDIBLE
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AIMS: The current study classified patients with a skeletal Class I (0° ≤ ANB ≤ 3°) lateral deviation of the mandible into those with or without a molar crossbite. This study compared the patterns of masticatory movements and axial inclination of the first maxillary and mandibular molars in those individuals.

SUBJECTS AND METHOD: Twenty two patients with an asymmetric skeletal Class I malocclusion who were diagnosed with lateral deviation of the mandible (deviation from Me of 5 mm of more and not including patients with a functional crossbite). If the first maxillary and mandibular molars were normally covered by the side of the jaw where the mandible was deviated, the subjects were assigned to the normal bite group (13 patients: 4 males, 9 females). If a crossbite existed on the side of the jaw where the mandible was deviated, the subjects were assigned to a crossbite group (9 patients, all female). A three-dimensional (3D) system to measure mandibular movement with 6 degrees of freedom was used to measure masticatory movements while chewing gum. Chewing patterns were assessed and classified into six patterns, and the frequency with which those patterns appeared was calculated. A contact 3D measuring system was used to measure axial inclination of the first maxillary and mandibular molars in a model of the mouth, and the groups were compared.

RESULTS: In the normal bite group, a type IV pattern of masticatory movement (a tear-drop pattern) was noted 45 per cent of the time. In the crossbite group, a type VII pattern of masticatory movement (a crossover pattern) was noted 29 per cent of the time. In the crossbite group, the first molars were significantly inclined buccally in comparison to the normal bite group. Thus, the molar region retained its normal coverage even when the mandible was deviated. This is presumably because chewing patterns and dental compensation of the mandibular molars cause buccal inclination of teeth on the side of the jaw where the mandible deviated.

CONCLUSION: Functional factors such as chewing patterns may affect the presence or absence of a crossbite of the first molars.

SP376 PREVALENCE OF INDIVIDUAL TEETH AMONG OLIGODONTIA PATIENTS
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AIMS: Oligodontia is a rare (frequency 3-11:1000 birth) disorder which may affect both the primary and permanent dentition. It characterises with a lack of six or more teeth. The cause of the syndrome is not proven, but there are a few genes (PAX9, AXIN2) considered to cause the disorder. It may occur spontaneously or accompanying general syndromes (for example ectodermal dysplasia). Females are reported to suffer from the syndrome more often than males (relationship 3:2). Patients with oligodontia are challenging cases in orthodontic practice. Their treatment should be interdisciplinary and needs cooperation between general practitioner, oral surgeon, prosthodontist, dentofacial surgeon and genetic practitioner. The aim of this research was to determine the prevalence of individual permanent teeth amongst patients with oligodontia undergoing an orthodontic treatment.

MATERIALS AND METHOD: The medical histories of 19 patients (8 females, 11 males; between 17 and 17.09 years, mean age 11.16 years) were reviewed. According to the dental pantomograph, a dentition diagram was made for every patient. The third permanent molars were not taken into consideration because of the wide age range of the patients. The prevalence of occurrence of every tooth was measured.
RESULTS: The patients were missing from 6 to 23 teeth (mean 13.63). In females between 10 to 22 teeth (mean 14.13) were missing, while for males the lack was between 6 and 23 teeth (mean 13.27). The teeth most commonly missing in patients with oligodontia were the second premolars, upper first premolars, upper lateral incisors and second molars.

CONCLUSION: Patients with oligodontia definitely need multidisciplinary care. Genetic tests should be undertaken in patients with oligodontia to determine if the syndrome is spontaneous or a symptom of a general disorder.

SP377 PSYCHOLOGICAL EVALUATION AT EACH TREATMENT STAGE IN MAXILLOFACIAL DEFORMITY PATIENTS – COMPARISON OF THE TYPES OF DEFORMITIES
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AIMS: The assessment of quality of life (QoL) is becoming increasingly important in dentistry, but it has not been fully investigated in orthodontic patients. The aim of this research was to investigate disease specific QoL (oral health) in patients who underwent surgical orthodontics at each treatment stage according to the type of deformities.

SUBJECTS AND METHOD: Sixty three mandibular protrusion, 12 maxillary protrusion and 36 facial asymmetry patients who received surgical orthodontics. The patients were divided into three groups based on their treatment stage: pre-treatment (T1), pre-orthognathic surgery (more than 4 months after set of appliances; T2), post-orthognathic surgery (more than 3 months after surgery; T3). The subjects of each group completed the Orthognathic Quality of Life Questionnaire (Cunningham et al., 2000), a disease specific QoL (oral health) assessment questionnaire. The instrument was developed for orthognathic patients and consists of 22 statements. The following were evaluated: ‘awareness of dentofacial aesthetics and oral function’ and ‘social aspects of dentofacial deformity’ using a visual analogue scale which was marked from 0 to 10; 0 being ‘no problem’ and 10 being ‘the worst problem’. Kruskal-Wallis and the Mann-Whitney U test were performed for statistical evaluations.

RESULTS: The score of ‘awareness of dentofacial aesthetics and oral function’ of mandibular protrusion patients were shown to worsen between T1 and T2, and to significantly improve between T2 and T3. Similarly ‘social aspects of dentofacial deformity’ score improved between T2 and T3. The score of ‘awareness of dentofacial aesthetics’ of facial asymmetry patients improved between T2 and T3. There were no significant differences in any group of maxillary protrusion.

CONCLUSION: The disease-specific QoL of the patients who received surgical-orthodontics were different between types of dentofacial deformity. The QoL of mandibular protrusion and facial asymmetry patients were in the aesthetically improved domain after orthognathic surgery.

SP378 FORCE DEGRADATION OF LATEX-FREE INTERMAXILLARY ELASTICS DURING ORTHODONTIC TREATMENT. AN IN VIVO STUDY OVER A 24 HOUR TIME PERIOD
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AIMS: To investigate, in vivo, the rate of force degradation of intermaxillary, latex-free elastics delivering two different force levels, over a time period of 24 hours.

SUBJECTS AND METHOD: Heavy (128 g) and extra heavy (170 g) latex free elastics were tested (non-latex elastics, WestElast, West Consult AB, Ljungskile, Sweden). Sample size calculation was based on a difference of 20 per cent in force reduction between the two types of elastics and a standard deviation of 10 per cent. Twelve patients were needed, and 16 were included to compensate for dropouts. Sixteen consecutive patients (8 boys, 8 girls; mean age 17.2 years) were chosen who satisfied the inclusion criteria: treatment stage of 0.019 × 0.025 inch stainless steel posted wires in both jaws, the need for Class II intermaxillary elastics and observed positive compliance. Class II ¼ inch (6.35 mm) heavy elastics were worn on the right side, and ¼ inch (6.35 mm) extra heavy elastics on the left side. The elastics were only removed when eating and brushing the teeth and immediately placed back. The force delivered by the elastics was measured before treatment (T0) and at 4 (T4), 8 (T8) and 24 (T24) hours with a calibrated electronic force gauge (Portable Electronic Scale WH-A04 Guangzhou WeiHeng Electronics, Guangzhou, China).
RESULTS: In the heavy elastic group, the majority of elastics broke between T8 to T24. The force dropped on average from 114 g to 49 g at T4, 30 g at T8 and 15 g at T24 for the heavy elastics and from 153 g to 78 g at T4, 61 g at T8 and 41 g at T24 for the extra heavy elastics. The heavy elastics dropped their force an average of 58 per cent between T0-T4, a further 35 per cent between T4-T8 and 56 per cent between T8-T24. The extra heavy elastics dropped their force an average of 50 per cent between T0-T4, further 22 per cent between T4-T8 and 37 per cent between T8-T24.

CONCLUSION: Both elastics experienced significant amounts of force decay in vivo over a 24 hour time period. The largest force loss occurred in the initial 4 hours and in both the heavy and extra heavy elastics. Elastics should be replaced within 4 hours or earlier.

SP379 HUMAN GENOME ANALYSIS FOR IMPACTED SUPERNUMERARY TEETH IN THE REGION OF THE MAXILLARY INCISOR
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AIMS: One of the disorders commonly found in the human dentition is the existence of supernumerary teeth. Amongst many locations, impacted supernumerary teeth in the maxillary incisor area, namely mesiodens, are the most common. Several theories have been proposed defining the aetiology of supernumerary teeth, including atavism, tooth germ dichotomy and hyperactivity of the dental lamina. Generally, their occurrence is considered as a combination of both genetic and environmental factors, as some cases are familial inherited while others accompany several syndromes, yet most cases are sporadic. Despite those claims, development of supernumerary teeth is still not clearly understood, moreover the genetic background of supernumerary teeth in humans remains unclear. In the present study, whole-exome sequencing of supernumerary teeth in non-syndromic Japanese individuals was conducted to identify the susceptible genes and/or loci.

SUBJECTS AND METHOD: Four Japanese families, two where the first and second generations have supernumerary teeth and two families where only the second generation had supernumerary teeth. Moreover, 14 sporadic Japanese individuals with impacted supernumerary teeth in the maxillary incisor area were included in the sample. Individuals were diagnosed by examining a panoramic or upper anterior occlusal radiograph and interviewing the patient about their medical and dental history. All individuals had no syndrome or congenital anomalies such as a cleft lip and palate. Whole-exome sequencing was conducted for all subjects. This study was approved by the Ethics Committee of Showa University.

RESULTS: Sixty five candidate genes were extracted from the results of whole-exome sequencing.

CONCLUSION: Whole-exome sequencing is considered an effective strategy to elucidate the aetiology of dental diseases. Some candidate genes for supernumerary teeth were identified in Japanese individuals.

SP380 EVALUATION OF MANDIBULAR VOLUME IN THE THREE-DIMENSIONS CLASSIFIED BY VERTICAL SKELETAL PATTERNS
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AIMS: To examine the relationship between anteroposterior and vertical differences in maxillofacial morphology and mandibular volume.

SUBJECTS AND METHOD: Two hundred and thirteen Japanese adults (84 males, 129 females) who were divided into three groups based on the mandibular plane angle (Mp) measured in a cephalometric analysis: hypodivergent (Mp < 23°), normodivergent (Mp = 23-30°), and hyperdivergent (Mp >30°). The subjects were also divided into three groups based on the mandibular basal arch (ANB): Class I (−1° ≤ ANB < 4°), Class II (ANB ≥4°), and Class III (ANB < −1°). Mandibular volume was measured from cone-beam computed tomographic (CBCT) images that were analyzed using Analyze™ image processing software and compared among the three groups in
each classification. The mandible was divided into the tooth crown region and the body of the mandible, setting the border at the cervical region of the teeth, and a three-dimensional model was constructed for measurements.

RESULTS: No significant differences were noted in mandibular volume among Classes I, II, and III, as reported previously. An inverse relationship was found between mandibular volume and Mp, and a significant difference was noted in mandibular volume between the hypodivergent and hyperdivergent groups.

CONCLUSION: A relationship was noted between mandibular volume and vertical skeletal patterns.

SP381  FLUCTUATION OF FORCE MAGNITUDE IN CERVICAL HEADGEAR THERAPY
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AIMS: To study force magnitude fluctuation in headgear (HG) therapy
SUBJECTS AND METHOD: Subjects with a Class II or end-to-end molar relationship, mixed dentition and moderate crowning to be treated with cervical headgear (HG) were recruited for the study. They were allocated to light (L, 300 g) or heavy (H, 500 g) force in the HG; measured and monitored by a Smartgear (Swissorthodontics, Switzerland) module on the right side. The force magnitude was set with the patient sitting and looking straight forward. The inner bow of the HG was expanded (3-4 mm) and a long outer bow bent upwards horizontal 10-20 degrees in relation to the inner bow. The patients were asked to wear the HG for 10 hours, i.e. during sleep and in the early evening. They were seen every 6-8 weeks until the end of the study at 10 months; the force and the use of HG was controlled during visits. The present research was based on 40 children, 20 in both groups (mean age 9.80 years, ±0.73 SD, 15 males, 25 females). The first 6-8 weeks was an adjustment period with 300 g force in both groups and thus omitted from the study. The total number of days monitored was 11344.

RESULTS: In both groups great variability in force magnitude was recorded (range 0-900 g). The force fluctuated in all subjects during use of the HG. The median force in the L and H groups was 320 g and 480 g, respectively, which difference was statistically significant (P < 0.001 Mann-Whitney test). In the L group the force was <270, 270-330 and >330 g in 17.8, 41.4 and 40.8 per cent, respectively of the time HG was used. In the H group the force was <450, 450-550 and >550 g in 35.5, 45.6 and 18.9 per cent respectively, of the time HG was used.

CONCLUSION: This clinical trial shows that the force magnitude can be influenced by adjusting the force level in HG treatment. The force magnitude does not, however, remain steady but fluctuates during use of the HG. The head position probably has an effect on the force magnitude.

SP382  EVALUATION OF FACIAL SOFT TISSUES IN SKELETAL CLASS II DIVISION 1 PATIENTS WITH DIFFERENT VERTICAL GROWTH PATTERNS IN TWO AGE GROUPS
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AIMS: To evaluate facial soft tissue features of Class II division 1 patients with different vertical growth patterns in different age groups.
MATERIALS AND METHOD: Pre-treatment lateral cephalograms of 54 Turkish individuals (18 males, 30 females) were divided into six groups according to their age [mean age 11.6 years (range 9.5-14.5) and mean age 17.6 years (range 15.1-23.1)] and vertical skeletal patterns (SN-GoMe angle). Group 1: Younger hyperdivergent patients (SnGoMe: >37°) (n = 10), Group 2: Older hyperdivergent patients (n = 10), Group 3: Younger normodivergent patients (SnGoMe: 27-36°) (n = 10), Group 4: Older normodivergent patients (n = 8), Group 5: Younger hypodivergent patients (SnGoMe: <37°) (n = 8), Group 6 older hypodivergent patients (n = 8). Lateral cephalograms were traced and 15 soft
tissue measurements were measured. For statistical evaluation, one-way ANOVA and Kruskal-Wallis tests were performed.

RESULTS: In hyperdivergent cases, vertical chin thickness was found to be significantly increased, and Ricketts’ E line to upper and lower lip decreased with age. In hypodivergent and normodivergent cases, Ricketts’ E line to upper lip and H angle was found to be decreased with age. In younger patient groups, chin thickness in hypodivergent patients was significantly greater than in hyperdivergent patients. The upper lip was more protrusive in hyperdivergent patients than in hypodivergent patients. In older patient groups, subnasale to H-line measurement was significantly greater in hyperdivergent cases than in hypodivergent cases. No statistically significant difference in soft tissue thicknesses was found in subjects from different age groups.

CONCLUSION: Facial soft tissues can be affected by orthodontic treatment and/or orthognathic surgery; so orthodontists should be aware of perioral soft tissue characteristics for correct diagnosis and treatment planning. Soft tissue dimensions, especially the positions of the lips are not only influenced by skeletal pattern but also by age.

SP383 HOW DO INCISOR INCLINATION CHANGES FOLLOWING ORTHODONTIC TREATMENT INFLUENCE THE THREE-DIMENSIONAL CONFIGURATION OF THE FACE?
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AIMS: To examine the relationships between changes in three-dimensional (3D) facial topography and those in incisor inclinations following fixed edgewise orthodontic treatment with extraction of premolars.

SUBJECTS AND METHOD: Thirty patients (mean age, 20.8 ± 7.6 years) who underwent orthodontic treatment with premolar extractions. 3D facial images and lateral cephalograms were obtained before and after treatment. From each record, 200 facial and 10 cephalometric variables were extracted. Based on the feature vectors that were effective in distinguishing differences in nose-lip-chin profiles (Tanikawa, 2014), the records were categorized into three subject groups using a clustering method. Changes following treatment were compared between the subject groups using the ANOVA (P < 0.05).

RESULTS: Group 1 (n = 8) was characterized by a Class II, a greater proclination of the maxillary incisors, smaller labiomental fold, and greater protrusion of the lower lip before treatment; group 2 (n = 11), a Class II with a high-angled retrognathic mandible and smaller labiomental fold; group 3 (n = 11), a Class I and a greater labiomental fold. After treatment, the maxillary and mandibular incisors were retracted. Facial variables showed group 3 had a greater post-treatment increase of cheek prominence in the subnasal region, when compared with group 1. The corner of the mouth in group 1 was repositioned downward whereas neither group 2 or 3 had any significant change. Groups 1 and 2 showed a greater decrease of the naso-labial and labio-mental angles, whereas group 3 did not show any significant change.

CONCLUSION: Orthodontic incisor retraction was found to influence the facial configurations, with the pre-treatment naso-lip-chin profile patterns as effective predictors.

SP384 ASSESSMENT OF SYMPHYSIS MORPHOLOGY AMONG SKELETAL CLASS I, II AND III PATIENTS
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AIMS: To analyze the relationship between the mandibular symphysis and skeletal Class by linear and angular skeletal values.

SUBJECTS AND METHOD: Three hundred and eight five patients who required orthodontic treatment and had a profile radiograph as part of their diagnostic records were divided into three groups (skeletal Class I, II and III) depending on the ANB angle and Wits appraisal. Nine mandibular symphysis bone measurements (5 linear, 4 angular) were analyzed.

RESULTS: For B-B1-Gn and B-Pg-Me angles similar values for the three skeletal Classes were found. However Id-B-Pg angle was lower in skeletal Class II, suggesting a lower concavity of the symphysis in
these patients, followed by Class I and Class III where the concavity was higher. B-Pg-Mb angle was higher in skeletal Class II, followed by skeletal Class I and III. For linear measurements: Id-B, B-Pg and Id-Me, demonstrated the highest value in skeletal Class II, followed closely by skeletal Class III. The lowest value was found in skeletal Class I.

CONCLUSION: Linear measurements of mandibular bone symphysis were not related to skeletal Class in isolation, except for Id-Me measurement. The angular measurements of the mandibular symphysis showed a statistically significant difference between skeletal Class for Id-B-Pg and B-Pg-Mb.

SP385 ASSESSMENT OF SYMPHYSIS SOFT TISSUE MORPHOLOGY AMONG SKELETAL CLASS AND DIFFERENT FACIAL PATTERNS
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AIMS: To analyze the relationship between mandibular symphysis soft tissue in the facial pattern in different skeletal Class patients with linear measurements.

SUBJECTS AND METHOD: Three hundred and eight five patients who required orthodontic treatment and had a profile radiograph as part of their diagnostic records. They were divided into three groups (skeletal Class I, II and III) depending on the ANB angle and Wits appraisal, and according to their facial pattern (dolicofacial, mesofacial and brachyfacial) in ‘facial axis of Ricketts’. Three soft tissue measurements (Pg-Pg’, Gn-Gn’, Me-Me’) were analyzed.

RESULTS: In patients with a mesofacial pattern, the thickness of the symphysis at the Pg level was higher in skeletal Class II than in Class I but lower than in skeletal Class III. In patients with a dolichofacial pattern, the thickness was similar in skeletal Class I and II but increased considerably in skeletal Class III. However, the behaviour of the parameter in brachyfacial patterns was totally opposite. At the Gn level, only the difference in facial pattern was significant; the opposite was observed for a brachyfacial pattern which had the highest value. At the Me level, patients with a mesofacial pattern and skeletal Class III had the highest value, however, in dolichofacial and brachyfacial skeletal Class III had the lowest value.

CONCLUSION: The thickness of the mandibular soft tissue symphysis was related to skeletal Class, but not in isolation. It was related in terms of interaction skeletal Class/facial pattern for PG-Pg’ and Me-Me’. Gn-Gn’ measurement was only related to facial pattern.

SP386 THREE-DIMENSIONAL EVALUATION OF SOFT TISSUE CHANGES DUE TO CLASS III DOUBLE-JAW ORTHOGNATHIC SURGERY: A RETROSPECTIVE STUDY
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AIMS: To evaluate the soft tissue changes after Class III double-jaw orthognathic surgery and to evaluate the correlation between the skeletal and soft-tissue changes on cone beam computed tomography (CBCT) records.

MATERIALS AND METHOD: CBCT images of 26 treated skeletal Class III adult patients. The CBCT images of the patients, who received a Le-Fort I maxillary osteotomy combined with a bilateral sagittal split osteotomy, captured with the same machine were retrieved from the archive. Using Mimics 16.0 software (Materialise Europe, Leuven, Belgium) a coordinate system based on stable skeletal points was created. The spatial displacement of a number of skeletal and soft tissue points was calculated. Standard descriptive statistics were used for the calculation of the means and standard deviations of the values. To evaluate the changes due to surgery a paired t-test, and to determine the relationships between the skeletal and soft tissue variables Pearson’s correlation test were used. Intraclass correlation coefficient (ICC) was calculated by repeating the measurements for 10 per cent of the sample.

RESULTS: All measurements were found to be reliable. Based on the skeletal values, the maxilla moved anteriorly and the mandible posteriorly and superiorly. The maxillozygomatic suture showed
small but statistically significant displacement. $A'$ and $L_s$ moved anteriorly with a ratio of 0.91 and 0.79 to the maxillary movement, respectively. The ratio of the posterior displacement of $Li$ was 0.86 to the point $B$ displacement. $Pog'$ and $Gn'$ moved superiorly, also, in a correlated way to the mandibular movement. $Pn$ and $Sn$ movement ratios were 0.29 and 0.53, respectively, to the maxillary movement on the sagittal level. On the maxillozygomatic suture the soft tissue moved anteriorly.

CONCLUSION: The soft tissue drape reacts as one flexible unit in which the positional changes due to skeletal repositioning may extend gradually over different parts of the face (i.e. malar area). The general fashion of the soft tissue reaction may be considered reliable to predict, however, the exact qualitative and quantitative prediction requires more extended, well-designed, prospective studies given the multifactorial contribution to the final outcome.

SP387 EVALUATION OF MANDIBULAR DENTAL ARCH FORM IN TURKISH SUBJECTS: RICKETTS’ CLASSIFICATION AND ARCH DIMENSION MEASUREMENTS

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AIMS: To evaluate the mandibular dental arch form of Turkish subjects with a neutral occlusion using Ricketts’ arch form templates and dental arch dimension measurements.

MATERIALS AND METHOD: The mandibular dental casts of 49 orthodontically untreated subjects (13 males, 36 females) with a neutral occlusion, symmetric arch form, minimal arch-length discrepancy, balanced facial aesthetics and without any missing teeth were collected. All casts were scanned with a non-contact, three-dimensional scanning system (Trios2, 3shapeDental, Denmark) to obtain digital model images. Using Ortho Analyzer™ analysis, the reference points digitized on the image of each cast were the midpoints of the incisal edges, the canine cusp tips, the buccal cusps of the premolars, the first and the second molars. The following four linear measurements were measured and two proportions were calculated: intercanine width, intermolar width, intercanine depth, intermolar depth, canine width/depth (W/D) ratio and molar W/D ratio. Additionally, an individual arch passing through digitized points was formed and superimposed onto the Ricketts’ pentamorphic arch form templates (1: tapered, 2: narrow tapered,3: normal, 4: narrow ovoid, 5: ovoid) to determine the best-fitting arch form for each subject. Non-parametric Spearman rank correlations between the mean rankings of the Ricketts’ arch forms and the intercanine and intermolar widths, depths and ratios were statistically analyzed.

RESULTS: An ovoid arch form was observed in 47.9 per cent of the subjects, while the least observed form was narrow tapered with a percentage of 8.3. Statistically significant positive correlations were found between Ricketts’ arch form rankings and intermolar width, depth and molar W/D ratio while there was no correlation between the rankings and intercanine parameters. There were also positive correlations between intercanine depth, intermolar depth, canine and molar W/D ratios.

CONCLUSION: The most common mandibular dental arch form was ovoid in Turkish subjects with a neutral occlusion. The form of a fabricated archwire is usually defined by the intercanine width of the wire and the wire should basically be selected according to the patient’s intercanine distance. However, no significant correlation was found between Ricketts’ arch forms and intercanine measurements in this study.

SP388 CORRELATION BETWEEN CROWDING AND INTERRADICULAR SPACES MEASURED ON Cone Beam Computed Tomographs and Panoramic Views: A Predictive Tool for Evaluation Before Miniscrew Insertion?

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AIMS: 1) To evaluate the difference in interradicular space measured on panoramic radiographs compared to cone-beam computed tomographs (CBCTs) and 2) To evaluate how the presence of
adequate interradicular spaces for miniscrew insertion correlates to dental crowding, in order to help the clinician choose the correct radiographic examination for treatment planning.

**MATERIALS AND METHOD:** Eighty pre-treatment panoramic radiographs and 80 CBCTs of patients who underwent orthodontic evaluation were randomly selected. For each patient, pre-treatment digital models were available and tooth size-arch-length discrepancy was measured. Interradicular spaces were measured on CBCTs and panoramic radiographs. To address magnification and distortion, panoramic radiographs were calibrated using the actual width of teeth measured on digital models. Data from interradicular space measurements were used to draw a map of ‘safe zones’ for miniscrew insertion, where a space greater than 3 mm was considered as adequate. Statistical analysis was performed to assess whether interradicular spaces measured on panoramic radiographs and CBCTs were comparable and to detect whether a correlation between interradicular spaces and dental crowding exists. The error of the method was measured with Dahlberg’s formula and Bland-Altman plots. Significance level was set as $P < 0.05$.

**RESULTS:** On average, crowding was mild to moderate. On CBCTs, interradicular spaces greater than 3 mm were found in the mandible between the second molars and first premolars, whilst in the maxilla between the two central incisors. On panoramic radiographs only the interradicular space between the maxillary canine and lateral incisor was greater than 3 mm. Overall, panoramic radiographs underestimated the available spaces. Statistically significant correlations between crowding and some interradicular spaces were found, and two ‘safe zones’ maps were subsequently generated.

**CONCLUSION:** Calibration of panoramic radiographs with dental casts is of great clinical importance, when assessing interradicular spaces, though panoramic radiographs generally underestimated the interradicular spaces available compared to CBCTs. Since some interradicular spaces were found to be influenced by dental crowding, the two maps presented can be used during the preliminary orthodontic examination to locate the best sites for miniscrew insertion.

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**THE IMPACT OF ORTHODONTIC BANDS ON THE PERIODONTAL ATTACHMENT OF THE UPPER FIRST MOLARS**

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**AIMS:** To compare the periodontal attachment of banded upper first molars to untreated controls using bitewing radiographs.

**MATERIALS AND METHOD:** This was a retrospective cross-sectional study, investigating the attachment level of the upper first molars of an orthodontic test group and an untreated control group. In order to make the two groups comparable, they were matched according to age (15-16.25 years). Eighty six individuals were included in each group. No new radiographs had to be taken for this survey. Three parameters were measured on the digital bitewings: periodontal ligament space (PLS), measured as the most coronal distance between the alveolar crest and the tooth surface, measured mesially and distally of the tooth and on both sides; loss of attachment (LA), distance between the cementoenamel junction (CEJ) and the projection of the alveolar crest on the root surface, measured mesially and distally of the tooth and on both sides, angle between the lines (alveolar crests mesial and distal and CEJ mesial and distal). Descriptive statistics, Mann-Whitney U- and unpaired t-tests were performed. The level of significance was set at $P < 0.05$.

**RESULTS:** The mean duration of orthodontic treatment in the test group was 2.5 years. PLS was significantly larger on the mesial right molars (mean 0.2 mm, $P < 0.01$), but there was no significant difference on the three other areas (right distal, left mesial and distal). There was a significant LA in the mesial areas; right mean 0.3 mm ($P < 0.001$) and left mean 0.2 mm ($P < 0.01$), but no significant LA was measured on the distal surfaces of the upper molars. The angle was higher on both sides for the test group (right $P < 0.001$, left $P < 0.05$).

**CONCLUSION:** While there were no statistically significant differences detected on the distal surfaces of the molars, some measurements on the mesial surfaces indicated a statistically
significant LA. Although there were statistically significant differences for some parameters, the clinical relevance of the findings is open to debate.

**SP390 FACIAL SOFT TISSUE DEPTHS OF CHILDREN WITH MALOCCLUSIONS**
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**AIMS:** Soft tissues affect orthodontic treatment and are a necessary component in forensic facial reconstruction. Facial soft tissue positions are influenced by underlying hard tissues; however, only midline soft tissue can be measured using two-dimensional (2D) cephalograms. This retrospective, forensic, three-dimensional cone beam computed tomography (3D CBCT) imaging study investigated the relationship between cephalometric measurements and facial soft tissue thicknesses at the midline and bilateral landmarks of children.

**MATERIALS AND METHOD:** 3D CBCT (iCAT, Imaging Sciences) images from the records of 75 Caucasians (30 males, 45 females, aged 5-13 years) were divided into three groups based on Angle dental classification. Following university IRB approval, preliminary reliability testing was conducted on 10 randomly selected coded CBCTs measured twice (Dolphin 3D Imaging Software) following rerandomization at two week intervals (Intraclass correlations >0.9 were considered acceptable). One investigator measured soft tissue depths perpendicular to the hard tissue at 32 facial landmarks (8 midline and 12 bilateral pairs of landmarks). Twelve hard tissue parameters were measured using CBCT-derived lateral cephalograms. Group comparisons of measurements were made using one-way ANOVA, then adjusted for age and gender using ANCOVA. Pearson correlation coefficients were calculated to evaluate linear associations among measurements. Significance was accepted at P < .05.

**RESULTS:** Significant differences were found in soft tissue depths between groups. Bilaterally, Class III had significantly greater mid-infraorbital, supra M1, and gonion measurements (all P < 0.016) than Class II, and significantly greater gonion (P = 0.036) than Class I. Class I had significantly greater supra M1 measurements bilaterally than Class II (P = 0.014). Class III had significantly greater nasion (midline landmark) measurements than Class II and Class I (all P < 0.002). Class III also had significantly greater SNB and 1/1 (all P < 0.014) than Class II and significantly smaller ANB, SN-MP, and MP-/1 (all P < 0.009) than Class II, confirming dental diagnosis.

**CONCLUSION:** For computerized forensic facial reconstruction, Class III children had thicker soft tissue from the midfacial areas to the mandibular angle than Class II, possibly influencing clinical impressions and unmeasurable using 2D radiographs, whereas Class II children had thinner soft tissue in the area covering the molars than Class I or III.

**SP391 SHORT-TERM SKELETAL AND DENTOALVEOLAR EFFECTS OF TWIN-BLOCK THERAPY**
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**AIMS:** In this retrospective study, the short-term skeletal and dentoalveolar effects of Twin-Block (TB) therapy was evaluated cephalometrically by means of dental and skeletal responses, considering the contribution of skeletal growth in the self-correction of Class II malocclusions.

**SUBJECTS AND METHOD:** Twenty one patients (8 females, 13 males, mean age: 12.3 years) with a Class II malocclusion treated with a TB appliance were compared with a control group of 20 untreated subjects (10 females, 10 males, mean age: 12.7 years) with a Class II malocclusion. The lateral cephalograms of the subjects obtained at the start and at the end of phase I treatment with the TB appliance were measured using Dolphin Imaging, version 11.5 software (Dolphin Imaging, USA). The following skeletal and dental measurements were performed: SNA, SNB, ANB, Co-ANS, Co-Gn, Co-Go, Go-Me, U1-PP, U1-OL, L1-OL, IMPA, U1-Apo, L1-APo. The data was statistically analyzed with an independent-samples t-test and paired-samples t-test.
RESULTS: The observation periods were 13.85 and 14.85 months for the TB and control groups, respectively. The difference in durations was insignificant between the groups. During the treatment period the TB group showed significant differences in SNB, ANB, Co-GN, Co-Go, Go-Me, U1-PP, U1-OL, U1-Apo and L1-Apo ($P < 0.05$); while only the changes in measurements of Co-ANS, Co-Gn, Co-Go were found to be statistically significant in the untreated control group ($P < 0.05$). When the TB and control groups were compared, no significant difference was found in skeletal measurements, except for SNB and ANB ($P < 0.05$). On the other hand, the parameters representing upper incisor inclination (U1-PP, U1-OL) and upper and lower incisor positions (U1-Apo, L1-Apo) were significantly different between the groups ($P < 0.05$).

CONCLUSION: By comparing the short-term cephalometric findings of treated subjects with untreated growing Class II subjects, TB therapy is not able to produce skeletal growth changes such as enhancement of mandibular growth. Instead, the effects of this therapy were found to be dentoalveolar.

SP392 A THREE-DIMENSIONAL ANALYSIS METHOD FOR THE EVALUATION OF LIP PROTRUSION
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AIMS: To devise a three-dimensional (3D) analysis method that can be applied to the evaluation of lip protrusion.

SUBJECTS AND METHOD: Fifteen Japanese patients (males, $n = 6$; females, $n = 9$; mean age, 8 years 7 months) diagnosed with a skeletal Class I malocclusion with an acceptable facial profile. 3D images of the face at rest were recorded using a 3D surface imaging device (3dMDcranial System, 3dMD, USA). Each facial image was transferred to a personal computer, and the mid-sagittal, axial, and frontal planes were determined based on several reference points using an image processing software program (3D-Rugle, Medic Engineering, Japan). The subnasale (sn) and labiomentale (labm) were identified. The plane through sn and labm, perpendicular to the mid-sagittal plane, was defined as the lip base plane. The lip surface area and volume anterior to the lip base plane were calculated as 3D variables. In addition, lateral cephalometric radiographs were taken for each subject. The lip protrusion distance anterior to the sn-labm line was determined using lateral cephalograms. Pearson’s correlation was used to identify significant correlations between the lip protrusion distance and the 3D variables on each side.

RESULTS: The upper lip protrusion distance had moderate positive correlations with the upper lip surface area ($r = 0.53$) and lip volume ($r = 0.59$). The lower lip protrusion distance also had moderate positive correlations with the lower lip surface area ($r = 0.55$) and lip volume ($r = 0.60$).

CONCLUSION: There were correlations between the lip protrusion distance and the 3D variables on either side. The lip surface area and volume, which can be determined using this 3D analysis method, can be useful for evaluating lip protrusion.

SP393 ASSOCIATION BETWEEN THE LOWER THIRD MOLAR AND UPPER CANINE CALCIFICATION STAGES AND SKELETAL MATURATION
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AIMS: To evaluate the association between the lower third molar (LM3) and upper canine (UC) calcification stages and skeletal maturation.

SUBJECTS AND METHOD: Two hundred and seventy four subjects with an age range from 7 to 19 years (12.66 ± 2.76). Pre-treatment digital panoramic and lateral cephalometric radiographs of the patients were analysed. The right UC and LM3 were used as the sample. Tooth mineralization was assessed using a modification of the method of Gleiser and Hunt. Skeletal maturation was assessed with the cervical vertebrae maturation (CVM) method.

RESULTS: A significant association was found between CVM stage 2 and UC stage 4 and LM3 stage 1. CVM stage 3 corresponded with UC stage 5 and LM3 stage 2. CVM stage 4 matched with UC stage 5.
and LM3 stage 3. The correlations between CVM and calcification stages for the UC was 0.812 ($P < 0.01$) and for LM3, 0.735 ($P < 0.01$).

CONCLUSION: The indicator of the pre-peak of pubertal growth spurt could be the opened apical end of the UC root. The indicator of a deceleration of the growth spurt could be the formation of the pulp chamber and radicular bifurcation of the LM3. The calcification stages of UC and LM3 as indicators of skeletal maturity could be clinically used with caution, until this method is verified with a larger sample group.

SP394 ASSESSMENT OF MUSCULAR AND OCCLUSAL BALANCE FOR ENHANCING STABILITY FOR OUTCOMES OF ORTHODONTIC TREATMENT
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AIMS: Making a complex diagnosis by associating orthodontic and neurophysiological diagnostic methods in children with an Angle Class III malocclusion, which produces an efficiency increase in rehabilitation by means of individualized treatment.

MATERIALS AND METHOD: The study was based on data acquired from clinical and para-clinical examination of patients with Angle Class III malocclusions, treated at the Department of Pediatric Maxillofacial Surgery, Pedodontics and Orthodontics at the Emilian Coţaga clinic, at the Institute of Mother and Child from Moldova and at a private dental clinic (Orto-Dental). Electro-neurophysiological investigations were carried out at the university clinic Neuronova. In the study, two groups of children equivalent by age and number ($n = 58$) were included. Group 1 included children with an Angle Class III malocclusion, with the exclusion criteria being previous orthodontic treatment and group 2 healthy children, without orthodontic disorders.

RESULTS: In children with an Angle Class III malocclusion, the functional plasticity processes are diminished for the anterior temporal, masseter and digastric muscles, with a worsening of the dysfunction level during the process of mastication, forced bite and deglutition. Restoring functional plasticity potential under the influence of orthodontic treatment takes place in the following increasing order: masseter muscle, anterior temporal muscle and then digastric muscle. The method of recording the functional plasticity of muscles from the stomatognathic system is modern, and harmless. It can be applied to children with a sagittal malocclusion in order to reveal the adaptive potential of the muscles. For children with Angle Class III malocclusion, creating a complex diagnosis by associating traditional orthodontic methods and modern neurophysiological methods leads to an increased effectiveness of rehabilitation through individualizing interdisciplinary treatment.

CONCLUSION: With today’s technology, a clinician has the unique opportunity to thoroughly evaluate the masticatory system. It is now possible to adjust the occlusion not only in order to balance occlusal forces, but also to create an environment in which muscles can function in harmony with each other.

SP395 CHANGES IN CHEWING EFFICIENCY BEFORE AND AFTER MAXILLOFACIAL SURGERY IN CONJUNCTION WITH ORTHODONTIC TREATMENT
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AIMS: Functional changes in masticatory performance that occur after orthognathic surgery are known to recover over time, but the mechanisms underlying this recovery are unknown. A better understanding of this would be useful to establish treatment goals for surgical orthodontics. Patients who underwent maxillofacial surgery were observed to investigate the primary factors responsible for changes in chewing ability.

SUBJECTS AND METHOD: Twenty-seven patients (15 males, 12 females) were examined pre-operatively, and at 3, 6 and 12 months. Bite force was measured using a pressure-sensitive sheet (Dental Prescale; Fuji Photo Film Co., Tokyo, Japan) and its analyzing apparatus (Dental Occlusion Pressuregraph Occluzer 709; GC Co., Tokyo, Japan) to determine occlusal parameters, and take an
occlusal record using Blue Silicone (GC Co.) and its analyzing apparatus (Biteeye BE-I; GC Co.) to measure occlusal contact area and occlusal contact point. Electromyography of the masticatory muscles was performed.

RESULTS: The chewing ability, occlusal contact point, occlusal contact area, occlusal force, and performance of the masticatory muscles were slightly decreased between the pre-operative and 3 month post-operative time points, as well as between the 3 and 6 month post-operative time points. However, masticatory efficiency increased slightly between the pre-operative and 3 month time points.

CONCLUSION: There were some cases where chewing efficiency was not increased but occlusal contact point, occlusal contact area, occlusal pressure and masticatory muscle electromyography integral value were increased. From this result the possibility that recovery and adaptation of masticatory function in the new lower jaw position are not catching up is considered. Chewing efficiency is involved in not only for tooth contact but masticatory muscle, tongue and saliva. From the above, the importance of chewing training is suggested.

SP396 THE RELIABILITY OF BOLTON AND RICKETTS SHORT-TERM GROWTH PREDICTION METHODS
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AIMS: To evaluate the reliability of Bolton and Ricketts growth prediction methods.

SUBJECTS AND METHOD: Ninety four children (51 females aged between 9.4-14.5 years, 43 males aged between 9.5-14.9 years) who had two cephalometric headfilms obtained at different time points (mean time span between the radiographs was 2.2 years). The subjects were divided into three groups in response to the sagittal skeletal relationship of the jaws, according to Wits appraisal (Class I, Class II, Class III). The cephalometric films were analyzed in Dolphin Imaging 11.5. Bolton and Ricketts growth prediction methods were applied to the initial cephalometric films (T1) of the subjects and the findings were compared with the final cephalometric films (T2) for the measurements of SNA, SNB, ANB, A-NaPerp, Pg-NaPerp, Wits appraisial, FMA, SN-GoGn, PP-GoGn, PP-OP, MP-OP, U1-APo, L1-APo, U1-PP, U1-OP, L1-OP, IMPA. The data was analyzed with SPSS version 16.0 (SPSS Inc.) using the analysis of variance for one factor (ANOVA).

RESULTS: For all parameters, the Bolton prediction method was consistent with the actual measurements in all groups ($P > 0.05$). For Ricketts prediction of Class I subjects, PP-OP was significantly different from the actual measurements ($P = 0.01$). The measurements of PP-GoGn, PP-OP and Wits appraisal were found to be significantly different from the actual measurements in Class II subjects ($P < 0.05$). In Class III subjects, the Ricketts prediction method revealed significantly different values for Wits appraisal ($P = 0.03$).

CONCLUSION: The Bolton prediction method was totally reliable for the measurements in all groups. Even if there were statistically significant differences in some parameters, the Ricketts method was able to make reliable predictions for most parameters.

SP397 IMPACTED MAXILLARY CANINES – A STUDY ON CLINICAL VARIABLES AND MOLECULAR REGULATORY FUNCTIONS OF THE DENTAL FOLLICLE
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AIMS: Ectopic eruption and impaction of permanent maxillary canines is a frequent problem in clinical orthodontics. Previous studies have used conventional univariate statistics to analyse if variables from radiographs and geometric measurements can be used to predict impaction. However, the results are controversial and suggest that the aetiology is complex and requires further analysis. Impaction may also be related to biological mechanisms involved in tooth eruption and regulated by the dental follicle. A further understanding of these regulatory pathways could provide more insight into factors responsible for tooth impaction. The aims of this study were therefore to evaluate potential predicting clinical factors associated with maxillary canine impaction by the use of multivariate data analysis (MVDA), and to study molecular signals regulating functions of human dental follicle cells in order to understand the biological cause of impaction.
MATERIALS AND METHOD: The position of the canine (dental pantomograms), skeletal variables (profile radiographs) and dentoalveolar traits (casts) were recorded retrospectively in patients referred for surgical exposure of impacted maxillary canines (n = 45). Age- (11-17 years) and gender-matched orthodontic patients (n = 45) with normally erupting canines were used as controls. MVDA was performed using Simca (MKS Umetrics, Sweden). Human dental follicles were collected from patients referred for surgical exposure of impacted maxillary canines. Gene expression analysis was performed with quantitative polymerase chain reaction (qPCR). Differentiation capacity was determined by staining (tartrate resistant acid phosphotase, Alizarin Red and Von Kossa) and qPCR. Finally, the time-of-flight secondary ion mass spectrometry analysis was used to determine the elemental composition of the formed bone nodule and crystals.

RESULTS: MVDA showed no correlation between impacted maxillary canines and skeletal or dentoalveolar variables. The position of the canine was the only factor identified as a positive predictor for impaction. Cultured follicle cells could be induced to differentiate towards osteoblasts and bone nodule formation, confirming the existence of pluripotent mesenchymal cells in the dental follicle. The formation of numerous crystals, pyramidal in shape and optically transparent, was a consistent finding only observed in follicle cell cultures.

CONCLUSION: The spatial localization of the unerupted tooth is the only prominent predictor for maxillary canine impaction. Dental follicles have high regulatory capacity and their pluripotent potential may also be advantageous for regenerative procedures.

SP398 COLLAGEN I AND III GENE EXPRESSION IN THE CONDYLES OF SPRAGUE-DAWLEY RATS DURING THE LATE GROWTH PERIOD
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AIMS: To assess post-pubertal changes in collagen I (Col1) and III (Col3) gene expression in the condyles of female Sprague-Dawley rats.

MATERIALS AND METHOD: Permission was obtained from the local authorities. The animals of the present investigation (n = 50 females, 35 days old at start) were used as untreated controls; a soft diet was given. The animals were divided into 10 groups (n = 5 each) and one group of animals each was euthanized after 30, 33, 36, 40, 44, 47, 50, 54, 58 and 72 experimental days. Condylar head specimens were retrieved and analysed for Col1 and Col3 mRNA expression changes in relation to the ß-actin expression in the same specimen by quantitative real-time polymerase chain reaction.

RESULTS: For Col1, a more or less constant increase from 7.6 ± 2.10 to 13.0 ± 5.31 copy numbers was seen over the 42-day experimental period. At the same time, the growth rate of the animals in terms of weight gain decreased constantly. For Col3, a slight increase in expression was seen until experimental day 54. The mean values increased from 1.0 ± 0.35 to 2.6 ± 0.52 copy numbers before a reduction to 1.3 ± 0.65 (at experimental day 72) occurred.

CONCLUSION: During the post-pubertal period, the ratio of Col1:Col3 in the condyle of female Sprague-Dawley rats changes from 7.6:1 (65th day of life) over 4.6:1 (89th day of life) to 10:1 (107th day of life). Thus, the rat condyle seems to exhibit a late pubertal growth spurt.

SP399 MALOCCLUSION PREVALENCE AND TREATMENT NEEDS OF PATIENTS WITH B-THALASSAEMIA IN THE TURKISH-CYPRIOT POPULATION
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AIMS: To evaluate the malocclusion prevalence and treatment needs of patients with hereditary B-thalassaemia in Cyprus.

SUBJECTS AND METHOD: Ninety seven thalassaemic patients (47 males, 50 females) of Turkish-Cypriot ethnic origin with a mean age of 36 ± 9.07 years were included in the study which was approved by the institutional review board of the current institution in Northern Cyprus.
Additionally, every patient was asked to sign an informed consent form. The β-thalassemia patients who required regular medical controls were evaluated over a 3-month period in 2014 using the Index of Complexity Outcome and Need and the Dental Aesthetic Index.

RESULTS: Intraexaminer calibration was based on re-examination of 20 patients from the main study, which demonstrated good reliability (Kappa = 0.79). Of the 97 β-thalassaemia patients, 60 were recorded to be in the easy treatment complexity (61.85%), 20 in the mild range (20.61%), six moderate (6.18%), six difficult (6.18%) and five in the range of difficult treatment complexity (5.15%). The antero-posterior molar relationships observed in this cohort were normal (30.92%), half cusp (40.2%) and full cusp (28.86%). None of the patients exhibited a negative overjet. Normal overjet values were observed in 69 per cent of the subjects whilst 31 per cent had an increased overjet.

CONCLUSION: A significant number of the subjects with β-thalassaemia had an increased overjet and abnormal molar relationships. The results revealed that about 40 per cent of the patients had a definite need for advanced orthodontic treatment. The remaining 60 per cent also needed dental and/or orthodontic treatment.

SP400 HISTOLOGIC AND HISTOMORPHOMETRIC EVALUATION OF TOOTH-BORNE MANDIBULAR DISTRACTION OSTEONEOGENESIS
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AIMS: Distraction osteogenesis (DO) is the biological process of new bone formation between segments separated by traction. McCarthy (1992) firstly applied distraction osteogenesis for mandibular lengthening of patients with facial deformities. Although osteodistraction has been well established in the extremities, parameters used in craniofacial distraction have been essentially borrowed from orthopaedic experience. The aim of this study was to establish the role of two different frequencies in new bone formation with an intraoral tooth-borne device for mandibular distraction osteogenesis.

MATERIALS AND METHOD: Seven Beagle dogs (15-18 kg) were submitted to DO and three remained as the control group. Both hemi-mandibles were used for experimental purposes: group A: control group, group B: two daily activations of 0.5 mm; group C: 1 mm single daily activation. The distraction period was followed by 12 weeks of bone consolidation. Samples were processed and embedded in methylmethacrylate. Toluidine blue stains were executed on specimens for histological and histomorphometric evaluation of bone tissue formed within the distraction gap. The level of significance adopted was 5 per cent (α = 0.05).

RESULTS: Heterogeneity in the distribution of newly formed bone in the apical-coronal and buccal-lingual direction was detected in both experimental groups. Histological examination revealed non-union to be more common in the once daily activation group as well as the presence of a higher number of areas filled by cartilage tissue. Histomorphometric evaluation did not reveal statistically significant differences in bone volume in the distraction gap between the two groups (group B: 77.47 ± 23.18%; group C: 75.13 ± 25.81%). Differences were found in the coefficients of variation between the medial (23.20%) and buccal (48.94%) areas (P < 0.001), and the buccal (48.94%) and lingual (21.87%) areas (P < 0.001).

CONCLUSION: Tooth-borne DO is an effective alternative method for sagittal lengthening of the mandible. A reduction from twice to once daily activations appears to negatively change the quality and structure of new bone. Moreover, the lingual periosteal preservation technique is favourable for bone formation.

SP401 POLYMORPHISMS IN VITAMIN D RECEPTOR
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AIMS: To investigate possible links between single nucleotid polymorphisms in vitamin D receptor gene and root resorption after orthodontic treatment.

SUBJECTS AND METHOD: One hundred children were included in this study (31 patients aged 10 ± 4.1 years with external apical root resorption greater than 2 mm on panoramic radiographs after orthodontic treatment and 69 patients aged 12 ± 3 years without resorption). DNA was analyzed with real-time polymerase chain reaction for TaqI, BsmI, Apal, FokI and Cdx2 polymorphisms. The obtained genotypes were evaluated in relation to gender, age, skeletal Class and the type of orthodontic treatment.

RESULTS: No statistically significant differences were found between patients with and without resorption concerning occurrence of alleles or genotypes for each polymorphism. In a more detailed analysis, marginally important differences (trends) were observed for the frequencies of Apal ($P = 0.059$) and the haplotype TGCTA ($P = 0.063$) in boys.

CONCLUSION: Even though a significant role of vitamin D receptor gene polymorphisms was not established in girls, more research is needed in boys. In this small cohort of patients no associations of vitamin D receptor polymorphisms in girls were observed. In boys more research is needed as the slight trends observed imply possible associations of vitamin D polymorphisms with external apical root resorption.

SP402 GINGIVAL RECESSIONS IN PATIENTS TREATED WITH FIXED APPLIANCES IN BARCELONA UNIVERSITY
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AIMS: To assess the prevalence of gingival recessions in patients before and immediately after orthodontic treatment.

MATERIALS AND METHOD: Labial gingival recessions for all teeth were scored (yes or no) by two raters on initial and end-of-treatment photographs of 100 patients (41% male, 59% female) selected from a post-treatment archive. A recession was scored ‘yes’ if the labial cementoenamel junction was exposed. Their mean ages were 23 years at the initial assessment and 26 years at the end of treatment. All patients had a fixed retainer bonded to all six mandibular anterior teeth.

RESULTS: The proportion of teeth with recessions was not consistently higher (46%) after orthodontic treatment compared with recessions before treatment (40%).

CONCLUSION: Within the limits of the present research design, orthodontic treatment may not be a risk factor for the development of labial gingival recessions.

SP403 ANALYSIS OF THE BIOMECHANICAL BEHAVIOUR OF DIFFERENT TYPES OF ORTHODONTIC RETAINERS USING THE FINITE ELEMENT METHOD
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AIMS: Two different types of fixed retainers are widely used in orthodontic therapy: multistrand wire retainers and fibre-reinforced composite (FRC) retainers. The aim of this study was to evaluate the biomechanical behaviour of the tooth-periodontium-retainer system from the anterior mandibular region through finite element analysis method.

MATERIALS AND METHOD: Four three-dimensional models of the anterior region of the mandible were constructed. In terms of the working method, system geometries were configured using Rhinoceros, Nurbs modelling for Windows, version 5.0 and ANSYS Workbench 15.0. For the initial model enamel, dentine, and pulp for each tooth, the periodontal ligament and the bone were modelled. In the next step, on the initial model three types of dental retainers: multistrand wire and composite, glass FRC and polyethylene, FRC were made, thus obtaining four mandibular models. In this study, force was applied to the incisor edges of the central and lateral incisors. Based on data reported in the literature regarding the variation of occlusal forces between 40-200 N, it was decided to apply an axial force of 150 N.
RESULTS: In terms of stress distribution on the retainer surface, it appears that the greatest stresses are concentrated at the wire in the interdental areas. This indicates that there is a risk of detachment of the composite adjacent to these areas due to shear forces. The retainers made of FRC glass/polyethylene allow distribution of stress in the whole splint mass. FRC retainers allow a more balanced distribution of forces, associated with uniformity of dental stresses at the level of the canines and incisors. When using wire-composite wire, there was a greater reduction of stresses at the incisor level (15-25%) associated with a greater increase of stresses at the canine level (30-40%), demonstrating the more rigid nature of this splint type.

CONCLUSION: FRC retainers present certain advantages compared to multistrand wire retainers, regarding biomechanical behaviour. This information must be correlated with aspects on the clinical behaviour of these retainers, in order to select the best therapeutic approach.

SP404 THE AESTHETIC INFLUENCE OF VARYING MAXILLARY LATERAL INCISOR DIMENSIONS PERCEIVED BY DENTAL PROFESSIONALS AND LAYPERSONS
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AIMS: To determine the influence of varying the dimensions of the maxillary lateral incisors on perceived smile aesthetics and to compare the difference in the perception between professionals and laypersons.

MATERIALS AND METHOD: A photograph of a female smile was intentionally altered with a software imaging program. In one group, the width of the maxillary lateral incisor, in proportion to the central incisor, was altered producing six images (52%, 57%, 62%, 66%, 70%, 80%). In a second group, the length of the maxillary lateral incisor was altered at a 0.5 mm increments to produce six images with the lateral incisor (0 mm, −0.5 mm, −1 mm, −1.5 mm, −2 mm, −2.5 mm). The photographs were ranked from 10 'most attractive' to 1, 'least attractive' by 58 professionals and 58 laypersons.

RESULTS: The 57 per cent lateral-to-central width proportion was the most preferred by all groups, followed by the 66 per cent in the professional group, and by 57 per cent in the layperson group. A maxillary lateral incisor 0.5 mm shorter than the central incisor was the most popular maxillary lateral incisor length. Different values were observed in both groups, professionals and laypersons.

CONCLUSION: There is no evidence that suggests that any maxillary lateral incisor proportion should be considered as the ideal aesthetic standard. It is an aesthetic perception that depends on the people who are valuing.

SP405 CHILDHOOD OBESITY – A RISK FACTOR FOR BAD COMPLIANCE?
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AIMS: To assess whether or not being overweight in childhood is associated with lower levels of compliance during orthodontic therapy with removable appliances.

SUBJECTS AND METHOD: Starting in 2011 all upper expansion plates and Sander II appliances were equipped with a Theramon® microsensor chip to objectively assess appliance wear time. According to their pre-treatment Body Mass Index (BMI), normal weight patients were matched to consecutively treated overweight/obese patients by gender, age and appliance type. Cooperation was assessed with microelectronic wear time documentation over a period of at least 6 months. A total of 50 patients (25 overweight, 25 normal weight) with upper expansion plates and 64 patients (32 overweight, 32 normal weight) with Sander II appliances were analysed.

RESULTS: Spearman Rho coefficients showed an indirect association between BMI and appliance wear time, indicating that the higher the BMI the less the patients wore their appliances (P < 0.05). Furthermore, both normal and overweight children wore upper expansion plates significantly more than Sander II appliances (P < 0.05). Whereas no gender specific difference was found (P = 0.723), an age related correlation could be verified, indicating a decrease of wear time with increasing age (P < 0.05).
CONCLUSION: An increased BMI appears to be a risk factor for less appliance wear during orthodontic treatment with removable appliances. Additional factors which influenced cooperation during treatment with removable appliances were patient age and appliance type.

SP406 APPLYING KERNEL DENSITY ESTIMATION ON A SPHERE TO ANALYZE FLATNESS IN HEAD SHAPE AND ASYMMETRY
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AIMS: Modern three-dimensional (3D) technology offers new tools for measuring plagiocephaly and brachycephaly in neonatal and early postnatal circumstances without radiation hazard. In the former condition, the soft occiput of the cranium is flattened in the supine sleeping position on one side, resulting in an asymmetrical shape of the skull. In the latter, the occiput is flattened symmetrically. These conditions also may occur simultaneously. Asymmetry in craniofacial 3D images has been quantified for example by measuring and comparing volumes enclosed by different parts of the skull, but comparing the cranial form has been difficult. The aim of this study was to develop a method to use surface normal vectors of 3D head images to measure asymmetry and flatness. The distribution of normal vectors by kernel density estimator (KDE) were estimated based on spherical data. On the flat regions the normal vectors point in the same directions and these regions cause peaks on KDE function. The densities can be displayed by creating a two-dimensional contour plot of KDE function. Severity of flatness and asymmetry were quantified by functionals of the KDE function.

MATERIALS AND METHOD: The data included the 3D head images of 3 month old infants (n = 99), which were recorded in 2012 to 2014 using a stereo-photogrammetric device (3dMD, Atlanta, USA). Head images were classified by two paediatricians and analyzed by the new and conventional volumetric methods.

RESULTS: The new asymmetry score and the flatness score correlated with clinical ratings better than the previous method.

CONCLUSION: This technology can be used in cranial, facial and occlusal form follow-up studies and it may be useful also for parental education in neonatal care.

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SP407 MATHEMATICAL WRITING OF FORCES AND MOMENTS APPLIED TO THREE TEETH IN THE THREE DIMENSIONS OF SPACE: THE FORGOTTEN BUCCO-LINGUAL DIMENSION
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AIMS: The literature has extensively detailed application of forces and moments on two adjacent teeth in one arch (Burstone and Koenig, 1974). These systems of forces and moments were initially established in two dimensions. The aim of this research was to determine the mathematical formulas in three dimensions applied during tooth movement on a clinical set-up including three teeth.

MATERIALS AND METHOD: A frequently encountered clinical situation was simulated: a high-up maxillary canine surrounded by its two adjacent teeth. The focus was on the initial treatment phase during which the canine is levelled by means of a straightwire. Torsors, commonly used in mechanics, allow forces to be developed (also called resultants and moments). For the study of tooth movement, at a given time, the laws of statics were applicable.

RESULTS: The formulas were first written down in two dimensions to illustrate commonly accepted equilibrium laws. The demonstration was constructed such that vertical forces were present on each tooth. Similarly, two equal and opposite moments were applied on adjacent teeth. The same problem was addressed but taking into account the three dimensions of space. The difficulty to take into consideration is that the forces are not applied onto the long axis of each tooth but on their buccal surface at the level of the brackets. It is acknowledged that d_2 is the distance between the
long axis of each tooth and its bracket. With this three-dimensional (3D) writing, it was shown that vertical forces are the same as those already found in the previous formula. However, not only mesio-distal moments commonly described around the z axis were identified, but also bucco-lingual moments were being exerted along the x axis. These moments, although clinically present, are often forgotten in diagrams.

CONCLUSION: The literature has identified, in two dimensions, the forces and moments delivered by a straightwire on two contiguous brackets of various mesio-distal inclinations. A clinical set-up including three teeth demonstrates 3D forces and moments, highlighting the presence of rarely described bucco-lingual moments. The next step would be to simulate this clinical situation where the three teeth would not be colinear but curvilinear, to the image of an archform.

SP408 EVALUATION OF ORTHODONTIC BRACKET PLACEMENT ACCURACY UTILIZING A NOVEL DIRECT BONDING STENT***
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AIMS: To evaluate orthodontic bracket placement accuracy when utilizing a novel direct bonding stent (DBS).
MATERIALS AND METHOD: DBS were fabricated for patient and control groups to guide placement of orthodontic brackets. In the patient group, the DBS were fabricated using ‘working’ models of the patient’s teeth with brackets attached in preferred positions. Eight in vivo bonding locations were assessed for bracket placement accuracy. The facial surfaces of the following teeth were selected: the right maxillary first molar, and first premolar; the left maxillary central incisor and canine; the left mandibular first molar, and first premolar; the right mandibular central incisor and canine. Following bonding in vivo, impressions were made to produce the ‘patient’ or ‘assessment’ models. The bracket positions on the patient models were then compared with the bracket positions of the original working models. The mesiodistal (M-D), and occlusogingival (O-G) positions of each bracket were measured on the working and patient models using digital photography. This method was then repeated using two identical dentoform models, which served as the control group. Paired t-tests were used to compare bracket positions between working and patient models, as well as the mean differences in bracket positioning between patient and control groups.
RESULTS: A statistically significant difference in O-G bracket position was observed in the patient group (n = 8; P < 0.05). The in vivo placed brackets were positioned on average 0.19 mm more gingival than the working models. No significant differences were observed in the patient group between the working and assessment models in M-D position (n = 8; P > 0.05). Also, no significant differences were found in the M-D or O-G bracket positions between patient and control groups (n = 8; P > 0.05).
CONCLUSION: The O-G placement difference in the patient group (0.19 mm), although statistically significant, may not be of clinical importance. Overall, the novel DBS had consistently high accuracy in bracket placement.
mandible. They were examined approximately 6 months after insertion. The following clinical parameters were recorded: Plaque Index (PI), Gingival Index (GI), probing depth, recessions, bleeding on probing (BOP). Tooth mobility was determined by Periotest. In an in vivo experiment material probes of Twistflex- and Nitinol-retainers were tested due to their bacterial adhesion and biofilm characteristics. Statistical analysis was performed via unpaired t-tests.

RESULTS: In group 2 the parameters of PI, GI, probing depth and BOP were significantly reduced compared to conventionally manufactured Twistflex-retainers (P < 0.05). Relating to marginal recessions and measured tooth mobility, there were no significant differences between the groups. Physiological tooth mobility was improved with CAD/CAM-retainers compared to Twistflex-retainers. Concerning bacterial adhesion characteristics, in vivo biofilm analysis showed significant differences between conventionally compounded Twistflex-retainers and CAD/CAM-retainers at 6 monthly periods (P < 0.05) in favour of CAD/CAM retainers.

CONCLUSION: CAD/CAM-retainers showed improved periodontal hygienic data with regard to PI, GI, probing depth and BOP in contrast to Twistflex retainers. Biofilm analysis of Nitinol retainers revealed reduced bacterial adhesion characteristics compared to Twistflex retainers. Retainers made of Nitinol seem to exert an improved influence on factors of periodontal hygiene.

SP410 METAL RELEASE PROFILES OF BANDS, BRACKETS AND WIRES
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AIMS: To evaluate Co, Cr, Mn and Ni release (amounts and temporal release patterns) by the components of a typical orthodontic appliance during orthodontic treatment by long-term exposure (at least 44 days) of a range of commercially available bands, brackets and wires in an artificial saliva solution and regular measurement of solubilized metals

MATERIALS AND METHOD: Metal ion release was quantitated using an inductively coupled plasma quadrupole mass spectrometer (ICP-MS, Elan DRC+, Perkin Elmer, USA). Corrosion products were investigated by a scanning electron microscope equipped with an energy dispersive X-ray micro analyzer.

RESULTS: Bands released the largest quantities of Co, Cr, Mn and Ni, followed by brackets and wires. Three different metal release profiles were observed: (i) constant, though not necessarily linear release, (ii) saturation (metal release stopped after a certain time) and (iii) an intermediate release profile that showed signs of saturation without reaching saturation. These temporal metal liberation profiles were found to be strongly dependent on the individual test pieces. The corrosion products which developed on some of the bands after immersion in artificial saliva for six months and the different metal release profiles of the investigated bands were traced back to different attachments welded onto the bands.

CONCLUSION: Whilst the data are consistent with heavy metal release during orthodontic treatment at levels well below typical dietary intake, nevertheless the use of titanium brackets and replacement of the band with a tube in cases of severe Ni or Cr allergy is recommended.

SP411 SKELETAL ANCHORED MESIALISATION OF THE UPPER DENTITION – A THREE-DIMENSIONAL ANALYSIS OF THE TREATMENT EFFECTS
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AIMS: Congenitally missing lateral incisors or second premolars, extremely displaced canines, or severe trauma to the central incisors all result in a reduced upper dentition. Space closure by means of mesial tooth movement seems to be the most desirable option in many cases. The Mesialslider, attached via coupled mini-implants in the anterior palate, is used for mesialisation of the upper dentition either unilaterally or bilaterally. The aims of this study were (i) to identify whether control
points located at the palate are eligible to register digitised plaster casts from different time points and (ii) to analyse the treatment effects three-dimensionally.

SUBJECTS AND METHOD: In a retrospective study the effects of 48 consecutive treated patients with the need for upper molar mesialisation were evaluated. For this purpose pre- and post-treatment models were digitised using a plaster cast scanner (Dentaurum SmartOptics Activity 300). The vertex coordinates of the respective surfaces were processed with a commercial software program (Matlab R2014a, Mathworks, USA). Control points on the hard palate were placed manually and used to register the digital casts through a least squares approach. After this, the treatment effects were assessed as the differences between coordinates of corresponding molars from the registered digital casts.

RESULTS: The average upper molar mesialisation was 6.8 ± 2.6 mm, whereas the average duration of upper molar mesialisation was 11.8 ± 7.7 months. Visual examination confirmed reliable registration results.

CONCLUSION: Mini-implants in the anterior palate facilitate upper molar mesialisation. Using three-dimensional scanning and a sufficient number of control points, accurate measurements of tooth displacement can be performed.

SP412 GROWTH MODIFICATION VERSUS SURGERY FOR SEVERE CLASS II MALOCCLUSIONS
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AIMS: To evaluate the clinical outcomes of severe Class II subjects treated with a growth modification protocol compared to matched non-growing control subjects with full fixed orthodontic therapy and surgery.

SUBJECTS AND METHOD: Fourteen skeletal Class II patients (ANB angles of 5 to 10°) with severe overjets (8-13 mm) were closely matched in two equal groups with similar growth patterns (Y-axis = 67-68°) and gender. The average age of the growth modification group was 11.7 years.

RESULTS: All treated subjects in the growth modification group achieved Class I molars, overjets, overbites and lip function, all within normal limits regardless of their pre-existing growth pattern as determined by the cephalometric Y-axis measurement. The orthopaedic phase of growth stimulation of the mandible (Phase 1) varied in duration from 4 to 11 months and the total treatment time for both phases 1 and 2 of treatment, varied from 19 to 30 months with an average of 24 months. Control subjects with severe skeletal Class II dysplasia who had not received any orthopaedic growth modification procedures during their pubertal growth phase, showed a persistence of increased overjets, Class II molar occlusions, inter-labial gaps and enlarged cephalometric ANB angles following presumed growth cessation (16 to 43 years of age). In contrast, the subjects in the growth modification group were not deemed to require surgery, or alternatively were satisfied with the facial aesthetics produced in the absence of a surgical corrective procedure.

CONCLUSION: Growth modification, despite recent randomised controlled trial data and judging from the results of this study, remains a valuable and viable clinical adjunct for everyday orthodontic practice for growing patients with skeletal Class II malocclusions. The two phase treatment protocol in the patients reviewed, benefited from successful treatment via a non-extraction, non-surgical approach and in addition, they attained normal occlusions and improvement of their facial disharmony within an average two year time frame.

SP413 SKELETAL CHANGES AFTER POLYCYCLIC MAXILLARY EXPANSION WITH A BONE-BORNE DEVICE WITHOUT SURGICALLY ASSISTED RAPID PALATAL EXPANSION IN ADULT PATIENTS
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AIMS: To longitudinally investigate skeletal changes after polycyclic expansion of the maxilla using a bone-borne device in adult patients.
SUBJECTS AND METHOD: Twenty adults (14 females, 6 males) between 18 and 54 years (mean 26.2 ± 6 years). An expansion device (MICRO4) was fixed with four orthodontic mini-implants (OMI) in the maxilla. A polycyclic expansion protocol was used to weaken and subsequently widen the midpalatal suture. A cone beam computed tomograph (CBCT) was obtained after placement of the four orthodontic mini-implants and a second CBCT with the expander in place 3-5 months after maxillary expansion. Measurements were performed on the coronal cross-sections of the CBCT with OsiriX software. Statistical evaluation was performed as appropriate.

RESULTS: The mean expansion in the area of the anterior nasal spine, maxillary tuber, infraorbital foramen, and the maxillo-zygomatic sutures was 6.0 ± 2.2 mm, 4.1 ± 2.3 mm, 0.5 ± 0.2 mm, and 1.4 ± 1.5 mm, respectively. These differences were statistically significant (P < 0.05). The expansion between the optic foramen and the sphenoid bone was statistically not significant. The mean (±SD) expansion between the canines and the first molars was 5.8 ± 1.6 mm and 5.6 ± 2.0 mm, respectively.

CONCLUSION: A polycyclic expansion protocol together with a bone-borne OMI fixed expander is a viable treatment option for widening the maxilla in adult patients. It should be used prior to surgically assisted rapid palatal expansion.

SP414 EVALUATION OF SOFT TISSUE NASAL CHANGES FOLLOWING MAXILLARY SURGERY USING THREE-DIMENSIONAL FACIAL IMAGES OF CHINESE PATIENTS
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AIMS: Although orthodontic treatment and the associated surgical procedures are carefully planned in the treatment of severe skeletal malocclusions, unwanted soft tissue changes are sometimes encountered in the nose. These soft tissue changes might pose aesthetic problems for Chinese patients who typically have a wider alar base and a lower columellar height. This study aimed to evaluate nasal soft tissue changes following maxillary advancement and/or impaction surgery using images taken with a three-dimensional (3D) digital camera of Chinese patients. A secondary objective was to determine if there is a correlation in nasal soft tissue changes to hard tissue movement.

SUBJECTS AND METHOD: Twenty one Chinese patients who had undergone single piece LeFort I advancement and/or impaction osteotomy as part of the orthognathic surgery procedure. The pre- and post-surgical lateral cephalograms were digitized and analyzed to determine hard tissue changes. Measurements were made on the pre- and post-surgical 3D photographs to determine the soft tissue changes. Paired t-tests were used to assess the pre- and post-surgical changes for the soft tissue variables. Pearson’s correlation analysis was used to assess the degree of correlation between the hard and soft tissue changes for variables where the data was normally distributed; otherwise, Spearman’s correlation analysis was used.

RESULTS: There were significant increases in interalar width, internosrill width, nasolabial angle and interalar angle. There was a significant decrease in nasal bridge length. However, no significant linear correlation could be observed between the soft tissue changes and the advancement of the maxilla, anterior impaction of the maxilla or posterior impaction of the maxilla.

CONCLUSION: The findings seem to suggest an increase in alar base width and nasal tip elevation. However, no linear correlations between soft tissue nasal changes and hard tissue movements could be determined.

SP415 A STUDY TO DETERMINE THE SITE AND SEVERITY OF RESIDUAL SOFT TISSUE DEFORMITIES OF ADULT CLEFT LIP AND PALATE PATIENTS PRIOR TO ORTHOGNATHIC SURGERY
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AIMS: To determine the site and severity of residual soft tissue deformities of a group of adult unilateral cleft lip and palatal (UCLP) and bilateral cleft lip and palate (BCLP) patients in Hong Kong prior to orthognathic surgery using average facial template meshes and dense alignment.

MATERIALS AND METHOD: This retrospective study was based on three-dimensional (3D) facial images captured using Di3D stereophotogrammetry and 3dMDface systems. The cleft group consisted of 16 male UCLP patients (mean age 19.3 years, SD 2.5 years) and 10 male BCLP patients (mean age 21.3 years, SD 7.6 years). The reference group consisted of 48 male subjects with a normal balanced facial profile and without any dentofacial deformities (mean age 24.2 years, SD 0.4 years). For the ease of comparison and measurements, all images of UCLP subjects were processed to compose a homogenous group with cleft deformities located on the left side. A Mann-Whitney U test was used to determine if there were any significant differences in linear and angular measurements and asymmetry scores between the reference group and the UCLP group ($P < 0.05$); and between the reference group and the BCLP group ($P < 0.05$).

RESULTS: Perfectly symmetrical faces were not found in the reference group. Both the BCLP and UCLP subjects showed significantly more facial asymmetry than the reference group ($P < 0.001$). Compared with the BCLP subjects, UCLP subjects showed significantly more facial asymmetry ($P < 0.05$). Compared with the reference group, BCLP subjects showed a significantly more obtuse naso-labial angle and nasal tip angle, wider nose, shorter cutaneous lip height, shorter upper lip length and shorter philtrum length ($P < 0.05$). Compared with the reference group, UCLP subjects showed a significantly narrower right nostril floor width, longer columella length on the right side, wider nose, shorter cutaneous lip height, shorter upper lip length and shorter philtrum length ($P < 0.05$).

CONCLUSION: Prior to orthognathic surgery UCLP patients had more facial asymmetry than the BCLP patients. CLP patients had wider noses and reduced facial dimensions in terms of cutaneous lip height, upper lip length and philtrum length compared to the reference group.

SP416 AN AUDIT TO ASSESS FACTORS AFFECTING TREATMENT TIME IN ORTHOGNATHIC PATIENTS

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AIMS: To determine the treatment time for patients undergoing orthognathic treatment and to investigate factors potentially impacting on this.

SUBJECTS AND METHOD: This retrospective audit included orthognathic patients treated at the Eastman Dental Hospital. Patients who underwent surgery between 1/1/11 to 31/12/13 were included. Patients with craniofacial syndromes, cleft lip/palate or who had started treatment elsewhere were excluded. Of the 173 patients who underwent treatment during this period, 80 fulfilled the criteria and had obtainable medical notes. The gold standard was set at 90 per cent of patients completing treatment within 36 months.

RESULTS: For this dataset, 31.3 per cent of patients presented with a Class II malocclusion and 62.5 per cent with a Class III. Fifty-four per cent of patients completed treatment within 36 months. The mean overall treatment time was 38 months (30.2 months for pre-surgical orthodontics, 7.8 months for post-surgical orthodontics). A key finding was that a third of patients who did not meet the standard had missed or cancelled a large number appointments during treatment (range 5 to 21 missed/cancelled appointments). Almost a fifth of patients who did not meet the standard had transferred from one clinician to another due to the initial clinician completing their training. When occlusal factors were analysed, a higher proportion of Class II division 1 patients (71.4%) completed treatment to the standard, compared with Class III patients. Two thirds of patients who underwent a LeFort I osteotomy met the standard, compared with 56.3 per cent of those who underwent sagittal split osteotomies only. For bimaxillary procedures, half of the patients completed treatment within the standard.

CONCLUSION: Both patient and clinician factors potentially affected treatment duration. The audit highlighted the effect of missed appointments and clinicians should reinforce regular attendance and consider terminating treatment early when there is continued poor attendance. Recommendations have been made that increased treatment times resulting from clinician transfers may be reduced by transferring to a senior clinician if transfer is required. The high complexity of
many of the patients treated was noted, this is due to the unit being a tertiary referral centre. This may explain the treatment times for some patients and future audits should explore this.

**SP417 INTERACTIONS BETWEEN GAS1 AND BOC DURING PALATOGENESIS**

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**AIMS:** To investigate potential interactions between Gas1 and Boc during facial development.

**MATERIALS AND METHOD:** Mice with targeted mutation in Gas1 and Boc were used to generate Gas1; Boc compound mutants. Proliferation maps of the early face and palate were generated through a computational quantification of BrdU-labelling and cell packing. Apoptosis was also assayed using TUNEL staining.

**RESULTS:** Combined loss of Gas1 and Boc revealed significant defects within the craniofacial midline not observed in Gas1−/− mutants, or Gas1−/−; Boc+/− mice. Specifically, there was a unilateral cleft lip and a marked increase in the severity of cleft palate, associated with hypoplasia, failed elevation and reduced proliferation in the palatal shelves. Gas1 and Boc are both strongly expressed in medial edge epithelium of the facial processes and interestingly, TUNEL staining revealed reduced apoptosis within these regions of Gas1−/−;Boc−/− mice.

**CONCLUSION:** The findings suggest a dual requirement of Boc and Gas1 during early development of the lip and palate, mediating cell proliferation during growth and development of the facial processes, and their subsequent fusion.

**SP418 A NOVEL CAUSATIVE GENE FOR MANDIBULAR ANTERIOR TOOTH AGENESIS**

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**AIMS:** Non-syndromic permanent tooth agenesis is one of the most frequently observed diseases in the stomatognathic area. MXS1, PAX9, AXIN2, and LTBP3 mutations are known to be causative in families with multiple missing teeth. However, the cause of a few missing teeth such as mandibular anterior tooth agenesis, which is common in Japan, is unknown. Recent studies have reported rare familial diseases in which the causative gene was identified using whole exome sequencing. This study therefore aimed to use this technique to identify the mutation causing non-syndromic mandibular anterior tooth agenesis in one family from Japan, one from Korea, and 32 sporadic patients with agenesis of 1-2 mandibular anterior teeth, excluding the third molar.

**MATERIALS AND METHOD:** Mandibular anterior tooth agenesis was diagnosed using panoramic radiography, and patients with other congenital anomalies were excluded. Whole exome sequencing was performed in the 32 sporadic patients and the Japanese family containing three patients with agenesis as a dominant trait. SIFT and Polyphen-2 programmes were used to predict the influences of amino acid changes on protein function.

**RESULTS:** The presence or absence of mutations in candidate genes known to induce permanent tooth agenesis was determined. Of 32 samples, five harboured AXIN2 mutations. Mutations in a novel gene encoding a calcium-dependent cell adhesion molecule not previously shown to be involved in non-syndromic permanent tooth agenesis was identified in six samples.

**CONCLUSION:** This mutation could partly explain the observed number of congenitally missing teeth and variety of affected areas in mandibular anterior tooth agenesis.

**SP419 THE RELATIONSHIP BETWEEN PALATAL FORM AND ORAL FUNCTION IN JAPANESE CHILDREN**

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**AIMS:** To investigate the relationship between oral function and facial morphology as a result of growth and development.
SUBJECTS AND METHOD: One hundred and forty five Japanese school children (70 males, 75 females). Palatal volume, palatal height, palatal width, masticatory path width, lip-closing force and tongue pressure were analyzed. The data were taken longitudinally at 6 (T1), 7 (T2), 8 (T3) and 9 (T4) years of age.

RESULTS: Palatal volume and palatal height were significantly increased from T1 to T4 ($P < 0.01$). Significant positive correlations were found between masticatory path width and palatal volume at T3 and T4 (T3: $r = 0.62$, T4: $r = 0.58$), palatal height and masticatory path width at T4 ($r = -0.50$) and inter first molar width and palatal volume at T4 ($r = 0.43$)

CONCLUSION: The results suggest that palatal volume is increased by the development of oral function such as mastication and tongue pressure. The tendencies were recognized after 8 years of age. Growth of palatal height and width relate to oral function. Palatal form is established by the development of oral function such as mastication and tongue pressure. The relationship was distinguished especially after 8 years of age.

SP420 THREE-DIMENSIONAL EVALUATION OF THE UPPER AIRWAY AFTER EXPANSION AND FACEMASK TREATMENT IN UNILATERAL CLEFT LIP AND PALATE CHILDREN
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AIMS: To evaluate the changes in dentofacial structures and upper airway using cone beam computed tomography following early treatment with a quadhelix and facemask in unilateral cleft lip and palate (UCLP) children who had mild or moderate maxillary retraction and a Class III malocclusion.

SUBJECTS AND METHOD: Nineteen patients (mean age 9.2 years) with a complete UCLP. After the completion of maxillary expansion with a quadhelix, facemask treatment started in conjunction with an intraoral bonded appliance. Extra- and intraoral photographs, cast models and cone beam computed tomographic scans were obtained at the beginning of treatment and after maxillary protraction via a facemask. Descriptive statistics were calculated. The paired sample $t$-test was applied for intra-group differences. Statistical significance was set at a level of $P < 0.05$.

RESULTS: The maxilla displaced forward with a mean difference of 2.5 mm, while the mandible rotated downward and backward. The maxillary incisors were proclined and extruded with a mean difference of 10 degrees and 2 mm, and the maxillary upper first molars were moved 3.3 mm anteriorly. The mandibular incisors were slightly retruded with a mean difference of 3.3 degrees and the vertical dimensions were increased. As a result of three-dimensional evaluation of the airway, nasopharyngeal and total volume of the airway increased significantly with a mean difference of 480.5 and 1031.1 mm$^3$, respectively, but oropharyngeal airway volume remained unchanged. There were no significant changes in minimum axial cross-sectional area.

CONCLUSION: After maxillary protraction treatment in UCLP patients, the maxilla moved anteriorly, the maxillary incisors were markedly protruded, the mandibular incisors were slightly retruded and facial vertical dimensions were increased. Nasopharyngeal airway volume increased. No change occurred in the oropharyngeal airway and the minimum axial cross-sectional area.

SP421 EFFECT OF ER:YAG LASER ETCHING WITH A DIGITALLY CONTROLLED HANDPIECE ON HUMAN ENAMEL: A SHEAR BOND STRENGTH AND ADHESIVE REMNANT INDEX SCORE STUDY
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AIMS: Laser irradiation of enamel is able to produce surface irregularity for bonding orthodontic attachments. A new Er:YAG laser handpiece (Xrunner) is unique in its ability to digitally control size, shape and depth of the irradiated enamel area. The aim of this study was to evaluate the effect of laser irradiation with this handpiece on shear bond strength (SBS) and adhesive remnant index (ARI) scores in comparison with various other etching procedures.

MATERIALS AND METHOD: Eighty human maxillary premolar teeth were divided into four groups and received the following surface treatments: Group 1: Acid etching (37% phosphoric acid), Group 2: Er:YAG laser etching (120 mJ, 10 Hz., 40% water, 50% air), Group 3: Er,Cr:YSGG laser etching (45
mJ, 50 Hz., 30% water, 60% air) and Group 4: Er:YAG laser etching with Xrunner handpiece (100 mJ, 10 Hz., 40% water, 50% air). The brackets were bonded on etched surfaces and samples were thermocycled for a total of 5,000 cycles at 5°C-55°C. SBS was measured using a universal testing machine at a crosshead speed of 0.5 mm per minute. After debonding, the amount of resin remaining on the teeth was evaluated using Årtun and Bergland's ARI classification. Data were analyzed using one-way ANOVA and Kruskal-Wallis test.

RESULTS: The mean SBS value was 7.75 ± 2.5 MPa for Xrunner laser (group 4) and 8.11 ± 3.5 MPa, 9.47 ± 3.3 MPa and 7.11 ± 3.7 MPa and for groups 1, 2 and 3, respectively. No significant differences were observed among the SBS values of the experimental groups (P = 0.148). The average ARI score of the Xrunner laser (group 4) was 0.65. There were no statistically significant differences among the ARI scores of laser groups while the acid etching group demonstrated significantly higher ARI scores compared to the other experimental groups (P < 0.001).

CONCLUSION: Within the limitations of this study it can be concluded that enamel etching with acid, Er:YAG, Er,Cr:YSGG or Er:YAG with Xrunner handpiece showed similar mean SBS values all of which were above the clinically acceptable range reported in the literature, while significantly more adhesive remained on tooth surface after debonding when acid etching was used.

SP423  

IN VITRO CYTOTOXICITY ASSESSMENT OF A LIGHT CURE BAND ADHESIVE  

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AIMS: To evaluate the cytotoxicity of Ultra Band-Lok (UBL), a light-cure band adhesive, using a culture media of human gingival fibroblasts (HGF).
SP424  **IN VITRO CYTOTOXICITY ASSESSMENT OF CYANOACRYLATE ADHESIVE**

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AIMS: To evaluate the cytotoxicity of cyanoacrylate adhesive (CA) using culture media of human gingival fibroblasts (HGF). CA is an adhesive that is activated when it comes into contact with a wet tooth surface.

MATERIALS AND METHOD: HGF were obtained from individuals with a healthy periodontium. HGFs were grown at 37°C in a humidified atmosphere of 5 per cent CO₂ in Dulbecco’s modified Eagle’s medium, supplemented with 10 per cent foetal calf serum, penicillin, and streptomycin. HGFs viability was determined using 3-(4,5-dimethyl-2-thiazolyl)-2,5-diphenyltetrazolium bromide (MTT) assay. There were four study groups and two control groups. After 24 hours of exposure to UBL, viability of groups 1 and 2 were evaluated on days 1 and 3, respectively. Groups 3 and 4 were assessed after 72 hours of exposure to UBL on days 1 and 3, respectively. Groups 5 and 6 were the controls for days 1 and 3.

RESULTS: Cell viability of the test groups was significantly lower than that of the controls on days 1 and 3 (P < 0.05) but showed an increase on day 3 (P < 0.05). The results revealed that exposure time did not have a statistically significant effect on cell viability (P > 0.05). The results of this study showed that toxic effects of UBL appeared at the initial stage and cell viability increased on day 3 even if exposure to the adhesive continued for 72 hours.

CONCLUSION: UBL may be mildly toxic for HGF but time significantly decreases its cytotoxicity. Cytotoxicity of UBL is not cumulative and cell viability increases despite the increased exposure time.
SP426  COMPARISON OF CLINICAL EFFICIENCY OF SELF-LIGATING BRACKETS VERSUS 0.022 INCH SLOT CONVENTIONAL BRACKETS
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AIMS: To compare the clinical efficiency of self-ligating brackets and conventionally ligated straightwire brackets using lateral cephalograms, orthodontic digital models and cone beam computed tomography (CBCT). A further aim was to evaluate overall treatment time.

SUBJECTS AND METHOD: Both study and control groups consisted of 14 patients. Damon Q brackets (Ormco Corporation Company, Glendora, California, USA) were applied to the patients in the study group. Conventionally ligated 0.022 inch slot Mini Sprint (Forestadent, Pforzheim, Germany) straightwire Roth system brackets were used for patients in the control group. Damon archwires (Damon archshape, Ormco) were used in both groups. Orthodontic treatment had been completed in both groups. Records were taken initially at the start of the treatment, 20 weeks after switching to copper nickel titanium wires and two months after changing to rectangular stainless steel wires for both groups. Statistical calculations were carried out with SPSS statistics 22 (IBM, USA). Records included intra and extraoral photographs, digital orthodontic models, lateral cephalograms and three-dimensional volumetric tomographs. Paired sample t and Wilcoxon tests were used in the assessment of pre- and post-treatment values. Mann Whitney U and Student t-tests were employed in the comparison of the two groups and a chi square test was performed for the evaluation of qualitative data. The reliability of repeated measurements were statistically evaluated.

RESULTS: In both groups, upper and lower incisor inclinations and lip projections increased and were comparable between the groups (P > 0.05). Intercanine, intermolar lengths were increased in both groups except for lower intercanine length in the control group; changes were similar between the groups (P > 0.05).

CONCLUSION: The treatment effects and clinical efficiency of both bracket systems were similar according to the results of this study.

SP427  THE ELUCIDATION OF MOLECULAR MECHANISMS UNDERLYING TUMOUR GROWTH FACTOR-BETA-INDUCED PATHOLOGICAL CHANGES OF SYNOVIAL CELLS DERIVED FROM THE TEMPROMANDIBULAR JOINT
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AIMS: It has been reported that mechanical stress against the temporomandibular joint (TMJ) in orthodontic treatment affects the status of the extracellular matrix and cytokine secretion from mesenchymal cells around TMJ tissue, such as synovial cells. However, it remains to be clarified how tumour growth factor-beta (TGF-β) regulates fibrous tissue formation by synovial cells around the TMJ with inflammatory diseases due to abnormal occlusion. Therefore, the aims of this study were to investigate whether TGF-β affects the status of proliferative activity and myofibroblastic differentiation of synovial cells derived from the TMJ. The findings may provide new insights to determine therapeutic targets for the treatment of this disease at the molecular level.

MATERIALS AND METHOD: Firstly, the expression vector which encoded SV40LT antigen and puromycin-resistant genes into primary fibroblast-like synoviocytes (FLSs) derived from mouse TMJ for the immortalization of these cells was introduced. Then, puromycin-resistant clones were obtained, and used to establish a mouse synovial cell line. Secondary, the mouse synovial cell line as follows were characterized: the proliferative activity of these cells was evaluated using an alamarBlue assay. The expression status of myofibroblastic differentiation markers and chemokines in these cells was also evaluated using qRT-PCR analysis.

RESULTS: A mouse FLS cell line derived from the TMJ was successfully established. It was found that TGF-β dose-dependently suppressed proliferative activity of the FLSs. In addition, myofibroblastic differentiation and expression of monocyte chemoattractant protein-1 were promoted by TGF-β stimulation in the FLSs. In contrast, expression of stromal-derived factor-1, which is known as a chemoattractant protein of mesenchymal stem cell (MSC), was suppressed. These results suggest
that TGF-β play important roles in fibrogenesis and progression of inflammation at the inflammatory site of the TMJ.

CONCLUSION: Signal transduction molecules activated by TGF-β stimulation in FLSs can be therapeutic targets for treatment of fibrotic and inflammatory diseases around the TMJ.

SP428 REPRODUCIBILITY OF REST POSITION OF THE ADULT FACE COMPARED TO THE ADOLESCENT FACE USING THREE-DIMENSIONAL STEREOPHOTOGRAMMETRY
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Aims: The accuracy of comparing three-dimensional stereophotogrammetric images depends on standardising image acquisition, image analysis software and techniques, and reproducibility of the face in repose. This study compared soft tissue variations of adult and adolescent faces captured in repose after two time intervals: 5 minutes, and 1-10 weeks.

Materials and Method: Using 3dMD Cranial™, three images were taken of 23 adults (30.2 ± 7.4 years) and 23 adolescents (15.8 ± 2.2 years) in repose at T0, T1 (5 minutes after T0) and T2 (1–10 weeks after T0). Comparisons were made for whole face, forehead, eyebrows, eyes, nose bridge, upper lip, lower lip, chin, right and left cheeks between images T0 and T1 and between T0 and T2 for each subject, after surface-based registration with 3dMD Vultus. Soft tissue variations measured in root-mean-square (RMS) error and differences between T0 and T1 and T0 and T2, and between adults and adolescents were tested using Student’s t-tests, Wilcoxon Signed-Rank test and Mann-Whitney U test. Twenty-two per cent of images were re-analyzed to examine intra-examiner agreement, using Bland-Altman plots. Method error was tested using mannequin images.

Results: All facial regions demonstrated statistically significant variations (adult whole face median T0 and T1 = 0.20 mm, T0 and T2 = 0.34 mm; adolescent median T0 and T1 = 0.22 mm, T0 and T2 = 0.29 mm). The median of most regions were significantly higher at T0 and T2. Comparing T0 and T1, and T0 and T2 images, eyebrows, eyes, upper and lower lips had higher variations (median = 0.23-0.26 mm) than forehead, nose bridge, chin and cheeks (median = 0.09-0.15 mm). Comparing adults and adolescents, the median variations of right and left cheeks at T0 and T1 for adults were significantly higher and the median of forehead, nasal bridge and right cheek at T0 and T2 for adults were significantly higher. The superimposed mannequin images’ variations were low (median range = 0.05-0.14 mm), indicating low image acquisition and analysis errors. Intra-examiner agreement was excellent.

Conclusion: The average variations of the adult and adolescent faces in repose are clinically small. The face in repose is more reproducible in 5 minutes than after intervals of weeks. The increased variability in reproducibility of the eyebrows, eyes, upper and lower lips must be considered in stereophotogrammetric image comparisons. The adolescent face in repose is sufficiently reproducible for image comparisons to be made.

SP429 FREQUENCY OF ANKYLOSIS IN THE PRIMARY AND PERMANENT TEETH AND THEIR RELATIONSHIP WITH HYPODONTIA. ORTHODONTIC-SURGICAL SOLUTIONS
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Aims: To study the prevalence of ankylosis in the primary and permanent teeth of treated patients, to determine the correlation of the problem with tooth agenesis and to identify the most frequently used surgical-orthodontic plan.

Materials and Method: The clinical records and radiographs 1404 patients (average age 14.03 years; 536 males (38.20%) and 867 females (61.80%) treated during the last 8 years. Two hundred and fifty eight (18.37%) were in the mixed dentition and 1146 (81.63%) in the permanent dentition. The data was uploaded and processed with IBM SPSS Statistics 22.0 software.

Results: From the analyzed group 19 (1.35%) were diagnosed with ankylosis; 12 with an average 2.33 primary molars ankylosed (from 1 to 5). Seven patients had ankylosis of the permanent teeth (4 lower molars, 2 upper canines and 1 central incisor). From all, 125 patients were diagnosed with tooth agenesis, excluding the third molars. Seventy three subjects had agenesis of the premolars, in
which ankylosis was observed in seven primary molars. Thirty nine patients had incisor tooth agenesis. In 13 of them tooth agenesis of the incisors and premolars was diagnosed and in two ankylosis of the primary molars. Three cases of ankylosis were not related to tooth agenesis. In a further two cases ankylosis was related to microdens or an impacted canine. Most often ankylosis was related to multiple tooth agenesis (in 7 of 9 of the cases with tooth agenesis). The most frequent surgical technique (9 cases – 75%) was extraction with a segmental osteotomy and bone-grafting. An ankylosed upper permanent canine was treated by corticotomy and traction via a miniscrew in the lower arch and ankylosed lower permanent molars with reconstruction of the occlusal surface only.

CONCLUSION: When the primary molar is ankylosed and the permanent premolar is congenitally missing, early orthodontic-surgical treatment has to be delivered with prosthetic restoration or closure of the space. Therefore, surgery should be the most gentler.

SP430 ORTHODONTIC OR SURGICAL-ORTHODONTIC TREATMENT OF ECTOPIC POSITION OR IMPACTION OF UPPER SECOND PREMOLARS AND LACK OF SPACE IN THE DENTAL ARCH
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AIMS: To analyze the correlation between treatment protocol and the stages of development of the dentition in cases of ectopic or impacted upper second premolars and lack of space for their eruption.

SUBJECTS AND METHOD: Thirty two patients were included in the survey with an average age of 13.28 years (9 to 21 years old, 11 males, 21 females), with an ectopic position of the upper second molars. There were classified into two groups: with mixed dentition eight subjects and permanent dentition 24 cases. A unilateral ectopic position was observed in 19 patients and bilateral in 13 patients.

RESULTS: All patients with in the mixed dentition (8 – 25%) were treated with the Pendulum appliance. The gained space was sufficient and the second premolars were aligned in the arch. The lengthening of the dental arch was supported by the growing process. In patients in the permanent dentition treatment with the Pendulum appliance was undertaken in 14 (43.75%). This treatment was not appropriate in all patients because of lack of anchorage (only first premolars) and the need for distalization of two or three molars. Thus in five patients (15.62%) distalization was carried out using the skeletal Frog appliance. Because of the poor position of the upper second premolars in five subjects (15.62%) the Frog appliance could not be used so the teeth were extracted. In three of the cases a lower jaw compensatory extractions were carried out. Because of the delay in seeking treatment and the age of the patients they could be treated only with extractions. Thus the same problem was treated in two ways: orthodontic and surgical-orthodontic. The choice between these two treatment plans depends on the developmental stage.

CONCLUSION: Good results were observed. A stable and complete dentition gives good bone support for the soft tissues in the process of ageing, gives width of the smile and sufficiency of all of functions.

SP431 EFFECTS OF COMPRESSION ON EXPRESSION OF TLR4, AKT, HIF-1α OF PERIODONTAL LIGAMENT CELLS
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AIMS: To investigate the effect of applying a compressive force to human periodontal ligament (PDL) cells during orthodontic treatment, on protein expression and the mRNA levels of TLR4, AKT, and HIF-1α.

MATERIALS AND METHOD: The PDL cells were collected from extracted human premolars for the purpose of orthodontic treatment, and cultured. Compression of 0, 0.1, 2, and 3g/cm² was applied to the cultured PDL cells for periods of 3, 6, and 24 hours. The compressive force was applied by constructing a resin block. MTT assays were performed to test cell viability. Then, quantitative polymerase chain reaction and Western blot were performed to test the mRNA level and protein expression.
RESULTS: Cell viability decreased at 48 hours in a statistically significant manner. The mRNA levels of TLR4, AKT, and HIF-1α in all of the experimental groups were statistically significantly increased to a maximum in 24 hours, which had no correlation with the amount of the compressive force. HIF-1α protein was expressed at 24 hours, while protein expressions of AKT were increased from 6 hours.

CONCLUSION: It was confirmed that compression-induced ischaemia in human PDL cells can affect osteoclasts by regulating the expression of several factors. Moreover, it was proven that the amount of compressive force does not affect the expression patterns of TLR4, AKT, and HIF-1α.

SP432 DIAGNOSIS OF MAXILLO-MANDIBULAR RELATIONSHIP AND ITS CORRELATION WITH FACIAL PATTERN. A THREE-DIMENSIONAL CONE BEAM COMPUTED TOMOGRAPHY STUDY
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AIMS: To analyze the differences in the diagnosis of skeletal Class relationship and their correlation according to two variables measured on cone beam computed tomographs (CBCT), and evaluate its correlation with variables measuring the facial pattern of patients.

MATERIALS AND METHOD: Ninety CBCTs of treated patients were selected. A cephalometric analysis was designed in three-dimensions and the means and standard deviations of each of the measurements were analyzed and the correlations between the different variables were found.

RESULTS: A correlation was found in the diagnosis of skeletal Class in 50 per cent of individuals between the two variables measured. A high correlation between the angle of the occlusal plane and ANB angle and between the mandibular plane angle and Wits was found. No correlation of ANB and Wits with age was observed.

CONCLUSION: Measurement of the values that refer to skeletal Class and the anteroposterior relationship such as the ANB and Wits appraisal should be included in three-dimensional cephalometric analysis. Both values are necessary to make an accurate diagnosis of the maxillo-mandibular relationship of patients. They provide a more complete view of all craniofacial structures and cephalometric measurements.

SP433 RADIATION OF CONE BEAM COMPUTED TOMOGRAPHY IN CHILDREN AND ADOLESCENTS. AN UPDATE OF THE LITERATURE
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AIMS: The introduction of cone beam computed tomography (CBCT) has been a major step in diagnostic imaging by providing information on the three planes of space. There are multiple advantages of CBCT such as: the ability to view high-quality images without overlapping and distortion, full-scale reconstructions, speed and convenience in conducting the test using shorter scans, measurability of images and finally, an acceptable cost to the patient. The only disadvantage is the high dose of radiation, one of the aspects to be taken into account when performing this diagnostic test especially in young patients or adolescents. In the present study the radiation doses of CBCT compared to conventional radiographs were analysed and the parameters that influence in the assessment of this radiation in children and adolescents described.

MATERIALS AND METHOD: A literature search was performed using the PubMed search engine of articles in English and a manual search of journals of orthodontics and paediatric dentistry for articles published in Spanish.

RESULTS: All studies emphasized the high dose of radiation of CBCT over conventional digital radiography, depending on various aspects (beam type, amount, type and form of the filter apparatus, scan time, image parameters employed, 360° rotation of the tube and the field of view). The studies concluded that special care and concern should be taken when dealing with children and that differences in their weight factors make them more susceptible to the effects of radiation, although most studies considered were based on young adults.

CONCLUSION: Therefore, considering the radiation dose of such records, CBCT is not recognized as a routine diagnostic tool for children and adolescents, having to be justified on grounds such as: tooth
impaction, presence of supernumerary teeth and agenesis, cases of skeletal abnormalities, traumatized teeth with suspected root fractures, suspected cystic lesions or possible tumours.

SP434 AESTHETIC PERCEPTION OF CERAMIC BRACKETS. EVALUATION BY ORTHODONTISTS, GENERAL DENTISTS AND LAYPERSONS
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AIMS: To determine the aesthetic evaluation of different ceramic brackets by orthodontists, general dentists and laypersons.

MATERIALS AND METHOD: A frontal facial photograph of a smiling woman was altered using AdobePhotoshop C3 (Adobe systems Inc, San Jose, California, USA) to create three images of the same smile with different brackets systems: A) Clarity Advanced Ceramic brackets (3M Unitek), B) Metal brackets Victory Series (3M Unitek) and C) Clarity Metal-Reinforced Ceramic brackets (3M Unitek). These photographs were evaluated by three groups: orthodontists with over 10 years’ experience, general dentists with over 10 years’ experience, and laypersons aged between 40 and 50 years. The proportion of male-female subjects was 20:20 in each group. Each image was evaluated, giving a value of 1 to 5 depending on aesthetic preference, 1 being the lowest value and 5 the highest. Data were analyzed with the Kruskal-Wallis test ($P < 0.05$) and the Mann-Whitney test applying the Bonferroni correction ($P < 0.016$).

RESULTS: There were no significant differences ($P > 0.05$) between the three groups of evaluators in the aesthetic evaluation of metal brackets (B). However, the two smiles with ceramic brackets (A and C) were marked as significantly more aesthetic by laypersons and general dentists than by orthodontists ($P < 0.016$). Significant differences were not found between laypersons and general dentists ($P > 0.016$).

CONCLUSION: General dentists and laypersons considered ceramic brackets more aesthetic than orthodontists.

SP435 CEPHALOMETRIC APPRAISAL OF TREATMENT EFFECTS AFTER FUNCTIONAL AND FIXED APPLIANCES: A RETROSPECTIVE STUDY
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AIMS: To assess the dental and profile changes after placement of a functional appliance and the subsequent changes after fixed appliances.

MATERIALS AND METHOD: A retrospective cephalometric investigation of dental and profile changes was performed in 125 patients (77 female, 48 male). Three lateral cephalograms per patient were available: one taken before treatment, one after completing functional treatment and one at the end of fixed appliances. The mean age at the beginning of treatment was 11.9 years, 12.9 years after functional treatment and 14.8 years after fixed appliances.

RESULTS: The upper incisor tended to recline 0.56 mm and incline 2.02 degrees towards the NA line after functional appliance therapy. Also towards the palatal plane, the angle of the upper incisor decreased by 2.2 degrees. After fixed appliances therapy however, the upper incisor tended to protrude again, both towards the NA line ($2.14^\circ$) and the palatal plane ($1.36^\circ$). The lower incisor moved 1.46 mm more ventral, and everted 4 degrees towards the NB line after functional appliance therapy. Also towards the mandibular plane (GoGn), the angle of the lower incisor increased by 4.3 degrees. Towards the FHP-line the upper molar and incisor remained approximately at the same place and the lower incisor and molar were positioned in a more ventral position, both after functional and fixed appliances. The angle of convexity of the profile tended to improve after functional treatment (increase of the N’-Sn-Pog’ angle by 2.93$^\circ$) but after fixed appliances this improvement was partially lost (decrease of 0.37$^\circ$). The distance from the FHP-line towards the lower lip changed the most after functional treatment, with an increase of 3.21 mm. After fixed appliances there was a minor increase of 0.72 mm.
CONCLUSION: Functional and fixed appliances both have an influence on dental and profile measurements. The largest changes are seen in the position of the lower incisor and the lower lip after functional appliances.

SP436 A THREE-DIMENSIONAL STUDY OF FACIAL SIMILARITY AND DIVERSITY BETWEEN UNITED KINGDOM FEMALE MONOZYGOTIC TWINS
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AIMS: To assess the similarity and diversity in three-dimensional (3D) facial morphology of UK adult female monozygotic twins.

SUBJECTS AND METHOD: 3D facial images (obtained with a 3dMDface system) of 63 white British female twin pairs (36 to 84 years old) were selected from the Twins UK Registry. The images were manually landmarked to produce 126 shapes each consisting of 21 landmark points and pairwise Procrustes was registered. Inter-landmark distances, Procrustes distance (PrD), and centroid size difference (CSD) was calculated for each pair of shapes. The calculations were repeated on a randomized sample and the results were compared with the matched pairs. The data was not normally distributed; therefore, the median and interquartile ranges (IQR) were used for comparisons. Linear regression was used to investigate associations between chronological age and changes in similarity.

RESULTS: The median inter-landmark distances ranged from 1.8 to 3.5 mm for the matched pairs and from 2.9 to 5.9 mm for the random pairs. A reliability study showed median landmarking error estimates ranging from 0.2 to 0.8 mm. The median PrD was 11.8 mm (IQR = 3.5 mm) and 18.7 mm (IQR = 5.6 mm) for the matched and random pairs, respectively. The median CSD was 4.1 mm (IQR = 4.7 mm) and 7.1 mm (IQR = 10.9 mm) for the matched and random pairs, respectively. Linear regression provided the following equations: (i) PrD = 0.069 Age + 8.163 (R2 = 0.042) for the PrD versus chronological age of twins and (ii) CSD = 0.05 Age + 1.41 (R2 = 0.022) for the CSD versus age.

CONCLUSION: The faces of adult female monozygotic twins differ in both shape and size. The differences are generally small as compared to those between randomized (unmatched) pairs, which indicates much greater within-pair similarity for matched twins. The differences are shown to slightly increase with age, which is likely due to accumulated environmental effects. The facial parameters suggested in the study may be used for forensic identification, facial recognition, dermatological studies of ageing, heritability studies and investigations into the effects of growth, treatment interventions and ageing on the facial morphology of twins.