

OP6 OP06 EVALUATION OF STABILITY OF SURGICAL CORRECTION BY MEANS OF
COUNTERCLOCKWISE ROTATION OF THE OCCLUSAL PLANE IN CLASS II HIGH-ANGLE FACIAL TYPES
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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.

OP2 TREATMENT OF BORDERLINE CLASS III MALOCCLUSION: SURGERY VERSUS ORTHODONTICS
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AIMS: One of the most controversial issues in treatment planning of Class III malocclusion patients is the choice between orthodontic camouflage or orthognathic surgery. The aim of this study was to delineate diagnostic measures in borderline Class III cases for choosing an appropriate treatment modality and also to compare the treatment effects between them.

MATERIALS AND METHOD: The pre-treatment lateral cephalograms of 42 patients exhibiting moderate skeletal Class III were analyzed. The inclusion criteria were ANB of 0 to -4 degrees and overjet of -1 to -4 mm. The camouflage group comprised 20 patients and the surgery group 22 patients. The camouflage group was corrected by flaring of the upper incisors and retraction of the lower incisors and the surgical group was corrected by setback of the mandible. A Mann-Whitney *U* test was used to compare the variables between the two groups. Stepwise discriminant analysis was applied to identify the dentoskeletal variables that best separate the groups.

RESULTS: Holdaway H angle was identified by stepwise discriminant analysis as the only variable to differentiate between patients suitable for orthodontic camouflage or surgical treatment. Based on this model 88.1 per cent of the patients were correctly classified. Two patients in the camouflage group ($n = 20$) and three in the surgical group ($n = 22$) were misclassified.

CONCLUSION: Holdaway angle can be used as a critical diagnostic parameter for determining the treatment modality in Class III borderline cases.

OP3 FACIAL SOFT TISSUE RESPONSE TO BIMAXILLARY ORTHOGNATHIC SURGERY IN CLASS III PATIENTS

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AIMS: To evaluate the facial soft tissue profile changes 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. All measurements were achieved on pre- (T0) and post- (T1) operative cephalometric films taken at least 6 months after surgery. Forty-eight soft tissue measurements were used to evaluate the facial profile changes after bimaxillary surgery and nine ratios were calculated to determine the relationship of linear changes in soft tissue variables following the skeletal landmarks. Linear regression analysis was applied to obtain a mathematical model for soft tissue movement. A 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: No gender difference was found after bimaxillary surgery. In the sagittal plane, the soft to hard tissue ratio for the maxilla was 45 per cent for Sn, 70 per cent for soft tissue A (A*) and 60 per cent for Ls. In the mandible, the soft to hard tissue ratios in sagittal plane were 77 per cent for Li, 83 per cent for Pog*, 81 per cent for Gn* and 95 per cent for Me*. The tip of the nose (Pn) was affected less by the movement of the underlying skeletal structure (23%), while the point B* moved equally with skeletal point B (101%).

CONCLUSION: The correlation between soft and hard tissue movement in the maxilla was less than in the mandible. The significant improvement in the facial profile of these bimaxillary surgery patients was primarily related to the backward movement of the mandible.

OP4 CELL ACTIVITY IN YOUNG ADULT HUMAN AUTOPSY CONDYLES, 18-31 YEARS. A SIGN OF GROWTH STIMULATION ALTERNATIVE TO SURGICAL TREATMENT

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AIMS: To determine the possibility of stimulated adaptive growth in human condylar cartilage and bone tissue changes in relation to age in a large sample of human autopsy condyles.

MATERIALS AND METHOD: Human condylar cartilage and bone were examined in autopsy material comprising 20 individuals aged 18-31 years. The condyles were embedded in methylmetacrylate, cut on a microtome and stained. Histomorphometry, scanning electron microscopy and cartilage histology were used to analyse the tissue.

RESULTS: The fibrocartilage tissue could clearly be described in three zones, the hypertrophic zone arranged in columns, the proliferative zone, and the fibrous zone with collagen fibres. Chondrocytes could be seen 'caught' in the underlying cancellous bone tissue with remodelling activity. There was a statistically significant correlation between age and fibrocartilage thickness, between age and hypertrophic chondrocytes, and between age and hypertrophic chondrocytes in bone.

CONCLUSION: Quantitative and qualitative investigations of the turnover activity in the fibrocartilage and the bone tissue indicated condylar growth potential until 30 years of age. The growth activity seemed to decline with age. The results show possibilities for biomechanical growth stimulation of the condylar tissue, ie. fixed Herbst treatment as an alternative to surgical treatment.

OP5 CONDYLAR RESORPTION IN ORTHOGNATHIC PATIENTS AFTER MANDIBULAR BILATERAL SAGITTAL SPLIT OSTEOTOMY. A SYSTEMATIC REVIEW

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AIMS: To systematically search the literature and assess the available evidence regarding the incidence and quantification of condylar resorption following bilateral sagittal split osteotomy (BSSO) of the mandible in orthognathic patients.

MATERIALS AND METHOD: Electronic database searches of published and unpublished literature were performed. The following electronic databases with no 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 handsearched 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 arbitrator.

RESULTS: From the 308 articles identified by the search, and after application of the specific inclusion and exclusion criteria, 16 studies were considered eligible for inclusion in this review. Only one randomized controlled trial was identified, most likely due to the inherent limitation and difficulty of randomizing surgical interventions. From the remaining 15 eligible studies, 13 were of retrospective and two were of prospective design. All studies were assessed for their methodological quality and reporting. The level of evidence was found to be from poor to moderate. The lack of standardized protocols among studies and the high amount of heterogeneity precluded a valid interpretation of the actual results through pooled estimates. There was substantial consistency among studies, however, that young, female patients with mandibular deficiency and a high mandibular plane angle, submitted to surgical counterclockwise rotation of mandibular segments are more prone to a higher risk for condylar resorption after BSSO.

CONCLUSION: Although in most cases the level of existing evidence ranged from poor to moderate, there is considerable agreement between studies that condylar resorption should be taken into account as a potential post-surgical complication after BSSO. Its multifactorial aetiology, including patient-related and surgical factors remains unclear and requires further investigation to draw reliable conclusions.

OP6 THE ROLE OF FIRST MOLAR EXTRACTION IN BORDERLINE SURGICAL AND NON-SURGICAL OPEN BITE TREATMENT

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AIMS: Treatment of an open bite malocclusion with increased facial height often requires surgery. The aim of this study was to evaluate vertical skeletal changes following first molar space closure in open bite patients.

MATERIALS AND METHOD: Cephalograms before and after treatment of 26 anterior open bite adult patients (14 males, 12 females) with an inter-incisal gap more than 2 mm (4 ± 2 mm) and an FMA $\geq 30^\circ$ were collected from a private orthodontic clinic. All patients had bilaterally maxillary or mandibular extracted first molar spaces closed via sliding with minimum to moderate anchorage using slot 0.018 standard edgewise fixed appliances. Hard and soft tissue vertical changes as well as the type of movement of the second molars and incisors were assessed after treatment. SPSS 17 and Wilcoxon statistical test were used for comparison of parameters. A *P* value less than 0.05 was considered significant.

RESULTS: After treatment, the hard and soft tissue parameters of LHFH and LAFH/TAFH, were significantly reduced ($P < 0.05$). On the other hand, FMA did not show any significant reduction in mandibular steepness ($P = 0.63$). This may be due to a decrease of posterior face height ($P < 0.05$). Also after treatment, both upper and lower incisors showed significant retrusion ($P < 0.005$) but with no extrusion. The upper second molars occupied the extracted first molar spaces with a slight mesial angulation ($P = 0.03$), whereas the lower second molar remained upright. No significant extrusion was noted for the second molars in either jaw.

CONCLUSION: First molar extraction might be an alternative option for open bite borderline surgical and non-surgical treatment. This treatment contributed to both vertical skeletal reduction and incisor retrusion.

OP7 CRANIOFACIAL MORPHOLOGY OF YOUNG PATIENTS WITH CONGENITAL OR EARLY ONSET OF MYOTONIC DYSTROPHY

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AIMS: To determine the craniofacial morphology of children and adolescents with congenital or early onset of myotonic dystrophy and its changes over a period of time, by comparing them with healthy subjects.

SUBJECTS AND METHOD: Participants in this study were all young patients diagnosed with myotonic dystrophy from the west and south regions of Sweden. Lateral cephalograms, at two different occasions, were taken with a 5 years interval from 36 subjects suffering from myotonic dystrophy. Analysis of the cephalograms was performed and compared with age and gender matched healthy individuals. Statistical analyses were performed to test the normality of data distribution. Paired *t*-tests were used to detect differences between measurements of cephalogram analysis ($P < 0.05$).

RESULTS: In the initial registrations myotonic dystrophy patients showed, in the sagittal plane, a larger SNA angle, a smaller SNB and SNPg angles and a larger ANB angle. In the vertical plane, ML/NSL and ML/NL were larger. During the 5-year follow-up, these values remained the same or became worse when compared to controls, thus, SNPg decreased by 1.1degrees ($\pm 3.1^\circ$; $P \leq 0.05$), the intermaxillary angle ML/NL was increased by 1.6 degrees ($\pm 4.2^\circ$; $P \leq 0.05$), and the gonial angle was increased by 2.7 degrees ($\pm 7.5^\circ$; $P \leq 0.05$).

CONCLUSION: Children and adolescents suffering from myotonic dystrophy, when compared to healthy individuals, in the sagittal plane, have a more retrognathic profile that increases over time. In the vertical plane, they have a hyperdivergent skeletal aberration with a large intermaxillary angle and a steep mandibular plane, which becomes more severe over time.

OP8 DENTAL MATURITY ASSESSMENT IN PREMATURELY BORN CHILDREN

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AIMS: To investigate if dental development, assessed on panoramic radiographs, is affected by prematurity and if an individual tooth or a group of teeth are more evidently affected.

MATERIALS AND METHOD: Panoramic radiographs were obtained from 116 children born in the south of Sweden; 36 extremely preterm (EPT), 38 very preterm (VPT) children and 42 full term controls (C). Five calibrated observers analyzed the radiographs according to the method of Demirjian *et al.* (1973). Dental maturity was determined through blinded assessment of the left permanent mandibular teeth. The level of development of each tooth was summed up to a dental maturity score that resembles the percentile distribution of dental maturity of the child that was compared between the groups, on a group level. Possible differences in maturity level of specific teeth in the different groups were also examined. Inter- and intra-observer agreements were calculated as Kappa (κ) values.

RESULTS: Comparisons at a group level showed that the EPT group had an average dental maturity score between 81.9 and 86.7, the VPT scored 85.2-89.1 and the C 88.1-91.0, depending on observer. All five observers showed significant differences ($P \leq 0.006$) in maturity score between the EPT and C groups. At the tooth level comparison, all observers noted a significant delay ($P \leq 0.002$) in the maturity of tooth 37 when EPT was compared with C. Significant differences of other teeth were also found but no consensus between the observers could be seen. The κ values of intra-observer agreement for all teeth varied between 0.16-1.00, and the κ values of inter-observer agreement were between 0.31-0.71.

CONCLUSION: The findings suggest a general delay in tooth maturity for the EPT children at 9 years of age. Lower gestational age seems to indicate a greater delay of tooth maturity compared to full term children.

OP9 DENTOFACIAL ALTERATIONS IN CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA

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AIMS: To compare dentofacial features in obstructive sleep apnoea (OSA) children with matched control children, and to compare the development of these variables prospectively 1 year after adeno-tonsillectomy (AT).

SUBJECTS AND METHOD: One hundred and three subjects aged 3 to 10 years diagnosed with OSA. The treatment for the OSA was AT. The control group comprised 62 age and gender matched children without breathing problems. Lateral cephalograms (for measuring ANB angle and the mandibular plane) and model casts (for measuring intercanine and intermolar width) were taken of the OSA children at baseline (T0) and then 1 year post-treatment (T1). The control records also comprised registrations at baseline and after 1 year. For comparison between the experimental and control groups at T0 and between T0 and T1, a *t*-test for quantitative variables were used ($P < 0.05$).

RESULTS: At T0 the OSA children, in comparison with the controls, exhibited significant dentofacial abnormalities such as a long face ($P < 0.020$), more Class II ($P < 0.037$), and a narrow maxilla ($P < 0.0000$) and mandible ($P < 0.00001$). At T1 there were no statistically significant differences between the OSA and control group regarding the mandibular plane, ANB angle and intercanine and intermolar mandibular width. However, there still remained a significant difference between both groups regarding intercanine ($P < 0.00034$) and intermolar maxillary width ($P < 0.0026$).

CONCLUSION: OSA in young children has an unfavourable effect on the development of dental and facial components. AT treatment helps to normalize dentofacial morphology in OSA patients. However, a certain amount of maxillary constriction is still present in OSA children after AT so orthopaedic treatment would be necessary. If OSA is diagnosed and treated at an early age, either with AT and/or orthopaedically an improvement of dentofacial morphology may be achieved.

OP10 EVALUATION OF MSX1 GENE AS THE COMMON CANDIDATE GENE OF NON-SYNDROMIC CONGENITAL HYPODONTIA AND CLEFT LIP AND PALATE

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AIMS: Non-syndromic cleft lip/palate (CLP) is a congenital anomaly and all types of this anomaly are always observed on the path between the maxillary canine and lateral incisor. The maxillary lateral incisors are the most common congenitally missing teeth. Absence of those teeth is also observed unilaterally or bilaterally similar to CLP and they also are located on the same suture with oral clefting. Additionally, both anomalies are observed more frequently on the left side. Therefore; the aim of this study was to investigate if there is a common genetic pattern between the occurrence of cleft lip/palate and congenitally missing maxillary lateral incisors (CMML).

MATERIALS AND METHOD: The common candidate gene of hypodontia and cleft lip/palate MSX1, encodes a homeobox protein and is involved in multiple epithelial-mesenchymal interactions during tooth development, therefore this gene has an important role in craniofacial development. In this study, the role of MSX1 as a candidate gene for CLP and CMML was evaluated. The CLP and CMML groups were consisted of 51 and 48 subjects, respectively. Three cubic centilitre blood samples with ethylenediaminetetraacetic acid were collected and genomic DNAs were isolated. In order to screen for putative mutations, two exons of MSX1 gene as well as their exon–intron boundaries, were amplified by the PCR and analyzed with the Sanger sequencing method.

RESULTS: In both groups, the same SNP (c.*6C>T, rs 8670) which is localized in 3' untranslated region of MSX1 gene was detected. Minor allele frequency, heterozygosity, χ^2 test for Hardy-Weinberg equilibrium at c.*6C>T variation were computed. The expected wild type, heterozygous and homozygous allele frequencies of c.*6C>T variation were 65.61, 30.78 and 3.61 per cent, respectively. However, the frequencies were 47.9, 45.8 and 6.3 per cent in the CMML group and 80.4, 11.8 and 7.8 per cent in the CLP group. These frequencies were diverted from normal for both groups and the differences between the groups were statistically significant $P < 000.1$ (Chi-square test).

CONCLUSION: The existence of common polymorphisms and diversions from the normal population in the 3' untranslated region of the MSX1 gene supports the hypothesis of a possible relationship between a CLP and CMML.

OP11 ASSOCIATION BETWEEN ARTHRITIS-INDUCED CONDYLAR CHANGES AND DENTOFACIAL ASYMMETRY IN PATIENTS WITH JUVENILE IDIOPATHIC ARTHRITIS

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AIMS: Arthritis in the temporomandibular joint (TMJ) in patients with juvenile idiopathic arthritis (JIA) may lead to altered mandibular morphology and dentofacial asymmetry. For many years erosions and degeneration of the TMJ condyles have been regarded as the primary causative factor for this unbeneficial mandibular development in patients with JIA. However, arthritis-induced condylar growth retardation has recently been proposed as an alternative aetiological explanation for this condition. The aim of this study was to investigate the association between condylar radiological appearance and dentofacial asymmetry in patients with JIA.

SUBJECTS AND METHOD: Forty-seven JIA patients and 19 control subjects were included in the study. All patients had a full-face cone-beam computed tomograph performed in line with their treatment. The radiological TMJ appearance was scored by an experienced radiologist. Normal radiological TMJ appearance in a minimum of one TMJ was set as the inclusion criterion for the patients with JIA. The patients were, thereafter, divided into one of three categories based on the radiological appearance of the other TMJ; 1) normal appearance, 2) adaptive deformation, 3) erosive changes. Dentofacial asymmetry was expressed in inter-side ratios and angular measurements. The type of TMJ abnormality was compared to the severity of dentofacial asymmetry. Inter-group ANOVA tests were performed with independent Student's *t*-tests serving as post-ANOVA tests. Intra-rater reliability and smallest detectable differences were accounted for in the data evaluation.

RESULTS: Severe asymmetries were found significantly more often in the two groups of JIA patients with unilateral abnormal condylar appearance (deformation or erosive changes) compared to the JIA group with healthy radiological appearance and the control group. In contrast, the JIA patients with normal bilateral TMJ appearances appeared similar to the control group for all outcome variables.

CONCLUSION: Mandibular development in JIA patients with condylar deformations was reduced to a similar degree as in patients with erosive condylar changes. None of the two types of condylar abnormality was associated with a greater reduction in mandibular development.

OP12 THREE-DIMENSIONAL ANALYSIS OF CRANIAL GROWTH IN THE FIRST YEAR OF LIFE – AN OROFACIAL-ORTHOPAEDIC APPROACH

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AIMS: The laying induced head asymmetry in infants (posterior deformational plagiocephaly) is accompanied by craniofacial growth aberrations resulting in orofacial-orthopaedic malformations. Against the background of the currently observed increase of a 25 per cent prevalence of posterior deformational plagiocephaly in infants a database of normative parameters of normal cranial growth must be obtained. Therefore the aim of this study was to generate a three-dimensional (3D) reference database of the physiological growth of the infant's cranium in the significant growth phase in the first year of life.

MATERIALS AND METHOD: In a longitudinal clinical controlled trial, non-invasive 3D data using an optical surface scanner were generated of the entire head of 40 Caucasian infants (21 females, 19 males). All infants were scanned longitudinally four times in the first year of life. The initial scan was at the age of four months following by an eight-week interval. To quantify the growth of the cranium, growth-related and symmetry-related cephalometric-parameters were defined in all three dimensions.

RESULTS: All growth related parameters showed a significant increase with the highest dynamic growth peak from the fourth to the sixth month of life. The highest increment observed was in the total volume of the cranium, with an increase of 12.94 per cent from fourth to sixth month of age and a 29.61 per cent increase throughout the entire observational period. Only the Cephalic-Index (width to length ratio) showed less dynamic growth with a total decrease from -1.85 per cent.

CONCLUSION: The high growth rate of the cranium in the first year of life suggests that this is a critical period in which the disruption of developmental processes may have long-lasting effects on the morphology of the cranium with a prognostically unfavourable effect on the further growth of the viscerocranium. Based on these growth data, it is possible to develop standard definitions for 'normal' baseline head symmetry for the first time. The orofacial-orthopaedic growth control represents a medical expansion of the range of orthodontic treatment with the aim of early identification of head asymmetries and prevention of potential consequences on the growth of the viscerocranium.

OP13 IMPACT OF ADENO-TONSILLECTOMY IN DENTOFACIAL MORPHOLOGY CLASS II MALOCCLUSION CHILDREN WITH OBSTRUCTIVE SLEEP APNOEA: A PILOT STUDY

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AIMS: To establish the impact of the surgical procedure for breathing pattern correction in dentofacial development for Class II malocclusion children.

SUBJECTS AND METHOD: This is a prospective study with Class II malocclusion children (n = 17) diagnosed with a sleep-related breathing disorder detected by polysomnography and treated with adeno-tonsillectomy (T0). A control group was selected and matched for age and malocclusion (n = 11). The age range for both group was between 3 and 7 years. One year after surgery, the dental and skeletal changes of the treated group were compared with the control group (T1). After adeno-tonsillectomy every subject underwent another polysomnography to confirm that a normal breathing pattern was established. Lateral cephalograms and dental casts were taken at two different treatment times.

RESULTS: The primary results showed no significant differences between the groups before treatment for variables ANB, mandibular plane and facial axis angle. Statistical analysis showed significant differences between groups for the transverse palatal width (83% of the treated group show a narrow palate proportions, against 57% in the control; $P = 0.024$) and presence of crossbite (45% treated group, 10% control group; $P = 0.020$). Skeletal and dental changes from T0 to T1 were not statistically different between the groups. The results followed the same pattern for changes in Class II malocclusion children with or without surgery. Intermolar distance showed on average -0.9 mm reduction for control group and -1.0 mm for the treated group, systematically for upper and lower arches. The intercanine distance showed no changes between the two different treatment times, with a transversal width reduction on average of -0.2 to -0.9 mm for both groups. Only one subject had the unilateral crossbite spontaneously corrected after surgery.

CONCLUSION: Class II malocclusion children with sleep-related breathing disorders have abnormalities in facial and dental development caused by upper respiratory obstruction. The surgical procedure was efficient to normalize the breathing pattern. Obstructive sleep apnoea must be diagnosed and treated at an early age for breathing and dentofacial morphology normalization. The primary short term follow-up results after adeno-tonsillectomy did not show an improvement for Class II malocclusion correction in children.

OP14 COMPARISON OF QUALITY OF LIFE IN ORTHODONTIC ONCOLOGY PATIENTS NEEDING RAPID AND STANDARD TIME OF TREATMENT

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AIMS: At present, the overall survival of childhood cancers is as high as 80 per cent resulting in increasingly common contact of orthodontists with this group of patients. Due to medical requirements some of them need a faster treatment which in turn can influence the quality of life (QoL). Therefore, the aim of this study was to compare QoL and treatment satisfaction in orthodontic oncology patients needing rapid and standard treatment.

SUBJECTS AND METHOD: Forty eight cancer patients (30 males, 18 females, median age 19.1 years). Thirty patients were cancer survivors and 18 patients were in maintenance therapy. Inclusion criterion into the rapid treatment group was based on the cancer therapy requirements. The 14-item version of the Oral Health Impact Profile was used to assess the effect of orthodontic treatment on QoL in the study sample. A score of occasionally, often and very often was used to identify patients who had experienced at least some oral health impact. The questionnaire was repeated before, during and after orthodontic treatment. Detailed treatment satisfaction was also measured at the end of the treatment.

RESULTS: The average time of treatment in the rapid group was significantly shorter (10.2 versus 17.1 months; $P < 0.01$). The overall QoL improved significantly after treatment (median number of subjects with oral health impact 6 versus 2; $P < 0.05$). However, there was no significant difference in QoL before and after treatment in either both group. The rapid group required significantly more follow-up visits in the given time period with an insignificantly higher impact on oral health QoL during treatment. Male cancer survivors patients reported significantly lower QoL during treatment (38% versus 23% $P < 0.05$). Patients in maintenance therapy had a significantly higher QoL during the adaptation period in both groups.

CONCLUSION: The orthodontic results obtained in both groups are comparable despite a significantly shorter duration of treatment. However, orthodontic treatment had an impact on oral health QoL both in the rapid and standard time of treatment of oncologic patients, with an insignificant higher impact in the rapid group. Treatment satisfaction was insignificantly higher in the rapid group.

OP15 EVALUATION OF CRANIOFACIAL MORPHOLOGY IN PATIENTS WITH CHRONIC KIDNEY DISEASE

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AIMS: To evaluate the effect of chronic kidney disease (CKD) on craniofacial morphology and growth by cephalometric analysis, in patients who were diagnosed with the disease during their growth and development period.

SUBJECTS AND METHOD: Thirty one patients with CKD divided into two subgroups according to the severity of the disease [those who did not require dialysis (pre-dialysis group) and those with end stage renal disease who underwent dialysis (dialysis group)]. The pre-dialysis group consisted of 13 subjects (6 females, 7 males) whose chronological ages ranged from 9.75 to 18.5 years (mean age 15.05 ± 2.91 years) and the dialysis group 18 subjects (7 females, 11 males) whose chronological ages ranged from 7 to 21 years (mean age 14.75 ± 3.76 years). The control group consisted of the archived pre-treatment material of 31 healthy age and gender matched subjects (13 females, 18 males), with skeletal Class I relationship and without any systemic medical disorders. Their chronological ages ranged from 7.5 to 21 years (mean age 14.92 ± 3.33 years). Lateral cephalometric, panoramic and hand and wrist radiographs were collected to evaluate craniofacial morphology, dental health status and bone age of the subjects. The data was analysed with parametric and non-parametric tests with a significance level of $P < 0.05$.

RESULTS: CKD patients in the pre-dialysis and dialysis groups had significantly reduced anterior and posterior cranial base lengths, larger cranial base and middle cranial base angles, decreased posterior cranial base angle, reduced maxillary base length, increased gonial angle, decreased posterior face height, increased maxillary/mandibular plane angle and increased mandibular posterior rotation. CKD patients in the dialysis group also showed significant decreases in ramus height, mandibular base length and upper anterior face.

CONCLUSION: Patients with CKD diagnosed during the growth and development period exhibit significant morphological changes in craniofacial features compared to healthy subjects.

OP16 PSYCHOLOGICAL DETERMINANTS OF ORTHODONTIC TREATMENT NEED AND DEMAND

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AIMS: To examine in a randomized, cross-sectional study a) how much of the variance in orthodontic treatment demand is explained by a set of psychological variables, b) if these contribute uniquely in explaining treatment demand, and c) how the psychological variables relate to assessed treatment need. The major aim was to put forward a model predicting treatment need and demand.

SUBJECTS AND METHOD: One-hundred and fifty adolescents, aged 13 years participated by completing a questionnaire developed for this age-group including measures of 'Perceived Malocclusion', 'Perceived Functional Limitation', 'Prioritizing Healthy and Straight Teeth', 'Psycho-Social Influence', 'Dental Self-Esteem', 'Global Self-Esteem', and 'Treatment Demand'. Occlusal status and treatment need based on the Dental Health Component of the Index of Orthodontic Treatment Need grading was collected from dental journals. Path analysis was used to examine the relationship between the variables and how these predict treatment demand and treatment need.

RESULTS: Analyses showed that the measures used had high reliability and were intercorrelated, with some exceptions. More importantly path analyses revealed that a proposed model had good fit to the data. This path model provides a test of the unique effect of all included variables on treatment need and treatment demand. This model explained 33 per cent of the variance in treatment demand and 22 per cent of the variance in treatment need.

CONCLUSION: Orthodontic treatment need assessments should, apart from clinical estimation, include validated self-assessment measures.

OP17 PERSONAL ACCOUNTS OF BULLYING ON SOCIAL MEDIA IN RELATION TO DENTOFACIAL FEATURES AND ORTHODONTIC TREATMENT

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AIMS: A significant proportion of adolescents may experience some form of bullying because of their malocclusions and/or orthodontic treatment. Social media offers a novel and accessible resource for gaining unrestricted insights into the social culture of oral health-related bullying. The purpose of this study was to investigate the nature and psychosocial impact of orthodontic and oral health-related bullying experiences reported in social media.

MATERIALS AND METHOD: Twitter's database was searched from 2010 to 2014 using several relevant keywords ('bullied' OR 'bullying' OR 'bully' OR 'teased' AND 'teeth' OR 'braces'). Two investigators assessed the Twitter posts, and selected those that conveyed the experiences or opinions of bullying victims. The posts were qualitatively analysed using thematic analysis.

RESULTS: Of the 548 posts screened, 321 met the study's inclusion criteria and were included in the final sample. Six primary categories relating to oral health and bullying were identified: (1) morphological features of teeth and malocclusions; (2) braces and orthodontic appliances; (3) personal attributes or personality traits; (4) coping mechanisms; (5) psychological and psychosocial impacts; (6) the role of family. Bullied individuals reported a diverse range of psychological impacts and coping mechanisms. Secondary categories were also identified. Family members, for example, were reported to play both a contributory and mediatory role in bullying.

CONCLUSION: Social media can provide new and valuable information about the causes and social issues associated with oral health-related bullying. Some coping mechanisms may minimise the negative effects of bullying. These findings have important clinical implications for the management of patient expectations and compliance.

OP18 HEALTH EXPERIENCES OF ORTHOGNATHIC PATIENTS. A QUALITATIVE STUDY COMPARING SURGERY FIRST AND TRADITIONAL PROTOCOLS

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AIMS: A qualitative research assesses why and how health experiences influence clinical outcomes. This is particularly important for orthognathic patients (OP) who undergo orthodontics and surgery in order to correct both malocclusions and aesthetic defects and who may therefore have an active part in selecting the appropriate treatment, considering the option of surgery first (SF) approach or a traditional sequence (TS) one. A qualitative research study to evaluate the health experience and the patient subjective perceptions of outcome in each protocol was therefore deemed appropriate.

SUBJECTS AND METHOD: In-depths interviews were conducted with 50 orthognathic patients: 25 SF (5 males, 20 females) and 25 TS (7 males, 18 females) who had undergone orthodontics and bimaxillary orthognathic surgery between 2012 and 2015. The patients ranged in age from 17 to 35 years; on average younger for SF. All surgical procedures were conducted by the same experienced surgeon on consecutively treated patients, using three-dimensional digital planning. The average duration of orthodontics was 6 months for SF, 14 months for TS. Inclusion criteria: Class III (14 SF, 17 TS), Class II (6 SF, 3 TS), asymmetries (11 SF, 14 TS), open bite (1 SF, 9 TS). Exclusion criteria: patients refusing interviews or failing to attend post-treatment follow-up. Interviews conducted 1 month after the completion of orthodontics, were recorded and transcribed, and extracted data were analyzed with the 'content analysis'.

RESULTS: All the patients defined the following health experiences as 'important': overall satisfaction with appearance (SF/TS); improved self-confidence and social life after surgery (SF); shorter overall treatment time (SF); less invasively perceived orthodontics (SF); functional recovery (SF/TS)

CONCLUSION: This qualitative study identified a series of 'positive' health experiences that accumulate for SF and TS patients, but the immediate satisfaction with appearance, the overall shorter treatment time and the less invasively perceived orthodontics could possibly be key issues for making patients prefer SF protocol. However, the final choice for a particular surgical approach does not depend exclusively on these qualitative outcomes.

OP19 ASSOCIATIONS BETWEEN CHANGES IN DEPRESSION, SELF-ESTEEM, AND QUALITY OF LIFE DURING TREATMENT OF SEVERE MALOCCLUSION

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AIMS: To investigate the changes in self-esteem and depression before and after treatment of severe malocclusion, and the associations between self-esteem, depression, and oral health-related quality of life (OHRQoL).

SUBJECTS AND METHOD: Sixty patients (46 females, 18 males, mean age 37.5 years, range 18–64 years), who had severe malocclusions. Forty-four patients underwent orthodontic-surgical treatment and 20 orthodontic treatment. A questionnaire was collected before treatment and, on average, three years after treatment. The Rosenberg Self-Esteem Scale was used to assess self-esteem. Depression symptoms were measured with Finnish modification of the short form of the Beck Depression Inventory. The 14-item Oral Health Impact Profile was used to measure OHRQoL.

RESULTS: Self-esteem and OHRQoL improved after treatment ($P < 0.001$). A decrease in depression symptoms was found among orthodontic-surgical patients ($P < 0.045$). Higher depression symptoms were associated with poorer OHRQoL and lower self-esteem before and after treatment. Improvement in OHRQoL correlated positively with diminished depression symptoms. Generally, the patients did not report high depression symptoms.

CONCLUSION: The improved OHRQoL due the treatment of severe malocclusion was associated with decreased depression symptoms. Those who reported depression symptoms were more likely to have lower self-esteem and lower OHRQoL before and after treatment.

OP20 EXAMINATION OF THE ORTHODONTIC PATIENTS' EXPERIENCE WITH BRACES VERSUS CLEAR ALIGNERS VIA TWITTER ANALYSIS

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AIMS: To examine the orthodontic patient experience with braces compared to the patient experience with Invisalign by means of a large-scale Twitter sentiment analysis.

MATERIALS AND METHOD: Twitter users share their thoughts and feelings in real-time, creating a unique data source to investigate their experiences. A custom data collection programme was created and utilized to collect 492,171 tweets containing the words 'braces' or 'Invisalign' from April until September, 2015. A hierarchical Naïve Bayes sentiment classifier was developed to analyze these Twitter posts. Tweets were sorted into one of five categories: positive, negative, neutral, advertisement, or not applicable. Chi-squared tests were employed to compare the results between braces and Invisalign.

RESULTS: Twitter users posted significantly more positive tweets (61%) than negative tweets (39%) about their orthodontic experience ($P = < 0.0001$). There was no significant difference in the distribution of positive and negative sentiment between tweets about braces and those about Invisalign ($P = 0.4189$), with 38.1 per cent of Invisalign tweets being classified as negative and 38.5% of braces tweets negative. There was a significant difference in the proportion of advertisements between Invisalign and braces tweets ($P < 0.001$), with 33 per cent of Invisalign tweets being classified as advertisements and only 7 per cent of braces tweets.

CONCLUSION: Twitter users express more positive than negative sentiment about orthodontic treatment with no significant difference between the patient experience with braces versus Invisalign.

OP21 ORTHOGNATHIC SURGERY FROM THE PATIENTS' PERSPECTIVES: A META-ANALYSIS OF HEALTH-RELATED QUALITY OF LIFE PERCEPTIONS

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AIMS: Unlike laboratory or clinical tests, health-related quality of life (HRQoL) may provide more information from the patients' perspective on the impacts of various conditions or treatments and can reveal effects on physical and psychosocial health. The aim of this research was to investigate HRQoL perceptions before and after orthognathic surgery.

MATERIALS AND METHOD: A search was conducted without restrictions for published and unpublished literature 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 Zentralbibliothek fuer 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 prospective trials that compared HRQoL before and after orthognathic surgery by means of psychometrically validated instruments and used the random effects method to combine changes were assessed. The clinical significance of the changes was determined following relevant guidelines.

RESULTS: Initially 4127 references were found and finally 16 prospective studies using the Short Form-36 Health Survey version, Sickness Impact Profile, World Health Organization Quality of Life-BREF, Oral Health Impact Profile-14 and Orthognathic Quality of Life Questionnaire instruments were identified. The last two were found to be the ones mostly used. Initially, statistically significant deterioration of HRQoL perception occurred, followed by a gradual improvement beyond pre-treatment levels up at the time of debonding orthodontic appliances. Large clinically significant changes were observed only for the dimensions relating to facial aesthetics and oral function.

CONCLUSION: Overall, moderate improvements in the perception of most HRQoL dimensions were observed following orthognathic surgery. Better standardization and reporting in long follow-ups are necessary in order to understand fully the effect of orthognathic surgery from the patients' perspectives.

OP22 PERSONALITY AND SELF-PERCEPTION OF FACIAL APPEARANCE

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AIMS: To investigate the effect of psychosocial traits and personality on self-perception of facial appearance.

SUBJECTS AND METHOD: Five hundred and twenty eight volunteers (186 males, 342 females), who were all dental students at Tufts University School of Dental Medicine. In order to be included in the study, participants had to be 21-35 years old and speak English as a native language. Volunteers with craniofacial syndromes, a history of facial plastic or reconstructive surgery, or visible deformations of the face were excluded from the investigation. Assessment of participants' perceptions regarding their facial appearance was performed with a short questionnaire, and answers were recorded with Visual Analogue Scales. Self esteem was evaluated with the Single-Item Self-Esteem scale, and the Antonovsky 13-item questionnaire (SOC-13) was used to assess participants' sense of coherence. The Positive and Negative Affects Schedule, the Satisfaction With Life Scale, and the Big-Five Inventory (44) were also used to assess participants' personality traits. Histograms were used to demonstrate data distribution and test for normality. Correlations between normally distributed and skewed continuous variables were performed using Pearson correlation and Spearman's rho, respectively. Comparisons between groups were performed with Student's *t*- and Mann-Whitney *U*-tests. All statistical analyses were performed at the 0.05 level of statistical significance.

RESULTS: Age and previous orthodontic treatment did not have an effect on participants' perceptions about their facial attractiveness. Females, however, appeared to perceive themselves less attractive, and were less satisfied with their facial appearance ($\Delta m = 3.8$; $P = 0.001$ / $\Delta m = 4.38$; $P = 0.018$). With regard to personality traits, self-esteem, extraversion, openness and conscientiousness had a weak positive impact on self-perception of facial appearance ($R_{se} = 0.43$ / $R_{ex} = 0.15$ / $R_o = 2$ / $R_{co} = 0.21$), whereas neuroticism tended to have a weak negative effect ($R_n = -0.3$).

CONCLUSION: Personality traits appear to be weakly associated with self-perception of facial appearance. Other factors such as facial shape and symmetry may be more important and need to be further investigated.

OP23 INFORMATION NEEDS IN ORTHOGNATHIC SURGERY – A QUALITATIVE STUDY OF THE PATIENTS' PERSPECTIVE

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AIMS: In the field of orthognathic surgery, patient-centered care has become an increasingly important goal. In this context, it is crucial that orthognathic patients are provided with enough and proper information in order to make evidence-based decisions, not only prior to treatment start, but also throughout the ongoing treatment. Adequate patient information is one of the major keys to patient satisfaction and the foundation of overall treatment success. The objectives of this qualitative study were to identify information needs of patients undergoing combined orthodontic-orthognathic treatment as well as their initial expectations and final satisfaction. Qualitative research methods provide in-depth views of the patient's perspective and expectations, yet have not been intensely used in the field of orthodontics.

SUBJECTS AND METHOD: In-depth, audiorecorded, semi-structured interviews were conducted with 10 adult patients who underwent combined orthodontic-orthognathic treatment. The interviews were carried out at the end of treatment. The study was approved by the responsible Committee of Ethics (University of Cologne, Germany). Among others, the used questions revolved around patient satisfaction with the treatment itself as well as with the information given prior to as well as throughout their treatment. The interviews were transcribed and analysed through Mayring's qualitative content analysis.

RESULTS: A series of codes were identified and combined to seven overarching schemes: 'doctor-patient communication', 'knowledge about own dental and skeletal findings', 'information needs', 'source of information', 'reasons for treatment start', 'perception of own treatment/satisfaction', 'oral health in the future'. Adult patients who underwent orthognathic surgery ranked patient information and doctor-patient communication high in the context of their treatment.

CONCLUSION: The patients' perspective on information transfer prior to and throughout treatment shows both met information needs as well as a lack of information transmission by the doctor, depending on the treatment stage and the type of information given. Further research should lead to providing more patient-focused information in the field of orthognathic surgery, combined with the integration of the professionals' point of view.

OP24 TRAJECTORIES OF ORAL HEALTH-RELATED QUALITY OF LIFE IN STANDARD, CLEFT AND SURGERY PATIENTS: A PROSPECTIVE CROSS-SECTIONAL STUDY

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AIMS: While the short-term impact of orthodontic treatment on oral health-related quality of life (OHRQoL) is well documented, there is limited data regarding the stability of such changes over time. The purpose of this study was, therefore, to assess long-term changes and describe trajectories of OHRQoL in a cohort of cleft, surgery and standard patients who received orthodontic treatment.

SUBJECTS AND METHOD: A cohort of 59 orthodontic patients were administered the Oral Health Impact Profile (OHIP-14) at baseline (T0), immediately post-treatment (T1), and approximately 5-years post-treatment (T2). OHRQoL trajectories for standard, cleft and surgery patients were determined by comparing OHIP-14 scores at the three time-points. All orthodontic treatment was carried out by one of the authors.

RESULTS: The study sample consisted of 17 standard (28.8%), 19 cleft (32.2%) and 23 surgery patients (39.0%). The mean age of the patients at T0 and T2 was 15.6 ± 4.3 and 23.6 ± 4.2 years, respectively. The mean dental aesthetic index score in the sample was 49.3 ± 12.9 , indicating a high degree of malocclusion severity. An overall reduction in OHIP-14 scores occurred after orthodontic treatment (T1), although this was only significant in the surgery and standard groups ($P < 0.05$). There was no significant change in OHIP-14 score between T1 and T2 in the three patient groups ($P < 0.05$). Relative to baseline, however, there was a significant reduction in mean OHIP-14 score at T2 in the standard (-24.2% ; $P < 0.05$) and surgery groups (-57.4% ; $P < 0.05$), indicating an improvement in OHRQoL. In contrast, the mean OHIP-14 score of cleft patients significantly increased by 40.2 per cent ($P < 0.05$). Using a mixed model analysis, a significant interaction was detected between time (i.e. study time-point) and patient group ($F = 6.0$; $P < 0.0001$), after adjusting for age and gender ($F = 0.6$; $P = 0.434$).

CONCLUSION: Distinct patient groups show different OHRQoL trajectories following orthodontic treatment. Treatment-related improvements in OHRQoL are maintained over time for standard and surgery patients, but not for those with orofacial clefts. In fact, the latter show significant deterioration in OHRQoL with time.

OP25 EFFICIENCY OF HERBST-MULTIBRACKET TREATMENT – AN ANALYSIS OF 526 CONSECUTIVE CLASS II, DIVISION 1 PATIENTS

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AIMS: To assess the efficiency and outcome quality of Herbst/Multibracket (MB) treatment (Tx) in all Class II, division 1 patients treated at the study centre until 2013.

MATERIALS AND METHOD: All patients of the Department of Orthodontics, University of Giessen, Germany in which a Herbst appliance and subsequently a MB appliance had been inserted between 1986 and 2013 and active Tx was finished in 12/2014. Study casts from before Tx, after Herbst-MB Tx and (if available) after at least 24 months of retention were evaluated regarding with the Peer Assessment Rating Index (Richmond *et al.*, 1992) and the Ahlgren-Scale (Ahlgren, 1993) as well as standard variables such as overjet, overbite and sagittal molar relationship.

RESULTS: A total of 526 Class II, division 1 patients with a mean pre-Tx age of 14.4 years (range: 9.8-44.4) had received Herbst-MB Tx. In 17 of the 526 patients (3.2%), Tx was discontinued before completion (1.5% during Herbst, 1.7% during MB). In the remaining 509 patients Tx began with a Herbst phase of 8.2 months which was followed by a MB phase of 16.0 months. Two hundred and forty patients had completed a retention phase of at least 24 months (mean 32.6 months). The pre-Tx PAR score was 33.4 ± 9.1 which reduced to 7.8 ± 4.8 post-Tx. This corresponds to an average reduction of 1.5 ± 0.3 points per month. During retention a slight increase to 9.0 ± 5.4 occurred. The percentage of patients that could be assigned to the category 'greatly improved' was 62 per cent after Tx and 57 per cent after retention; only 2-3 per cent had to be assigned to the category 'worse/no different'. The ratings according to the Ahlgren-Scale revealed the following percentages: 17 excellent, 35 good, 42 satisfactory, 1 unsuccessful and 5 not assessable results.

CONCLUSION: Herbst-MB Tx is a very efficient approach in orthodontic care of moderate to severe Class II, division 1 patients. During an active Tx period of on average 2 years high quality results can be obtained in 62 per cent of patients.

OP26 EVALUATION OF THE ROOT RESORPTION AND REPAIR IN CONTACT WITH MINISCREWS USING MICROCOMPUTED TOMOGRAPHY

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AIMS: To determine the area and volume of the root surface resorption craters which contact directly with the miniscrews and learn about the repair after the resorption process using microcomputed tomography (μ CT).

SUBJECTS AND METHOD: Twenty one patients, ranging in age from 13.4 to 18.1 years at the start of treatment. The patients were treated with routine orthodontic fixed appliances with crowding of 8-10 mm, and treatment planning included two upper first premolar extractions. Two miniscrews (Medicon, Aarhus Screw) were placed between the first and second upper premolar root in each patient, and the first premolar roots were tipped into contact with the miniscrews using tipping springs (G&H, BT3 Beta Straight Lengths $14 \times 0.017 \times 0.025$ inch) with a standardized force (150 g/f). The patients were divided three groups. In each group the teeth on the right side were selected as the controls. In all segments, miniscrews were placed for contact damage with the root surface. After one month, the right teeth were extracted and on the left sides the miniscrews were removed. Following removal of the miniscrews on the left side, the teeth were extracted at 4, 8 and 12 weeks and then when the expected repair process had been completed. The extracted samples were scanned with μ CT (SkyScan 1172) using a 9 micron slice width. Statistical analyses were performed using Kruskal Wallis one-way ANOVA and Bonferroni's adjusted Mann-Whitney U , and Wilcoxon signed rank tests.

RESULTS: Evaluation at 4 and 8 weeks showed that the control group (right side) had fewer, and smaller root resorption craters, and the study group (left side) had more and larger root resorption craters than the control group ($P < 0.05$). On the other hand no significant differences were observed in root resorption crater numbers or volume between the control and study groups at 12 weeks ($P > 0.05$). In addition, generally resorption craters localized apically and in the middle third, and on the disto-buccal root surfaces ($P < 0.05$).

CONCLUSION: Root resorption continued within 4 weeks even after removal of miniscrews. However; the root repair process had apparently started at 12 weeks. Clinicians should avoid contacting with root surface when using miniscrews.

OP27 ARE SELF-LIGATING BRACKETS WORTH THE EXTRA-MONEY? AN UPDATED META-ANALYSIS OF RANDOMIZED CONTROLLED TRIALS AND SPLIT-MOUTH DESIGN STUDIES

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AIMS: To test the null hypothesis that there is no difference in treatment efficiency between fixed orthodontic therapy undertaken with conventional compared to self-ligating brackets.

MATERIALS AND METHOD: An electronic search was performed in four databases (PubMed, Web of Science, Cochrane Oral Health's Group Trials Register, Cochrane Central Register of Controlled Trials) up to April 2015 with supplemental hand searching of the references of retrieved articles. The search was strictly restricted to randomized controlled trials (RCT) and split-mouth design studies (SMD). Review authors screened the search results, extracted data and assessed risk of bias according to the Cochrane Handbook for Systematic Reviews of Interventions (4.2.6.), used mean differences and 95 per cent confidence intervals (95% CI's) for continuous outcomes and odds ratios and 95% CI's for dichotomous outcomes. RCT and SMD were initially processed in the meta-analysis as two sub-groups according to Lesaffre *et al.* (Statistics in Medicine, 2009) and subsequently combined with the R project for statistical computing software.

RESULTS: Out of the initial 76 retrieved papers, 23 RCT and six SMD ultimately met the inclusion criteria. The following variables were scrutinized: treatment duration, number of visits, occlusal outcome, mandibular alignment efficiency, transverse dimension changes, mandibular and maxillary incisors position modification, time required for space closure, anchorage loss, bracket failure rate, perception of discomfort and self-prescription of analgesics during the initial phase of treatment and pain experience during wire insertion or removal, time to ligate in or to untie an archwire. There was no significant difference in treatment efficiency between conventional and self-ligating brackets for all those variables. Two exceptions to this statement could be identified: significantly greater discomfort was experienced during rectangular archwire insertion and removal with SmartClipTM compared to conventional VictoryTM brackets, and ceramic In-Ovation CTM attachments were quicker to untie and ligate than conventional ClarityTM brackets.

CONCLUSION: There was no significant difference in treatment efficiency between conventional and self-ligating brackets in all variables except greater pain experience during rectangular wire insertion or removal in/from self-ligating attachments, and decreased time to ligate in or untie an archwire from self-ligating brackets. This meta-analysis cannot confirm most of the statements put forward by orthodontic distributors promoting their self-ligating brackets.

OP28 VIBRATIONAL FORCE DOES NOT CAUSE GREATER ROOT RESORPTION DURING ORTHODONTIC ALIGNMENT: A MULTICENTER RANDOMIZED CLINICAL TRIAL

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AIMS: A multicenter parallel three-arm randomized clinical trial was carried out in two teaching and one university hospital in the United Kingdom to investigate the effect of supplemental vibrational force on the level of orthodontic-induced inflammatory root resorption (OIIRR) during the initial alignment phase of fixed appliance therapy.

SUBJECTS AND METHOD: Eighty-one subjects <20 years-old with mandibular incisor irregularity undergoing extraction-based fixed-appliance treatment were randomly allocated to supplementary (20-minutes/day) use of an intra-oral vibrational device (AcceleDent®) (n = 29); an identical non-functional (sham) device (n = 25) or fixed-appliances only (n = 27). OIIRR was measured blindly from long cone periapical radiographs of the upper right central incisor taken at the start of treatment (T1) and end of alignment (T2) when a 0.019 × 0.025-inch stainless steel wire was placed (mean follow-up: 201.6 days; 95% CI: 188.6 to 214.6 days). Data were analyzed blindly on a per-protocol basis (since losses to follow-up were minimal with descriptive statistics) using ANOVA and univariable/multivariable regression modelling.

RESULTS: Nine subjects were excluded from the analysis, which were evenly distributed across groups. Overall mean OIIRR was 1.08 mm (95% CI: 0.89 to 1.27 mm) amongst the 72 subjects analyzed. Multivariable regression indicated no significant difference in OIIRR for AcceleDent (difference: 0.22 mm; 95% CI: -0.20 to 0.64; *P* = 0.300) or sham groups (difference: 0.26 mm; 95% CI: -0.28 to 0.80; *P* = 0.339) compared to the fixed-appliance only group, after accounting for patient gender, age, alignment time (T1-T2), maximum pain experienced, history of dento-alveolar trauma and initial root length of the upper right central incisor. No other side-effects were recorded apart from pain and OIIRR.

CONCLUSION: Supplemental vibratory force during orthodontic treatment with fixed appliances does not affect OIIRR during the initial alignment phases of orthodontic treatment.

OP29 A RANDOMIZED CONTROLLED TRIAL ON GINGIVAL INVAGINATIONS

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AIMS: Gingival invaginations are a common side effect related to orthodontic extraction space closure. They present with bone loss, inflammation and jeopardized space closure. In clinical practice, there is considerable variation in the timing of space closure initiation. In this RCT, conducted at two centres in Germany, whether the timing of orthodontic space closure after extraction influenced the incidence and severity of gingival invaginations was examined.

SUBJECTS AND METHOD: Fifty four non-smoking and healthy patients (26 male, 28 female, mean age 14.8 years), with an indication for extraction of a minimum of one premolar were randomly assigned to initiation of space closure 2-4 weeks (A) or >12 weeks (B) after tooth extraction. During and after space closure clinical data (occurrence and severity of gingival invaginations, probing depths, progress of space closure, oral hygiene, bleeding on probing etc.) were recorded and transferred to a biometrical institution by special case report forms. The study was conducted under constant surveillance of an independent study control centre.

RESULTS: Seventy four extraction regions (28 in the maxilla, 38 in the mandible) were evaluated. There was no significant differences for the incidence of gingival invaginations (Fisher exact test $P = 0.17$) (treatment A 37/84.1% with and 7/19% without gingival invaginations versus treatment B 29/96.7% with and 1/3.3% without gingival invaginations). The same was true when comparing the groups within one jaw (upper jaw $P = 0.52$; lower jaw $P = 0.21$). Also the degree of severity of gingival invaginations showed no significant differences in the treatment groups.

CONCLUSION: There was no significant effect of timing of the orthodontic space closure on the incidence and severity of formed gingival invaginations. The findings suggest that timely initiation of space closure may contribute to a reduction of treatment time without increasing the occurrence and severity of gingival invaginations. With the existing data it may be possible to identify confounding variables, perform case load calculations and plan future clinical trials with smarter designs. Further studies with larger sample sizes are needed to confirm the results.

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OP30 EVALUATION OF ROOT RESORPTION CRATERS FOLLOWING RAPID MAXILLARY EXPANSION USING MICROCOMPUTED TOMOGRAPHY

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AIMS: To evaluate root resorption and to quantitatively measure volume and numbers of resorption craters following rapid maxillary expansion (RME) with different screw activation protocols using microcomputed tomography (μ CT).

SUBJECTS AND METHOD: Fifteen patients (11 girls, 4 boys) who had maxillary constriction and required extraction of the maxillary first premolars as part of their orthodontic treatment. The mean age was 14.18 years; range, 12.1-15.3 years. A Hyrax type banded RME appliance was used in all subjects. The patients were randomly divided into three groups of five each. Group I one turn screw activation daily, group II two turns daily and group III one turn every other day. Active treatment was followed by a retention period of 3 months for all patients, after which the left and right premolars were extracted. The extracted samples were scanned with μ CT (SkyScan 1172) using a 10 micron slice width. Statistical analyses were performed with Kruskal Wallis one-way ANOVA, Bonferroni's adjusted Mann-Whitney *U*, and Wilcoxon signed rank tests. Volumetric analyses of root resorption and number of craters were defined with CTAn (SkyScan) software analysis program.

RESULTS: No statistically significant difference was found in terms of numbers of craters among the groups. For all groups, the mean volume of resorption crater was more at the buccal root surface than the lingual surface. The mean volume of resorption craters was 0.263 mm³ for group I, 0.257 mm³ for group II and 0.153 for group III, significantly less resorption craters in group III ($P < 0.05$). Cervical buccal, total buccal and total resorption volume was statistically different among Groups I and III and Groups I-III ($P < 0.05$). There was no significant difference between groups I and II ($P > 0.05$).

CONCLUSION: A screw activation protocol every other day results in significantly less root resorption than one or two screw daily activations. A slower screw activation protocol during the active RME phase might be safer and minimise root resorption.

OP31 EFFECT OF PIEZOCISION ON ROOT RESORPTION

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AIMS: To investigate the effect of piezocision on root resorption and root damage when used to accelerate orthodontic tooth movement.

SUBJECTS AND METHOD: Fourteen patients were included in this split mouth study; one side was assigned to 'piezocision', while the other side served as the 'control'. Vertical corticotomy cuts of 4-5mm in length were performed on either side of the piezocision premolar. Buccal tipping forces of 150 g were applied to the premolars. After 4 weeks the maxillary first premolars were extracted and scanned with microcomputed tomography.

RESULTS: There was significantly more total amount of root resorption seen on the piezocision sides when compared to the control sides ($P = 0.029$). The piezocision procedure resulted in a 44 per cent average increase in root resorption. In five patients there was noticeable piezocision related iatrogenic root damage. When combined with the orthodontic root resorption found on the piezocision treated teeth, there was a statistically significant 110 per cent average increase in volumetric root loss when compared to the control side ($P = 0.005$).

CONCLUSION: Piezocision results in a statistically significant increase in the amount of root resorption in comparison to controls after the application of a buccally directed tipping force to maxillary first premolars for four weeks. There is a risk of iatrogenic root damage when performing corticotomy procedures such as piezocision.

OP32 CLINICAL EFFECTIVENESS OF FIXED FUNCTIONAL APPLIANCES IN THE TREATMENT OF CLASS II MALOCCLUSION: A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: To assess the treatment effects of fixed functional appliances (FFAs) in treated Class II patients versus their matched untreated controls by means of lateral cephalometric radiographs.

MATERIALS AND METHOD: Unrestricted and systematic literature searches of 18 electronic databases and complementary manual searches were performed up to October 2014. Only randomized and prospective non-randomized controlled clinical trials reporting on cephalometric angular measurements of Class II patients treated with FFAs and their matched untreated controls were included. Skeletal, dental, and soft tissue angular cephalometric measurements were annualized and stratified according to time point. The risk of bias within and across the studies was assessed by means of the Cochrane Risk of Bias tool, the Downs-Black checklist, and the GRADE approach. Mean differences (MDs) and the respective 95 per cent confidence Intervals (CIs) were calculated with the random-effects meta-analyses. Subgroup analyses and sensitivity analyses were performed with mixed-effects models.

RESULTS: Nine studies were included involving a total number of 244 treated patients (mean age: 13.5 years) and 174 untreated individuals (mean age: 12.8 years). Most of the included studies reported on cephalometric effects directly after removal of FFAs. FFA treatment was associated with statistically significant, but clinically small effects: In comparison to untreated individuals, a small annual reduction of the SNA angle (nine studies, MD = -0.83 degrees/year, 95% CI: -1.17 to -0.48), a small annual increase of the SNB angle (nine studies, MD = 0.87 degrees/year, 95% CI: 0.30 to 1.43), and a moderate annual decrease of the ANB angle (nine studies, MD = -1.74 degrees/year, 95% CI: -2.50 to -0.98) was observed. FFA treatment was also associated with significant dentoalveolar and soft-tissue treatments effects. Subgroup analyses indicated that several patient- or appliance-related factors seem to affect treatment outcome, yet their credibility remains questionable. The overall quality of evidence according to the GRADE approach ranged between 'low' and 'very high'. The long-term effectiveness of FFAs could not be assessed due to limited relative evidence.

CONCLUSION: Based on current evidence, FFAs seem to be effective in improving Class II malocclusion in the short-term, yet their effects seem to be mainly dentoalveolar rather than skeletal.

OP33 EVIDENCE BASED EFFICIENCY OF AN ORTHODONTIC TREATMENT: DO PSYCHOLOGY AND TREATMENT NEEDS HAVE ANY IMPACT?

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AIMS: To assess the quality of compliance in patients treated with removable appliances in relation to personal traits of both the patients and their caregivers.

SUBJECTS AND METHOD: Ninety six randomly selected patients aged 9-12 years, treated with removable appliances. In order to evaluate the temperamental and personality traits of the patients' and their caregivers', as well as the latter's attitude to the children, suitable psychological tests were applied. The Index of Orthodontic Treatment Need, Dental Health Component (IOTN DHC) enabled assessment of the treatment needs of every patient. Thera Mon[®] electronic sensors mounted in the appliances allowed objective control of the patients' compliance.

RESULTS: Statistical analysis revealed strong positive correlation between appliance wear time and the caregivers' generalized sense of efficacy, conscientiousness and the severity of requirements imposed on the child. As for the children themselves, their emotionality correlated negatively with their compliance. The patients with low (IOTN DHC=2) and high (IOTN DHC=5) levels of treatment need presented statistically poorer and better cooperation respectively, in comparison with patients with a moderate level of treatment need (IOTN DHC = 3 or 4).

CONCLUSION: Cooperation of children treated with removable appliances may be foreseen based on the patients' and their caregivers' traits as well as on objective assessment of the patient's treatment needs. Objective evaluation of the patient's cooperation and psychological tests may be valuable tools for re-assessment of the paradigm of early orthodontic treatment.

OP34 WHAT IS THE EFFECT OF HEADGEAR ON CRANIOMANDIBULAR GROWTH? A SYSTEMATIC REVIEW AND META-ANALYSIS

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AIMS: To compare in a systematic review the effect of extraoral maxillary traction for Class II malocclusions with headgear on craniomandibular growth, based on clinical trials on human patients in an evidence-based manner.

MATERIALS AND METHOD: Five electronic databases were searched from inception to November, 2015 without year, language, or publication type limitations for randomized controlled trials (RCTs) and prospective non-RCTs comparing Class II patients treated with headgear and untreated Class II patients, 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 treatment-induced annualized mean differences (MD) and 95 per cent confidence intervals (CIs) were conducted, followed by mixed-effects subgroup and sensitivity analyses.

RESULTS: A total of 27 papers pertaining to 10 clinical trials (3 RCTs, 7 prospective non-RCTs) with over 500 patients were included. Headgear treatment had, in the short-term, a significant restraining effect on SNA angle (6 studies; MD = $-0.99^\circ/\text{year}$; 95% CI = -1.43 to $-0.55^\circ/\text{year}$; $P < 0.001$), essentially no effect on SNB angle (5 studies; MD = $-0.02^\circ/\text{year}$; 95% CI = -0.30 to $0.25^\circ/\text{year}$; $P = 0.870$), and a significantly improving effect on ANB angle (6 studies; MD = $-1.06^\circ/\text{year}$; 95% CI = -1.51 to $-0.61^\circ/\text{year}$; $P < 0.001$) compared to normal growth. The stability of the attained effects was problematic, especially with partial retention protocols, while the overall quality of evidence according to GRADE was moderate to low. Finally, significant signs of overestimation of headgear's effectiveness from prospective non-RCTs compared to RCTs were identified (difference in standardized effect sizes = 0.47; 95% CI = 0.07 to 0.86; $P = .020$).

CONCLUSION: Based on existing trials, there is insufficient evidence to make robust recommendations about a headgear effect on craniomandibular growth, as the quality of evidence was low. Future clinical recommendations should be based on evidence arising exclusively from well-conducted RCTs on headgear in order to avoid bias.

OP35 CREVICULAR ALKALINE PHOSPHATASE ACTIVITY DURING THE APPLICATION OF TWO PATTERNS OF ORTHODONTIC FORCE

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AIMS: Optimal orthodontic force is characterized by maximal cellular response from the supporting tooth tissues. However, no evidence-based force level can be recommended for optimal efficiency in clinical orthodontics. The objective of this study was to test the hypothesis that using a gradually increasing orthodontic force would induce increased osteoblast activity compared to a relatively constant orthodontic force.

SUBJECTS AND METHOD: Twelve orthodontic patients participated in this study. In a split mouth design, one maxillary canine undergoing distal movement received a relatively constant continuous retraction force, while the contralateral canine received a gradually increasing retraction force. Gingival crevicular fluid samples were collected from both experimental sites at weekly intervals and analyzed spectrophotometrically for the activity of alkaline phosphatase (ALP) enzyme, which was used as a biological marker for osteoblastic activity. A one-way ANOVA test was conducted to determine the presence of significant differences between each groups' means, followed by *post-hoc* tests to investigate the difference between each groups' means. A paired-samples test was used to compare enzyme levels at different points in the two experimental groups.

RESULTS: With the exception of the maxillary first molar receiving gradually increasing orthodontic force, the results revealed a consistent pattern of ALP activity. This pattern included an initial rise from baseline to the first week, then a peak in the second week. This peak was followed by a reduction in enzyme activity in the third week. The overall increases in enzyme activity at the maxillary canines and the maxillary first molars in the relatively constant force group were 179.76 and 332.90 per cent, respectively. The overall increases in enzyme activity at the maxillary canines and maxillary first molars in the gradually increasing force group were 304.81 and 493.08 per cent, respectively.

CONCLUSION: The use of gradually increasing orthodontic force induces increased activity of osteoblasts during the initial stage of orthodontic tooth movement compared to that induced by a relatively constant orthodontic force.

OP36 THE EFFECTS OF LOW-LEVEL LASER THERAPY ON ORTHODONTIC ROOT RESORPTION AND PAIN MANAGEMENT: A PILOT STUDY

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AIMS: To evaluate the effect of low-level laser therapy (LLLT) on the extent of root resorption and pain after orthodontic force application. This is also the first study to measure the amount of laser energy transmitted to the tooth socket.

SUBJECTS AND METHOD: In this prospective randomized split-mouth trial, 20 patients were randomly allocated to the laser and sham laser side. The maxillary first premolars were loaded with a 150 g buccal tipping force. The laser regimen was applied on day 1, 2, 3, 4, 7, 14 and 21 on four points on the buccal and four points on the palatal mucosa of the experimental premolar. Sham-laser was also applied in the same regimen on the control premolar. On day 28, the premolars were extracted and root surface analysis was performed with microcomputed tomography. A visual analogue scale evaluating pain was employed on days 1, 2, 3, 4, 7, 14 and 21 of the experimental period to compare the effect of LLLT on orthodontic pain. After premolar extraction, an ammeter was placed inside the tooth socket to measure laser transmission.

RESULTS: LLLT significantly reduced total root-resorption by 23 per cent compared to the sham-laser ($P = 0.026$). LLLT tended to reduce orthodontic pain compared to the sham-laser. The result of the laser transmission study found that for each extra millimeter of bone there was an extra 6.81 per cent loss in laser transmission (with standard error 0.87).

CONCLUSION: LLLT is effective at reducing root resorption and pain associated with orthodontic force application. Additionally, the thickness of bone affects the amount of laser energy transferred to the tooth.

OP37 RELATIONSHIP BETWEEN TREATMENT DURATION AND PRE-TREATMENT CASE COMPLEXITY DETERMINED BY THE AMERICAN BOARD OF ORTHODONTICS DISCREPANCY INDEX

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AIMS: To retrospectively evaluate the relationship between the pre-treatment dental cast discrepancy index (DI) scores and total active treatment duration.

MATERIALS AND METHOD: One thousand six hundred and ninety three cases (853 females, 840 males, mean age = 16.3 years) were selected from the archives of nine postgraduate university orthodontic clinics. Pre-treatment cephalometric and panoramic radiographs and dental models were used to determine DI scores. Treatment duration was recorded from the patients' files. Correlation analysis and multiple variable regression analysis were used to determine which variables predict treatment duration at the $P < 0.05$ significance level.

RESULTS: The mean pre-treatment DI score was 16.2 and mean treatment duration was 27.07 ± 11.56 months. A statistically significant relationship was found between DI components and treatment duration. Treatment duration increased approximately 9 days for each point in DI score.

CONCLUSION: Active treatment time may also be different for the various components of the DI as indicated; approximately 12 days for each point increase in overjet; approximately 20 days for each point increase in overbite; approximately 12 days for each point increase in crowding; approximately 21 days for each point increase in occlusion; approximately 30 days for each point increase in lingual posterior crossbite; approximately 29 days for each point increase in buccal posterior crossbite; approximately 18 days for each point increase in other components.

OP38 DOES ADMINISTRATION OF ANTIBIOTIC PROPHYLAXIS INCREASE ORTHODONTIC MINI-IMPLANTS SUCCESS RATE? A PRELIMINARY STUDY

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AIMS: Introduction of temporary intraoral skeletal anchorage devices (TISAD) to orthodontics resulted in a significant enhancement of orthodontic treatment capabilities. However, loss of stability and eventual failure of TISAD remains the main problem related to their application. One of the major factors contributing to instability and loss of mini-implants is inflammation of the tissues surrounding the miniscrews induced by bacteria from oral microflora. The aim of this study was to verify if administration of a single dose antibiotic prophylaxis prior to mini-implant placement results in reduction of peri-mini-implant infection incidence, hence improving the stability and success rate of mini-implants.

SUBJECTS AND METHOD: Initially 50 generally healthy orthodontic patients aged 15-30 years with a malocclusion requiring maxillary anchorage reinforcement were selected. Ten patients having an immunological system impairment, allergy to any drug or heart and kidney Streptococcus spp. related diseases were precluded from the study. Subsequently, the patients were randomly assigned by means of minimization to control (16 females, 4 males) and study groups (13 females, 5 males). A placebo pill containing glucose and 875 mg amoxycillin with 125 clavulanic acid were administered in the control and study groups respectively, one hour prior to surgery. As for group allocation, both the patients and the operator were blinded: auxiliary staff secured double blinding using opaque envelopes. Blood samples were collected from the patients prior to and on days 1, 3 and 7 following surgery and procalcitonin and C-reactive protein (CRP) levels were measured for objective infection identification. The levels of inflammatory markers were compared between groups by means Friedman ANOVA. Simultaneously peri-mini-implant site was assessed clinically two weeks after surgery in order to identify any signs of inflammation.

RESULTS: One and two mini-implants were lost in study and control groups respectively. There were no statistically significant differences in inflammatory markers levels or success rate between groups.

CONCLUSION: Administration of antibiotic prophylaxis prior to mini-implant placement does not reduce the incidence of peri-mini-implant tissue infection and does not improve mini-implant success rate.

OP39 ORAL CANDIDA CARRIAGE IN PATIENTS WITH MULTIBRACKET APPLIANCES AND WHITE SPOT LESIONS

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AIMS: To investigate the oral microbiota [especially *Candida*, *Streptococcus mutans* (*S. Mutans*) and *Lactobacilli*] in patients with multibracket appliances in relation to the quality of oral hygiene.

MATERIALS AND METHOD: Salivary and plaque samples were collected from 75 patients, divided into three groups of 25 patients each (good oral hygiene, poor oral hygiene and poor oral hygiene with development of new white spot lesions (WSL). Counts of colony forming units (CFU) and species of candida were analyzed. Group differences were tested with Chi-square- and Mann-Whitney-U-tests.

RESULTS: Both salivary and plaque samples showed a high prevalence of candida. In the saliva samples, 73.4 per cent of all patients were candida carriers, while in the plaque samples a prevalence of 60.9 per cent was detected. For the salivary samples, a statistically significant difference in the amount of CFU was found between the groups with good and poor oral hygiene ($P = 0.045$) and between groups with good oral hygiene and newly developed WSL ($P = 0.011$). The main candida species was *C. albicans*. *S. mutans* and *Lactobacilli* were found in salivary and plaque samples of all patients. For the salivary samples, a statistically significant difference in the amount of *Lactobacilli* was found between the groups with good oral hygiene and newly developed WSL ($P = 0.047$).

CONCLUSION: Patients developing new WSL during multibracket appliance treatment show by trend, but not consistently higher counts of *Candida* and *Lactobacilli* compared to patients with good oral hygiene.

OP40 ASSOCIATION BETWEEN PAIN DURING ORTHODONTIC ALIGNMENT AND ORTHODONTICALLY INDUCED ROOT RESORPTION

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AIMS: To assess the association of dental pain during orthodontic alignment and orthodontically induced root resorption (OIRR).

SUBJECTS AND METHOD: This study is part of a multi-centre randomized clinical trial (mRCT) in Scotland. The first 105 patients recruited (in the mRCT) were included. All patients had fixed upper and lower pre-adjusted orthodontic appliances. Patient perception of fixed orthodontic appliance treatment was assessed using a patient based questionnaire 'Smiles Better' after 6 months of the start of treatment. A section in the questionnaire addressed patient perception of dental pain using a Likert style question. All patients had periapical radiographs taken for the maxillary central incisors before the start of treatment and after 9 months to assess the extent of OIRR. A Spearman rank correlation coefficient test was used to assess the association between patient perception of pain and OIRR.

RESULTS: Eighty eight participants completed the questionnaire where most reported mild pain (78.5%) during the first 6 months of treatment while (10.2 %) and (11.3%) reported no pain or significant pain, respectively. Only 68 participants had pre-treatment and 9 months periapical radiographs available. From the available records it was noticed that the majority of patients, 56.3 per cent, had no radiographically detected OIRR; while 27.2 and 16.5 per cent showed mild and increased OIRR, respectively. No statistically significant association was found between patient perception of pain and OIRR during the 6-9 months of alignment. The results of this study should be considered with caution due to the number of dropouts.

CONCLUSION: There is no statistically significant association between the perception of pain during alignment and OIRR.

OP41 LONG-TERM INFLUENCE OF FIXED LINGUAL RETAINERS ON THE DEVELOPMENT OF MANDIBULAR GINGIVAL RESSIONS

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AIMS: Orthodontic treatment and fixed lingual retainers have been reported to be a potential risk factor for the development of labial gingival recessions. The aim of this study was to investigate the long-term influence of fixed lingual retainers on the development of mandibular gingival recessions and calculus retention.

SUBJECTS AND METHOD: From a pool of 298 orthodontically treated patients who underwent routine retention control 5 years after treatment, 48 patients were identified without any retainer in the mandible. Forty-eight patients with a fixed retainer were randomly chosen from the remaining patients. An age matched control group (n = 48) of untreated individuals was chosen from the growth archives at the Department of Orthodontics, University of Oslo. Plaster models and intraoral photographs were used for evaluation of the presence or absence of calculus and labial gingival recessions on all teeth before treatment (T0), after treatment (T1) and 5 years after treatment (T5). Chi squared test, one way ANOVA with Tukey *post hoc* test and related samples Cochran's Q test were used to evaluate group differences.

RESULTS: There were no significant differences between the experimental groups in terms of age, gender and Angle classification at T0. The prevalence of mandibular gingival recessions increased significantly within all the groups at T5 compared to both T1 and T0. At T5 the group with fixed retainers had most patients with recessions on the anterior teeth (37.5%), but overall, it did not differ significantly when compared to the group without retainers (33.33%) and the untreated group (20.83%). When evaluated separately, 31 was the only tooth with significantly more recessions in the group with a retainer at T1 and T5. Calculus formation was significantly higher in the group with a retainer (39.58%), than in the group without a retainer (20.83%) at T5. The duration of orthodontic treatment, extractions and gender did not influence gingival recession prevalence on the six anterior teeth together, or on each tooth individually.

CONCLUSION: Even though fixed lingual retainers lead to increased calculus formation, gingival recession development was not aggravated.

OP42 LONG-TERM COMPARISON BETWEEN AUTOTRANSPLANTED TEETH WITH DEVELOPING ROOTS VERSUS TEETH WITH COMPLETELY FORMED ROOTS

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AIMS: To assess the success and survival rates of autotransplants with developing roots versus teeth with completely formed roots

MATERIALS AND METHOD: Three hundred and seventy nine transplants, evaluated 1 to 11 years after transplantation. The surgery was performed between 2004 and 2014 at the interdisciplinary clinic Proclin in Rotterdam. Four groups were used, based on root development and observation time. Groups 1 and 2 had an average observation time of 36 months, group 3 and 4 had an observation time of 90 months. Group 1: 130 developing teeth one to five years after transplantation; Group 2: 87 completely formed roots one to five years after surgery; Group 3: 50 developing teeth five tot eleven years after surgery; Group 4: 18 completely formed roots five to eleven years after transplantation. The survival and success rates were assessed. The criteria for the succes were the absence of: any form of root resorption, including ankylosis or endodontic treatment in teeth with developing roots. Endodontic treatment was performed before transplantation in all transplants with completely formed roots.

RESULTS: The survival rates were: group 1 100 per cent, group 2 98 per cent, group 3 98 per cent and, group 4 94 per cent. The success rates were: group 1, 96 per cent, group 2, 97 per cent, group 3, 80 per cent and group 4, 83 per cent. The following complications were seen: external root resorption: group 1, 3 (2%), group 2 1 (1%), group 3, 3 (6%), group 4, 2 (11%); endodontic treatment: group 1, 2 (2%), group 2, 6 (12%); failures (loss of the transplant): group 1, 0 (0%), group 2, 2 (2%), group 3, 1 (2%), group 4 1 (6%).

CONCLUSION: In the evaluated group of patients, survival and success rates of autotransplants with completely formed roots are similar to the rates of autotransplants with developing roots in the long-term perspective. Autotransplantation can be performed with developing roots as well as completely formed roots. If possible, transplantation is an even more predictable treatment than dental implants.

OP43 EVALUATION OF THE EFFECTS OF FUNCTIONAL APPLIANCE THERAPY ON UPPER AIRWAY DIMENSIONS AND SLEEP-RELATED BREATHING

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AIMS: To investigate, in a randomized controlled trial, changes in upper airway dimensions and sleep-related breathing disorder (SRBD) following functional appliance therapy with the Herbst or Twin-Block (TB) appliance.

SUBJECTS AND METHOD: Twenty-six adolescents (9 males, 17 females, aged 13.1 ± 1.5 years) with a Class II malocclusion deemed to require functional appliance therapy were randomized to receive either Herbst or TB appliances. Magnetic resonance images were obtained before and after treatment (in the awake state). Parents completed the 22-item SRBD scale at baseline and after treatment. Changes in upper airway dimensions (width, depth and area) and SRBD scores over time were determined and compared between appliances.

RESULTS: Increases in upper airway dimensions, width, depth and area, were observed for most parameters and several reached statistical significance ($P < 0.05$). A decrease in SRBD scale scores was observed ($P < 0.05$). There was significant but weak/moderate correlation between the change in the depth of the retropalatal oropharynx and improvement in SRBD scores ($r < 0.5$). No statistical significance in airway dimensions or SRBD scores were evident comparing the outcomes of Herbst versus TB appliances ($P > 0.05$).

CONCLUSION: The size of upper airway can be increased three-dimensionally by one-year's growth and functional appliance therapy. In addition, some improvements in sleep-related behaviour is evident; and significantly correlated to airway dimension changes. No significant difference in airway dimensions or sleep-related behaviour comparing Herbst or TB appliances was evident.

OP44 LONG-TERM EVALUATION OF THE PENDULUM APPLIANCE: WHAT HAPPENS 7 YEARS AFTER DEBONDING?

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AIMS: To describe dental and skeletal changes associated with the Pendulum and fixed appliance treatment over time.

SUBJECTS AND METHOD: Seventy six Class II patients (35 males, 41 females) treated with Pendulum and fixed appliances. Lateral cephalograms were obtained at the start of treatment (T1; 12 years 11 months); end of distalization (T2; 13 years 8 months); end of orthodontic fixed appliances (T3; 15 years 4 months); and long-term observation (T4; 7 years 2 months later; 22 years 5 months). A paired *t*-test was used to identify significant between-group differences between T2-T4 and T3-T4

RESULTS: Distal molar movement was obtained during the distalization-phase (T2) and about one-half of the distalizing effect was maintained at the end of maxillary growth (T4). Most of the relapse occurred during fixed appliance therapy (T3), whereas no significant change was detected in the post-retention period (T4). The molar relationship did not show any significant difference between T2 and T4. The vertical facial dimension increased both during T2 and T3, but returned to the initial values during T4. Overjet and overbite were corrected during T3 but showed a slight relapse in T4.

CONCLUSION: The Pendulum appliance induces significant dentoalveolar effects, which can be partially maintained during the long-term period. A Class I molar relationship does not change during completion of individual growth. The increase in vertical facial dimension represents a temporary effect.

OP45 FACIAL ASYMMETRY EVALUATION IN JUVENILE IDIOPATHIC ARTHRITIS PATIENTS BASED ON CONE-BEAM COMPUTED TOMOGRAPHY AND THREE-DIMENSIONAL PHOTOGRAPHY

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AIMS: To assess the degree of and correlation between facial hard and soft tissue asymmetry in patients with juvenile idiopathic arthritis (JIA), identify valid soft tissue points for clinical examination and assess the smallest clinical detectable level of dentofacial asymmetry.

SUBJECTS AND METHOD: Twenty-one JIA patients diagnosed according to the ILAR criteria, participated in the study. Full-face cone-beam computed tomography (CBCT) scans and three-dimensional (3D) photographs were used to measure and assess facial hard and soft tissue asymmetry with regression analysis. A survey of 13 postgraduate orthodontic residents and five senior staff members of Aarhus University Section of Orthodontics was also conducted to assess how asymmetry is observationally perceived based on CBCT scans and 3D photographs. Descriptive statistics was applied for the presentation of the survey results.

RESULTS: Significant linear correlation was found between the hard and soft tissue gonial deviations at both the transverse and vertical positions ($R^2 = 0.486$ and $R^2 = 0.535$), while transverse asymmetries of pogonion presented high correlation ($R^2 = 0.786$). The occlusal plane canting and the vertical difference of cheilion were correlated ($R^2 = 0.349$). The occlusal plane canting was also correlated to the vertical asymmetry of the zygomatic processes ($R^2 = 0.470$), while it was found to coincide with vertical hard tissue gonion deviations ($R^2 = 0.564$). Transverse and vertical positions of the soft tissue gonion and cheilion were correlated ($R^2 = 0.313$ and $R^2 = 0.446$). Among medial soft tissue points, glabella was found to present the smallest deviation and pogonion the largest deviation from the midsagittal plane. The participants' assessment of hard and soft tissue deviations in the survey was found to be in agreement with linear measurements when deviation exceeded ± 2 mm.

CONCLUSION: Facial asymmetries are most pronounced at the lower facial third. Soft tissue pogonion and gonion were identified as the most appropriate landmarks to clinically assess the presence of facial asymmetry. Professionals can accurately identify asymmetry when this exceeds 2 mm.

OP46 EFFICACY OF A MANDIBULAR ADVANCEMENT APPLIANCE IN PAEDIATRIC SLEEP DISORDERED BREATHING

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AIMS: Sleep disordered breathing (SDB) varies from habitual snoring to obstructive sleep apnoea and can be found in up to 10 per cent of children. Mandibular advancement splints (MAS) are a non-invasive alternative treatment to adenotonsillectomy. The efficacy of MAS is well established in adults but unclear in children. The aim of this study is to report the findings of a randomized clinical trial testing the efficacy of MAS appliance in SDB children.

SUBJECTS AND METHOD: The study was designed as a single-blind crossover randomized controlled trial with administration of active MAS 'Twin-Block '(TB) and a placebo MAS 'Sham MAS'. Eighteen participants (9.8 ± 1.1 years) with ≥ 4 snoring nights per week were enrolled and randomly assigned to either a sequence starting with TB or Sham MAS. They wore the appliances for three weeks separated by a two-week washout period. Home-based polysomnographic data was collected four times for each participant-at baseline, and after treatment with TB or Sham MAS. Supine Apnoea-Hypopnea Index (AHI) was calculated and assessed as the main outcome variable. In addition, parent's reports of snoring frequency were collected as secondary outcome.

RESULTS: *Ad-interim* results were obtained from five participants (9.9 ± 0.7 years). Polysomnography data showed an average baseline supine AHI of 9.4 ± 10.8 events/hour. Participants showed improvement with TB as supine AHI decreased 52 per cent (from 9.5 ± 10.3 to 4.6 ± 5.0) events/hour. Conversely, supine AHI showed an increase of 14 per cent (10.1 ± 11.2 to 11.7 ± 9.7) events/hour with Sham MAS. Parents reported less snoring when participants wore the TB MAS (2.6 ± 4.2 snoring-nights) in comparison with the Sham MAS (5.4 ± 2.5 snoring-nights).

CONCLUSION: The preliminary findings suggest that the use of MAS reduced both the supine AHI and frequency of snoring nights in children with SDB.

OP47 INCISOR ROOT RESORPTION IN PATIENTS WITH AN ANGLE CLASS II DIVISION 2 OCCLUSION IN RELATION TO ORTHODONTIC TREATMENT: A STUDY OF ONE- VERSUS TWO-PHASE TREATMENT
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AIMS: To analyse 1) differences in the occurrence of orthodontic induced inflammatory root resorption (OIIRR) of the maxillary and mandibular incisors in Angle Class II division 2 subjects, between patients treated with a fixed appliance only (one-phase) or those treated with a removable appliance before treatment with fixed appliance (two-phase), 2) associations between OIIRR and treatment time, age, gender and additional dentofacial deviations in the total group, 3) differences in OIIRR between tooth groups in the total group.

SUBJECTS AND METHOD: Seventy four subjects treated for a Class II division 2 malocclusion were divided into two groups: 46 patients in the one-phase group (28 girls, 18 boys, mean age 14.4 years) and 28 in the two-phase group (18 girls, 10 boys, mean age 12.4 years) . OIIRR was assessed on intraoral radiographs, dentition deviations on dental pantomograms and craniofacial morphology on lateral cephalograms. Differences were tested by Fisher Exact test, McNemar and multiple regression analysis.

RESULTS: The one-phase group showed significantly more OIIRR for the lower central incisors ($P = 0.002$) compared to the two-phase group. For the total group only gender was associated with OIIRR, where boys showed more OIIRR than girls for the lower central incisors ($P = 0.002$). The upper lateral incisor was the tooth group that showed most OIIRR ($P < 0.001$) compared to other tooth groups.

CONCLUSION: OIIRR of the lower central incisors is more common in one-phase treatment compared to two-phase treatment, that boys show more OIIRR, and that upper lateral incisors are more at risk for showing OIIRR.

OP48 LONGITUDINAL EFFECTS OF RETRAINING DETRAINED ADULT JAW MUSCLES ON THE MORPHOLOGY OF THE MANDIBLE

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AIMS: To experimentally investigate the longitudinal effects of increased masticatory function on the morphology of the mandible of adult rats with an earlier reduced masticatory muscle function.

MATERIALS AND METHOD: Fifty-five young male rats were used. The experimental group received soft diet for a prolonged period, so that the animals developed weak masticatory muscles. A control group (normal group) received ordinary food during the whole experimental period (27 weeks). After 21 weeks when the animals had nearly ceased body growth the rats in the experimental group were divided into two groups. One group continued with a soft diet until the end of the experiment (hypofunctional group). The other group received ordinary food in an endeavour to retrain their masticatory muscles (rehabilitation group). At week 21 and at the end of the experimental period (week 27) lateral cephalograms were taken. Eight landmarks were defined to measure six distances and angles of the mandible of the rat. To investigate the longitudinal morphological differences between the three groups between week 21 and week 27 and to study the cross-sectional effect at week 21, the ANOVA statistical procedure was used.

RESULTS: The angle between the mandibular occlusal planes was less acute in the soft diet groups at week 21 compared to the normal group. The inclination of the angular process was more acute in the soft diet groups compared to the normal group. Concerning the difference between weeks 21 and 27 there was a significantly larger increase of the length of the angular process in the normal group compared to the hypofunctional group, the largest increase was in the normal group. In the rehabilitation group the length of the mandible had significantly increased compared to the hypofunctional group. There was also a catch-up tendency towards the normal group concerning the inclination of the angular process.

CONCLUSION: Masticatory muscle function influences the morphology of the mandible during growth. Six weeks of retraining the masticatory muscles of the adult animals resulted in a certain catch-up effect in the rehabilitation group due to residual growth.

OP49 EFFECTIVENESS OF EXTRACTION OF THE PRIMARY CANINES FOR THE INTERCEPTIVE MANAGEMENT OF PALATALLY DISPLACED PERMANENT CANINES: A META-ANALYSIS

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AIMS: Although extraction of primary canines in the mixed dentition has been suggested as a measure to prevent impaction of palatally displaced permanent canines (PDC), the respective evidence has been inconclusive. The aim of this study was to investigate the effectiveness of this practice.

MATERIALS AND METHOD: A search without restrictions for published and unpublished literature and hand searching took place. The data on the prevalence of physiologic PDC eruption from randomized controlled trials (RCTs) that compared the extraction of primary canine to either no treatment or delayed treatment was reviewed. 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: One thousand eight hundred and seventy eight references were initially identified and finally included data from five RCTs involving 329 patients with 479 PDC in total, following them for up to 48 months post-intervention. One study presented data also for the 12-month evaluation. Two studies were at low and the rest at high risk of bias. At the 12-month evaluation, extraction of the primary canine does not result in a statistically significant benefit compared to no treatment [risk ratio (RR): 1,537; 95% confidence interval (CI): 0.656 - 3,601; 1 study, n = 67 participants and 99 canines]. Beyond 12 months, overall, there was moderate quality evidence that extraction of the primary canine provides a statistically significant benefit compared to no treatment or delayed treatment [RR: 1,784; 95% CI: 1,376 - 2,314; 5 studies, n = 214 participants and 261 canines; I² = 0%]. Analysis of the studies at low risk of bias confirmed the abovementioned result [RR: 1,713; 95% CI: 1,226 - 2,394; 2 studies, n = 91 participants and 147 canines; I² = 0%].

CONCLUSION: Extraction of the primary canines in the mixed dentition may increase the chance of subsequent successful eruption of PDC in the long term. However, better study standardization and reporting in long follow-ups are necessary.

OP50 DENTAL DEVELOPMENT IN PATIENTS WITH AGENESIS

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AIMS: To evaluate if dental development of patients with agenesis is delayed compared to a control group.

MATERIALS AND METHOD: One thousand one hundred and forty seven panoramic radiographs of patients with dental agenesis were collected [452 males, 695 females; age range 6.2 to 24.8 years (mean age 12.0 years)]. In the control group, 2032 panoramic radiographs were included [977 males, 1055 females; age range 6.0 years to 24.4 years (mean age 11.6 years)]. A total of 3,179 dental pantomograms were scored according to Demirjian. All present left permanent teeth in the mandible (excluding the third molar) were given a score from 1 to 8 according to their developmental stage. A continuation ratio model (Agresti, 1990) was used per tooth position to model the ordinal Demirjian scores. A likelihood-ratio test was performed to evaluate if the groups differed in their relation between age and Demirjian score. In an alternative approach to evaluate the difference between subjects with and without agenesis a developmental score (DS) was made. The association between the DS and the number teeth with agenseis was evaluated with a Spearman correlation.

RESULTS: Based on the DS, subjects with agenesis have delayed development compared to control subjects. The difference equaled 0.68 standard deviations for females [AUC = 0.711 (CI:0.686 to 0.736), $P < 0.0001$] and 0.58 standard deviations for males [AUC = 0.695 (CI: 0.666 to 0.725), $P < 0.0001$]. The result on delayed development based on the DS was confirmed by the results of the continuation-ratio model applied per tooth position. Within the group of subjects with agenesis, there was a weak relationship between the number of teeth with agenesis teeth and the DS: the higher the number of teeth with agenesis, the lower the DS: $\rho = -0.16$ ($P < 0.0001$) and $\rho = -0.09$ ($P = 0.05$) for females and males, respectively.

CONCLUSION: Dental development in patients with dental agenesis is delayed compared to the control group. There also seems to be a weak correlation with the number of agenetic teeth and the degree of delay in dental development. This can be an important factor for treatment planning in patients with dental agenesis. New dental age estimation methods should be made for these specific subjects.

OP51 OBLIQUE LABIAL AND PALATAL ROOT RESORPTION OF MAXILLARY INCISORS DURING ORTHODONTIC TREATMENT

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AIMS: To evaluate and compare the amount of orthodontically induced root resorption on the labial, mid-radicular and palatal surfaces of the upper incisors during treatment with fixed appliance. Furthermore, to identify possible correlations between the extent of root resorption and the amount of root movement, inclination changes and the proximity of the root to cortical bone.

MATERIALS AND METHOD: Two hundred and fourteen incisors (108 centrals, 106 lateral incisors) from 60 patients treated with fixed appliances and extraction of four premolars. Cone beam computed tomographic (CBCT) data from a previous study on root resorption, approved by an ethical and a radiation protection committee, were available from before and after treatment. The CBCT scans were reformatted and images were obtained from the sagittal cut on the mesio-distal centre of the root and perpendicular to the incisal edge. Reference points were determined to measure the resorption on the labial, mid-radicular and palatal surfaces of the root. Root movement was measured by the changes in the distance from the root surfaces to the buccal and palatal cortical bone. The inclination was measured by the angle between the tooth long axis and palatal plane.

RESULTS: There was a significant difference between the mean amounts of root resorption between the three sagittal surfaces. The resorption was largest on the palatal followed by the mid-radicular and labial surfaces. The mid-radicular and the palatal resorption both showed a significant correlation with the amount of root movement. There was a significant correlation between the palatal and mid-radicular root resorptions and the final proximity of the root tip to the palatal cortical bone-plate ($P < 0.01$) indicating that more resorption was seen when the root tip ended up close to the palatal compact bone.

CONCLUSION: There was a significantly larger amount of root shortening on the palatal surfaces of the maxillary incisor roots which results in oblique root resorption. This causes an underestimation of the extent of resorption seen in two-dimensional frontal periapical radiographs

OP52 CHANGES IN WHITE-SPOT LESIONS FOLLOWING POST-ORTHODONTIC WEEKLY APPLICATION OF 1.25 PER CENT FLUORIDE GEL OVER 6 MONTHS – A RANDOMIZED CONTROLLED TRIAL

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AIMS: *In vivo* monitoring of white-spot lesion (WSL) changes and dental status in response to weekly 1.25 per cent fluoride gel application after multibracket appliance treatment (Tx).

SUBJECTS AND METHOD: In this randomized, single-centre, double-blind, parallel-group, placebo-controlled study conducted in compliance with good clinical practice and the Declaration of Helsinki, patients with ≥ 1 WSL (modified score 1 or 2; Gorelick *et al.*, 1982) on ≥ 1 of the four upper front teeth (UFT) after debonding of multibracket appliances were randomly assigned to a test or placebo group. The participants attended six appointments (T0-T5) over 6 months. At T0 (baseline) to T2 (2 weeks after debonding), professional gel (1.25% fluoride or placebo) application was performed. Thereafter, the subjects continued gel application at home for 22 weeks. For WSL assessment, photographs of the UFT were taken using a standardized imaging technique at each appointment. In addition, saliva buffer capacity and stimulated salivary flow rate as well as WSL index, caries activity index, plaque index, gingival bleeding index and decayed, missing, and filled teeth were evaluated clinically.

RESULTS: While improvement of WSL luminance was seen in both groups (mean value teeth 12-22, fluoride group: 26.9%, placebo group: 23.2%) after 6 months, no statistically significant group difference was seen. The same was true for all other clinical parameters except stimulated salivary flow rate (fluoride group: 1.1 ml/minute, placebo group: 0.74 ml/minute; $P = 0.022$). Data suggest that the parameter WSL is difficult to measure with respect to reliability and repeatability and further improvement and validation of methods for monitoring WSL in clinical trials is required.

CONCLUSION: Based on the results of this study, no treatment difference could be detected in respect of the outcome of WSL by post-orthodontic high-dose fluoride treatment.

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