# ABSTRACTS

# OF POSTERS

Please note that the authors of those abstracts marked with three asterisks have declared a financial and/or beneficial interest



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## 1 SHORT-TERM EFFECT OF MASTIC GUM ON SALIVARY CONCENTRATION OF CARIOGENIC BACTERIA IN ORTHODONTICS

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AIM: Patients with malocclusions often have large number of retention sites for plaque. It has been shown that mastic chewing gum has both anti-plaque and anti-bacterial effects. The present study aimed to evaluate the anti-bacterial effect of mastic gum by investigating the saliva of orthodontically treated patients.
SUBJECTS AND METHOD: Twenty-five subjects who presented with severe malocclusions and who were assigned for orthodontic treatment. None had undergone any treatment of dental caries prior to the investigation. At the start of active orthodontic treatment brackets were bonded on all teeth anterior to the first molars, which were banded. The short-term effect of mastic gum, cultivated in the Aegean region of Turkey, on the salivary concentration of total viable bacteria, *Streptococcus mutans* (*S. mutans*) and lactobacilli, were evaluated. This was undertaken by inoculation of the saliva samples on blood agar for total bacterial count, mitis salivarious selective medium for *S. mutans* count and rogosa agar for lactobacilli count. The bacterial counts were assessed at six stages after bonding: prior to chewing gum; just after removal of the gum from the mouth and at 30 minutes intervals thereafter lasting two hours after removal of the gum.
RESULTS: A significant decrease was observed in the bacterial levels of *S. mutans*, lactobacilli and total viable bacteria during the follow-up period ($P < 0.05$).
CONCLUSION: Chewing mastic gum decreases *S. mutans*, lactobacilli and total viable bacterial counts in the saliva of orthodontic patients with fixed appliances and therefore might be useful in preventing carious lesions.

## 2 AESTHETICS IN THALASSAEMIA MAJOR PATIENTS (***)

S H Alavi, A Boshagh, Department of Orthodontics, Isfahan University of Medical Sciences, Iran

AIMS: Using anthropometric techniques, craniofacial disorders are apparent in subjects suffering from thalassaemia major. The aim of this study was to evaluate craniofacial dimensions in patients 17-21 years of age.
SUBJECTS AND METHOD: Ninety-eight patients suffering from thalassaemia major. Thirteen anthropometric indicators were measured using digital callipers with a precision of 0.01 mm.
RESULTS: Comparison of craniofacial anthropometric measurements between thalassaemic boys and girls indicated significant differences in inter-canthal width, nasion-gnathion, upper lip vermilion, subnasal gnathion, bigonial and bizygomatic parameters ($P < 0.05$). However, comparison of craniofacial anthropometric ratios between thalassaemic boys and girls failed to show any significant differences. Parameters such as bizygomatic distance, inter-canthal width, upper lip vermilion and stomion gnathion distance were significantly greater in thalassaemic males than normal males. Parameters such as bizygomatic distance, intercanthal width, subnasal gnathion, upper lip vermilion and stomion-gnathion distance were significantly greater in affected females than normal females. Regarding anthropometric ratios, some ratios such as n-gn/zy-zy, n-sto/zy-zy, ch-ch/zy-zy, sto-gn/n-gn, o-go/zy-zy, bi-par/In-na, were reduced in affected males as compared with normal males. In

females, only the go-go/n-gn ratio was not significant when comparing affected and normal subjects.
CONCLUSIONS: Patients with thalassaemia major have poor facial aesthetics due to enlargement of the cancellous bones.

## 3 AN ALTERNATIVE APPROACH TO MANDIBULAR WIDENING USING A BONE-BORNE SYMPHYSEAL OSTEODISTRACTION APPLIANCE

T Alcan, S Sonmez, S Tuncer, Department of Orthodontics, Marmara University, Istanbul, Turkey

AIM: To determine the effects of a bone-borne midline symphyseal osteodistaction device on the widening effect on the mandible, the distraction gap formed, the condition of teeth adjacent to the surgical cut and the status of the periodontal tissues.
SUBJECTS AND METHOD: A bone-borne labially positioned Hyrax device was used in the lower arch of 11 patients with transverse maxillomandibular deficiencies. Prior to mandibular widening, the maxilla was expanded by rapid palatal expansion. Records, which included a dental pantomogram, postero-anterior, cephalometric and periapical radiographs, were taken pre-distraction (3 months before surgery), post-distraction (at the end of mandibular widening), and after the removal of the screw.
RESULTS: Post-distraction radiographic evaluation showed that symphyseal distraction osteogenesis produced an increase in mandibular arch width and a parallel distraction gap was observed in the symphyseal region. Dental crowding was resolved by movement of teeth into the newly formed bone. The teeth were vital post-surgically and the surrounding periodontal structures were healthy.
CONCLUSION: Mandibular symphyseal distraction osteogenesis using a bone-borne intraoral device increases mandibular arch width and corrects dental crowding with a proportionate distraction pattern in the frontal plane without the need for extraction of teeth.

## 4 ENHANCED SETTING OF GLASS IONOMER MATERIALS USED FOR ORTHODONTIC APPLICATIONS

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AIM: To evaluate the influence of ultrasound or heat application on the adhesive tensile bracket bond strength of conventional glass ionomer cement (GIC) and a resin modified GIC (RMGIC).
MATERIALS AND METHOD: Sixty mesh-based brackets were randomly bonded with a GIC (Fuji IX Fast, GC Corp., Japan), or a RMGIC (Fuji Ortho LC, GC Corp.), to bovine enamel. In addition to standard curing, ultrasound (Satelec Suprason P5, a tooth scaler device) or heat (70ºC) was applied during setting of the materials for 1 minute through the bracket. For the RMGIC-groups the enamel was pre-treated with polyacrylic acid gel. Tensile testing was performed 15 minutes after initiation. The mode of failure was scored using the Adhesive Remnant Index (ARI). ANOVA was used to determine the differences between the mean tensile forces ($P < 0.05$).
RESULTS: The bond strengths and ARI scores measured for the standard cured groups were 23.2 N/2.2 (GIC) and 38.7 N/0.9 (RMGIC), respectively. Heat improved the tensile bond strength of RMGIC (49.0 N) and GIC (29.4 N) and increased the ARI scores of both groups (2.8 and 2.9, respectively) while ultrasound improved the bond

strength of the RMGIC (51.1 N) and increased the ARI score of the GIC (2.8) only. The application of ultrasound had no effect on GIC bond strength (18.0 N) or the ARI score of the RMGIC (0.5).
CONCLUSION: Application of heat or ultrasound has beneficial effects on the tooth-cement-bracket bonding of GIC and RMGIC after 15 minutes.

**5** CLEFT LIP AND PALATE IN JORDAN: BIRTH PREVALENCE RATE

I K H Al-Omari, F Al Omari, Faculty of Dentistry, University of Jordan, Amman, Jordan

AIM: To retrospectively investigate the prevalence rate of Jordanian children born with oral clefts from 1991 to 2001.
MATERIALS AND METHOD: Hospital surgical records from two main sources were used to identify all children born with orofacial clefts. Information relating to date of birth, sex, cleft type and associated major anomalies and/or syndromes were recorded.
RESULTS: The overall prevalence rate for cleft lip and/or palate live births was 1.39 per 1000 live births. Thirty per cent of the clefts affected the lip, 22 per cent the palate and 48 per cent involved clefts of the lip and palate. In general, there was a higher prevalence rate for males (55% compared with 45% females). There was a statistically significant sex differences between the cleft types. Isolated clefts of the palate, however, were more common in females. Eighteen per cent of cleft cases were associated with major anomalies and/or syndromes.
CONCLUSION: The reported prevalence rate for orofacial clefts among Jordanians is similar to that for white Caucasians.

**6** SIZE AND SHAPE OF DENTITIONS WITH MILD, MODERATE AND SEVERE HYPODONTIA

M H Al-Sharood, Riyadh Dental Center, Ministry of Health, Kingdom of Saudi Arabia

AIM: Many subjects with hypodontia present significant variation in odontogenesis and/or morphology that may complicate orthodontic and restorative management. The aims of this research were to investigate variations in the mesiodistal (MD) and occluso-gingival (OG) dimensions of all teeth and tapering of incisors, and to test influence of gender and severity of the anomaly on morphology.
MATERIALS AND METHOD: A digital image analysis system was used to determine the MD, OG and tooth taper, based on buccal images of maxillary and mandibular teeth from a 160 subjects. The data was analysed for the influence of gender and severity of hypodontia (control, mild, moderate and severe), using a two-way ANOVA with the Bonferroni correction being applied.
RESULTS: Significant interactions were seen between the severity of hypodontia and gender, when evaluating the MD and OG dimensions for some teeth (mean values in hypodontia groups were smaller than controls). These variables remained consistently smaller in the hypodontia group when taking the influence of gender in to consideration. When evaluating incisor tapering, the analysis showed significant interactions and differences between groups and genders (more tapering in subjects with hypodontia).
CONCLUSIONS: Two main trends are suggested: 1) Hypodontia results in diminished tooth size, shape and form compared with normal dentitions. 2) As the

severity of hypodontia increases, tooth size generally decreases and incisor tapering increases. Additional research is required to clarify the aetiological mechanism for the variation between genders and tooth types.

## 7 CORRELATION BETWEEN OVERJET AND SOFT TISSUE FACIAL PROFILE

M H Al-Sharood, Riyadh Dental Center, Ministry of Health, Kingdom of Saudi Arabia

AIM: Controversy exists in the literature concerning dentofacial appearance. The aims of this study were to propose a method to quantify facial morphology and to investigate the relationship between overjet and soft tissue facial profile, taking into account gender and severity of overjet.
MATERIALS AND METHOD: Facial profile was defined by hard and soft tissue linear and angular variables using standardized lateral cephalometric radiographs of 40 patients with an increased overjet (>4 mm) and 40 patients with a normal overjet (2-4 mm). The groups were matched for gender and age. Data was analyzed using ANOVA for comparison purposes, and a linear regression analysis to evaluate correlations between overjet changes and soft tissue variables (upper and lower lip thickness, upper and lower lip-E line, superior and inferior sulcus depth, lower lip-H line, H angle, nasolabial angle and labiomental groove). In addition, an error study was undertaken.
RESULTS: Comparative findings revealed significant differences between groups, but not between males and females. There were significant correlations between the degree of the overjet and various soft tissue variables. In the study group, as the overjet increased, the nasolabial angle decreased and both the upper lip-E line and superior sulcus depth increased. In the control subjects, the lower lip thickness increased.
CONCLUSIONS: There are different facial morphological characteristics in individuals with an increased overjet as compared with those with a normal overjet.

## 8 FREQUENCY AND DISTRIBUTION OF DENTAL ANOMALIES IN ORTHODONTICALLY TREATED PATIENTS

A T Altug, D Erdem, Department of Orthodontics, University of Ankara, Turkey

AIM: To analyse the frequency and distribution of several dental anomalies observed in a group of Turkish children.
SUBJECTS AND METHOD: Three thousand and forty three Turkish children treated between 1978-2003. The anomalies selected in this study were those involving the number (anodontia, congenitally missing teeth, supernumerary teeth), shape (fusion, peg-shaped lateral incisors, deformed central incisors, deformed premolars, radiculomegaly), structural anomalies (amelogenesis imperfecta), rotation of more than 90 degrees, and transposition of the teeth.
RESULTS: Dental anomalies were found in 6.5 per cent of the subjects and 17.5 per cent of these patients had an additional dental anomaly. The distribution of the dental anomalies was: anodontia (0.13%), congenitally missing maxillary lateral incisor (1.74%), congenitally missing mandibular incisor (0.36%), congenitally missing mandibular canine (0.066%), congenitally missing premolars (0.46%), supernumerary incisors (0.30%), supernumerary premolars (0.066%), fusion (0.23%), peg-shaped lateral incisors (1.57%), macrodontia and radiculomegaly (0.033%), rotation more

than 90 degrees (0.56%), transposition (0.43 per cent) and amelogenesis imperfecta (0.43%).

**9** EFFECTS OF PROTRACTION ON THE MAXILLA

Z Altug, A Dalkiran, H Gokalp, Department of Orthodontics, Ankara Universitesi, Turkey

AIM: To compare the effects of an Altug mini maxillary protractor and a Delaire facemask on the maxilla, mandible and soft tissues.
SUBJECTS AND METHOD: Forty-three subjects with a Class III malocclusion with maxillary deficiency. The Altug and Delaire groups each comprised 15 subjects and the control group 13 subjects. Lateral cephalograms and hand-wrist films were obtained of all subjects at the beginning and end of treatment. The average treatment period was 9 months. The cephalograms were superimposed according to the structural method of Björk.
RESULTS AND CONCLUSION: Advancement of the maxilla in the Altug group was greater than in the Delaire group. Soft tissue improvement was more positive in the Delaire group. It was found that mandibular growth continued and the mandibular growth model was changed by both the Altug mini maxillary protractor and Delaire facemask.

**10** COMPARISON OF THREE-DIMENSIONAL BIMETRIC DISTALIZING ARCHES WITH MAXILLARY EXPANSION AND A DISTALIZATION APPLIANCE

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AIM: To evaluate and compare the effects of three-dimensional bimetric maxillary distalizing arches (3D-BMDA) and maxillary expansion and distalization appliances (MEDA) on dentofacial structures of subjects with an Angle Class II molar relationship, skeletal Class I or Class II malocclusion.
SUBJECTS AND METHOD: Twenty-one patients treated with 3D-BMDA and 21 with a MEDA. In order to define the similarities and differences between the groups, 12 angular, 36 linear and two proportional parameters related to skeletal-dentoalveolar structures and soft tissues were measured on lateral cephalograms.
RESULTS: The time for moving the molars from a Class II to Class I relationship for the 3D-BMDA and cervical headgear groups was 3.4 months and 6.2 months, respectively. A significant amount of maxillary molar distalization was achieved with both techniques. A Class I molar relationship was achieved with pure upper first molar distalization in the MEDA group, and with both upper first molar distalization and lower first molar mesialization in the 3D-BMDA group. In the 3D-BMDA group, the mandibular incisors were protruded significantly by the effect of Class II elastics used with a fully bonded mandibular arch. Although no change was found at the mandibular plane angle in the 3D-BMDA group, a significant increase was observed in the MEDA. The MEDA created a retrusive effect on sagittal growth of the maxilla. The most noteworthy finding was the significant effect of 3D-BMDA on sagittal growth of the mandible.

**11** LAMBERT-EATON MYASTHENIC SYNDROME WITH A SKELETAL OPEN BITE

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AIM: To present a 14-year-old female patient with Lambert-Eaton myasthenic syndrome (LEMS) and a skeletal open bite. LEMS is a neuromuscular disorder seen in 1:1 000 000 people, affecting young or old adults but rarely children. The disease is characterized by weakness and fatigue of the trunk and proximal limb muscles and, less commonly, the muscles of the neck, speech, swallowing, breathing and eye movement.
SUBJECT AND METHOD: The patient had an anterior open bite varying from 3 to 5 mm between the incisors and an overjet of 3 mm. Maxillary and mandibular crowding was 5 and 7 mm, respectively. The tongue was placed over the lower incisors during rest and between the incisors during swallowing. Cephalometric evaluation revealed over eruption of the lower molars and insufficient eruption of the lower incisors. The primary aim was to intrude the lower molars. Any surgical procedure was avoided and orthopaedic approach was preferred for intruding the lower molars. A modified monobloc was designed such that the acrylic width between the posterior teeth was limited with the patient's freeway space. Active intrusion of the lower molars was achieved by the bilateral screws inserted at the lower molar region. A thin layer of acrylic was kept over the upper molars to prevent extrusion of the upper molars. The modified monobloc also prevented tongue-thrust swallowing and, as a consequence, spontaneous eruption of the incisors occurred.

**12** ELECTROMYOGRAPHIC ACTIVITY OF MASTICATORY MUSCLES IN DEEP AND OPEN BITE SUBJECTS DURING PUBERTY

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AIM: To investigate bilateral electromyographic (EMG) activity of the masticatory muscles in different vertical craniofacial patterns (skeletal deep and open bites) and different developmental stages (pre- and post-pubertal).
SUBJECTS AND METHOD: Surface EMG assessment of the temporal and masseter muscles during swallowing, chewing and maximum voluntary clenching were performed by surface disk electrodes (Nihon Kohden Neuropack-8, Japan) on 12 pre-treatment orthodontic patients (three pre- and three post-pubertal subjects in each deep/open bite group) who reported no history, signs or symptoms of myofacial pain. The mean amplitudes of the records were calculated to assess inter-group differences.
RESULTS: Pre-pubertal period: The mean EMG activity was higher in the deep bite group (Mean amplitudes: 419.1 versus 203.2) for all functions and muscles. Post-pubertal period: the difference between deep and open bite EMG activity during swallowing and maximum intercuspation decreased, while EMG activity during chewing was higher in the deep bite group when compared with the open bite group (658 versus 247.7). Pre versus post-pubertal period: No remarkable difference in muscle activity was detected in the open bite group. EMG activity during swallowing and chewing decreased for both muscles in the post-pubertal deep bite group. However, both groups showed increased EMG activity during maximum intercuspation, with growth (open bite: 212.9 to 281.5, deep bite: 271 to 375.2)
CONCLUSION: The EMG activity of temporal and masseter muscles differs in deep and open bite subjects; however, growth changes in these activities was not noticeable.

## 13 EFFECTS OF ADHESIVE LAYER THICKNESS ON SHEAR BOND STRENGTH OF A RESIN-MODIFIED GLASS IONOMER CEMENT

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AIM: To investigate the effects of the adhesive thickness on the shear bond strength (SBS) of a light-cured, resin-modified glass ionomer cement (RMGIC; Fuji Ortho LC, GC Corporation). A conventional light-cured composite resin (Transbond, 3M Unitek) was used as the control.
MATERIALS AND METHOD: One hundred and twenty mesh-based premolar brackets bonded to extracted human premolar teeth using either the light-cured RMGIC or the light-cured composite resin. During bonding, adhesive thickness between the bracket base and the enamel surface was controlled with a device, in increments of 0.25 from 0 mm (bracket base in contact with enamel surface) to 0.50 mm. Three subgroups of adhesive layer thickness (0, 0.25 and 0.50 mm) were achieved for both adhesive groups. All bonded specimens were stored in water at 37ºC for 48 hours and thermocycled between 5-55ºC for 200 cycles prior to testing the *in vitro* SBS.
RESULTS: One-way analysis of variance showed statistically significant differences between the mean SBS of the groups at $P < 0.001$. The highest mean SBS was found for the group bonded using the light-cured composite resin with a 0 mm (theoretically) adhesive thickness. The light-cured RMGIC had the highest value with an adhesive layer thickness of 0.25 mm.
CONCLUSION: The thickness of the adhesive layer under a bracket could be particularly important for the bond strength of RMGICs.

## 14 MANDIBULAR CHANGES DURING NITINOL FLAT SPRING APPLIANCE TREATMENT

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AIM: To investigate the effects of Forsus nitinol flat spring appliance treatment on the antero-posterior mandibular length and intercondylar distance by means of three-dimensional computerised tomography (3D CT) in a group of Class II patients. A comparison of the treatment changes with the corresponding growth changes in untreated subjects with a Class II malocclusion was also undertaken.
SUBJECTS AND METHOD: Ten patients with an Angle Class II division 1 malocclusion with an overjet greater than 5 mm. All treatment was carried out without extractions using straightwire brackets and an integrated Forsus appliance. The average treatment time was 7.4 months. For evaluation of mandibular length and intercondylar distances, 3D CT scans were obtained before and after treatment. The average treatment changes were compared with the growth changes that took place during 7.5 months in the untreated subjects with a Class II malocclusion.
RESULTS: Although the intercondylar distance increased, on average 2.62 mm, in the appliance group and 1.56 mm in the control group, this difference was not statistically significant ($P = 0.43$). However, there was a significant difference between the groups for mandibular length measurements ($P < 0.05$). Mandibular length increased in the appliance group 2.66 mm, and in the control group by 1.91 mm.

CONCLUSION: Forsus appliance treatment has a favourable effect on antero-posterior mandibular growth in subjects with a Class II malocclusion.

## 15 EFFICIENCY OF NASOALVEOLAR MOULDING IN UNILATERAL CLEFT LIP AND PALATE PATIENTS

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AIM: To quantify the efficiency of nasoalveolar moulding (NAM) on the alveolus and columella of complete unilateral cleft lip and palate (UCLP) patients.
SUBJECTS AND METHOD: Pre-operative orthopaedic treatment using NAM was performed on 18 (14 boys, 4 girls) consecutively treated infants with UCLP (8 right side, 10 left side clefts). Alveolar and nasal impressions were taken at the beginning and on completion of NAM. Measurements of alveolar cleft width, maximum arch width and columella length on the cleft side were undertaken on stone casts of these impressions using a compass.
RESULTS: The initial cleft width was 7 mm (SD 4.5 mm) and the initial columella length 0.3 mm (SD 0.5 mm). After NAM for 24 weeks (SD 6 weeks), the cleft was reduced to 0.6 mm (SD 2.4 mm), whereas the maximum arch width increased 26 mm (SD 4 mm). The increase in columella length was 4 mm (SD 2 mm).
CONCLUSION: NAM is very effective in reducing alveolar cleft width without constricting the alveolar arch. Columella elongation was also achieved leading to improved aesthetics post-operatively. The only disadvantage was the delay in primary surgical repair. The long term-effects need to be evaluated.

## 16 EVALUATION OF SKELETAL CHANGES OBTAINED BY REVERSE HEADGEAR THERAPY

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AIM: To evaluate the skeletal changes achieved by reverse headgear therapy in Class III subjects.
MATERIALS AND METHOD: Lateral cephalometric films of 13 Class III patients obtained at the beginning of treatment (T1), immediately after reverse headgear therapy (T2), and at the end of treatment (T3). Treatment began at a mean age of 12.14 years and lasted 2.8 years (T2-T1: 0.7 years, T3-T2: 2.1 years). All patients were treated with reverse headgear plus bonded maxillary expansion appliances, with a protraction force of 400-600 g per side for 14-16 hours/day, followed by fixed appliances. The cephalometric films were analysed according to the structural superimposition method of Björk. ANOVA and Duncan tests were used to evaluate the treatment changes.
RESULTS: The maxilla moved forwards and the maxillary effective length increased significantly from T1 to T3 ($P < 0.001$). The mandible was positioned backward, showing a posterior rotation. The mandibular effective length increased significantly ($P < 0.05$). ANB angle increased, indicating a significant improvement in the inter-maxillary relationship ($P < 0.01$). Overjet increased significantly during treatment ($P < 0.001$).
CONCLUSION: The changes obtained immediately after orthopaedic treatment were maintained at the end of fixed appliance therapy. Long-term studies are required to evaluate the stability of these changes.

## 17 FUNCTIONAL PERIODONTAL EVALUATION OF PASSIVE SELF-LIGATION AND A LIGATION BRACKET SYSTEM

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AIM: To compare the functional changes in periodontal tissues during treatment with passive self-ligation (Damon 2-system) and normal ligation.
SUBJECTS AND METHOD: Thirty patients (12-15 years of age) with anterior crowding treated with self-ligating brackets, were compared with a group treated with the usual ligation for the same pathology. The reaction of periodontal tissues was evaluated by periodontal blood supply and bone density. Blood flow changes were studied with a rheographic method and laser Doppler flowmetry, and bone density by ultrasonic osteometry. The data was obtained before and after a treatment period of 1 and 6 months.
RESULTS: The regional vessels in the crowded segment showed a high level of constriction (RI = 0.043 Om, IPR = 176%), capillary blood flow decreased (IM = 14.08), bone density increased (2461 m/second). During expansion of the dentoalveolar arches after 1 month there was a significant difference in periodontal blood supply and bone density: this was decreased more in the ligation cases (RI = 0.031, IPR = 166%, IM = 9.88, USV = 2078 m/second), compared with the Damon 2-system (RI = 0.055, IPR = 123%, IM = 11.73, USV = 2656 m/second). After 6 months blood flow rate increased considerably in the ligation cases (RI = 0.107, IPR = 81%, IM = 14.31) with significant decreased bone density (1780 m/second). Damon 2-system (RI = 0.072, IPR = 94%, IM = 11.6, USV = 2862 m/second).
CONCLUSION: Using low force and friction in a passive self-ligation system is more physiological for tooth movement and results in faster periodontal remodelling ($P < 0.05$).

## 18 ORTHODONTIC SUPPORT OF PATIENTS UNDERGOING MANDIBULAR COMPRESSION DISTRACTION OSTEOSYNTHESIS

O I Arsenina, V Roguinski, A V Popova, Central Research Institute of Dentistry, Moscow, Russia

AIM: To determine complex methods of age-dependent orthodontic treatment for patients undergoing mandibular compression distraction osteoynthesis (CDO).
SUBJECTS AND METHOD: During the last five years CDO has been carried out in 87 patients with congenital and acquired mandibular defects and deformities from 1 to 18 years of age. Prediction of combined orthodontic-surgical procedures was based on clinical, cephalometric evaluation, dental study models, three-dimensional computed tomographic scans and stereolithographic modelling using CAD. After CDO treatment the majority of patients had disocclusion which lead to orthodontic treatment after removing the compression-distraction devices (CDD). The algorithm of the stage of orthodontic treatment was determined after CDD. In the period of the primary and mixed dentition before removing the CDD a removable bimaxillary orthodontic appliance was made and fitted which stabilized the achieved position of the mandible. Use of the appliance for 6-12 months preserved the size of the new bone up to its complete mineralization, and normalized the muscle function in the new mandibular position. At the next stage of treatment of children under 12 years, functional appliances were constructed for optimisation of maxillary growth

according to the mandible. For treatment of children over 12 years of age in the permanent dentition fixed appliances were used.
RESULTS: Analysis of treatment showed that a good result was achieved in 90 per cent of subjects, satisfactory results in 6 per cent and unsatisfactory results in 4 per cent. Lengthening of bone was between 13 and 40 mm.

## 19 IMPACTED MAXILLARY CANINES AND SIGNS OF DEVELOPMENTAL INSTABILITY OF THE DENTITION

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AIM: Most recent studies on impacted maxillary canines suggest a strong genetic contribution to the phenomenon. The aim of this investigation was to detect radiological signs of dental developmental instability in patients with impacted maxillary canines.
SUBJECTS AND METHOD: Forty-three females and 20 males with impacted canine(s), consecutively taken from the files of the Orthodontic Department. The following dental anomalies were recorded: missing teeth, irregularities such as taurodontism, small laterals, peg-shaped teeth, short, crooked or curved roots.
RESULTS: Missing teeth were observed in 31.7 per cent of the group. Taurodontism, short roots, crooked roots existed in 33.3, 22.2 and 38.9 per cent, respectively. Small laterals and peg-shaped teeth were seen in 19 and 4 per cent, respectively. Taurodontism, short roots and crooked roots were more prevalent in females ($P < 0.05$).
CONCLUSION: The existence in patients with impacted maxillary canines of a high prevalence of dental anomalies such as tooth size, morphology and development, strongly suggests that impacted maxillary canines are associated with deficient or disturbed genetic control of dental development

## 20 DEVELOPMENT OF A DENTAL/ORTHODONTIC QUESTIONNAIRE – THE DUTCH EXPERIENCE

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AIM: To develop a questionnaire, suitable for both children and care givers, producing information about the ways oral and oro-facial disorders affect the lives of children.
SUBJECTS AND METHOD: A group of investigators, representing the UK, New Zealand, the USA, Canada, France, Brazil, South Africa, China and the Netherlands spent the last two years on developing an international useable questionnaire for children. Different steps in the questionnaire development were carried out: face validity, item reduction and reliability. An existing questionnaire developed by Jokovic and Locker was used during the first stage of the questionnaire development – face validity. In each country 30 care givers and five dental specialists were queried regarding the clarity and content relevance of this questionnaire. Based on the feedback, items were revised. In the next stage, item reduction, 30 care givers and children provided data on frequency and importance. Items with a low frequency or importance were excluded from the questionnaire. Finally the questionnaire was tested among 30 care givers and children for reliability.
RESULTS: Experiences with this questionnaire development and the Dutch data collected in this research showed that substantive modifications were made during the

process. Items that were not sufficiently clear or were not interpreted unambiguously were revised. Items that did not contribute to answering the research question or were not applicable to the target population were excluded.
CONCLUSION: Questionnaire development is a multi-stage process.

**21** PRENATAL GROWTH OF THE MANDIBLE

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AIM: The mandible is created during the 5th and 6th week of prenatal life. Although the mechanism of mandibular growth is understood, there is a difference of opinion on the rate and duration of mandibular development. The aims of this study were, therefore, to evaluate the rate, duration, and direction of foetal mandibular development.
MATERIALS AND METHOD: Sixty foetal mandibles with a developmental range between 4 and 9 months were investigated. Two types of measurement were carried out: linear measurement using digital radiography (Diagora) and calculating indices describing the rate and duration of foetal development.
RESULTS: Between the 4th and 9th month of prenatal life, the length of the mandible increased from 24.58 to 37.96 mm. The anterior part of mandible increased from 10.45 to 17.96 mm, while the posterior part of mandible increased from 17.08 to 30.17 mm.
CONCLUSION: Mandibular growth assessed by linear measurement shows that changes take place in three directions. The rate and duration of these changes are significant. However changes in proportions, as revealed by the described indices, cannot discriminate between development rates of different parts of the mandible during prenatal life.

**22** DENTAL HARD TISSUE ABNORMALITIES IN PATIENTS WITH MARFAN SYNDROME

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AIM: To examine the prevalence of dental hard tissue abnormalities in subjects with Marfan syndrome.
MATERIALS AND METHOD: Panoramic and intraoral radiographs of 21 patients with Marfan syndrome. The 11 female and 10 male patients had a mean age of 38 years (17-57 years). The control group contained the radiographs of 100 randomly selected patients (64 females, 36 males) with a mean age of 37 years (15-67 years). All radiographs were examined for abnormalities of tooth number (hypodontia or hyperdontia), tooth size (microdontia or macrodontia) and root and pulpal morphology (root deformities and pulp obliteration).
RESULTS: Hypodontia was observed in 14.3 per cent, hyperdontia in 9.5 per cent, microdontia in 14.3 per cent and macrodontia in 0 per cent of the Marfan patients, however, without statistically significant differences compared with the control group. In contrast, patients with Marfan syndrome revealed a significantly higher ($P < 0.001$) frequency of pulp obliteration (42.9%) and root deformities (33.3%) than those in the control group (3 and 4%, respectively). Both parameters were more common in premolars and molars than in canines and incisors ($P < 0.01$).

CONCLUSIONS: Root deformities and pulp obliteration seem to be frequent findings in Marfan syndrome. Therefore, an increased risk of root resorption and pulp necrosis during orthodontic treatment of patients with Marfan syndrome should be taken into consideration.

**23** AUTOTRANSPLANTATION OF THIRD MOLARS INTO EDENTULOUS AND ATROPHIED JAW SECTIONS

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AIM: To assess the results after transplantation of immature third molars into various recipient sites, using different surgical techniques.
MATERIALS AND METHOD: The long-term results after preparation of a new alveolus (n = 17), splitting osteotomy of the alveolar process (n = 16) or use of free bone autografts (n = 19) were compared with the results after transplantation into a fresh extraction site (control group; n = 33). All transplants were followed clinically and radiologically for a mean period of 3.4 years (1.0 to 6.3 years).
RESULTS: Transplantations into a prepared socket showed equal results to the control group (success rates of 94%, respectively). Transplantations in connection with free bone autografts (84%) or after splitting osteotomy of the alveolar process (63%) showed poorer success rates. Significant differences were observed between the success rates after a splitting osteotomy of the alveolar process, and preparation of a new socket ($P$ = 0.039) or after transplantation into a fresh extraction site ($P$ = 0.010).
CONCLUSION: Transplantation of immature third molars is a safe, useful, procedure when appropriate conditions of the recipient site are present. Where the alveolus is atrophic, a splitting osteotomy should be performed only in exceptional cases and preference should be given to alternative methods such as primary bone augmentation or bone-regenerative procedures.

**24** DOES CLASS II CORRECTION RESULT IN GROWTH MODIFICATION?

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AIM: To investigate sagittal changes of Class II malocclusions with various orthodontic devices.
SUBJECTS AND METHOD: (1) Fixed appliance group: 18 consecutive subjects, non-extraction and Class II elastics, (2) Removable functional appliance group: 17 consecutive subjects, Headgear-Activator (HA), and (3) Fixed functional appliance group: 22 consecutive subjects, Headgear-Herbst (HH) with step-by-step advancement and HA. Growth data from a matched group was used for comparison. Lateral cephalograms were obtained at the start of treatment (T0), after 6 (T6), 12 (T12) and 18 (T18) months. Mandibular change was assessed by measuring Olp-Pg and maxillary change by Olp-A.
RESULTS: Changes in the maxilla/mandible over 6 months for Groups 1, 2 and 3, respectively were at T6: 0.4/–0.1; 0.2/1.3**; 0.0/3.1***; T12 1.3*/1.7*; 0.1/2.8***; –0.6**/5.0***; and at T18 1.0*/2.1*; –/–; 0.3/6.6***; T0-T6: there was no difference in the maxillary change between the groups, whereas the mandibular change was greater in group 3 than in group 2 which was greater than in group 1; T0-T12 the mandible in group 3 had greater changes than in group 1 and 2; T0-T18 there was no

difference in maxillary change between groups 1 and 2, whereas mandibular change was larger in group 3.
CONCLUSION: Growth modification occurred during treatment of Class II: maxillary forward growth was restrained to a similar extent with all three devices. Compared with 'normal' growth', mandibular growth was less for the Begg-group, unaffected in the HA group, and enhanced in the HH group, i.e. it seems that growth is affected to a different extent.

## 25 THE EFFECT OF RAPID MAXILLARY EXPANSION ON NASAL AIRWAY RESISTANCE

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AIM: To evaluate the effects of rapid maxillary expansion (RME) on nasal airway resistance (NAR) using acoustic rhinometry (AR) in two groups of subjects.
SUBJECTS AND METHOD: Twenty-nine patients with maxillary constriction divided into two groups according to individual skeletal maturation as assessed by the cervical vertebral maturation method (CVM). Group I included 16 patients (eight girls, eight boys) before the pubertal peak (CVM Stage 1-3) and group II 13 patients (eight girls, five boys) during or after the pubertal peak (CVM Stage 4-6). An acrylic bonded RME appliance was used in both groups. AR was used to measure NAR before treatment (T1), after expansion (T2), and at the end of the three-month retention period (T3).
RESULTS: NAR significantly decreased with the use of RME in both groups (T1-T2). However, the decrease was significantly greater in group I than in group II. No statistically significant difference was found between post-treatment and post-retention values for either group (T2-T3). There was also no difference between the groups. At the end of the three-month retention period, when compared with pre-treatment values (T1- T3), both groups exhibited a significant decrease in NAR, but there was a significantly greater decrease in group I compared with group II.
CONCLUSION: RME treatment before the pubertal peak in skeletal growth velocity is able to induce a greater decrease in NAR.

## 26 MODIFIED TETRACYCLINES AFFECT GELATINASES FROM PERIODONTAL LIGAMENT CELLS

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AIM: Orthodontic tooth movement requires extensive remodelling of the periodontium. Matrix metalloproteinases (MMPs) play an important role in these remodelling processes. The gelatinases, MMP-2 and -9, are important for the breakdown of extracelluar matrix in the periodontium. Chemically modified tetracyclines (CMTs) have been developed, which have lost their antimicrobial activity, but retained an inhibitory effect on MMPs. The aims of the present study were to determine the role of MMPs in orthodontic tooth movement and relapse, along with the effect of CMTs on MMP-2 and -9 produced by periodontal ligament (PDL) cells were studied.
MATERIALS AND METHOD: PDL cells from extracted healthy third molars were cultured with CMT 1, 3, 5, 7 and 8 in concentrations ranging from 0 to 500 μM. The effect of CMTs on MMP production was analyzed with gelatine zymography. A

viability assay was performed to determine the cytotoxic effect of CMTs. Alternatively, CMTs were added to purified human MMP-2 and -9 to analyse the effect of CMTs on their activity, using a fluorescent substrate. All CMTs, except CMT-5, significantly stimulated gelatinase production and reduced gelatinase activity. Only CMT-3 and -8 showed a significant reduction of vital cells at the highest concentrations.
RESULTS: As shown previously, there was a reduction of gelatinase activity by CMTs. Surprisingly, a stimulation of gelatinase production by CMTs was found. However, the inhibition of activity was much stronger than the stimulation of production, so the net result would be a reduction of gelatinase activity produced by the PDL cells.

## 27 VALIDITY OF THE SAGITTAL-OCCLUSAL ANALYSIS USING DIFFERENT REFERENCE LINES

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AIM: For cephalometric roentgenographic evaluation of orthodontic treatment results, the validity of the sagittal-occlusal (SO) analysis (Pancherz, 1982) was assessed using different reference lines.
MATERIALS AND METHOD: From each of 17 hypo- and 13 hyperdivergent subjects two lateral head films were evaluated: one from before (T1) and one from after (T2) Herbst treatment. Five transferred reference lines (defined on T1 and transferred to T2) and four separately defined reference lines (defined on T1 as well as on T2) were used: the maxillary occlusal line, the mandibular occlusal line, the average maxillary/mandibular occlusal line, the average jaw base line, the Frankfort horizontal and the nasion-sella line.
RESULTS: The skeletal and dental contribution to overjet correction differed considerably depending on which reference line was used. For the separately defined reference lines the skeletal contribution varied between 40-143 per cent in hypodivergent and between 20-99 per cent in hyperdivergent subjects. For the transferred reference lines the corresponding variation was 35-45 and 24-32 per cent, respectively.
CONCLUSION: For SO analysis, the reference lines transferred from T1 to T2 are more valid than those defined separately on each head film because of the change in reference line angulation during orthodontic therapy. With Herbst treatment this is especially true for the mandibular occlusal line.

## 28 HERBST TREATMENT OF RETROGNATHIC AND PROGNATHIC CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To compare the short- and long-term outcome of Herbst treatment in Class II division 1 subjects with a retrognathic or prognathic facial type
SUBJECTS AND METHOD: From a total of 360 Herbst subjects 57 were chosen according to their facial type, being either retrognathic or prognathic. Lateral head films were analysed from before (T1) and after Herbst treatment (T2), one year (T3) and three years (T4) after treatment. The sagittal-occlusal (SO) analysis of Pancherz (1982) was used.

RESULTS: During the treatment period (T2-T1) an overjet correction of 8.8 mm (24% skeletal and 76% dental) was achieved for the retrognathic group. The overjet correction achieved for the prognathic group was 8.2 mm (32% skeletal and 68% dental). No significant group difference existed. During the period T4-T2 an overjet relapse of 4.0 mm, comprising 30 per cent skeletal and 70 per cent dental changes, was determined for the retrognathic group. The overjet relapse in the prognathic group was 3.4 mm (9% skeletal and 91% dental). No significant group difference was seen.
CONCLUSION: Successful Herbst treatment does not depend on facial type. Concerning post-treatment skeletal changes, retrognathic subjects however tend to relapse more than prognathic subjects.

Pancherz H 1982 The mechanism of Class II correction in Herbst appliance treatment. American Journal of Orthodontics 82: 104–113

## 29 RE-ORIENTATING COMPUTED TOMOGRAPHIC IMAGES: EVALUATION OF AN IMAGE-PROCESSING SOFTWARE TOOL

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AIM: Computed tomographic (CT) scanning has been used increasingly in both orthopaedics and orthodontics. However, it is known that CT images are subject to 0-10 per cent distortion, which may affect both diagnosis and treatment planning. Distortion might be caused by malpositioning of the patient, movement of the patient during scanning, and saturation of the pixels composing the image. As a solution to the first problem software to obtain a correct orientation and measurement of the implant site has been proposed. A new tool specially designed to re-orientate voxel-based three-dimensional (3D) data sets 'DentalVox' was developed. The aim of this study was to test accuracy of DentalVox versus other commercially available dental scan-based systems (DentalScan, SimPlant and Surgicase).
MATERIALS AND METHOD: Nine titanium cylinders of known length were used as reference markers, placed on a diagnostic acrylic template and positioned on the crest of a partially edentulous dried mandible. The mandible was mounted on a Plexiglas rig, which could be aligned with different angulations (0, 10, 15, 20 and 30°) with respect to the lower mandibular plane. After CT scanning, the parameters obtained from the 3D scanning were elaborated by the four different software systems and the lengths of the cylinders, as well as the distance between the top of the reference marker and the mandibular channel were measured.
RESULTS: Comparison of the measured values with the actual dimensions showed that the average distortion error was 5-6 per cent, while for DentalVox this was reduced to less than 1 per cent.

## 30 PERMANENT FRACTURE RESISTANCE OF RETRIEVED ORTHODONTIC NICKEL TITANIUM WIRES

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AIM: The fracture of an orthodontic archwire results in a loss in treatment time, a risk of injury for the patient, and necessitates a change of the archwire, representing a complication in orthodontic treatment. It was the objective of this study to investigate

whether the reduced permanent fracture resistance of nickel titanium (NiTi) wires, determined earlier, is affected by the clinical application.
MATERIALS AND METHOD: Seventy-two NiTi wires (German Orthodontics, 0.012", 0.014", 0.016", 0.016 × 0.016", 0.016 × 0.022") were retrieved after varying treatment times (30-180 days). The retrieved wires were investigated in a custom-made permanent fracture set-up, simulating intraoral conditions. A cyclic loading of up to 2 mm was applied until fatigue fracture. As a reference, permanent loading tests with as-received NiTi wires of the same cross-sections were performed. The deflections ranged from 0.5 to 4.5 mm. The recorded cycles of fatigue fracture were arranged in stress-number curves and the permanent fracture resistance behaviour of retrieved and as-received wires was compared. The fracture surfaces were inspected by light and scanning electron microscopy.
RESULTS: Similar to earlier studies, as-retrieved NiTi wires showed extreme variability: 0.014" round wires displayed permanent fracture after 12305 up to 190700 loading cycles at a deflection of 2.5 mm, at a deflection of 2.0 mm there was no more fatigue fracture. Retrieved wires of that dimension displayed permanent fracture at a deflection of 2.0 mm after 28 900 cycles.
CONCLUSION: Intraoral application significantly affects permanent fracture behaviour.

## 31 PREVALENCE OF CROSSBITE IN 1250 CHILDREN AGED 6 TO 16 YEARS

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AIM: A crossbite is a serious malocclusion that develops during eruption of the primary dentition and can involve, at a later stage, the permanent dentition. It is characterised by dental malrelationship but may lead to mandibular displacement, neuromuscular dysfunction, and asymmetric skeletal development. The aim of this study was to evaluate the prevalence of a dental crossbite in a group of children, from November 2002 to November 2003.
SUBJECTS AND METHOD: From a total sample of 1250 children aged from 6 to 16 years with general malocclusion, 200 children showed a crossbite. These subjects were evaluated by clinical examination and cephalometric analysis and classified, from a dental point of view, as follows: posterior right unilateral, posterior left unilateral, posterior bilateral, anterior, anterior and posterior unilateral, anterior and partial bilateral, and complete crossbite.
RESULTS: The prevalence of crossbites in this group of 1250 Italian children was 16 per cent, with the following frequency distribution: 49 per cent posterior unilateral (52% posterior right unilateral, 48% posterior left unilateral), 16 per cent posterior bilateral, 17 per cent anterior, 15 per cent anterior and posterior unilateral, 2 per cent anterior and partial bilateral, 1 per cent complete crossbite.
CONCLUSIONS: A posterior unilateral crossbite was found most frequently, with anterior and posterior bilateral crossbites showing almost the same percentage, half that of a unilateral crossbite.

## 32 REVERSE CHEWING CYCLES IN SUBJECTS WITH POSTERIOR UNILATERAL CROSSBITE AND NORMAL OCCLUSION

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AIM: To evaluate the prevalence of reversed sequencing chewing cycles in children with a unilateral posterior crossbite and in a control group with normal occlusion.
SUBJECTS AND METHOD: Twenty-five children, aged from 7 to 11 years, with a posterior unilateral crossbite, and a control group of 25 children of same age, with normal occlusion, were asked to chew premasticated chewing gum (soft bolus) and a wine gum (hard bolus) on the right and left sides. The mandibular motion was measured with a kinesiograph (K6-IMyotronics Inc., Tukwila, WA, USA), which was interfaced with a computer for data storage and subsequent analysis. Statistical evaluation was performed by a two-sample Mann-Whitney rank-sum test.
RESULTS: There was a statistically significant difference between the percentage of reverse sequencing of the children with crossbite, when chewing on the crossbite side, and the control group, for all mastications (soft bolus/right side: $P = 0.0007$, hard bolus/right side $P = 0.0003$, soft bolus/left side $P = 0.0315$, hard bolus/left side $P = 0.0439$).
CONCLUSIONS: Children with a unilateral posterior crossbite exhibit an uncommon chewing pattern on the affected side, characterised by a considerably increased frequency of reversed sequencing chewing cycles. This means that the function is asymmetric and that neural control of mastication is closely involved.

**33** ASSESSMENT OF TOOTH MOVEMENT USING THREE-DIMENSIONAL REVERSE ENGINEERING TECHNOLOGY **(***)**

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AIM: To evaluate the reliability of tooth movement analysis by three-dimensional (3D) digital model superimposition compared with traditional cephalometric analysis.
MATERIALS AND METHOD: The maxillary casts and lateral cephalometric radiographs of 31 patients, who underwent extraction orthodontic treatment, were observed at two different times. The cephalometric superimposition technique was patterned after Ricketts' four-position analysis. 3D scanning of the maxillary dental casts was performed using Inus dental scanning solution®, which consists of a 3D-scanner (optoTop®, white light projection type), and a 3D reverse modelling S/W (Rapidform 2003®). 3D superimposition was carried out using the surface to surface matching (best fit method) function of the Rapidform 2003®, which involved initial registration followed by regional global registration. Descriptive statistics (paired *t*-tests) were calculated.
RESULTS: No statistical differences were found between tooth movement assessed by cephalometric superimposition and measurements from superimposed models.
CONCLUSIONS: Tooth movement can be evaluated more accurately in all three dimensions with the 3D model than with either the stone model or cephalometric superimposition. Advancements in 3D reverse engineering technology are expected to elevate the orthodontic practice to higher levels of treatment efficacy and efficiency.

**34** THE NASOLABIAL ANGLE IN ADULT PATIENTS WITH A SKELETAL CLASS III MALOCCLUSION

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AIM: To evaluate nasolabial angle changes between closed lip position at centric occlusion and relaxed lip position at which the bite is open so that the lips do not touch, and to elucidate the significance of the relaxed lip position for dentofacial diagnosis.
SUBJECTS AND METHOD: Sixty adult patients (35 males, 25 females, mean age 23.3 years) with a skeletal Class III malocclusion and anterior crossbite. To determine whether the nasolabial angle in the closed lip position was different from that in the relaxed lip position, a paired *t*-test was used. To elucidate skeletal and dental variables which correlated with nasolabial angle changes between the two lip positions, Pearson's correlation analysis was used. Using cluster analysis, the subjects were divided into three groups according to the pattern of nasolabial angle change: group 1 (27 subjects, –8~1 degrees), group 2 (30 subjects, 2~17 degrees), and group 3 (three patients, more than 18 degrees). One-way analysis of variance (ANOVA) was used to compare the dentofacial characteristics among the groups.
RESULTS: The pattern of the nasolabial angle change between the closed and relaxed lip position varied according to the dentofacial characteristics of the patients.
CONCLUSION: A relaxed lip position should be taken into account when diagnostic records are obtained and analyzed to accurately evaluate the facial soft tissues and predict facial aesthetics after surgical-orthodontic treatment.

## 35 ORTHODONTISTS' AND GENERAL DENTISTS' APPRECIATION OF CHANGES IN TOOTH POSITION

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AIM: To evaluate whether orthodontists and general dentists are equally capable of assessing the same clinical situation, or if there is a disparity of diagnosis between them.
MATERIALS AND METHOD: Study casts of five adult patients were randomly selected. The casts were copied and modified so that changes such as supraeruption, rotation or tipping would be present on at least one molar. Ten orthodontists and 10 general dentists assessed 20 pairs of casts. Each was given one initial and the respective modified cast to evaluate supraeruption, rotation and tipping of the teeth.
RESULTS: The orthodontists were more accurate in evaluating tipping and rotation than general dentists, while the two groups assessed supraeruption with the same precision. Furthermore, orthodontists presented lower variation in the estimations of changes in all measurements, whereas general dentists had greater intra-group variation in the estimation of rotation and tipping.
CONCLUSIONS: Substantial differences seem to exist among general dentists and orthodontists in the assessment of intraoral parameters. This may cause semantic disparities in the diagnostic description of cases.

## 36 A THERMOPLASTIC APPLIANCE FOR MANAGEMENT OF SNORING: A RANDOMIZED CONTROLLED STUDY

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AIM: This randomised, crossover study aimed to assess the effectiveness of an adjustable thermoplastic mandibular advancement device (MAD), the TheraSnore, in managing non-apnoeic snoring.

SUBJECTS AND METHOD: Twenty-three adults referred for a MAD for the management of non-apnoeic snoring wore the appliance in both the non-advanced (NA) and advanced position (A) for 4-6 weeks. Start position was randomised. Outcomes were assessed using questionnaires, visual analogue scales, and overnight sleep studies at baseline and after each phase. Supine radiographs were used to assess the oropharyngeal airway.
RESULTS: By comparison with the non-advanced MAD, the advanced MAD reduced the snores per hour from a median of 157 to 18 ($P$ = 0.003), improved daytime sleepiness ($P$ = 0.036) and sleep quality ($P$ = 0.041). Sleeping partners reported an improvement in their daytime tiredness ($P$ = 0.002) and sleep disturbance ($P$ = 0.001) when the subject wore the active appliance. Radiographic analysis revealed a significant vertical opening associated with the appliance and small but significant post-lingual changes with protrusion. The TheraSnore is easy to fit and adjust. The most common side-effect was a dry mouth, and 64 per cent of patients considered the device bulky.
CONCLUSIONS: 1. The advanced TheraSnore MAD is effective in the treatment of snoring in 2 out of 3 non-apnoeic snorers. 2. Sleep partners derive benefits from this form of treatment for non-apnoeic snorers. 3. Complaints of bulkiness and a dry mouth may to be related to the inherent vertical opening of the TheraSnore.

## **37** MAXILLARY ARCH ANALYSIS IN RAPID PALATAL EXPANSION PATIENTS

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AIM: To evaluate dental arch form variation in 34 patients (21 females, 13 males) treated by rapid palatal expansion (RPE) anchored on the primary dentition, with the maxillary first permanent molar erupted or in eruption (age 5-8 years). No other treatment performed was analyzed.
MATERIALS AND METHOD: Impressions were taken and dental casts developed and scanned. The images were obtained before RPE treatment (T1), after RPE debonding at least 10 months after the active phase (T3), and at least 1 year after the end of treatment (T4). The following landmarks were identified: inter-incisal, distal of central and lateral incisor incisal edge, canine cusp and top of first molar mesio-buccal cusp and the best-fit curve for each image (8 and 9° polynomial curve) was selected.
RESULTS: The respective mean inter first molar and canine distances were 46.2 mm (SD 3.2) and 29.5 mm (SD 2.3), at T1, 49.6 mm (SD 2.6) and 34.4 mm (SD 2.4) at T3 and 49.1 mm (SD 3.0) and 32.9 mm (SD 2.5) at T4. The respective mean first molar and canine circumferential lengths were: 80.1 mm (SD 5.5) and 35.0 mm (SD 4.5) at T1, 84.4 mm (SD 5.3) and 40.1 mm (SD 2.6) at T3 and 82.6 mm (SD 4.4) and 39.1 mm (SD 3.9) at T4. The respective mean first molar and canine arch depth were: 28.1 mm (SD 2.6) and 7.9 mm (SD 1.6) at T1, 28.8 mm (SD 2.5) and 8.5 mm (SD 1.4) at T3 and 28.5 mm (SD 2.3) and 9.1 mm (SD 1.4) at T4.
CONCLUSION: RPE especially modifies the inter-canine area. The major effects are an increase in transversal dimension and arch length. The inter-canine arch depth increase continues while inter-molar arch depth has a tendency to decrease in the long-term.

## **38** SOFT TISSUE PROFILE CHANGES AFTER MAXILLARY

DISTRACTION

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AIM: To evaluate skeletal and soft tissue changes after maxillary advancement with distraction osteogenesis (DO).
SUBJECTS AND METHOD: Thirty-one unilateral cleft lip and palate (UCLP) patients aged 12 to 18 years who had undergone maxillary advancement with DO after a high Le Fort I osteotomy. Lateral cephalometric radiographs and facial photographs were obtained pre-operatively and 3, 6 and 12 months after DO. A line, 7 degrees to the SN plane was used as the horizontal reference, and a perpendicular line through sella as the vertical reference in an *x*-*y* coordinate system.
RESULTS: The mean pre-operative facial concavity was reduced by 20.8 degrees (N'SnPg'). The nasolabial angle increased by 5.5 degrees and the upper lip length was increased by 2.2 mm. The nasal tip moved anteriorly by 3.3 mm and upwards by 2.1 mm. The maxillary height (Sn to maxillary incisor tip) to mandibular height (mandibular incisor tip to Me') ratio was increased by 8.4 per cent. The mean maxillary skeletal advancement (point A) during surgery was 6.8 mm and the mean vertical lengthening was 2.2 mm. The mean mandibular skeletal movement (point B) was –3.8 mm and the mean vertical movement was 4.5 mm.
CONCLUSION: DO is a valuable method for improving the soft tissue profile in cleft lip and palate patients who present with marked retrusion of the midface. Maxillary distraction improved the soft tissue profile by increasing nasal projection, normalizing the nasolabial angle and making the upper lip more prominent.

**39** RELATIONSHIP BETWEEN RESPIRATION AND DENTOFACIAL MORPHOLOGY

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AIM: To evaluate whether or not breathing mode affects dental and facial skeletal characteristics.
SUBJECTS AND METHOD: Thirty children between 8 and 14 years of age, with nasal obstruction compared with a control sample matched for age, sex and number. The two groups were examined medically, dentally and cephalometrically. Measurements were obtained from lateral skull radiographs and dental casts. Seven dental, five craniometric and five cephalometric variables were recorded and statistically compared.
RESULTS: Children with difficulties in nasal breathing were characterized by increases in both total anterior and lower anterior face heights. The mouth breathers had more anteriorly positioned upper incisors, retroclined mandibular incisors, a larger overjet, narrower upper dental arches, deeper palatal height and shorter lower dental arches. Cephalometric analyses showed that the mouth breathers had more retrognathic and posteriorly inclined mandibles with large ANB angle differences, a posteriorly positioned maxilla, a steeper occlusal and mandibular plane, larger gonial angle, and smaller SNB and SN/Pg angle compared with the control sample.
CONCLUSION: Disturbed nasal respiration can affect both facial morphology and the dentition.

**40** A CEPHALOMETRIC EVALUATION OF TWO APPLIANCES

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AIM: To compare the dentoalveolar and skeletal effects of Pendulum and Fast Back appliances in Class II patients as they relate to the amount of distalisation of the maxillary molars, the reciprocal effects on the anchoring maxillary first premolars were studied as well as the skeletal and soft tissues changes.
MATERIALS AND METHOD: Initial and final cephalometric radiographs were used to document the treatment of 30 patients treated with a Pendulum and 30 with a Fast Back. The amount of horizontal movement of the premolar and molar was determined from superimposition of cephalometric radiographic tracings on the pterygoid vertical plane. The vertical movements were determined from superimposition on the palatal plane, and angular differences in tooth position by inclination of the teeth long axes to the SN plane.
RESULTS: Correction of the Class II relationship was achieved with the Pendulum appliance by a mean maxillary first molar distalisation of 3.79 mm and mean distal molar tipping of 8 degrees, and for the Fast Back 4.12 mm and 7.5 degrees, respectively. Loss of anchorage measured at the first premolar was 2.2 mm with a mesial tipping of 2.7 degrees in both groups. Vertical height increased by approximately 1 degree in 80 per cent of the patients in both groups.
CONCLUSION: The Pendulum and Fast Back can effectively achieve distal movement of the maxillary first molar. There were no significant cephalometric differences between the two appliances, only a different clinical approach.

## 41 EFFECT OF TWO MOUTH RINSES ON THE BOND STRENGTH OF ORTHODONTIC COMPOSITE

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AIM: To determine whether the application of chlorhexidine (CHX) mouth rinse and povidone-iodine (PI) affect the shear bond strength (SBS) of an orthodontic composite.
MATERIALS AND METHOD: Eighty-five crowns of extracted incisors were mounted in acrylic resin. CHX and PI were applied to the teeth under the following conditions: Group 1 (control group): no mouth rinse was used; group 2: The teeth were stored in 0.2 per cent CHX for 60 seconds before etching; group 3: the teeth were stored in 7.5 per cent PI for 60 seconds before etching; group 4: The teeth were stored in 0.2 per cent CHX for 60 seconds after etching; group 5: The teeth were stored in 7.5 per cent PI for 60 seconds after etching. An orthodontic composite resin was applied to the surface into cylindrical shaped o-plastic matrices after application of an orthodontic bonding agent (Transbond XT). For SBS testing, a stubby-shaped apparatus was applied at a crosshead speed of 1 mm/minute to each specimen. Data were analyzed using one-way ANOVA and *post hoc* Tukey HSD tests.
RESULTS: There was no significant difference between group 1 (31.64 ± 3.621) and other experimental applications. However, the mean SBS value of group 3 (36.56 ± 5.95) was significantly higher than those of group 4 (30.00 ± 4.97) and group 5 (30.26 ± 7.30). No statistically significant differences were observed between group 2 (34.33 ± 7.26) and group 3 (36.56 ± 5.95) ($P > 0.05$).
CONCLUSION: The use of CHX and PI is advisable under orthodontic composite resin to achieve an anti-bacterial effect.

## 42 DETERMINATION OF INCISOR INCLINATION ON DENTAL CASTS – A PILOT STUDY

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AIMS: To investigate a method to determine upper incisor inclination on dental casts and to compare this method with conventional measurement on lateral radiographs.
MATERIALS AND METHOD: Upper incisor inclination on dental casts was measured using three radiographic markers: a lead strip on the clinical crown of a central incisor and two reference points on the palate. A standardised radiograph of the dental cast was taken with a self-developed mini-cephalostat. The error of the method was tested for different set-ups (different positions and materials for the reference points) in an attempt to find the most accurate measurement procedure on the dental cast. With the finally selected measurement method, a comparison was carried out with cephalometric measurements on lateral headfilms. Dental casts and lateral headfilms of 32 patients before and after orthodontic treatment were obtained. The difference in angulation of the incisors before and after treatment was measured on the radiographs and dental casts. Duplicate measurements were made, and compared (Dahlberg's method).
RESULTS: The most accurate measurement method was obtained by placing a lead strip on the central incisor and two lead ball markers on recognisable positions in the midsagittal palatal plane. The measurement error of the central incisor inclination was 1.4 degrees with the selected method on dental casts and 2.5 degrees with the conventional radiographic method.
CONCLUSION: The determination of upper incisor inclination on dental casts is a valuable alternative to the cephalometric measurement.

## 43 PROFILE CHARACTERISTICS IN YOUNG ADULTS WITH DIFFERENT OCCLUSAL CLASSES

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AIM: To evaluate and compare soft tissue angular parameters in male and female young adults with occlusal Class I, II and III.
SUBJECTS AND METHOD: Fifty subjects (25 males, 25 females) between 20 and 30 years of age. Thirty individuals, 10 from each occlusal Class, were later analyzed separately. Their soft tissue profiles were photographically recorded with a camera and then analyzed using a computer. The following parameters were analyzed: angle of total facial convexity (with nose), angle of facial convexity (without nose), nasolabial and mentolabial angle.
RESULTS: The average values were for males and females respectively: angle of total facial convexity (140.3 ± 5.4° and 138.9 ± 4.3°); angle of facial convexity (172.3 ± 7.6° and 170.4 ± 3.9°; nasolabial angle (103.9 ± 9.4° and 108.8 ± 10.6°); mentolabial angle (120 ± 17.9° and 123.3 ± 12.7°). The results for the different occlusal Classes were: angle of total facial convexity in Class I (139 ± 4.4°), Class II (137,7 ± 6.9°), Class III (141.1 ± 5.6°); angle of facial convexity in Class I (170,8 ± 4.8°), Class II (165,8 ± 5.6°), Class III (172 ± 4.9°); nasolabial angle in Class I (104.8 ± 9.2°), Class II (107.8 ± 7.1°), Class III (113.1 ± 4.7°); mentolabial angle in Class I (124.7 ± 13.4°), Class II (118 ± 15.3°) and Class III (138.5 ± 9.7°).

CONCLUSION: Facial convexity in females is not significantly greater than in males.

**44** LIP INCOMPETENCE INFLUENCES ORAL HEALTH

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AIM: To evaluate the prevalence of lip incompetence and to determine its correlation and interaction with other orofacial malfunctions, morphological malocclusions, craniofacial skeletal relationships, medical history, physical growth and nasopharyngeal status in 9-year-old children.
SUBJECTS AND METHOD: Eighty-four randomly selected children from the Ljubljana area (mean age = 8.9 years; SD 0.66) were examined. Lip incompetence was found in 30 children (35.71%) and a normal lip seal in 54 (64.29%). An orthodontic clinical examination together with study cast and lateral cephalometric analysis were carried out. An otorlaryngologist and paediatrician also examined the children.
RESULTS: There was a strong correlation between the prevalence of morphological malocclusions and lip incompetence ($P < 0.001$). An infantile swallowing pattern ($P < 0.05$) and speech disorders ($P < 0.001$) were found more frequently in children with an incompetent lip seal. Children with lip incompetence had larger ML/NL ($P < 0.001$), ML/OccL ($P < 0.001$), ANS-Me ($P < 0.05$) and Ili/NB ($P < 0.001$) values. Significantly more respiratory diseases up to 9 years of age ($P < 0.001$) and slower physical growth were observed in the group with lip incompetence. An otorhinolaryngolocial pathology was found in 76.67 per cent of the children with an open mouth posture.
CONCLUSIONS: Lip incompetence should be diagnosed and treated as soon as possible since it has a strong influence on oral and general health.

**45** THE RELATIONSHIP BETWEEN TEMPOROMANDIBULAR JOINTS AND OCCLUSION IN ORTHODONTIC PATIENTS

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AIMS: To compare 1) a patient's demonstrated intercuspal tooth position with the position of their left and right temporomandibular joints (TMJs) and 2) this relationship to the occlusion of the teeth when the condylar heads are centrally located in their respective joints.
SUBJECTS AND METHOD: Using a recording facebow and an intraoral Gothic arch tracing, measurements of the sagittal condylar inclination and registration of centric relation were made for nine subjects. Three did not require orthodontic treatment, three were about to have orthodontic treatment and three were already undergoing orthodontic treatment. After record taking, the casts were facebow mounted on a condylar articulator and a Lauritzen split-cast assessment was made.
RESULTS: Although the subjects not requiring orthodontic treatment had premature occlusal contacts, these caused minimal condylar displacement of the joints and the Gothic arch tracings had a normal shape. In those subjects examined before and during orthodontic treatment, the premature contacts observed caused a displacement of the condyle heads from their central position in their respective joints. Gothic arch

tracings for this group showed that the subjects mostly made lateral and protrusive jaw movements from the acquired habitual jaw positions.
CONCLUSION: Assessment of the influence of occlusal contacts on the positions of the TMJs may be reliably obtained with the method and equipment described.

**46** MORPHOGENESIS OF THE INCISIVE CANAL

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INTRODUCTION: The literature describing the formation of the incisive canal is very confusing. It has been proposed that the fusion of the primary and secondary palatal processes leads to the formation of a triangular seam, which erroneously has been taken for the incisive canal. If this were the case, then the nasopalatine nerve and its accompanying vessels would be regarded as passing through empty space. This is biologically impossible. This study aimed to shed light on this region of fusion.
MATERIALS AND METHOD: The sample consisted of seven horizontal cross-sections of human embryos and foetuses from the 7th to the 24th week of pregnancy (between 25 and 225 mm crown-rump length). These were examined histologically and partly reconstructed in three-dimensions, applying the analySIS® software (Soft Imaging Systems, Münster, Germany).
RESULTS: The incisive canal does not develop at the junction of the primary and secondary palate, but within the primary palate anterior to that location.
CONCLUSIONS: The nasopalatine nerve and its accompanying vessels never leave the mesenchyme of the primary palatal process.

**47** ALVEOLAR BONE THICKNESS CHANGES DUE TO ALTERATION OF LOWER INCISOR POSITION

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AIM: To examine the influence of sagittal and vertical alteration of lower incisor position on alveolar bone thickness.
SUBJECTS AND METHOD: Forty-five patients treated with fixed appliances and with complete records to 5 years post-treatment. The sample comprised three groups based on the vertical cephalometric pattern (SN-GoGn), 23 of them having undergone extractions. Alveolar base thickness changes perpendicular to the long axis of the tooth and to NB were related to alterations of the angulation and vertical position of the lower incisors (1-GoGn, 1-NB).
RESULTS: The total alveolar base thickness (perpendicular to the incisor long axis) increased by proclining the lower incisors, and decreased in individuals with excessive vertical growth. The lingual part of the alveolar bone decreased by proclination and/or extrusion of the lower incisors. Geometric influences on these cephalometric results should be considered.
CONCLUSIONS: Dimensional changes in the alveolar base follow sagittal and vertical alteration in the position of the lower incisors.

**48** INTERCEPTIVE ORTHODONTICS – A RANDOMISED CONTROLLED TRIAL

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AIM: To determine if extraction of the primary canines is a valid interceptive procedure to relieve crowding of the labial segment.
SUBJECTS AND METHOD: Two groups of patients with similar levels of lower incisor crowding. The patients were followed for a period of two years. Eighty-three dental casts were obtained from research units in Italy, Germany and Wales (53 extraction and 30 non-extraction cases). The measurements recorded were Little's index, arch perimeter, overbite, overjet, molar width, incisor inclination and arch length.
RESULTS: In both the extraction and non-extraction groups, crowding improved over time; 1.27 mm in the non-extraction group and 6.03 mm in the extraction group. The difference between the two groups was 4.76 mm ($P < 0.05$). The arch perimeter decreased more in the extraction group (2.73 mm; $P < 0.05$). As the incisor inclination remained essentially the same, the loss in arch length was attributed to the molars moving forward. The net gain from extracting the primary canines was 2.03 mm (4.76-2.73 mm) for the incisors but at the expense of a reduced arch perimeter of 2.73 mm. The space for the erupting lower permanent canines was compromised. Despite extraction of the primary canines, significant crowding still prevailed.
CONCLUSION: It would appear that retention of the primary canines has greater long-term benefits compared with extraction.

## 49 STIMULATION OF CONDYLAR GROWTH USING ULTRASOUND IN MONKEYS

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AIM: Previous research has shown that ultrasound can stimulate bone fracture healing as well as condylar and mandibular growth in rabbits. The objective of this study was to evaluate the effect of ultrasound application on condylar growth in monkeys.
MATERIALS AND METHOD: Two growing and one post-adolescent Baboon monkeys were used. One growing monkey received a fixed bite-jumping appliance and the other two monkeys did not receive any appliance. Ultrasound was applied to all three monkeys to one condyle and the other condyle was used as a control. All procedures were carried out following the regulations of the Research Center at KAAU. The monkeys were anaesthetized and ultrasound was applied for 20 minutes per day. The procedure was repeated daily for 4 months. Pre- and post-study models, lateral and postero-anterior cephalometric radiographs were taken. The animals were sacrificed after 4 months and the heads were prepared for bone scanning using 99-Technetium, and histological evaluation.
RESULTS: More condylar growth was found following ultrasound application in all animals, which confirms the effectiveness of ultrasound application to enhance condylar growth in monkeys. Further long-term evaluation of this technique is required.
CONCLUSION: Ultrasound application may be useful to treat different craniofacial disorders such as hemifacial microsomia.

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## 50 EVALUATION OF TOOTH MOVEMENT ON LATERAL CEPHALOGRAMS AND ORTHODONTIC CASTS

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AIM: Evaluation of molar distalization and premolar and incisor movements from cephalograms and orthodontic casts and comparison of these results with each other.
SUBJECTS AND METHOD: Nineteen subjects (14 females, 5 males) treated with the Pendulum appliance. At the beginning and end of distalization cephalograms and orthodontic casts were obtained. Molar distalization and premolar and incisor movements were measured from cephalograms and photocopies of casts. For cephalogram evaluation, a vertical line was passed through Se and Ptm points, which served as a reference line. For orthodontic cast evaluation, a horizontal line was passed through the most distinct palatal ruga, which served as a reference line. Comparison of values measured from cephalograms and casts were carried out with the Wilcoxon test.
RESULTS: Incisor (1.19 mm) and premolar (1.93 mm) movements measured from the casts were less than incisor (2.11 mm) and premolar (2.94 mm) movements measured from the cephalograms. These differences were significant at $P < 0.001$ for incisor and $P< 0.05$ for premolar movements. The molar distalization value obtained from casts (5.08 mm) was higher that from cephalograms (4.20 mm). This difference was significant ($P < 0.01$).
CONCLUSION: The values for molar distalization and incisor and premolar movements showed significant differences between cephalograms and casts. The reason for this difference might be explained by anterior movement of the palatal rugae due to the effect of the Nance appliance.

## 51 IS THERE ANY DIFFERENCE BETWEEN DIFFERENT DEGREES OF ACTIVATION WITH THE PENDULUM APPLIANCE?

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AIM: To assess the dentoalveolar effects of the Pendulum appliance (PA) with different degrees of activation.
SUBJECTS AND METHOD: In group A (9 females, 2 males) the TMA springs were activated 60 degrees (150 g/side) and in group B (7 females, 4 males) the springs were activated 90 degrees (230 g/side). All subjects had a Class II molar relationship and maxillary second molar crowns at the level or above the first molar trifurcation. During monthly controls no reactivation of the springs was performed. The molars were distalized into an overcorrected position. Nineteen parameters were used to analyse the changes during molar distalization. For statistical analyses, Wilcoxon and the Mann-Whitney *U* tests were used.
RESULTS: PA application lasted for an average of 93.45 days in group A and 91.7 days in group B. In group A anterior movement and tipping of incisors (1.73 mm, 2.91°), anterior movement and tipping of the first premolars (2.68 mm, 4.64°), distal movement and tipping of the first molars (3.41 mm, 15.14°) were significant ($P <$ 0.01). In group B anterior movement and tipping of the incisors (2.41 mm, 7.09°),

anterior movement and tipping of the first premolars (3.05 mm, 6.60°), distal movement and tipping of the first molars (4.50 mm, 16.32°) were significant ($P < 0.01$). Incisor tipping and overjet change showed statistically significant differences between the groups ($P < 0.05$).
CONCLUSION: Different degrees of PA activation did not result in a significant difference in molar and premolar tooth movements. However, an activation of 60 degrees might be preferred due to less anchorage loss.

**52** EFFECTS OF DIFFERENT DEBONDING METHODS ON ORTHODONTIC BRACKET DIMENSIONS

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AIM: To study the effect of three methods of debonding on three different metal bracket dimensions.
MATERIALS AND METHOD: One hundred and eight standard edgewise brackets, 0.22 inch system from three companies; American Orthodontics (AO), 3M Unitek (3M) and Dentaurum (Dent) were bonded on extracted upper and lower premolars and 0.018 inch round wire was engaged in 54 brackets. The brackets were debonded using three methods; cutting the bracket base mesiodistally, applying a peeling type force of 45 degrees outward using bracket removing pliers, and debonding with a lift off debracketing instrument (LODI). The dimensions of the bracket (slot width, slot depth and bracket width) were evaluated with a stereomicroscope at ×20 magnification and Adobe Photoshop software and compared by multifactorial variance analysis and a least squares difference test.
RESULTS: Cutting the base was destructive for AO and Dent brackets. The mean slot width increased, with Dent brackets having the most changes. The presence of wire in the slots had no effect on the changes.
CONCLUSION: For AO and Dent foil mesh brackets, the best method for debonding is a peeling type force with a 45-degree outward direction, and for 3M integral brackets cutting the bases mesiodistally. Using a LODI was an acceptable method for all brackets.

**53** CRANIAL BASE GROWTH IN DIFFERENT FACIAL TYPES AND CLASSES

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AIM: To retrospectively assess cranial base growth in different facial types and Classes.
SUBJECTS AND METHOD: A random sample of 300 Brazilian Caucasian patients (131 males, 169 females), initial (T1) and final (T2) mean age (10 years 2 months; 14 years 8 months) and mean treatment time (4 years 5 months) selected from a private clinic. There were 118 Class I, 151 Class II and 31 Class III subjects. A total of 600 lateral cephalometric radiographs were analysed, all taken using the same X-ray equipment. The facial type and maxillomandibular relationship was evaluated using the Ricketts-Faltin and Schwarz-Faltin analyses. The linear measurements (Ba-Na, CC-Na, CC-Ba, CF-Po) were performed and analyzed by the same examiner at T1 and T2. All subjects were studied individually and collectively taking in to account

facial type and sex. Statistical analysis was performed using the Student's *t*-test, paired *t*-test and ANOVA.
RESULTS: The overall male and female annual mean growth rates were: Ba-Na 1.42 mm (1.76; 1.15); CC-Na 0.74 mm (0.93; 0.60); CC-Ba 0.64 mm (0.76; 0.55); CF-Po –0.46 mm (–0.57; –0.38), respectively. The retroversion facial type grew significantly more in CC-Na ($P < 0.05$) in Class II patients as well as the neutroversion in Class I and II ($P < 0$ .05). The proversion had CC-Na and CC-Ba equivalent growth in all Classes.
CONCLUSIONS: These results will be useful for growth forecast, prognostics and treatment planning in growing patients.

## 54 CASTRATION DECREASES BONE DENSITY OF MANDIBLE IN NEWBORN MICE

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AIM: It is well known that sex hormones influence bone metabolism. However, it remains unclear how these hormones affect bone growth in newborn mice. It has previously been shown that orchiectomy (ORX) and ovariectomy (OVX) in newborn mice inhibit mandibular growth. The aims of this study were to evaluate the relevant change in the internal structure of the mandible in ORX and OVX newborn mice.
MATERIALS AND METHOD: ORX and OVX were performed in 5-day-old C57BL/6J mice. Eight weeks after surgery, the mice were killed under general anaesthesia. Trabecular (Tr) and cortical (Ct) bone mineral density (BMD) of the mandible were measured using peripheral quantitative computed tomography (pQCT). The condyle sections were stained with Azan and tartrate resistant acid phosphatase (TRAP) and observed microscopically.
RESULTS: Mandibular Tr-BMD and Ct-BMD were significantly decreased in the experimental mice compared with the controls. Tr condyle bone volume, measured on Azan sections, was also significantly decreased in the experimental mice compared with the controls. The number of TRAP-positive cells in the condyle increased more in the experimental mice than in the controls.
CONCLUSIONS: Mandibular growth is inhibited by sex hormone disturbances and mandibular bone metabolism is changed. These findings emphasize that sex hormone is related not only to bone growth but also mandibular bone architecture immediately after birth.

## 55 HYGIENE PROTOCOL IN DOWN SYNDROME PATIENTS UNDERGOING ORTHODONTIC TREATMENT

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AIM: To evaluate the effectiveness of an oral hygiene protocol in special needs periodontally compromised patients undergoing an orthodontic treatment.
SUBJECTS AND METHOD: Thirty Down syndrome patients 8 to 30 years of age periodontally evaluated by three different clinicians (clinical and radiographic examination). Fifteen subjects (8 males, 7 females) underwent the oral hygiene protocol. They were motivated and educated concerning the importance of oral hygiene, and professional hygiene prophylaxis was carried out at 0, 3 and 6 months. During orthodontic treatment, the patient's status was evaluated monthly and, if

required, additional professional cleaning was undertaken. Radiographs were obtained and probing depth assessed by three different operators at 0, 3 and 6 months.
RESULTS: At 6 months only two patients showed clinical signs of gingivitis compared with the control group, where 10 subjects had periodontal involvement. Even if it is difficult to treat Down syndrome patients, this hygiene protocol resulted in good compliance. The results need to be confirmed in order to evaluate stability.
CONCLUSION: A firm protocol of motivation, instruction and oral hygiene has to be applied before and during orthodontic treatment in periodontally compromised patients and motivation verified, because the effectiveness and stability of treatment depends on compliance.

**56** INFLUENCE OF ORTHODONTIC TREATMENT ON PULPAL SENSITIVITY OF AUTOTRANSPLANTED TEETH

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AIM: To investigate the influence of orthodontic derotation or extrusion on pulpal sensitivity of autotransplanted immature third molars.
MATERIALS AND METHOD: Eighty transplanted immature third molars with radiological signs of pulpal vitality (pulp obliteration with no periapical radiolucency). Three to six months after transplantation, 20 transplants had been derotated and 19 had been extruded orthodontically to a correct position in the dental arch. Forty-one teeth with no orthodontic treatment need served as the controls. Pulpal sensitivity was tested with a cryogenic spray. The mean post-operative observation period was 4 years.
RESULTS: Positive sensitivity was observed in 45 per cent of derotated, 78.9 per cent of extruded and 80.5 per cent of control teeth. Four derotated teeth lost pulpal sensitivity temporarily after the onset of orthodontic derotation (4 to 6 months after transplantation). In all cases, sensitivity was regained at subsequent follow-up (3 months later). Compared with the controls ($P = 0.008$) and extruded transplants ($P = 0.048$), the derotated transplants showed a significantly lower sensitivity rate.
CONCLUSIONS: Orthodontic extrusion represents no additional risk to pulpal re-innervation of autotransplanted immature third molars. In contrast, orthodontic derotation of these teeth leads to impairment of pulpal re-innervation and, in some cases, results in temporary loss of pulpal sensitivity.

**57** TREATMENT OF ECTOPIC MANDIBULAR SECOND MOLAR USING TITANIUM MINISCREWS

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AIM: Impacted second molars are a relatively rare dental anomaly (0.03%) more commonly present in the mandible than in the maxilla. These ectopic teeth are frequently mesially inclined. The aim of this presentation is to describe the treatment of deeply impacted lower second molars using miniscrews.
MATERIALS AND METHOD: This clinical report concerns a typical condition of ectopic eruption of the mandibular second molars. The aim of orthodontic treatment was to upright the impacted second molar using a mini-screw placed in the retromolar region after extracting the third molar. On the same day the mini-screw was placed, traction was applied by means of a closed Ni-Ti coil spring tied from the miniscrew to the orthodontic attachment on the impacted molar, exerting approximately 50 g of

force. The force applied on the ectopic molar generated an extrusive movement and allowed for distal tipping of the crown.
RESULTS: A finishing phase with fixed appliance is necessary to provide correct uprighting of the root. The miniscrew was removed after eight months and active treatment lasted 9 months.

**58** MAGNETIC RESONANCE IMAGING OF SKELETAL AND TEMPORO-MANDIBULAR COMPONENTS AFTER CHIN-CUP THERAPY

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AIM: To clarify the source of improvement in subjects with a skeletal Class III malocclusion after chin-cup therapy by means of magnetic resonance imaging (MRI).
SUBJECTS AND METHOD: Twenty individuals ranging in age from 6-8 years. The treatment group consisted of 13 subjects (10 girls, 3 boys) with mandibular prognathism, and the control group seven subjects (6 girls, 1 boy) with skeletal Class III malocclusions. A chin-cup force of 600 g was applied from the condylion-gnathion direction. Unilateral MRIs of the temporomandibular joint (TMJ) and lateral cephalograms were obtained of the subjects at the beginning and end of treatment. Data from the treatment and control groups were evaluated by Student's *t*- and paired *t*-tests. Skeletal parameters (from lateral cephalograms) and TMJ parameters (from MRI) were correlated with Pearson's correlation analysis.
RESULTS: Disc and condyle position did not change after chin-cup therapy. Condylar morphology was stable during the treatment period. The mandibular ramus and corpus lengths decreased. Gonial angle was increased. A negative correlation coefficient was found between Co-Go and disc position. A positive correlation was observed between gonial angle and condyle position.

**59** EFFECTS OF A CHIN-CUP APPLIANCE ON THE MAXILLA

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AIM: There is a wide range of research on the effect of a chin-cup on the mandible, with it being reported that mandibular growth is limited, or the mandibular growth pattern is changed, but the effects of a chin-cup on the maxilla have not been investigated. It is known that in skeletal Class III patients maxillary growth is insufficient when compared with normal individuals. The aims of this study were to determine the effects of a chin-cup on the maxilla and whether this could enhance maxillary growth.
SUBJECTS AND METHOD: Fifteen patients (10 girls, 5 boys) 8 years of age were selected for the chin-cup group. The mean ANB was –2.6 degrees. The control group comprised 10 patients (6 girls, 4 boys) with a mean age of 8 years and an ANB of 3.1 degrees. The chin-cup was applied in the direction of the chin point-tragus line with 500 g of force, until a normal overjet and overbite was obtained. Hawley retainers were used to avoid lower incisor retrusion. No maxillary orthodontic treatment was carried out. The groups were compared with a Student's *t*-test. Differences between the groups were analyzed using paired *t*-tests.
RESULTS AND CONCLUSION: During the treatment period of 1 year 4 months, there was an increase in mandibular ramus, corpus and effective lengths and a decrease in gonial angle. There was a significant increase in maxillary dimensions in the treatment group, but no change in the control group.

**60** DO INTERMITTENT FORCES CHANGE MANDIBULAR EFFECTIVE LENGTH IN CLASS II SUBJECTS?

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AIM: To clarify whether the functional intermittent forces that are used for the treatment of Class II subjects increase effective mandibular length or change the position of the condyle in the glenoid fossa.
SUBJECTS AND METHOD: Five female subjects (mean age 10.9 years) with a skeletal Class II malocclusion. All were treated with an Andreasen activator for 1 year and 4 months. Pre- and post-treatment lateral cephalograms and unilateral temporomandibular joint magnetic resonance images (MRI) were obtained. Mandibular corpus (Gn-Go), mandibular ramus (Co-Go) and mandibular effective (Co-Gn) lengths were measured directly on the lateral cephalograms. The position of the condyles in the glenoid fossa was evaluated on the MRIs.
RESULTS: There was a significant increase in all three mandibular dimensions after activator application. The position of the condyles in the glenoid fossa also changed from an eccentric to a concentric position.
CONCLUSION: With the application of functional intermittent forces there was a change in condyle position and consequently mandibular effective lengths were increased.

**61** RELAPSE, PREVENTION AND AESTHETICS IN CLASS II DIVISION 2 MANAGEMENT

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AIM: To evaluate the correlation of the post-treatment and out of retention position of the lower lip and the stability of the treatment outcome in individuals with Class II division 2 malocclusions, and lip-incisor relationship after treatment, by means of posed smiles.
SUBJECTS AND METHOD: Fifteen individuals, with Class II division 2 incisor relationships, treated with fixed appliances including the use of Class II elastics. The overbite was reduced by intrusion and torque of the upper and lower incisors. The position of stomion in relation to the upper centrals was measured on lateral cephalograms pre- and post-treatment and 2 years out of retention. The lip-incisor relationship was analysed according the smile mesh (Ackermann *et al*., 1998).
RESULTS: The contact area of the lower lip with the upper incisors was reduced after treatment. In all cases the smile became more harmonious at the end of treatment. The dentofacial aesthetics in two additional patients, who underwent orthognathic treatment, also improved.
CONCLUSIONS: In patients with a Class II division 2 incisor relationship, stable results and a more attractive smile are achieved with orthodontic treatment. Neither root resorption nor attrition due to bruxism was observed.

**62** IS THERE A VERTICAL 'PRICE' FOR CORRECTION OF A CLASS II MALOCCLUSION?

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AIM: The amount of growth any individual can be expected to grow may or may not depend on the particular form of treatment (Johnston, 1999). The aim of this study was to investigate vertical skeletal changes during treatment of a Class II malocclusion with various orthodontic devices.
SUBJECTS AND METHOD: (1) Fixed appliance group: 18 consecutive subjects treated non-extraction and Class II elastics, and (2) Headgear-functional appliance group: 22 consecutive subjects treated with Headgear-Herbst with step-by-step advancement of the mandible followed by a headgear-activator as a retainer. Lateral cephalograms were obtained at the start of treatment (T0), and after 6 (T6), 12 (T12) and 18 (T18) months. LFH (Me to Sp') and mandibular plane angle (NSL/ML) were estimated.
RESULTS: The growth changes over 6 months in millimetres were: LFH +1.8*** and NSL/ML 0.0. For group 1 LFH and NSL/ML changed 3.1***/1.5* at T6; 4.2***/1.3*.at T12, and 5.0***/1.0* at T18. For group 2 the corresponding figures were 2.2**/0.1, 2.7***/–0.6*, and 2.7***/–1.1*, respectively. There was a statistically significant difference for both cephalometric variables between the two treatment groups at all occasions, except for LFH at T6 ($P < 0.07$).
CONCLUSION: With orthodontic treatment of Class II malocclusions the change in the vertical dimension is affected in various ways with different orthodontic device, varying from good control of the vertical dimension to a significant price in lengthening of the face and opening of the mandibular plane angle.

**63** ORTHODONTICS IN A HEALTH CARE PERSPECTIVE

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In 1987 the Government of Sweden established the Swedish Council on Technology Assessment in Health Care (SBU) and gave, among other assignments, the following task to the Council: promote the rational utilization of health care resources and toward this assess the existing evidences on the clinical, economic and social implications of both new and established medical technologies in Sweden.
In 2003 the SBU appointed a group of experts to evaluate the evidence behind orthodontic care of children and adolescents, which is free of charge in Sweden. The team laid down the following headings for the systematic literature review. 1. What are the consequences for the individual if orthodontic treatment is not carried out? 2. Who decides if treatment is necessary; orthodontists, dentists, parents or patients and what are these decisions based on i.e. criteria for treatment need e.g. priority indices? 3. Does orthodontic treatment give long lasting results (at least 5-years follow-up)? 4. Is there any difference in costs between treatment regimes that give a long lasting result? 6. How is patient satisfaction related to treatment outcome? 7. What are the side-effects and complications of orthodontic treatment? The review includes non-experimental human studies only. In the evaluation, the main focus will be towards clinical controlled trials, however other studies may also be reviewed.
The publishing date for the SBU report is expected to be 2005. This presentation is directed towards the background and working procedures of the systematic review.

**64** SEXUAL DIMORPHISM IN TOOTH SIZE AND ARCH FORM

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AIM: To determine sexual dimorphism in tooth size and arch form.

MATERIALS AND METHOD: The mesio-distal crown dimension of the six upper and lower anterior teeth were measured on serial casts of 300 Greeks (150 male, 150 female) in the permanent dentition, who requested orthodontic treatment. Subjects with missing teeth, except for third molars, were excluded. The arch form of each dental cast was determined using a computer generated digital system and classified into one of six separate groups regardless of malocclusion type or other parameters, on the basis of arch shape.
RESULTS: No differences were detected in arch symmetry between the sexes. Males had significantly larger teeth than females ($P < 0.001$). The mandibular lateral incisors showed the least sexual dimorphism whereas the canines were the most dimorphic teeth in both arches. In both sexes the maxillary lateral incisors showed the greatest variability. The cumulative tooth widths of males exceeded those of females by a sum of 2.5 mm in the maxilla and 3.1 mm in the mandible, with these differences being statistically significant. The six separate groups formed according to arch shape, were then compared for tooth size. Poor correlation was detected between tooth size and arch form. Tapered arch forms were the most predominant in males whereas ovoid and square were most common within females. Nevertheless, sex had no statistically significant effect on these variables.
CONCLUSION: In both sexes the maxillary lateral incisors showed the greatest variability in tooth size, whilst the dental arches of females were, on average, smaller than males.

## 65 RAPID MAXILLARY EXPANSION WITH DIRECT PALATAL IMPLANT ANCHORAGE

W Harzer, M Schneider, T Gedrange, Technical University of Dresden, Germany

AIM: Rapid maxillary expansion (RME) with fixation of the device at the molar and premolar bands leads to tipping of the maxillary halves and overloading of the roots of the teeth. The aim of this pilot study was to avoid these disadvantages by direct fixation of the hyrax screw with implants or onplants.
SUBJECTS AND METHOD: Four patients (3 females, 1 male) with an initial mean age of 21 years. All had transverse deficiency and underwent dentofacial surgery. After osteotomy of the palate as well as to the lateral walls of the maxillary sinuses (Glassmann), the hyrax screw was applied with one implant (length 4.0 mm, diameter 3.3 mm, shoulder 5.0 mm) to one side and with a screw on the other side. For improvement of guidance for the palatal half, an orthodontic wire was used, fixed with brackets at the incisors.
RESULTS: After four weeks a widening of 8.0 mm was achieved. After removal of the hyrax screw the implant remained in the palatal jaw and was used as an orthodontic implant for fixation of the palatal bar during the retention period. The movement of maxillary halves was almost parallel (0-3° against 15° in banded fixation). No root resorption or tooth loosening were observed.
CONCLUSION: The direct fixation of a RME device with a minimum of surgical intervention is satisfactory and moves the maxillary halves more parallel.

## 66 CRANIOFACIAL GROWTH IN FERRETS (*MUSTELA PUTORIUS FURO*): A CEPHALOMETRIC STUDY

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AIM: To quantify normal craniofacial growth in the ferret.
MATERIALS AND METHOD: Sixteen ferret kits (8 male, 8 female) were selected. Serial lateral and dorsoventral cephalograms were taken of each animal at a mean age of 25, 35, 55, 80 and 300 days. The cephalograms were then digitised and the co-ordinates of 33 landmarks were identified. Thirty-four variables were then calculated using a computer image program in conjunction with the co-ordinate data. The results were analysed statistically, and the craniofacial growth pattern and related sexual dimorphism described in three perspectives: lateral and dorsoventral, viscero- and neurocranium, and lateral mandible.
RESULTS: For both sexes, the viscero- and neurocranium followed an orderly pattern of expansive growth in all three dimensions. Growth of the mandible was mainly characterized by an antero-posterior elongation of the body, an enlargement of the coronoid process, and an increase in height of the alveolar process. The growth rate varied with site. Craniofacial growth in ferrets started to slow down and finally ceased earlier in female than in male animals.
CONCLUSION: The skull of the male adult ferret is not simply a larger version of the female one, it is broader. Most of the craniofacial growth (88-99%) is complete by 80 days of age.

## 67 ARE PERSONALITY FACTORS RELATED TO THE DEMAND FOR ORTHODONTIC TREATMENT?

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AIM: To investigate to what degree orthodontic demand is associated with personality factors.
SUBJECTS AND METHOD: Four hundred and thirty five Dutch psychology students were asked to fill out three questionnaires assessing several psychological characteristics, i.e. the Amsterdam biographic questionnaire (ABV), the performance motivation test (PMT) and the 5-personality factors test (5PFT.) Subjective orthodontic demand was assessed with the question 'Would you like to change something about the position of your teeth or jaws?' In addition, demand was established as to whether the students had undergone orthodontic treatment or were being treated at the moment (T+), or had never been treated (T–).
RESULT: Of the subjects, 31.2 per cent had a subjective demand and 68.8 per cent did not. Independent sample *t*-tests showed that subjects who had a subjective demand scored higher on PFT neuroticism, ABV masculine-feminine, ABV neuroticism and ABV somatic neuroticism, and lower on ABV vulgar-negative and ABV vulgar-total than subjects without such a demand. Furthermore, 51.8 per cent of the subjects had been treated in the past or were being treated at the moment, whilst 48.2 per cent had never been treated. Subjects in the T+ group scored higher on ABV somatic neuroticism, and lower on ABV social desirability, ABV vulgar-negative and ABV vulgar-total than subjects in the T– group. For both demand variables, there was no significant difference between males and females.
CONCLUSION: Psychology students with an orthodontic demand seem to have a slightly different personality profile than those without an orthodontic demand.

## 68 CONDYLAR CHANGES AND TEMPOROMANDIBULAR SYMPTOMS AFTER MANDIBULAR ADVANCEMENT

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AIM: To retrospectively evaluate condylar status and temporomandibular dysfunction (TMD) symptoms after mandibular advancement and to determine pre-operative cephalometric features to predict the risk for condylar resorption.
SUBJECTS AND METHOD: Seventeen males and 30 females, mean age 35.7 years. Pre- and post-operative information was registered from patient documents. Condylar status on panoramic radiographs was evaluated in mutual agreement by two observers pre-operatively and at least 0.5 years after surgery (mean 1.5 years post-operatively, SD 0.9 years). Condylar changes were pooled into three categories: no change, remodelling and resorption. Cephalometric linear and angular measurements were traced manually with good reliability – intraclass correlation coefficient ranged from 0.82 to 0.99. Statistical analysis was carried out with the SPSS program.
RESULTS: There was no condylar change in 66.0 per cent of the subjects, 19.1 per cent had remodelling and 14.9 per cent had changes considered as resorption. Pre-operatively TMD symptoms were reported by 80.9 per cent. One-quarter of the subjects had no change in TMD symptoms during follow-up, symptoms improved in 61.7 per cent and deteriorated in 12.8 per cent. There was no statistically significant correlation between condylar resorption, TMD symptoms and cephalometric measurements.
CONCLUSION: Condylar resorption is a complication after mandibular advancement, but there are minimal pre-operative features to predict these unwanted changes. Most TMD symptoms in severe Class II patients seem to improve with surgical-orthodontic treatment.

## 69 INHIBITION OF TOOTH MOVEMENT BY A CHEMICALLY MODIFIED TETRACYCLINE

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INTRODUCTION: During tooth movement, extensive tissue remodelling occurs in the periodontium. Matrix metalloproteinases (MMPs) are thought to play an important role in this process. Chemically modified tetracyclines (CMTs) are known to inhibit MMP activity. CMT-3 appears to be one of the most potent inhibitors of MMP-activity. The aims of this investigation were to determine the role of MMPs in tooth movement and the effects of CMT-3 in a rat model.
MATERIALS AND METHOD: In 18 rats a molar block was moved mesially using closed coil springs, delivering a force of 10 cN, for 14 days. The rats were divided into three groups, with each group receiving a daily dose of either 0, 6 or 30 mg/kg of CMT-3. The amount of tooth movement was measured during the experimental period. Histological material was collected and studied afterwards using haematoxylin-eosin-staining.
RESULTS: A dose-dependent inhibition of tooth movement by CMT-3 was found ($P = 0.037$). Histology suggested a decreased number of osteoclasts and less bone resorption in the group that had received 30 mg/kg of CMT-3.
CONCLUSIONS: CMT-3 reduces tooth movement, probably by the inhibition of MMPs. This model will be used to further investigate the role of MMPs in tooth movement. CMTs might offer new perspectives for the improvement of tooth anchorage and the prevention of relapse.

## 70 FACTORS CAUSING ROOT RESORPTION DURING ORTHODONTIC TREATMENT

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AIM: Root resorptions are sometimes observed as a result of orthodontic treatment. The aim of this study was to analyse factors that possibly increase the occurrence of root resorption.
MATERIALS AND METHOD: The panoramic radiographs of 229 patients before and after orthodontic treatment were analysed concerning root resorption. Reductions of more than 2 mm in root length were registered. In order to take distortion of the radiograph into account, the length of the crown was registered in relation to the length of the root. The influence of the following factors was analysed: type of dysgnathia, type of growth, age at start of treatment, overall treatment time, fixed appliance treatment time, shape of the root, crowding of the germs, malfunction of lip and tongue, sucking, allergies, aplasia of teeth, trauma, and root canal fillings.
RESULTS: The accumulation of root resorptions was statistically significant in combination with malfunction of the lip or tongue, allergies, wide log-shaped roots, thin pointed roots, as well as thin pointed and curved roots. No significant influence could be found for age at the beginning of treatment, time of treatment, time of fixed appliance therapy, sucking, aplasia, trauma or root canal fillings.
CONCLUSION: Patients with a risk of root resorption can be recognized before starting treatment. The type of therapy for these patients can be chosen accordingly.

## 71 CORROSION BEHAVIOUR OF RETRIEVED ORTHODONTIC NICKEL TITANIUM LEVELLING ARCHES

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AIM: Alloy composition, surface roughness and surface morphology are factors influencing the corrosion behaviour and biocompatibility of orthodontic archwires. In a previous study, *in vitro* experimentation produced massive corrosive defects of several orthodontic nickel titanium wires. It was the aim of this investigation to determine whether the massive corrosion processes are also possible during clinical application. Additionally, the influence of surface modifications on clinical corrosion behaviour was investigated.
MATERIALS AND METHOD: A total of 115 orthodontic levelling arches made of nickel titanium [cross-sections 0.35 mm round, 0.40 mm round, 0.40 × 0.40 mm² and 0.40 × 0.56 mm² (Forestadent Titanol Low Force: 28 specimens and Martensitic: 18 specimens, Ormco Copper Ni-Ti 35C: 55 specimens, Ortho Organizer NiTi: 14 specimens] were used clinically during the levelling phase with treatment times ranging from four weeks to 10 months. Wires from the same manufacturers and from the same batches were investigated in a potentiodynamic corrosion test set-up. The wire surfaces were examined with a scanning electron microscope.
RESULTS: Only minor corrosion defects (small pitting corrosion) could be registered for 20 per cent of the wires with an intraoral retention period up to two months. Longer retention periods, especially above six months, resulted in more pronounced surface defects in 95 per cent of the wires. The different products did not

show remarkable differences in their corrosion behaviour. This is a distinct discrepancy to the *in vitro* results of this and earlier studies.

**72** THE 22QLL DELETION SYNDROME

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The syndrome has been reported at different times under various names, with the focus on different symptoms: Di George syndrome, Sphrintzen syndrome, velocardiofacial syndrome and CATCH 22.
With improved DNA techniques in the 1990's, these syndromes were found to be different expressions of the same deletion on the site 22qll.2. Unlike many other syndromes, there are no signs that are obligatory for diagnosis. Some patients exhibit severe problems in one field but no problems in others. The variation in severity is also very large. However, it is obvious that the expression becomes more severe, if the syndrome is inherited.
The symptoms are seen at many different levels: cardiac problems; immune deficiency because of absence of the thymus; hypoparathyroidism with problems in the Ca-blood level, velopharyngeal insufficiency or palatal cleft; speech and language problems; hypotonia; mild mental retardation; motor, behavioural and psychiatric problems.

**73** A STUDY OF MAXILLARY SINUS DEVELOPMENT VIA FAULT PLANE FIGURE **(***)**

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AIM: To measure the maximum area of the maxillary sinuses, the upper and lower wall directions, nominal clearance volume, and centre of gravity coordinates. Furthermore, the relationship between these developmental stages and dental occlusion was examined via computer tomographic scanner image analysis.
MATERIALS AND METHOD: Ten individual dried human skulls were selected for each Hellman's dental stage. (IA: Predental stage, IC: Before attained occlusal position, IIA: Attained occlusal position, IIC: Commenced eruption of M1 teeth, IIIA: Attained eruption of M1 teeth, IIIB: Exchange stage of lateral segment teeth, IIIC: Commenced eruption of M2 teeth, IVA: Attained eruption of M2 teeth, IVC: Commenced eruption of M3 teeth, VA: Attained eruption of M3). The maxillary sinus was measured with computed tomography. The fault area was set to 4 mm in the orbital and alveolar process direction in the upper and lower walls, respectively. The maxillary sinus area was calculated by multiplying slice width and cross-sectional area on scanned film.
RESULTS AND CONCLUSION: 1. Maximum maxillary sinus area grew 59 per cent relative to that of the adult between the IA and the IIC periods. 2. The area in the maxillary orbital direction, the IA to VA period displayed stable growth from 200 $mm^2$ to 350 $mm^2$. 3. The area in the maxillary alveolar process direction increased significantly from 50 $mm^2$ to 450 $mm^2$ between IA and VA. However, this parameter decreased in area between IIIA and IIB. 4. The change in volume was 40 per cent of that of adult growth between IA IIC; subsequently, this area displayed 57 per cent of that growth observed in adults until the IVC period.

**74** MESIODENS – A STUDY OF TWENTY TEETH

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AIM: Assessment of the number and morphology of mesiodens as well as disorders in the number of teeth concurrent with their occurrence.
SUBJECTS AND METHOD: Sixteen patients (9 males, 7 females), aged 5-35 years with mesiodens. The number and morphology of the mesiodens as well as concurrent disorders were assessed on study models, intraoral photographs and panoramic views.
RESULTS: In 13 patients (81.25%) one mesiodens was found. Two mesiodens were diagnosed in two patients (12.5%) and three in one patient (6.25%). Eleven teeth (55%) had a conical shape, seven (35%) were tuberculate and two (10%) molariform. In the patients with two mesiodens the teeth were of different morphology: in one subject tuberculate and molariform, and in the other conical and tuberculate. In the patient with three mesiodens two were tuberculate and one molariform. The concurrent disorders in tooth number comprised: a supernumerary upper central incisor of typical morphology in two patients, and hypodontia of the lower second premolars in two patients: both in one patient and a single in the other. Multiple mesiodens were found in three patients (18.75%). The majority of mesiodens were conical, and in subjects with multiple mesiodens they were of different morphology. The concurrent disorders comprised the supernumerary of an upper central incisor and hypodontia of the lower second premolars.

## 75 CLUSTER ANALYSIS OF NORMAL SOFT TISSUE PATTERNS FOR A GROUP OF EGYPTIAN ADULTS

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AIM: To establish a mathematical classification of normal soft tissue pattern by cluster analysis based on lateral cephalometric radiograph measurements.
SUBJECTS AND METHOD: Ninety-six Egyptian adults (52 females, 44 males) with a normal occlusion, and an age range from 18-25 years. For each subject linear and angular soft tissue measurements were recorded and ratios between the linear facial profile parameter were calculated.
RESULTS: Cluster analysis for the collected data resulted in classification of the normal sample into three clustered groups which reflected the size and shape of normal Egyptian soft tissue patterns. Most of the linear and angular parameters showed a significant difference between the centre of each cluster.

## 76 POSITION OF THE LOWER INCISORS AFTER ORTHODONTIC TREATMENT

T Kambara, N Kazuya, H Hayato, Department of Orthodontics, Osaka Dental University, Japan

AIM: The soft tissue profile plays an important part in orthodontics. The controversy regarding correlations between soft tissues and the underlying hard tissues (including anterior teeth) has been discussed. The present study was undertaken to explore how well the soft tissue profile in extraction cases can be used to measure 'beauty' with respect to the position of the lower anterior teeth, the height and length of the nose and soft tissue pogonion.

SUBJECTS AND METHOD: Sixty female subjects in whom upper and lower premolars were extracted. The measurements included in the analysis were: Ricketts' E line, Steiner's S line, soft tissue facial angle, angle of S - tip of nose (NT) and S - soft tissue pogonion (SP), FMA, pogonion and lower incisor to NB.
RESULTS AND CONCLUSION: A satisfactory profile could not be obtained without a positive value for the distance Po to NB line. The findings in this investigation agree with the theory that the nose and soft tissue pogonion should be taken into consideration when judging a beautiful profile.

## 77 A KINESIOLOGICAL STUDY OF THE INFLUENCE OF ACTIVATOR TREATMENT ON MANDIBULAR MOVEMENTS

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AIM: Functional appliances are considered to alter the neuromuscular environment through alteration in the position of the mandible. There are, however, no investigations as to whether this change influences the kinesiology of the mandible. The purpose of this investigation was to examine the influence of the monobloc activator on dynamic movements of the mandible using the Kinesiograph computer system as the measuring device.
SUBJECTS AND METHOD: Sixteen young children, 9-12 years of age, who exhibited a Class II division 1 skeletal malocclusion with a retrognathic mandible. All the subjects had no pathological signs or symptoms from the temporomandibular joint and all agreed to participate in the investigation. Mandibular movements were recorded during maximum opening-closing, protrusion, left and right excursions and during mastication of different types of food (apple, peanut and chewing gum). The recordings were obtained twice, before the beginning of activator treatment and 12-18 months after the use of the monobloc. The non-parametric Wilcoxon's signed rank test was used for statistical analysis.
RESULTS: There was a measurable difference in maximum vertical opening during opening-closing movement and in antero-posterior displacement during protrusion. None of the other parameters tested showed any significant differences. In the present investigation, the 'figure 8' crossover pattern characterized most pre-treatment mandibular movements and remained after treatment in most of the subjects.

## 78 INGROWTH OF BLOOD VESSELS IN IMPLANTED CATHETER TUBES WITH A VARYING DIAMETER

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AIM: After removal of pulpal tissue, revascularisation of autotransplanted teeth can occur in empty pulp chambers (Laureys *et al*., 2001). The aim of this study was to evaluate ingrowth of blood vessels in catheters with different diameters.
MATERIALS AND METHOD: Ten teeth from two beagle dogs (incisors and premolars) were extracted and immediately replaced by catheters with different diameters (0.6, 0.75, 0.9, 1.3 and 1.5 mm). The catheters were inserted in the extraction alveolus together with rasped bone and completely covered by the mucosa. After 9 weeks, the dogs were killed and histological sections were made of the areas where the catheters were inserted.

RESULTS: During histological preparation, part of the material was lost due to sectional problems of the plastic catheters. Although the amount of histological material was rather limited, ingrowth of blood vessels was observed even in the catheters with a diameter as small as 0.75 mm. Compared with histological sections of regularly transplanted teeth, no inflammation was observed in any of the histological sections.
CONCLUSION: The absence of necrotic pulpal tissue, always occurring after regular tooth transplantation, could be an explanation for an easier ingrowth of new pulpal tissue through small openings.

**79** ORTHODONTIC ASSESSMENT OF PATIENTS WITH UNILATERAL CLEFT LIP AND PALATE

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AIM: To develop an index to assess standards of orthodontic treatment in patients with complete unilateral cleft lip and palate (UCLP)
MATERIALS AND METHOD: Fifty-five sets of dental casts before and after orthodontic treatment of UCLP patients were scored using the Peer Assessment Rating (PAR) Index. An expert panel evaluated each pair of casts and gave their opinion regarding the degree of improvement achieved by orthodontic treatment on a visual analogue scale. Each case was then assigned a single score based on the mean score of the experts. Reliability tests were carried out on the PAR Index scores and the experts' ratings. Correlation analysis of the difference in PAR scores between the pre- and post-treatment casts and the degree of improvement perceived by the panel were performed. Alternative weightings for the PAR Index, suitable for UCLP were calculated.
RESULTS: The results of the reliability tests were excellent ($P < 0.001$). The alternative weights for the PAR Index correlated highly with the experts' opinions.
CONCLUSION: A modified PAR Index, to predict current opinion regarding orthodontic treatment for complete UCLP patients has been validated. This objective index will allow a statistical audit and improvements in the quality of future care. It is currently being successfully used at a cleft unit.

**80** AN EXPERIMENTAL, NUMERICAL AND IMMUNOHISTOCHEMICAL STUDY OF SHORT-TERM RAT TOOTH MOVEMENT

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AIM: In this novel study design, combined experimental, numerical and immunohistochemical investigations were performed to identify the initial mechanical and biological reactions to a short-term application of an orthodontic force system.
MATERIALS AND METHOD: In the animal experimental study, the right upper first molars of 25 anaesthetized rats were loaded with forces of 0.1N. The forces were recorded with a high-resolution force/torque transducer, and were kept constant for 15 minutes, 1, 2, 4 or 8 hours. After loading, the deflection of the teeth was recorded with resin and the inner surfaces of the corresponding replicas were scanned with a three-dimensional surface scanner to determine tooth translations and rotations. In the numerical part of the investigation, finite element models were developed based on histological sections of the left molars (MSC.Marc Mentat), to analyse stress and strain distributions around the roots under the same force systems as in the

experiment. After histologic processing the following proteins were analysed to quantify the cell biological reactions in the periodontium: cytokine interleukin-6, proliferation marker PCNA, the mediators endothelin-1 and substance-P and the enzymes endothelial nitric oxide synthase and cyclooxygenase-2. Correlation of mechanical and biological reactions in the periodontal ligament and the bone was undertaken with respect to stresses and strains and the above proteins.
RESULTS: The first results indicate that strains and stresses in the PDL seem to be the mechanical key stimulus of biological activity, whereas strains or stresses in the alveolar bone seem to be of minor importance.

**81** TOOTH SIZE RATIO FOR SUBJECTS REQUIRING EXTRACTION OF FIRST PREMOLARS

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AIM: To determine a mathematical tooth size ratio specifically designed for patients requiring extraction of four first premolars and to compare anterior '6' and overall '12' ratio values reported by Bolton to calculated anterior '6' and overall '10' ratio values obtained in this investigation.
MATERIALS AND METHOD: This study consisted of three phases. In the first two phases, the aim was to select ideal post-treatment models that would be used in the third phase, using the Peer Assessment Rating Index and ideal cephalometric norms. In the third phase, the mean overall '10' ratio and the mean anterior '6' ratio were calculated for selected post-treatment models of 53 first premolar extraction cases. Bolton's mean overall '12' and anterior '6' ratios were compared statistically with calculations derived from this study using a Student's *t*-test.
RESULTS: The mean overall '10' ratio and the mean anterior '6' ratio for post-treatment orthodontic models were: 89.28 ± 1.07 and 77.68 ± 1.12, respectively. For overall ratio, a statistically significant difference was found between Bolton's study and the present investigation. No statistically significant difference was found between the anterior ratio in this study and Bolton's.
CONCLUSION: A mathematical tooth size overall ratio of 89.28 per cent, which is recommended to be helpful in diagnosis and treatment planning, was determined for subjects requiring extraction of all first premolars.

**82** BEYOND 2000: A VARIATION OF TREATMENT MECHANICS

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Various potential problems such as dental caries, periodontal disease, and remaining band space may develop in the anchor teeth during routine orthodontic treatment despite plaque control procedures. C-orthodontic treatment is the mechanics during which carefully controlled movement of teeth in three planes is carried out solely by specially designed skeletal anchorage appliances designated: C-tube, C-palatal plate, and C-implant without the assistance of bonded or banded anchor teeth. These appliances may offer greater anchorage with no potential trauma to the other teeth and can move large numbers of teeth over comparatively longer distances than conventional methods. With the C-skeletal anchorage appliances, the time required in anchorage preparation is reduced and tooth movement is expedited by incorporating a minimal number of teeth in the mechanics.

Based on the successes achieved so far, it is proposed that C-skeletal anchorage appliances are not auxiliaries to conventional orthodontic mechanics, but an independent orthodontic treatment system in itself. C-mechanics can be used in treatment requiring maximal anchorage, such as severe crowding, bialveolar protrusion, anterior protrusion, and in some subjects with dental caries, periodontal involvement, and bone loss at the anchor teeth.

## 83 OCCLUSAL PATTERNS AND THE INDICATOR LINE IN BIOBLOC TREATMENT

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AIM: To investigate changes in the values of occlusal patterns, overjet/overbite, and the length of the Indicator Line before and after Biobloc treatment in Class III malocclusion subjects.
SUBJECTS AND METHOD: All 24 subjects were Japanese. The occlusal patterns were measured using the Dental Prescale-Occluser System for occlusal contact areas (area), an average occlusal pressure on occlusal contacts (ave), and all of the occlusal force (force). The Indicator Line and occlusal pattern were used to compare Class III malocclusion subjects before and after Biobloc treatment. In this investigation, those subjects within the ideal 2.5 mm Indicator Line range (AIG) and those outside the ideal Indicator Line range (NAIG) were studied.
RESULTS: The average treatment term was 38 months. There were 15 cases (62.5%) of AIG and nine cases (37.5%) of NAIG. The average values of AIG before and after treatment were: area 4.99 $mm^2$, ave 55.10 MPa and force 246.12 N and 7.71 $mm^2$, 47.95 MPa and 369.68 N, respectively. The average values of NAIG before and after treatment were: area 4.99 $mm^2$, ave 50.09 MPa and force 241.74 N and 6.34 $mm^2$, 50.94 MPa and 317.10 N, respectively. Overjet/overbite changed from –2.57/2.63 mm to 2.16/2.30 mm in AIG and from –0.77/2.06 mm to 2.72/2.0 5 mm in NAIG. There was an effective improvement in all subjects with AIG, whereas those with NAIG exhibited horizontal change and measured improvement in occlusal and facial conditions.
CONCLUSION: Biobloc treatment might result in occlusal stability. It is important to achieve the ideal 2.5 mm Indicator Line range.

## 84 EFFECTIVE DISTALISATION OF LOWER MOLARS

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AIM: Analysis of forces and moments and movement simulation of a biomechanical distalisation appliance.
MATERIALS AND METHOD: For minimal side-effects and low frictional movement, a lingual slide mechanism positioned near the centre of resistance was used in individual NiTi coils to distalize the lower molars. The resultant forces and moments were analyzed using the Orthodontic Measuring and Simulation System. Using steel and TMA wires, the amount of distalisation obtained was evaluated. Uprighting and intrusion were also combined with distalisation.
RESULTS: The constancy of force of the used coils was nearly 10 times lower than of coils used for distalization with the straightwire technique. The amount of orthodontic force on the molar during distalisation was approximately equal to the reactive force measured at the anchorage. Compared with straightwire, mesial movement simulations of 5.0 mm, the observed side-effects were minimal (buccal

movement = 0.45 mm, extrusion/intrusion = 0.1 mm, buccal torque = 1.3°, tip back = 2.6°, rotation = 3.5°). The initial uprighting moment of 32.0 (steel) and 16.0 Nmm (TMA) corrected the initial tip forward of 20 degrees during distalization of 4.5 mm up to nearly 95 per cent. The intrusive design showed after 4.5 mm distalisation, 0.5 mm intrusion.
CONCLUSION: The efficiency of this appliance is expected to be substantiated by further clinical testing.

**85** TREATMENT OF TEMPOROMANDIBULAR JOINT ANKYLOSIS

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AIM: To present clinical experience in using external distraction devices for reconstruction of temporomandibular joints (TMJ).
SUBJECTS AND METHOD: Nineteen patients, aged 2 to 15 years with TMJ ankylosis, amount of opening 1.5-4.5 mm, treated by distraction osteogenesis. Radiographic analysis, including dental tomography, lateral and postero-anterior cephalometry and computed tomography, was carried out. Simultaneous release of the joint and reconstruction of the condyle with distraction and bone transportation was undertaken. A reverse-L osteotomy was performed on the mandibular ramus and an extraoral Molina distractor was fixed on the osteotomised fragment and the mandibular ramus. The osteotomized ramus fragment was activated after a latency period of five days at a rate of 1-mm per day until satisfactory results were obtained. The distractor was kept in place for approximately 3-4 months after completion of distraction and then removed under local anaesthesia.
RESULTS: The average duration of distraction was 18 days. Excellent results were observed both clinically and radiologically with minimal relapse. Good occlusal relationships were achieved and most cephalometric values were normalised. The mean pre- and post-operative 6-month inter-incisor opening values were 4.5 and 35.6 mm, respectively
CONCLUSION: Osseus mandibular distraction together with arthroplasty offers an excellent new alternative for treatment of patients with mandibular hypoplasia and associated ankylosis, with minimal morbidity and complications.

**86** CONDYLAR ASYMMETRY IN PATIENTS WITH AND WITHOUT TEMPOROMANDIBULAR DISORDERS

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AIM: The clinical significance of a difference between the length of the left and right mandibular condyle has been discussed controversially. This presentation will look at associations between condylar asymmetry and radiological and clinical findings in patients with and without temporomandibular disorders (TMD).
MATERIALS AND METHOD: Using the approach proposed by Habets *et al*. (1988) condylar asymmetry was calculated on rotational panoramic radiographs of 654 patients from two TMD clinics and one implant registry. The subjects were functionally asymptomatic. Asymmetry was determined and measurement reliability was related to pain history and clinical TMD and radiological condylar findings.
RESULTS: Condylar asymmetry exceeding 10 per cent could be reliably re-determined on a second set of radiographs taken on a different occasion. For the

cephalometric analysis the finding was not reliable due to measurement error if the mean length of a patient's condyles was below 6 mm. The reported location of facial pain and the clinical findings were associated with condylar asymmetry: transversal dento-alveolar and skeletal midline deviation, asymmetric slide from the retruded to the intercuspal position of the mandible, condyle-disc-incoordinations, and the distribution of static pain on isometric functional tests. Radiological findings of the mandibular condyle were also related to condylar asymmetry.
CONCLUSION: As condylar asymmetry seems to be associated with well-described symptoms and signs of TMD, its significance in the diagnosis and treatment of dental and orthodontic patients should be considered.

## 87 ROOT LENGTHS OF THE PERMANENT TEETH OF 45,X/46,XX FEMALES

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AIM: Studies on individuals with sex chromosome anomalies have demonstrated the promoting effect of the Y chromosome on growth of tooth crown enamel and dentine, whereas the X chromosome effect on crown growth seems to be restricted to enamel formation. After the completion of crown development root dentine forms and determines root size. 45,X females show reduced permanent tooth crown size, which is due to reduced enamel thickness, and the roots are also reduced in size. 45,X/46,XX females also show reduced crown size and enamel thickness. The aim of the present study was to investigate the root lengths of permanent teeth in 45,X/46,XX females and to obtain additional information regarding their growth.
SUBJECTS AND METHOD: Fifteen 45,X/46,XX females (mean age 23.4 years) were examined. In addition, a number of control groups were identified: nine female relatives (mean age 24.5 years); 45 females (mean age 30.4 years) and 57 males (mean age 31.5 years). Root length measurements were obtained from panoramic radiographs (except for third molars) using digital callipers, following a previously reported technique. Statistical testing was carried out with a two-tailed *t*-test.
RESULTS: The root lengths of permanent teeth in 45,X/46,XX females are, in general, significantly shorter than those of the female population or the female relative controls.
CONCLUSIONS: The root lengths of permanent teeth in 45,X/46,XX females are reduced, accompanying the reduction of tooth crown size.

## 88 THE VALIDITY OF TRANSCRANIAL RADIOGRAPHY IN THE DIAGNOSIS OF INTERNAL DERANGEMENT

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AIM: To determine whether associations exist between temporomandibular joint (TMJ) characteristics on transcranial radiographs (TR) and TMJ internal derangement, and to evaluate the validity of TR in the diagnosis of internal derangement,
MATERIALS AND METHOD: TR and magnetic resonance images (MRI) of 113 TMJs from 76 subjects (50 females, 26 males) with a mean age of 22.27 years. MRI were evaluated to determine disc displacement following which the subjects were classified into three groups: normal, disc displacement with reduction, and disc displacement without reduction. TR analysis included linear measurement of joint

spaces and condylar head measurement. To determine any relationship between TR measurements according to disc displacement, one-way ANOVA was used.
RESULTS: The condyle-fossa relationship on standard TR had no relationship with disc displacement. As disc displacement progressed, the condylar angle between the head and neck significantly increased. This result can be interpreted that the condylar head angle reflecting structural hard tissue change according to internal derangement progress, but is insufficient in the determination of internal derangement.
CONCLUSION: Although clinically helpful, the validity of standard TR to diagnose TMJ internal derangement is questionable.

**89** PROFESSIONAL BLEACHING IN THE ORTHODONTIC PATIENT

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AIM: To emphasize the potential for using modern technology in producing optimal aesthetic results. For the last two years, a professional dental bleaching system (Brite-Smile 3000 - IOTA) has been employed.
SUBJECTS AND METHOD: To-date, 12 patients (7 males, 5 females) aged between 20 and 40 years (average: 30 years) have been successfully treated. The clinical protocol involves: clinical and radiographic examination of teeth and surrounding tissues to identify any non-vital teeth which require internal bleaching; bleaching to improve tooth colour; evaluation of the psychological profile of the patient and objective information regarding treatment outcome and duration of treatment.
CONCLUSION: The increasing number of requests for bleaching requires co-operation from the patient and members of the dental team. The treatment may be demanding for the patient when they have completed a long course of orthodontic treatment.

**90** DENTAL AGE IN DUTCH CHILDREN

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AIM: To study dental age in a sample of 451 Dutch children (226 boys, 225 girls) according to the method of Demirjian.
SUBJECTS AND METHOD: The children were born between 1972 and 1993 and were between 3 and 17 years of age at the time a dental pantomogram (DPT) was obtained. The children were grouped in the age group closest to their chronological age (3.5-4.4 became age group 4, etc.). One examiner scored all 451 DPTs. A subset of 52 DPTs were scored by a second examiner and the intra-class correlation coefficient (ICC) and the Kappa coefficient were calculated. The ICC was 0.99 and Kappa was 0.68. Boys and girls were analyzed separately.
RESULTS: A significant difference was found between chronological age and dental age. On average the Dutch boys were 0.4 years and the girls 0.5 years ahead of the French-Canadian children analyzed by Demirjian. Therefore the French-Canadian standards are not suitable for Dutch children. New graphs for the Dutch population were constructed using a logistic curve with the equation $Y= 100* \{1 / (1+e-a(x-x0) \}$ as a basis. The 95 per cent confidence interval was calculated. To check whether the logistic curve was correct, a residual analysis was carried out. The explained variance was 93.9 per cent for boys and 94.8 per cent for girls, indicating that the logistic curve was appropriate to use for Dutch children. In addition to the graphs, tables were

produced which transferred the maturity scores calculated by the method of Demirjian into Dutch dental age.

**91** INTEGRIN REGULATION OF MOTILITY IN HUMAN OSTEOBLASTS

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AIMS: Integrin-matrix interactions are important regulators of cell function. Using cell migration as an index, the role of integrin mediated cell-matrix interactions as regulators of HOB cell behaviour when cultured on fibronectin (Fn) or collagen type 1 (COL1), ligands for the α5ß1 and α2ß1 integrins, respectively, were investigated.
MATERIALS AND METHOD: HOB cells were obtained from primary explant culture. Cell surface expression was confirmed using flow cytometry. Migration studies were performed using a standard migration chamber assay (8 μm pore size) coated with Fn (10 ug/ml) or COL1 (100 ug/ml). These studies were complemented by immunohistochemistry to localise the α2, α5 and ß1 subunits and by scanning electron microscopy following culture on Fn or COL1.
RESULTS: HOBs expressed each of the integrins but there were differences in the pattern of expression and cell morphology when cultured on different matricides. After 4 hours, migration was observed in wells coated with either substrate but not in uncoated controls. Migration on Fn and COL1 was partially blocked in the presence of an RGD peptide. Pre-incubation with α5 (10 ug/ml) blocking antibodies partially blocked migration on Fn with no significant effect on COL1. In contrast, the use of α2 blocking antibodies caused a marked reduction in migration on COL1 but not Fn.
CONCLUSION: Cell matrix interactions involving the α2 and α5 integrin subunits are determinants of HOB function *in vitro*. They influence cell surface integrin expression and participate in the regulation of cell migration.

**92** POST-TREATMENT STABILITY OF THE CURVE OF SPEE.

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AIM: To assess long-term stability of orthodontic correction of the curve of Spee (CS).
SUBJECTS AND METHOD: Seventy-five subjects previously treated with full fixed appliances, with good occlusion after active treatment, and at least 3 years out of retention. Standardized photographs of study models were taken pre-treatment (T1), end of active treatment (T2) and at least 3 years out of retention (T3). CS depth in the lower arch was defined as the line segment between the occlusal plane and the cusp tip most distant to it, and measured on photographs using image analysis. CS depths were designated as deep (>2 mm), normal (1-2 mm) and flat (<1 mm).
RESULTS: Between T2 and T3 CS remained stable in 46 per cent of the subjects, relapsed in 39 per cent and changed spontaneously in 15 per cent. The frequency of a deep CS changed from 42 per cent at T1, to 9 per cent at T2, to 21 per cent at T3. Depending on the original CS depth, both post-retention stability and relapse varied from 39-47 per cent and spontaneous changes from 6-31 per cent. Stability was most likely after correction of a deep CS. Spontaneous changes, both deepening and flattening, occurred most frequently after treatment of a normal CS. Nineteen per cent of deep T1 CS showed relapse, and 6 per cent flattened after correction to normal at T2. Fifty-eight per cent of normal T1 CS remained normal at T3, whilst the

remainder deepened or flattened between T1 and T2 or T2 and T3. Ten per cent of flat T1 CS deepened between T2 and T3.
CONCLUSIONS: Stability of orthodontic correction of CS is low. Unexpected post-retention changes are relatively frequent.

**93** THE RELIABILITY OF DIAGNOSING A TONGUE-THRUST SWALLOW

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AIM: To test the reliability of diagnosing a tongue-thrust swallow according to the method described by Moyers (1988).
SUBJECTS AND METHOD: Seventy-eight children, 12-13 years of age, were examined consecutively for a swallowing pattern in connection with their regular dental check-up. The examination was undertaken separately by their general practitioner and two orthodontic specialists. To reflect ordinary clinical situations, the examinations were carried out without prior calibration but following instructions according to print-outs of Moyers' method and criteria for his five different swallowing patterns.
RESULTS: Total agreement in diagnoses between the general dentists and the two specialists was found in 33 of the subjects (42%), most of them mature swallowers. There was a total lack of agreement for 17 classifications of complex tongue-thrust swallow. The two specialists gave the same diagnosis in 68 per cent of the cases, while the specialist and a general dentists agreed about the diagnoses in 55 and 58 per cent of the cases, respectively. Kappa value for agreement between specialists was 0.35 (weak agreement), and for the general dentists and the specialist 0.08 and 0.09 (an agreement is weak or missing).
CONCLUSION: There is a weak agreement or lack of agreement in classification of swallowing patterns. Classification of different swallowing patterns according to Moyers cannot be recommended for regular clinical examinations because of low reliability.

**94** DEVELOPMENT OF OXYTALIN FIBRES IN RAT PERIODONTAL LIGAMENT

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MATERIALS AND METHOD: Having improved the histochemical staining technique described by Fullmer (1974) that has been used previously (Baratieri 1965-66), in this investigation 32 Wistar rats were divided into eight groups and sacrificed at 1, 10, 20, 30 days of age, etc.
RESULTS: Histological sections showed that fibres could be identified even on day 1, although the quantity and size was so small that they could not be completely stained. Sections of the animals sacrificed later showed that, parallel to dental development and eruption, oxytalin fibres increased in number and thickness in all periodontal spaces, not only in the periapical region where they formed a complicated mesh, but also in the middle and coronal thirds of the periodontium, where they appeared parallel and perpendicular to the major axis of the tooth.
CONCLUSION: Previous studies have demonstrated the real function of oxytalin fibres but it is interesting to hypothesize that the longitudinal fibres could help to support the twisting and bending movements of the dental element while the fibres in

the apical area could somehow absorb pressure. Although this study does not intend to attribute any specific function to these fibres, it is considered important that oxytalin fibres that mature during dental eruption, as do those of the rest of the periodontal ligament, complete their development together with other periodontal structures once dental eruption has been completed, and modify their structure during orthodontic movement.

## 95 EFFECT OF INTERMITTENT PARATHYROID HORMONE TREATMENT ON PERIODONTAL LIGAMENT CELLS *IN VITRO*

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AIM: Parathyroid hormone (PTH) has been shown to primarily exert catabolic actions accompanied by bone resorption when administered continuously, while anabolic effects characterized by an increase in bone mass have been observed following intermittent PTH injections. The aim of the present investigation was to address the question as to whether PTH modulates the response of periodontal ligament (PDL) cells with respect to proliferation and local factor production in terms of anabolic effects.
MATERIALS AND METHOD: PDL cells were cultured from human premolars and then incubated over three cycles of 48 hours each. The cells were cultured in the presence of 10-8M or 10-7M PTH (1-34) for 0, 1, 3, 6 or 24 hours. At harvest, cell numbers were determined. The production of key regulatory bone remodelling factors, osteoprotegerin (OPG) and receptor activator of nuclear factor kappaß ligand (RANKL) were determined using semi-quantitative PCR and immunoassays. Dermal fibroblasts and MG63 osteoblast-like cells were employed as a reference.
RESULTS: In PDL cells, intermittent PTH-treatment caused a significant dose- and time-dependent increase in proliferation whereas OPG decreased both at the transcriptional and translational level. RANKL was hardly detectable. Similar results were obtained in MG63 cells, whereas PTH-stimulation did not alter any of the parameters examined in dermal fibroblasts.
CONCLUSION: The anabolic effects of intermittent PTH treatment are not mediated by the RANK/RANKL or OPG systems but suggest a role for other local factors such as components of the IGF-system.

## 96 SELF-ESTEEM AND SATISFACTION WITH DENTAL APPEARANCE IN 8-9 YEAR-OLD CHILDREN

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AIMS: Many studies have tried to clarify the role of malocclusion on an individual's self-concept or on the level of satisfaction with dental appearance, but little research on psychosocial attitudes towards malocclusion has been conducted on pre-adolescent children. The aim of this study was to compare dental self-concept and satisfaction with dental appearance in 8-9 year old schoolchildren from an urban and rural context.
SUBJECTS AND METHOD: One hundred and sixty nine children (73 females, 96 males, age range 8-9 years) from a third-grade elementary school. Fifty-eight (21 females, 37 males) were from a large urban area and 111 (52 females, 59 males) from a small rural town in the south of Italy. To evaluate self-concept and satisfaction with

dental appearance, the COAS questionnaire, modified for 7-9 year-old children, was used and the findings from the questionnaire were compared between the two groups. The correlations between social status and questionnaire findings were also analysed.
RESULTS: Urban children had a better opinion of braces: they would like to have braces and considered that they needed braces statistically more often than rural children. Conversely, the poorest children thought that braces would look 'funny' on their teeth, they would not want to wear braces, and considered it unimportant to have 'straight' teeth.
CONCLUSIONS: Social status and geographic context play an important role in children's self-esteem and in their satisfaction with dental appearance.

**97** USE OF SELF-ETCHING PRIMER: A MICROSCOPIC AND COLORIMETRIC STUDY

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AIM: Different types of new materials for bonding orthodontic accessories have been developed in recent years. The development of new compositions, consisting of acid and primer in one single product and thus forming a self-etching system, has been reported in the literature. The purpose of this study was to evaluate microscopic characteristics and colour alterations of bovine enamel after self-etching primer application in preparation for direct orthodontic bonding.
MATERIALS AND METHOD: For microscopic analysis 16 teeth were divided into two equal groups, according to the enamel conditioning used: SEP group (Transbond Plus Self Etching Primer) and PT group (37% phosphoric acid and Transbond Primer). All brackets were bonded with composite (Transbond XT). The colorimetric study comprised 78 teeth divided into three groups of 26 samples. Both experimental groups (SEP and PT) were submitted to the same bonding protocol described for the microscopic analysis. However, the control group received only enamel prophylaxis. Readings before bracket bonding, immediately after debonding, and post-accelerated ageing test were obtained.
RESULTS: Microscopic analysis of the SEP samples revealed the presence of a hybrid layer in the composite/tags interface. In addition, shorter and thinner tags were also observed in this group when compared with the results registered for the PT samples. Comparison of colorimetric readings from all three groups showed no clinically significant colour differences.

**98** SUMMARY OF ORTHODONTIC TREATMENT WITHIN THE MULTIDISCIPLINARY PROGRAMME FOR CHILDREN WITH CLEFTS

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AIM: From 2000 to 2002 the Polish Ministry of Health financed the 'Multidisciplinary Programme of Care for Children with Clefts of the Primary and/or Secondary Palate'. The aim was to organize multidisciplinary centres where interdisciplinary surgical and orthodontic treatment could be provided. Treatment was based on an elaborated protocol.
SUBJECTS AND METHOD: During the first year 53.9 per cent of patients were treated by removable and 35.5 per cent by fixed appliances. In the following years more children were treated with fixed appliances e.g. in 2002, 41.8 per cent. During the three years of treatment, the percentage of subjects with a severe malocclusion,

with higher scores assessed by the Goslon Index, showed a tendency to decrease while those with lower scores, minor malocclusion, increased. The distribution of scores was as follows:
2000: score 3 – 22.5 per cent; score 4 – 28.9 per cent; score 5 - 13 per cent
2001: score 3 – 33.6 per cent; score 4 – 21.2 per cent; score 5 – 9.3 per cent
2002: score 3 – 33.6 per cent; score 4 – 17.6 per cent; score 5 – 9.6 per cent
Between 2000 and 2002, 1.8 per cent of patients who entered the programme finished the active phase of treatment.
CONCLUSION: It is advisable to increase the effectiveness of orthodontic treatment, in multidisciplinary centres for children with clefts of the primary and/or secondary palate, by conforming treatment to established standards.

## 99 PARAMETERS FOR DIGITAL ACQUISITION AND STORAGE OF ORTHODONTIC RADIOGRAPHIC FILMS

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AIM: To establish conditions for digital acquisition and storage of panoramic radiographs (DPT), and lateral (L) and postero-anterior (PA) cephalograms.
MATERIALS AND METHOD: The films were digitized using two flat bed scanners with transparency adaptors and two reflex digital cameras. The resulting files were elaborated on three computers running different Oss and graphic software. Digital acquisition of DPT, L and PA films was performed at different resolutions (dpi), optical density (dynamic range, D) and colour (bit) depth. Samples identical on visual evaluation on the computer screen were analyzed with a semi-quantitative method based on the steepness of transition between the dark and light areas of the film. Images acquired with scanners were compared with those obtained with digital cameras.
RESULTS: With a scanner the best digitising conditions were 1200 dpi resolution, 4.2 D and 42 bit depth. The file obtained under these conditions (250-350 MB depending on film size) was too large for storage and elaboration. The resolution was reduced to 200 dpi and the image compressed to 150 KB without information loss. With a digital camera, photographs of the DPT were of sufficient quality, whereas those of L and PA films were not.
CONCLUSION: The dynamic range of scanners was a limiting factor for quality. This was partly overcome by scanning at a higher resolution and bit depth, resulting in a more refined image. The definition was not lost by subsequently reducing resolution while compressing images. Compressed files were of appropriate size for network file transfer and printing.

## 100 COMPARISON OF THREE SOFT TISSUE ANALYSIS TECHNIQUES FOLLOWING ORTHOGNATHIC SURGERY

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AIM: A new method of morphing optical surface laser scans has been developed, with the potential for prediction of orthognathic surgery soft tissue outcome in three dimensions. To validate the technique, the process was compared with current two-dimensional profile prediction methods.

SUBJECTS AND METHOD: Sixteen patients fulfilled the selection criteria for this study involving prospective data collection in the form of lateral cephalograms and optical surface scans. The actual surgical movements that were performed were defined by superimposition of pre- and immediate post-operative lateral cephalograms. This data was used for three profile prediction methods: hand tracing, OPAL prediction software, and the laser scanning Cloud© software for morphing. The laser scan prediction was based on 1:1 ratio of hard to soft tissue movement in the midline. Each patient acted as their own control since all methods were carried out for each patient. The predictions were compared with the actual profile from long-term records.
RESULTS: All three prediction methods were similarly variable. Statistical analysis demonstrated two areas where there was significant difference in the variability of the prediction methods. Nasolabial angle was poorly predicted by the OPAL software due to an inherent measurement problem. Lower lip length was poorly predicted with the laser method.
CONCLUSIONS: The 1:1 ratio of soft to hard tissue change in the midline, which was used for the laser method, provides a similar basis for profile prediction as other methods in current use, such as hand planning and OPAL software.

**101** SKELETOFACIAL MORPHOLOGY OF ATTRACTIVE AND NON-ATTRACTIVE INDIVIDUALS

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AIM: To determine if there are differences between attractive and non-attractive males and females with respect to their skeletofacial morphology.
SUBJECTS AND METHOD: Thirty attractive and 32 non-attractive subjects selected by a panel of 54 dental students from a group of 398 orthodontically treated patients. Facial attractiveness was assessed using full-face photographs and skeletofacial morphology was determined on lateral cephalometric radiographs taken at the same time as the facial photographs. The radiographs were analyzed with respect to sagittal and vertical jaw relationships, face height, profile convexity and lip position.
RESULTS: With the exception of lower lip position, there were no significant differences between attractive and non-attractive subjects.
CONCLUSIONS: Facial attractiveness is not associated with a specific skeletofacial morphology in the lateral plane.

**102** LIGHT-CURING TIME REDUCTION: *IN VITRO* EVALUATION OF NEW INTENSIVE LIGHT EMITTING DIODE CURING UNITS

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AIM: To evaluate, *in vitro*, the minimal necessary curing time to bond stainless steel brackets using new, intensive, light-emitting diode (LED) curing units.
MATERIALS AND METHOD: Seventy-five bovine primary incisors divided into five equal groups. A standard light-cure adhesive was used to bond stainless steel brackets using different lamps and curing times. Groups A and B were bonded using an intensive LED curing lamp (Ortholux LED) for 5 and 10 seconds, respectively. Groups C and D were bonded using another intensive LED curing device (Ultra-Lume LED 5) also for 5 and 10 seconds, respectively. Finally, a standard halogen lamp

(Optilux 501) was used for group E, which served as the control. All teeth were fixed in hard acrylic and stored for 24 hours in water at 37°C. Shear bond strength (SBS) was measured using a universal testing machine (Instron). Weibull analysis and analysis of variance were used to test for significant differences.
RESULTS: The SBS values obtained were significantly different between groups ($P < 0.001$). When used for 10 seconds, both intensive LED curing units achieved sufficient SBS, comparable with the control. In contrast, 5 seconds resulted in significantly lower SBS. The adhesive remnant index was not significantly affected.
CONCLUSION: A curing time of 10 seconds was found to be sufficient to bond metallic brackets on incisors using intensive LED curing units. These new, comparatively inexpensive, curing lamps seem to be an advantageous alternative to conventional halogen lamps for bonding orthodontic brackets.

## 103 HEREDITY VERSUS ENVIRONMENTAL FACTORS IN THE AETIOLOGY OF MALOCCLUSIONS

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AIM: The importance of heredity as a possible cause of malocclusions has been confirmed by evidence from genetic and anthropologic research. The purpose of this study was to evaluate the incidence of hereditary transmitted versus environmentally related malocclusions.
SUBJECTS AND METHOD: Three hundred and seventy five subjects were selected from a larger pool treated over a 5-year period (1999-2003). Family history, clinical and complementary investigations recorded in the subject's clinical notes were used to establish the aetiology of their malocclusion.
RESULTS: In this sample 64.3 per cent of malocclusions were identified as having an hereditary component, justified by the presence of at least one affected first degree relative. Although among the remaining 35.7 per cent of subjects hereditary factors could not be completely excluded, the intervention of environmental factors was believed to have a determining role in the development of their malocclusion. Slight differences between extremely similar malocclusions in monozygotic twins have been attributed solely to environmental factors, while differences between them and their first degree relatives were regarded as a result of differences in both environmental exposure and genetic influence.
CONCLUSION: Given the high incidence of hereditary factors in the aetiology of malocclusion, establishing the cause can prove important in both treatment and stability.

## 104 TREATMENT CHANGES IN CLASS II MALOCCLUSION – TWO METHODS OF ANALYSIS

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AIM: To evaluate changes after different treatment approaches in Class II malocclusions estimated using Björk's method and projection of posterior (sella, gonion, articulare) and anterior (nasion, pogonion, A, B) facial skeletal points on the occlusal plane.
MATERIALS AND METHOD: Pre- and post-treatment cephalograms of patients with Class II malocclusions treated with orthopaedic appliances and orthodontic

procedures. All pre- and post-treatment cephalograms were analyzed using Björk's method and projection of points on the occlusal plane.
RESULTS: Skeletal and dentoalveolar post-treatment changes were described by both methods. An altered sequence of projections of points on the occlusal plane was observed post-treatment.
CONCLUSIONS: Some types of treatment alter the cant of the occlusal plane such that the post-treatment results described by projection of the points method give the impression of greater treatment skeletal changes than those expressed by angular measurements.

**105** THE TELEROENTGENCEPHALOGRAM – A GRAPHIC METHOD OF INTERPRETATION OF PROFILE TELERADIOGRAPHY

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AIM: To develop a dentofacial template, the teleroentgencephalogram, in order to assess growth from profile teleradiography.
SUBJECTS AND METHOD: Forty-four healthy children (22 girls, 22 boys), with no dentofacial anomalies were examined annually in the mixed dentition. Seven angular and nine linear measurements were undertaken: planum N-S; clivus S-Ba; sphenoidal angle N-S-Ba; anterior and posterior maxillary angles: S-N-Nsa, N-S-Nsp; anterior and posterior height of the maxilla: N-Nsa, S-Nsp; S-Nsp-Nsa angle; palatal plane Nsa-Nsp; anterior and posterior profile angle: N-Nsa-Gn, S-Nsp-Go; anterior and posterior height of lower face: Nsa-Gn, Nsp-Go; mandibular base length Go-Gn, mandibular angle Kdl, ramus length Kdl-Go. Statistical analysis was undertaken annually assessing the influence of age and sex, and confidence intervals were identified.
RESULTS: Based on the mathematical data derived, a transparent template, the-teleroentgencephalogram, with angular and linear data relating to the cranial base, maxillary and mandibular areas was constructed for each age and sex group. The template permits assessment of facial growth patterns from the cranial base to the mandible.
CONCLUSION: The teleroentgencephalogram allows comparative growth analysis by sex and an assessment of quantitative versus directional growth disorders in subjects with dentofacial anomalies.

**106** PATIENTS' SATISFACTION VERSUS SKELETAL CHANGES FOLLOWING ORTHOGNATHIC SURGERY

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AIMS: (1) to assess patients' satisfaction following orthognathic surgery, (2) to assess post-surgical skeletal stability and (3) to explore the relationship between patients' satisfaction and the skeletal changes.
SUBJECTS AND METHOD: Forty-four patients (mean age 23.5 years) were recruited prospectively. Twenty skeletal Class III patients had mandibular setback and maxillary advancement (Group A); 12 skeletal Class III patients were treated by maxillary advancement only (Group B); 12 skeletal Class II patients had mandibular advancement and maxillary impaction (Group C). Satisfaction questionnaires were

completed at 1, 3 and 6 months following surgery. Cephalometric assessment was performed immediately before (T1), immediately following (T2) and six months after (T3) surgery.
RESULTS: Patient satisfaction was generally high among the three groups, with group B showing higher satisfaction scores, though not significant ($P > 0.05$). A significant increase in satisfaction scores was observed post-surgically in group C ($P = 0.036$). In group A, maxillary advancement relapsed significantly ($P < 0.05$), whereas mandibular advancement relapsed significantly in group C ($P < 0.01$). Correlation of patients' satisfaction scores at 6 months following surgery with the antero-posterior skeletal relationship was weak (r = 0.18).
CONCLUSION: Post-surgical satisfaction levels correlated weakly with antero-posterior cephalometric parameters.

**107** TIP AND TORQUE OF PERMANENT TEETH – A COMPARISON BETWEEN TREATED PATIENTS AND A NORMAL GROUP

A Miresmaeili, N Farhadian, M Farahani, Orthodontic Department, Hamedan University, Iran

AIM: To determine the average tip and torque of each permanent tooth in a well treated patient group in comparison with a control group with normal occlusion.
SUBJECTS AND METHOD: Nineteen subjects treated non-extraction with the standard edgewise technique and a control group of 20 pre-university students with normal occlusion were selected according to the Index of Orthodontic Treatment Need. Reference points and lines were marked on the facial surface of each tooth on casts. A special device was designed for measuring the facio-lingual and mesio-distal inclination of the crowns. A Student's *t*-test and Kruskal-Wallis analysis were used for statistical analysis.
RESULTS: The mean age of the control group was 18.8 ± 0.5 years and for the treated group 20.3 ± 0.8 years. There was a significant difference between the mean torque in the control and treated group for the upper lateral incisor (4.75 ± 5.21, 8.76 ± 5.82, respectively, $P < 0.03$). A significant difference was also seen in the average torque of the lower second premolar between the control and treated group (–23.48 ± 5.99, –26.66 ± 4.64, respectively, $P < 0.05$). There were no significant differences in the tip of the teeth between the two groups. In comparison with Andrews' study, in the normal occlusion group the upper canine and first molar and the lower lateral and first premolar had more buccal root torque.
CONCLUSION: Except for the upper lateral incisor and lower second premolar, the torque and tip of other teeth was not significantly different.

**108** CHANGES IN MAXILLOFACIAL MORPHOLOGY OF JAPANESE SUBJECTS WITH NORMAL OCCLUSION

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AIM: Standard maxillofacial values for Japanese subjects with normal occlusion have been changing over time. The aims of this study were to compare standard values for the contemporary Japanese population with normal occlusion with those in earlier studies to reveal morphological changes.
MATERIALS AND METHOD: Lateral cephalometric radiographs of Japanese males with a normal occlusion, across three decades: 1950s: 19 males (mean age, 21.2 years); 1980s: 15 males (mean age, 23.0 years); 2000s: 24 males (mean age, 17.4

years). Ten items were measured, including angles and distances by Downs' analysis. The averages (± SD) for the three groups were calculated. Scheffe's multiple comparison tests were used to assess statistical significance across the three decades.
RESULTS: From the 1950s to the 2000s, the angle of convexity decreased, the A-B plane angle increased and the Y-axis decreased. The differences were statistically significant.
CONCLUSION: In skeletal morphology, there was mandibular protrusion, relative to the maxilla in the 2000 group, compared with that of the 1950s. As with earlier reports, the average maxillofacial morphology of contemporary Japanese subjects with normal occlusion has gradually been approaching that of Caucasians for the last 50 years.

## 109 DIAGNOSTIC MEASUREMENT OF LIP PRESSURE WITH A LIP PRESSURE GAUGE

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AIM: To measure and record the strength of upper and lower lip pressure separately using a specially designed lip pressure gauge. Use of the gauge allows high-precision decision making and assists in diagnosis.
SUBJECTS AND METHOD: Maximum upper/lower lip pressure was measured with a lip pressure gauge in 511 normal occlusion subjects (245 males, 265 females, 6 to 18 years of age) without any strain in the perioral musculature.
RESULTS: 1) lower lip pressure was usually stronger than upper lip pressure for all age groups, 2) the lip pressure of males was stronger than that of females, and 3) lip pressure increased with age.
CONCLUSION: Decisions for diagnosis should be made by comparison between normal and abnormal occlusion and by taking into account the strength of the perioral musculature and buccinator strap.

## 110 A NEW EVALUATION OF MUSCLE FUNCTION IN JAW DEFORMITY PATIENTS

Y Nakashima, H M Ueda, K Tanne, Department of Orthodontics, Hiroshima University, Japan

AIM: Various evaluations have been developed to determine masticatory function in jaw deformity patients in terms of the changes in bite force, and maximum muscle activity in prognathic patients after orthognathic surgery. However, maximum effort is an unusual event during the day, and it may thus be insufficient to evaluate muscle function. In this study, changes in muscle activity were evaluated with a new indicator before and after orthognathic surgery.
SUBJECTS AND METHOD: Ten patients with mandibular prognathism (5 females, 5 males) and 10 healthy controls (5 females, 5 males) with normal occlusion. The activity of the masseter and temporal muscles was recorded during maximum voluntary clenching (MVC), tapping, and chewing gum. The average rectified values for 1 second were obtained by dividing the absolute integrated electromyographic (EMG) values. The average rectified values in different performances were then normalized with special reference to EMG amplitude induced by MVC.
RESULTS: The normalized values of masticatory muscle activity were significantly higher in the patients than in the control group. The normalized values of temporal muscle activity became significantly larger post-surgery.

CONCLUSIONS: The masticatory muscles in jaw deformity patients might be overloaded during eating.

**111** THE NASAL BONE IN CLEFT LIP AND PALATE SUBJECTS

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AIM: In a recent study, Hansen *et al*. (2003) found that the nasal bone in human foetuses with cleft lip (CL) was significantly shorter compared with human foetuses with a cleft palate (CP) and foetuses with a combined cleft lip and palate (CLP). The aims of the present study were to analyse human post-natal nasal bone length in newborns and male adults with CL, CP and unilateral CLP, and make a comparison with previously studied human pre-natal nasal bone length in these cleft groups.
MATERIALS AND METHOD: Profile radiographs from 60 newborns (20 CL, 20 CP and 20 UCLP) and 60 male adults (20 CL, 20 CP 20 UCLP palate) were selected from non-syndromic subjects from the Cleft Lip and Palate Centre, Hellerup. On the profile radiographs the nasal bone lengths were measured with a digital calliper. Student's *t*-tests were preformed.
RESULTS: Human nasal bone length in male adults was significantly shorter in CL compared with CP, and borderline significance was seen when CL was compared with UCLP. In newborns, the nasal bone length was significantly shorter in CL compared with UCPL. There was no significant difference between CP and UCPL either in newborns or male adults.
CONCLUSIONS: In CL the nasal bone is shorter compared with other cleft types. The differences in nasal bone lengths both pre- and post-natally in subjects with varying degrees of clefting, affecting the lip and/or palate, suggests that the short nasal bone in CL is not a question of delayed maturation, but an actual deviation from normal.

**112** EVALUATION OF DENTOALVEOLAR COMPENSATION IN PATIENTS WITH A VERTICAL GROWTH PATTERN

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AIM: Long face problems may occur in patients who have a normal or deep bite relationship. The aim of this study was to analyse skeletal and dental characteristics at different stages of dental maturity and to assess possible skeletal and dentoalveolar compensatory mechanisms for the vertical growth pattern.
SUBJECTS AND METHOD: One hundred and eighty untreated patients with a vertical growth pattern. The subjects were divided into mixed and permanent dentition groups. Each group was then divided into four sub-groups, based on the amount of overbite. Pre-treatment lateral cephalographs were obtained for all subjects and traced using a cephalometric software program. For each cephalometric variable, the mean and standard deviation was determined. A Student's *t*-test for unpaired samples was used to analyse statistical differences between the groups and the correlation coefficient (r) to describe the interrelationship between overbite and skeletal and dentoalveolar variables.
RESULTS: In the mixed dentition the values for anterior upper and lower dentoalveolar height were significantly increased in the positive overbite groups

compared with the open bite group. In the permanent dentition, the values for posterior lower dentoalveolar heights were significantly decreased in the positive overbite group compared with the open bite group.

**113** CORRELATION BETWEEN TRANSVERSE AND ANGULAR MEASUREMENTS USING FRONTAL CEPHALOGRAMS

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AIM: To correlate linear and angular measurements from postero-anterior cephalograms using Ricketts-Faltin analysis during two different growth periods.
SUBJECTS AND METHOD: Forty-five white Brazilian children (25 females, 20 males), in the mixed dentition, with good facial aesthetics, including symmetry and balance, with no orthodontic or orthopaedic therapy before their radiographic registration. The initial mean age was 7 years 7 months, and the final mean age 13 years 3 months. Ricketts' cephalometric measurements were: facial transverse dimension (DTF), maxillary transverse dimension (DTMx), nasal transverse dimension (DTN), inferior intermolar transverse dimension (DTII), mandibular transverse dimension (DTMd), and craniofacial posture right and left (PCF). Faltin's cephalometric measurements were: occlusal vertical dimension (DVO), total vertical dimension (DVT), maxillary posture right and left, and mandibular posture right and left.
RESULTS: All transverse measurements (DTF, DTMx, DTN, DTMd) were strongly positively correlated amongst themselves and with vertical measurements (DVO, DVT), apart from DTII where no correlations were found. Bilateral measurements (PCF, PMx, PMd) did not present any correlations with other measurements, but were strongly positively correlated amongst themselves.
CONCLUSION: The face is composed of intercorrelated interdependent regions, which are maintained during growth.

**114** DENTOFACIAL RESULTS IN OPEN BITE PATIENTS TREATED WITH THE CLOSE BIONATOR

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AIM: To investigate the effects of a close bionator appliance on the craniofacial complex in anterior open bite (AOB) patients.
SUBJECTS AND METHOD: Eleven growing patients (6 boys, 5 girls), with an average age of 8 and 11 years and a treatment period of 18 months. Two lateral cephalograms were taken, one before treatment and the other after appliance removal. The behaviour of 12 vertical variables was verified, comparing the differences found in their measurements between the initial and final treatment times.
RESULTS: The statistically analyzed results indicated that a significant vertical overbite increase positively affected the AOB; an increase of posterior facial height was found that demonstrated an increase in the mandibular ramus. Increases in the distance of the upper molars to the palatal plane and in upper incisor angle and a decrease in lower incisor angle contributed to improve the AOB. An increase in maxillary height caused the posterior maxilla to rotate.
CONCLUSION: The close bionator appliance is effective in AOB treatment when used in growing patients.

**115** INTRAORAL ASSESSMENT OF MALOCCLUSION IN 14-YEAR OLDS

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AIM: To evaluate the numerical assessment of malocclusion of 15 morphological signs measured intraorally, and to assess malocclusion severity grades in 14-year olds.
SUBJECTS AND METHOD: The research was part of a longitudinal study on a sample of 530 three-year-old children. At 14 years of age (mean 14.8; SD 0.18), a cohort of 92 school children (53 girls, 39 boys) was selected at random from the population of Maribor, Slovenia. None had been orthodontically treated. Registrations according to the Eismann index were used and evaluated. All 15 morphological signs were scored and the total malocclusion score for each subject was calculated. The subjects were categorized into four grades of malocclusion severity. Malocclusion traits, significant for the total malocclusion severity score, were determined by regression analysis.
RESULTS: The mean total malocclusion score was 21.6 (median 15), ranging from 2 to 84. Fifty per cent of the subjects scored under 15 (no significant malocclusion), a moderate malocclusion (16-45) was found in 34 per cent, severe (46-65) in 12 per cent and very severe (over 66) in 2 per cent. Regression analysis yielded the following hierarchical order of traits significant for the total malocclusion score: open bite, rotation, overjet, transverse and sagittal buccal occlusion, and axial tooth inclination.

## 116 DENTAL CHANGES INDUCED BY NITINOL FLAT SPRING AND HERBST APPLIANCES

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AIM: To compare the dental changes contributing to Class II correction in subjects treated with either the Forsus nitinol flat spring (3M, Unitek) or integrated Herbst (Dentaurum) appliances.
SUBJECTS AND METHOD: Twenty patients (mean age 12.4 years) with a Class II division 1 malocclusion, whose treatment did not include extractions, were divided into two groups. The ANB angle was 5 degrees and the overjet 5 mm in all patients. Ten patients were treated with the Forsus appliance, and 10 with the integrated Herbst for an average period of 7.2 ± 1.2 and 6.3 ± 1.4 months, respectively. Cephalometric lateral radiographs in habitual occlusion were taken just before placement and after removal of both appliances. The dental changes were analysed according to the method of Pancherz (1982).
RESULTS: Treatment with both appliances resulted in a Class I dental arch relationship in all patients. The maxillary incisors retroclined, on average, 2.1 mm in the Forsus group and 1.3 mm in the Herbst group ($P < 0.05$). Although the maxillary molars moved more posteriorly in the Forsus (1.2 mm) than in the Herbst group (0.7 mm), this difference was not statistically significant. The mandibular incisors and molars moved anteriorly in both groups and with no statistically significant differences between the groups.
CONCLUSION: The Forsus and integrated Herbst appliances are efficient in the correction of Class II division 1 discrepancies. However, retroclination of the upper incisors is more with the Forsus appliance than with the Herbst.

## 117 EFFECTS OF SANDBLASTING ON THE CLINICAL PERFORMANCE OF A RESIN-MODIFIED GLASS IONOMER CEMENT

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AIM: To evaluate the effects of sandblasting of the bracket base on the clinical performance of a resin-modified, chemically-cured, glass ionomer cement (RMGIC; Fuji Ortho, GC Corporation).
SUBJECTS AND METHOD: Forty patients with a range of malocclusions were randomly allocated to two groups. For the first 20 cases, the teeth were divided into quadrants so that sandblasted, mesh-based, metal brackets (Midi Diogonal, Leone Sesto) were directly bonded to the upper left and lower right quadrants using the RMGIC. The mesh based (no sandblasting) brackets were bonded to the other quadrants with the same adhesive. For an equal distribution between right and left sides, a split mouth design was used and the allocation of the brackets per quadrant was reversed for the second 20 cases. Sandblasting of the bracket bases was carried out using 25 μm aluminium oxide particles for 3 seconds. For bonding, the manufacturer's instructions were followed. The number, site and date of first time bracket failures were monitored throughout active orthodontic treatment.
RESULTS: The mean active treatment time was 19 months. The bond failure rates were 3.79 and 3.20 per cent for the sandblasted and non-sandblasted metal brackets bonded with the RMGIC, respectively. There was no significant difference between the groups.
CONCLUSION: Sandblasting does not have a positive effect on the clinical performance of mesh-based metal bracket bases when were bonded with RMGIC.

## 118 THE INFLUENCE OF PITUITARY DWARFISM ON THE DENTOFACIAL STRUCTURES

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AIM: To evaluate the correlation between the low secretion of somatotrophic hormone and the presence of dentofacial anomalies.
SUBJECTS AND METHOD: Twenty children aged 6-16 years were examined as two distinct groups: mixed (n = 10) and permanent (n = 10) dentition. The endocrinological illness was diagnosed by anthropological, radiological and laboratory examinations. The children were orthodontically examined to determine craniofacial bone development, facial symmetry, the extent of dentoalveolar development, occlusion and dental age.
RESULTS: The deficiency in bone growth was apparent at the craniofacial level in 95 per cent of subjects. The mandible was most commonly affected, demonstrating both mandibular micro- and retrognathism. Ninety per cent of subjects in the mixed dentition demonstrated abnormalities of dental structure and disturbance of normal eruption. Subjects in the permanent dentition demonstrated frequent anomalies in tooth position, facial and arch symmetry, and a number of malocclusions.
CONCLUSION: Subjects with pituitary dwarfism demonstrate a number of anomalies that affect the dentofacial complex and therefore require careful monitoring.

**119** PAIN DISCOMFORT DURING INITIAL HERBST TREATMENT

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AIMS: To analyse patients' pain/discomfort during the initial treatment period in a consecutive group of patients treated with the Herbst appliance.
SUBJECTS AND METHOD: Fifty patients (20 males, 30 females) between 10 and 17 years of age treated with the Herbst appliance. A questionnaire with a visual analogue scale was given to the patients immediately after insertion of the Herbst appliance. The questionnaire was constructed with 10 lines, each to be filled out with a mark crossing the line, for the first 10 days, indicating the level of pain level. The lines began with: 'I have no pain at all' and ended with 'I cannot imagine more pain'.
RESULTS: Most pain/discomfort was experienced during the first 3-4 days, and acceptance of normal chewing after one week. There were large deviations in the level of reported pain/discomfort. Most patients felt severe discomfort whilst a few experienced only minor pain/discomfort in the first 3-4 days. Some of the patients who experienced great pain/discomfort had taken analgesics during the early days of treatment.
CONCLUSION: Most patients reported severe pain/discomfort in the first 3-4 first days.

**120** FINNISH ORTHODONTISTS' VIEWS ON TREATMENT PRACTICES IN PUBLIC ORTHODONTIC CARE

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AIM: The variation in subsidized orthodontic care in Finnish municipalities has resulted in discussions on equal availability of orthodontic treatment. The aim of this study was to determine professional opinions on treatment practices. The results will help to develop guidelines suggested by government authorities.
MATERIALS AND METHOD: In April 2002, a questionnaire was sent to all 146 specialist orthodontists younger than 65 years in Finland; 57 per cent responded. The questions dealt with the indications, timing and methods of treatment, division of tasks, and suggestions for improvement of service provision.
RESULTS: According to the respondents, the ideal age to assess occlusion for the first time was on average 5.5 years (range 3-10 years). Most frequently mentioned indications for treatment were crossbites in the primary dentition, a severe Class II malocclusion, crossbites and severe crowding during the mixed dentition, and crowding in the permanent dentition. Forty-two per cent wanted to devolve easier treatments to dentists and 88 per cent routine tasks to auxiliaries. The respondents suggested that orthodontic care could be improved by increasing the number of posts for orthodontic postgraduate education and the availability of auxiliary personnel. Further, the diagnostic skills of dentists should be improved. The organization of orthodontic care on a population basis was considered as an appropriate way for successful treatment provision.
CONCLUSION: Finnish orthodontists were satisfied with the orthodontic care given, but emphasized the need for national guidelines and additional education and training in orthodontics.

**121** CAUSES FOR SHORT-ROOT ANOMALIES

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AIM: To assess the reasons for generalized root shortening in patients who have not undergone orthodontic treatment.
SUBJECTS AND METHOD: Eight patients aged 8-38 years with generalized root shortening without a previous history of orthodontic treatment were identified. Short-root anomaly was diagnosed when the root length was less than crown height. The diagnostic records consisted of study models, intraoral photographs and panoramic views.
RESULTS: The following dental developmental conditions were identified in this group of subjects: dentinal dysplasia type I (4 subjects); dentinogenesis imperfecta type II (2 subjects) and osteogenesis imperfecta (1 subject). The remaining subject had undergone radiotherapy for nasopharyngeal rhabdomyosarcoma at 2 years of age.
CONCLUSIONS: Subjects presenting with generalized root shortening, in the absence of any orthodontic treatment, should undergo a detailed history as part of their assessment. The dominant patterns of inheritance associated with some dental developmental conditions necessitates examining the family of the affected patient.

## 122 SUPERELASTIC PALATAL ARCH AND QUADHELIX: A COMPUTATIONAL ANALYSIS.

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AIM: To analyse the mechanical behaviour of two types of palatal arches, CPASE and Quadhelix, by means of numerical computations based on the finite element (FE) method. The analysis focused on the evaluation of the forces and the moments transmitted to the teeth after two modes of symmetric activation of the devices: expansion and rotation.
MATERIALS AND METHOD: The performed analysis included several steps: creation of the three-dimensional model of the devices and discrimination by means of FE analysis; definition of the model constraint and load conditions; definition of the mechanical properties of the materials; and numerical simulation of appliance activation, insertion and deactivation.
RESULTS: Based on the results of this study, the following curves were constructed as a function of activation: moment/force transmitted to the tooth by the device versus rotation/translation of the teeth in the buccal direction. The results showed that these two appliances delivered lighter and more constant moments, when compared with the data available for palatal bars.
CONCLUSIONS: The use of FE analysis for the evaluation of the mechanical behaviour of orthodontic palatal arches is the innovative feature of this study.

## 123 ULTRASONOGRAPHY OF THE TONGUE PATTERN DURING SWALLOWING IN CLEFT LIP AND PALATE SUBJECTS

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AIM: To determine the difference in tongue pattern during swallowing between unilateral cleft lip and palate (UCLP) and somatic cases, and to identify myofunctional exercises to improve tongue position.

SUBJECTS AND METHOD: Twelve UCLP (6 females, 6 males) and 11 somatic (5 females, 6 males) swallowers aged between 14-18 years were examined with the B+M mode ultrasound technique. The real time ultrasound system was a mechanical sectoring scanner (Sonodiagnost 360) with a 3.5 MHz transducer. The transducer was positioned perpendicular to the scanning sector through the midsagittal plane with the transducer holder. The M-position was in the middle of the B-sector, which is the superior most point on the dorsal surface of tongue. All M-mode images were observed and correlated with tongue movements on B-mode images during each phase of swallowing, according to the definitions of Graber.
RESULTS: During the first and second phases of swallowing no significant differences were found between the groups. For somatic subjects, during the third phase, the superior most point on the dorsum of the tongue was found to be in close contact with the palate, while in UCLP patients these patterns were different; the M-mode image did not have a 'special' platform. For the UCLP group during the fourth stage, swallowing was longer due to an increase in time during the last phase.
CONCLUSIONS: The greatest difference in tongue pattern during swallowing was in phase 4. Special myofunctional exercises, which can be used in subjects with these tongue dysfunctions, have been designed.

**124** ASSESSMENT OF ORTHODONTIC MICROIMPLANTS BY HISTOMORPHOMETRY AND MICROCOMPUTED TOMOGRAPHY

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AIM: Osseointegration of orthodontic microimplants is commonly investigated by means of histology and histomorphometry. The aim of this study was to compare these methods to recently developed microcomputed tomography (micro-CT) which, in contrast to anatomical methods, avoids destruction of the specimens.
MATERIALS AND METHOD: Five orthodontic microimplants (length 13 mm, diameter 2 mm, made of commercially pure titanium) were placed in the mandibular alveolar process of mini pigs. All implants were loaded immediately by an orthodontic coil spring delivering a continuous intrusive force of 1.5 N to the first molar. After three months all implants were removed together with the surrounding bone. Laboratory processing consisted of dehydration and embedding, producing acrylic blocks. Histology and micro-CT were performed to investigate bone structure and osseointegration.
RESULTS: Both histology and micro-CT revealed a high degree of osseointegration in all specimens (>80%). Resolution of CT was at least 25 µm and allowed good assessment of the interface between implant and bone.
CONCLUSION: Immediate loading of microimplants using continuous forces of 1.5 N does not seem be an obstacle for osseointegration. Micro-CT is an alternative to conventional histology for the assessment of implant osseointegration avoiding the destruction of the specimen and allowing three-dimensional assessment.

**125** FEATURES OF DISTAL OCCLUSION IN ADULTS

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AIM: To compare dental, occlusal and skeletal features of adult subjects with Class I and Class II occlusions.

MATERIALS AND METHOD: The material for this study was collected at the Institute of Dentistry, Kuopio University in 1980s. The 285 participants were Finnish university students born in the 1950s and 1960s and very few of them had received orthodontic care. Impressions for study casts and lateral and postero-anterior headfilms were taken. Tooth and dental arch sizes were measured with sliding callipers and occlusal characteristics were determined by inspecting the study casts. Cephalometric analysis was carried out with the Pordios-program. The comparisons were undertaken between Class I and Class II molar relationship cases. Unilateral cases were included in the latter group.
RESULTS: Tooth sizes in the Class I and II groups were generally similar. Dental arch widths and crowding behaved differently in the male and female groups. The male lower alveolar arches and the distances between the lower first and lower second molars were larger in the Class II group than in the Class I group. For females the upper first molar and upper canine distances differed between Class I and II. Females had more crowding both in the upper and lower arches in Class II cases than in Class I cases. Male lower arch crowding was similar for both Classes. Mandibular unit difference was 5.26 mm** between male Class I and Class II, and the female difference was 2.17 mm (NS). Male SNA- and NSAR-angles and incisor relationships behaved differently in Class I and Class II cases.
CONCLUSIONS: Compensatory adaptation to distal molar relationship seems to be different between males and females.

**126** A COMPARATIVE STUDY OF FRICTIONAL FORCE IN CANINE SLIDING MOVEMENT USING STAINLESS STEEL WIRES AND BRACKETS **(***)**

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AIM: To determine and compare the frictional resistance offered by stainless steel (SS) brackets from different companies, used in combination with SS wires of various sizes and from different manufacturers during simulated canine retraction.
MATERIALS AND METHOD: SS 0.016 × 0.016 inch and 0.016 × 0.022 inch wires (Dentaurum, Ortho Organizers and Unitek) were tested in the 0.018 inch slot of Dentaurum (Germany), Orsu (China) and Unitek (USA) SS brackets. A testing apparatus was used to simulate the clinical situation when retracting canines through tipping and uprighting movements. The measurements were carried out with an Instron universal testing machine and frictional force was recorded graphically on an *X-Y* recorder.
RESULTS: Statistical analysis showed significant difference in frictional force among wires from different manufacturers ($P < 0.05$), with Ortho Organizers wires showing the least friction. The differences in friction between different wire sizes were also significant ($P < 0.05$); the thicker wires produced more friction. However, different brackets did not produce statistically significant differences in frictional force ($P > 0.05$).
CONCLUSIONS: The minimum frictional force, using 0.016 × 0.022-inch wires, was found between Ortho Organizers wires and Orsu brackets. When using 0.016 × 0.016-inch wires, the minimum frictional force was between Dentaurum wires and Orsu STD brackets.

**127** A NEW ORTHODONTIC SCREW FOR REMOVABLE BITE JUMPING

APPLIANCES **(***)**

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AIM: To develop an advancement device that can be re-activated by the clinician without laboratory support to provide stepwise advancement up to 12 mm and have provision for opening of the posterior segments during advancement of the mandible.
MATERIALS AND METHOD: In initial studies, a modified reciprocally expanding rapid palatal expander (RPE) orthodontic screw was incorporated into 40 split monobloc activators. Deficiencies with the modified RPE screw were encountered. To address this, a stronger component was developed. This device incorporated a machined rotating screw fixed to the maxillary appliance with a hinged carrier unit attached to the mandibular appliance. Simultaneously the posterior section of the appliance was allowed to separate occlusally according to the patient's individual condylar movement. This improved screw design was tested in 10 split monobloc activator appliances and fitted to patients with skeletal Class II malocclusions.
RESULTS: The improved appliance comfortably fitted to all patients, maintained protrusion and provided further advancement. No laboratory assistance was required.
CONCLUSION: This improved device is a suitable mechanism for applying gradual advancement that is tolerated by patients.

**128** PREVALENCE OF DENTAL TRAUMA IN CANDIDATES FOR ORTHODONTIC TREATMENT

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AIM: To investigate the prevalence of dental trauma in candidates for orthodontic treatment and to examine the influence of increased overjet and overbite.
MATERIALS AND METHOD: The dental records (study models, radiographs, photographs) of 1367 consecutive patients (731 female, 636 male) for orthodontic treatment between 1998 and 2002 were examined for data relating to trauma to the permanent incisors. The mean age of the patients was 14.8 years (range 6.0 to 55.5 years). Overjet and lip coverage were determined on pre-treatment study models and photographs, respectively.
RESULTS: Of the examined patients, 10.3 per cent had suffered dental trauma before the onset of orthodontic treatment. The most frequently affected teeth were the maxillary central incisors (79.6%), followed by the maxillary lateral incisors (16.4%). The most common types of trauma were: fracture of enamel-dentine without pulpal involvement (42.7%) and fracture of enamel (33.8%). Compared with patients with a normal overjet and adequate lip coverage, the frequency of dental trauma was significantly higher in patients with an increased overjet and adequate lip coverage ($P = 0.028$) or with increased overjet and inadequate lip coverage ($P = 0.003$).
CONCLUSIONS: A significant percentage of subjects for orthodontic treatment, and especially those with increased overjet and inadequate lip coverage, suffer trauma to their permanent incisors before the onset of orthodontic treatment.

**129** EVALUATION OF RAMUS AND CONDYLAR HEIGHT ON ROTATION PANORAMIC RADIOGRAPHS

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AIM: Rotation panoramic radiographs are widely used to examine the jaw skeleton and recently to diagnose vertical asymmetry between the right and left mandibular ramus and condyle. The purpose of this study was to assess whether it is possible to derive accurate measurements of the jaws from panoramic radiographs.
MATERIALS AND METHOD: A dry skull was shifted along the sagittal and transversal plane and tilted around the three co-ordinate axes (sagittal, transversal, vertical). A set of 420 digital radiographs (Orthophos, Sirona) was produced, with defined positioning errors. The distances between the metal markers (d = 2 mm) were measured on images that had been attached to the mandible. These automated measurements were performed using Sigmascan Pro 5 software (SPSS, Chicago, USA).
RESULTS: Overall, assessments of the vertical dimensions were significantly more accurate than those of the horizontal dimensions. Sagittal shifting and tilting had only a slight effect on condylar and ramus height measurements. However, when the skull was tilted around the vertical or transversal axis, this significantly affected the vertical measurements. The greatest error was observed when the skull was inclined laterally around the antero-posterior axis. With this type of deviation of head position, asymmetry averaged 2.9 per cent (2° inclination) and 5.7 per cent (4° inclination), respectively.
CONCLUSION: Asymmetries of more than 6 per cent are probably not due to the positioning of the patient in the panoramic machine.

**130** ASSESSMENT OF ANTERO-POSTERIOR JAW RELATIONSHIP

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AIM: A number of studies have shown that the ANB angle does not provide an adequate assessment of variations in skeletal relationships. The purpose of this study was to consider all related factors and their interaction in influencing ANB, and to present a new method for correcting these geometric effects.
MATERIALS AND METHOD: Two co-ordinates are needed to define the position of a point in the plane. Likewise, two angles are necessary to define the position of a point on a cephalometric plane. In the first part of the study, the angles SNA, ASN and SNB, BSN were varied for the same skeletal Class I relationship, and ANB calculated in each case. The second part of the study used 110 lateral cephalometric radiographs of patients who had not undergone orthodontic treatment. The patients were clinically classified into Class I and Class II malocclusion groups. To analyze the variation of SNB, a multiple linear regression was computed for the Class I group, using the angles SNA, ASN and BSN.
RESULTS: 1) It was observed that variation in these four angles will cause significant variation in ANB under the same skeletal Class I conditions. 2) A coefficient of determination of 0.86 was calculated based on this regression model ($P < 0.001$). A comparison between the actual measured SNB and the calculated SNB showed that 89.4 per cent of the Class II malocclusion group could be diagnosed as skeletal Class II.
CONCLUSIONS: This new method allows improved diagnosis of clinical problems rather than using established norms to evaluate ANB.

**132** SANDBLASTED BANDS AND RESIN MODIFIED CEMENTS FOR IMPROVED BAND RETENTION

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AIM: To investigate the stress required to deband untreated and sandblasted first molar stainless steel bands (3M Unitek, UK) cemented using a chemically-cured glass ionomer cement (GIC; Ketac Cem, Espe Dental, Germany) and a light-cured resin modified GIC (RMGIC; Fuji Ortho LC, GC Int. Corporation, Japan). The best band-cement combination was determined.
MATERIALS AND METHOD: Four human mandibular molar teeth were mounted in acrylic blocks to which 40 samples of each band-cement combination were sequentially cemented. The force (Newtons) required to deband the specimens was attained using an Instron universal testing machine (Instron Limited, UK). The surface area of each band was calculated using the Wild M400 stereomicroscope (Wild Heerbrugg Ltd., Switzerland). The stress required to deband (MPa) was then calculated by dividing the force to deband by the surface area of the band ($mm^2$). The results were subjected to a three-way ANOVA.
RESULTS AND CONCLUSION: The mean stress required to deband sandblasted molar bands was greater than that needed to remove untreated bands ($P < 0.001$). Bands cemented with light-cured RMGIC required a greater mean stress to deband than those cemented with chemically-cured GIC ($P < 0.001$). The combination of light-cured RMGIC and sandblasted band gave the best band retention. The lowest stress to deband was found for the chemically-cured GIC and untreated bands.

## 133 AWARENESS OF FACIAL APPEARANCE IN JAPANESE FEMALE LAYPERSONS

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AIM: To investigate the relationship between the awareness of facial appearance of Japanese female laypersons and the morphology of their own profiles.
SUBJECTS AND METHOD: Fifty-three Japanese female laypersons, aged from 19 to 24 years, who had not undergone orthodontic treatment. All subjects had their facial photographs taken and completed a questionnaire regarding awareness of their facial appearance as divided into 15 segmental parts, including eyelids, nose, cheeks, lips, teeth, chin, etc. From the photographs, profile lines were measured as the interior angles formed from the subnasale, sellion, and pogonion points on the soft tissues, which indicate the soft tissue antero-posterior jaw relationship. The responses to the questionnaire, especially regarding feelings about their own profile, were compared with the profile measurements.
RESULT: The interior angles formed from the subnasale, sellion, and pogonion points were from +0.5 degrees (Class III tendency) to +17 degrees (Class II tendency), with a median of +8.5 degrees. The subjects with lower interior angles had the highest scores in the questionnaire thus indicating dissatisfaction.
CONCLUSION: Japanese female laypersons tend to be dissatisfied with their profile if they have a protrusive chin.

## 134 HERBST MULTIBRACKET APPLIANCE TREATMENT IN ADULT CLASS II DIVISION 1 MALOCCLUSIONS

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AIM: To assess cephalometrically the amount of dentoskeletal and facial changes during Herbst multibracket appliance treatment.
SUBJECTS AND METHOD: Twenty-three adult Class II division 1 subjects. Lateral head films in habitual occlusion from before treatment, after 8.7 months of Herbst treatment, and after 12.8 months of multibracket appliance treatment were analyzed. All subjects were treated to a Class I occlusal relationship with a normal overjet and overbite.
RESULTS: The improvement in sagittal occlusion (overjet and molar relationship) was achieved by 82 per cent dental and 18 per cent skeletal change. During the total treatment period sagittal jaw relationship was improved, vertical jaw relationship was unaffected, lower face height was increased both anteriorly and posteriorly, and skeletal and soft tissue facial profile convexity was reduced.
CONCLUSIONS: Treatment of adult Class II division 1 malocclusions with the Herbst multibracket appliance is successful on a regular basis. Furthermore, the treatment approach may be considered as an alternative to surgical mandibular advancement in borderline adult Class II subjects.

## 135 THE EFFECT OF THERMOCYCLING ON THE BOND STRENGTH OF TWO ORTHODONTIC COMPOSITES

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AIM: To compare the effects of thermocycling on the shear bond strength of two light-cured orthodontic bonding system (Transbond, 3M Unitek, and Light Bond™, Reliance).
MATERIALS AND METHOD: Sixty human premolars recently extracted for orthodontic purposes were collected and stored in a solution of 0.1 per cent thymol until used. The teeth were cleaned, polished, and randomly separated into two mean composite groups: Transbond XT and Light Bond™. The vestibular surface of the teeth was used to bond the buttons and the palatal surface to bond the composites without a button. The composites were cured by Optilux 501 (Kerr, Orange, California). Each group was divided into two: the first group was exposed to thermal cycling between 5-55°C for a total of 1000 cycles with a computerized thermal cycling machine (Konya, Turkey). For shear bond testing, a knife-edge was applied at a crosshead speed of 1 mm/minute to each specimen at the interface between the tooth and composite until failure occurred. Independent sample *t*-tests were used for statistical analysis.
RESULTS: When the orthodontic composites were exposed to thermocycling, significant statistical differences were observed among the materials ($P < 0.05$). Thermocycling caused a decrease in the bond strength of Transbond with a button and of Light Bond™ without a button ($P < 0.05$).
CONCLUSION: Thermocycling causes a significant change in bond strength.

## 136 EFFECT OF XYLITOL LOZENGE ON REMINERALIZATION OF ARTIFICIAL CARIOUS LESIONS

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AIM: To evaluate the effect of a lozenge containing xylitol on *in situ* remineralization of artificial carious lesions.

SUBJECTS AND METHOD: Eleven healthy fixed appliance orthodontic patients (between 12 and 15 years of age) with normal salivary flow. Enamel blocks (4 × 3 × 3 mm) were prepared from the teeth extracted for orthodontic purposes. Artificial carious lesions were prepared. Each subject wore an acrylic resin intraoral jaw appliance containing the enamel block. The study was a crossover design of two 14-day periods: control (no lozenge) and xylitol lozenge (5 times a day after meals). Non-fluoridated dentifrice was used during the study. After each stage, surface enamel microhardness (Vickers, load 300 g) was analysed.
RESULTS: Friedman's one-way ANOVA was used for statistical analysis. Microhardness results demonstrated that there was no remineralization in either of the two groups. The remineralization percentage (±SD) was 197.5 (±127.3; 185.2 (±106.7); and 193.2 (±103.4) for the artificial carious, control, and xylitol groups, respectively.
CONCLUSION: Xylitol lozenges are not effective on *in situ* remineralization of artificial carious lesions.

## 137 SOFT TISSUE CEPHALOMETRIC ANALYSIS: EFFECT OF HEAD POSTURE, OCCLUSION, AND LIP POSITION

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AIM: To compare the effect of two different methods of obtaining cephalograms on soft tissue parameters, and to evaluate their influence on diagnosis and treatment planning.
MATERIALS AND METHOD: Fifty radiographs of 25 patients obtained by two different methods. The first films were obtained in the natural head position, centric relation (upper most condyle position) and relaxed lip posture, and the second using the conventional method where the Frankfort horizontal planes were parallel to the floor, the teeth were in centric occlusion and the lips were closed. Skeletal, dentoalveolar and soft tissue measurements were undertaken on each tracing. Besides conventional measurements, vertical and horizontal reference line projections were used. The measurements were compared with a Student's *t*-test.
RESULTS: Skeletal and dentoalveolar measurements were found to be similar. However significant differences were observed in the lower soft tissue region. The sagittal lip relationship was found to be different in the two groups ($P < 0.05$). The vertical position of the lower lip, soft tissue point B, and lip thickness were significantly different between the groups ($P < 0.01$).
CONCLUSION: The method of obtaining cephalometric measurements greatly influences the soft tissue parameters especially in the mandibular region. When evaluating the soft tissues, the cephalometric method used to obtain the radiographs should be considered.

## 138 FIBRE REINFORCED COMPOSITES AND ORTHODONTIC WIRES: COMPARISON OF MECHANICAL PROPERTIES

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AIM: To compare the mechanical properties of fibre reinforced composites (FRCs) and orthodontic wires.
MATERIALS AND METHOD: Different sizes of FRCs (diameter: 0.6, 1.2, 1.6 mm) were compared with four different sections of orthodontic stainless steel (SS) wires commonly used in orthodontic therapy. Beyond the different diameter, the other FRC

variables examined were the effect of different light-curing systems and storage conditions. Each sample was tested with a three-point bending test on a universal testing machine (Lloyd LRX, Fareham, U.K.). For each FRC group and orthodontic wire section, six specimens were tested up to 1 and 2 mm deflections. Data were statistically analysed (three-way ANOVA and Tukey's multiple comparison test).
RESULTS: ANOVA indicated statistically significant differences for the three factors (diameter, light-curing, and storage). The 1.2 mm FRCs showed significantly higher deflection values than those of all the remaining groups, particularly when stored in a dry environment. When the FRCs were stored in distilled water and cured with Optilux (40 seconds), they produced maximum deflection values not significantly different from those achieved with 0.019 (0.026 inch) SS orthodontic wires. Both SS round wires did not show statistically significant differences compared with 0.6 mm FRCs stored in distilled water.
CONCLUSION: For patients who have aesthetic concerns or allergies to conventional orthodontic wires and brackets, FRCs might represent an advantageous alternative.

**139** INFLUENCE OF ORTHODONTIC TREATMENT ON MASSETER AND TEMPORALIS ACTIVITY

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AIM: To investigate electromyographic (EMG) activity of the masseter and temporal muscles before (T1) and 3.5 years after (T2) treatment and to relate these findings to the occlusion before treatment and to the result of treatment.
SUBJECTS AND METHOD: Subjects with a Class I (n = 47) and Class II division 1 (n = 56) malocclusion were examined. Integrated EMG activity was assessed during maximal clenching and chewing of peanuts.
RESULTS: At T1 no significant differences were found between the two malocclusion groups. At T2 a significant increase ($0.001 < P < 0.05$) in EMG activity could be detected for all muscles in both malocclusion groups. At T1 the Class II division 1 open bite subjects exhibited larger temporal EMG activity ($P < 0.01$) during clenching than those with a deep bite. At T2 the opposite results were found ($P < 0.05$). Furthermore, T2 Class I and Class II division 1 subjects with a very good treatment result exhibited larger ($P < 0.001$ and $P < 0.05$) masseter EMG activity than subjects with a poorer treatment result.
CONCLUSION: The influence of orthodontic treatment on EMG activity could not be verified. However, masseter EMG activity seemed to be positively affected by a good treatment result.

**140** DOPPLEROGRAPHY IN ORTHODONTIC TREATMENT OF PATIENTS WITH PERIODONTAL DISEASE

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AIM: To study gingival blood flow in patients with periodontal disease undergoing orthodontic treatment.
SUBJECTS AND METHOD: Fifteen patients with chronic periodontal disease undergoing orthodontic treatment. The patients were divided into those presenting with anterior protrusion and a second group in whom there was incisor crowding. Using ultrasonic Doppler flowmetry (Minimax-Doppler K, SP-Minimax, St

Petersburg, Russia), the microcirculation of the gingiva was studied. Velocity and direction of blood flow was assessed prior to commencement, at completion, and 6 months after orthodontic treatment.
RESULTS. The velocity and direction of gingival blood flow underwent changes in the presence of chronic periodontal disease accompanied by dental anomalies. Microcirculation indices changed by 45-57 per cent during active orthodontic treatment. However, it returned to normal values 6 months after completion of active orthodontic treatment during the retention phase.
CONCLUSIONS. Ultrasonic Doppler flowmetry represents a valuable and informative method to determine microcirculation in patients presenting with malocclusion and periodontal disease.

**141** PERIODONTAL HEALTH IN INDIVIDUALS WITH CROWDING – CORRELATION ANALYSIS

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AIM: To evaluate the role of dental crowding as an aetiological factor for clinical identification of periodontal disease.
SUBJECTS AND METHOD: The degree of correlation between indices of dental plaque, bone resorption and periodontal health was investigated in 100 subjects aged 10 to 14 years with crowding. Gnathometric, clinical and dental tomography were used and stain tests were performed. The results were processed using Statistica 95 for Windows, applying a Student's *t*-test and Spearman Rank correlation analysis.
RESULTS: In the group with dental arch crowding there was a high correlation coefficient between dental plaque and the Ramfjord periodontal index (R = 0.65). Dental plaque and bone resorption had a very low correlation coefficient (R = 0.16).
CONCLUSION: Correlation analysis revealed that dental plaque manifests the pathological effect on the periodontium.

**142** EFFECTS OF REMOVABLE COMPARED WITH FIXED RETAINERS ON PERIODONTAL HEALTH

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AIM: To assess periodontal health among individuals with fixed and removable retainers after active orthodontic treatment.
SUBJECTS AND METHOD: Sixty individuals aged 12-16 years, of both sexes, 35 with removable and 25 with fixed retainers were subjected to periodontal health follow-up assessing plaque, gingivitis, calculus, probing depth, and attachment loss, on the facial and facial-mesial surfaces of the Ramfjord teeth at various time periods.
RESULTS: No significant intergroup differences were found for any of the variables. A comparable limited gingival inflammation was found in the presence of both types of retainers. Slightly more dental plaque was present on the lingual surfaces in the fixed retainer group. However, this did not result in more pronounced gingival inflammation than in the removable retainer group, within the evaluated period. In both groups, no signs of gingival inflammation or periodontal involvement were

found. In the group with lingual retainers, higher dental plaque values were observed 8 months after debonding.

**143** ASSESSMENT OF NASAL VOLUME CHANGES WITH TWO DIFFERENT METHODS

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AIM: To assess the increase in nasal volume after rapid maxillary expansion (RME) using two different methods.
SUBJECTS AND METHOD: Ten subjects (6 girls, 4 boys) with an average age of 12 to 14 years. The criteria for selection of subjects for RME were: maxillary transverse narrowness with bilateral crossbite and no history of nasal disease. Nasal volume was measured with acoustic rhinometry (AR) and computed tomography (CT), before treatment and at the end of the six month retention period.
RESULTS: There was a significant volume change between the periods with the two methods ($P < 0.05$). The differences between the two methods were, however, not significant.
CONCLUSION: Although patients are exposed to radiation, the sensitivity of CT makes it possible to identify hard and soft tissues in multiple, sequential, radiographic slices. However AR, which is a non-invasive, easy and economical method to measure volume, showed similar results to CT.

**144** EFFECTS OF SERIAL EXTRACTIONS ON CRANIOFACIAL GROWTH – A LONGITUDINAL STUDY

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AIM: To assess the effects of serial extraction treatment on craniofacial growth and to define the indications for this therapy.
SUBJECTS AND METHOD: Eighty-eight children with dental crowding treated by serial extractions and removable appliances (start of treatment: 9.6 years, duration of follow-up: 5.2 years). Two control groups: (1) 82 patients with anterior crowding, non-extraction therapy, duration 4.3 years, (2) 32 children with normal occlusion, no orthodontic therapy, duration the same as for the study group. Cephalometric analysis of lateral cephalograms: 1) Metric analysis of 41 cephalometric parameters and 2) Tensor analysis (Järvinen, 1987) evaluating 16 triangles. Statistical analysis was carried out using a *t*-test ($P < 0.05$).
RESULTS: The clockwise rotation of the mandible was significantly reduced in the study group. Maxillary growth in the sagittal dimension was not reduced during treatment either in the study or non-extraction group. Maxillary base length increased even more in the study group when compared with the non-extraction subjects. Retrusion of upper and lower incisors increased slightly in the extraction group.
CONCLUSION: Normal sagittal and vertical incisor relationships can be achieved early by means of exactly timed primary tooth extractions. This has a positive effect on the developing maxilla. A reduced clockwise rotation of the mandible was the main therapeutic effect. This should limit the indication for serial extraction treatment. Unfavourable side-effects, such as incisor retrusion, can be avoided by using additional therapy with removable appliances.

## 145 PRE-SURGICAL ORTHODONTIC TREATMENT OF NEWBORNS WITH CLEFT LIP, ALVEOLUS AND PALATE

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AIM: To assess the outcome of early orthodontic treatment in newborns with cleft lip, alveolus and palate (CLAP). Growth induced by functionally-orientated treatment should be analysed by evaluating cleft width and long-term stability of the results.
MATERIALS AND METHOD: Plaster casts of 19 patients with unilateral and 24 patients with bilateral total clefts were analysed. A Hotz plate was fitted in all newborns and adjusted every 3 weeks in the sagittal, transversal and vertical dimensions to help reduce the cleft width. Casts were taken prior to pre-surgical orthodontic treatment, at the end of early orthodontic treatment, and after eruption of all primary teeth. Thus, casts were obtained at approximately: 2 weeks, 1, 3 and 14 years of age. Reference points were marked on the casts to permit measurement of right and left dental arch width and length, cleft width and thus 'shift' of the lateral segments. The surfaces of the segments were measured planimetrically. The patients were re-examined at 14 years of age.
RESULTS: Alveolar cleft width decreased significantly in subjects with unilateral total clefts during pre-surgical orthodontic treatment. The cleft width in patients with bilateral total clefts was reduced by 30 per cent. Whilst cleft width decreased continuously, the anterior dental arch width remained stable and the lateral segments doubled in size. A further finding has been the notable reduction in extraction therapy in these patients following the introduction of this technique.
CONCLUSION: Stimulation of bone growth can only be achieved during the first 18 months of life in children with CLAP.

## 146 PREVALENCE OF SYMPTOMS OF DISTURBED DEVELOPMENT OF THE DENTITION

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AIM: Congenital hypodontia is one of the most frequent anomalies of the human dentition. Several symptoms are considered to indicate a predisposition to congenital hypodontia. The aim of the present study was to examine the prevalence of such symptoms in a group of patients undergoing orthodontic treatment.
MATERIALS AND METHOD: The panoramic radiographs of 968 patients were evaluated. Each radiograph was examined for nine characteristic symptoms: absence of tooth buds, delayed mineralisation of tooth buds, hyperdontia, atypical position of tooth buds, microdontia, displaced teeth, taurodontism, increased distance between molar buds (only for permanent teeth) and infraposition of the primary molars.
RESULTS: Three hundred patients (31%) were found to have one or more symptoms of a disturbed development of the dentition. The most frequent symptoms were atypical position of tooth buds (15.5%), displaced teeth (10%) and the absence of buds for permanent teeth (7.5%). Seventy-two per cent of the patients had only one symptom and 28 per cent two or more. Displaced teeth were associated more frequently than aplasia with other symptoms. All other symptoms were found significantly ($P < 0.05$) more often in patients with than in those without displaced teeth.

CONCLUSIONS: The initial detection of symptoms of a disturbed development of the dentition suggests that further developmental disturbances are likely to be encountered to some degree. Early recognition of these symptoms allows early application of preventive orthodontic measures.

**147** LOWER ARCH TRANSVERSE DIMENSIONS AFTER CETLIN NON-EXTRACTION TREATMENT MECHANICS

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AIM: To retrospectively investigate changes in lower transverse arch dimensions arising from the use of Cetlin non-extraction treatment mechanics.
MATERIALS AND METHOD: Study models of 34 subjects were measured and data from the Michigan Growth Study was used as the controls. The purpose was to determine the effects of using Cetlin mechanics on the width and perimeter of the lower dental arch and to compare them with the changes expected from growth alone. Data were tested for normality using the normal curve histogram and the Shapiro-Wilks statistic. As not all variables were normal, hypothesis testing was by the non-parametric Mann-Whitney test. Measurement was by reflex metrograph. Reliability assessed using Dahlberg's method on six pairs of before and after models gave a method error of 0.215 mm.
RESULTS: The mean arch widths of the canine, premolars and first molar teeth increased after treatment, 1.45 sd 1.6 mm, by more than could be expected from growth, 0.75 sd 0.5 mm ($P$ = 0.008). The mean arch perimeter decreased after treatment with large standard deviation by less than occurred in the control group and was not significantly different from growth, $P$ = 0.053.

**148** TEMPOROMANDIBULAR JOINT DYSFUNCTION IN ORTHODONTICALLY TREATED AND UNTREATED YOUNG ADULTS

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AIM: The influence of orthodontic treatment on temporomandibular joint (TMJ) dysfunction is controversial. The aims of this study were to evaluate the possibility of using instrumental methods in the diagnosis of TMJ function in untreated patients with malocclusions before and after orthodontic treatment.
SUBJECTS AND METHOD: One hundred and thirty two subjects examined in two independent groups: group 1 before and group 2 after orthodontic treatment. The examination consisted of an interview, TMJ functional examination, static and dynamic occlusion examination and instrumental examination of joint function using ARCUS digma. The data from the clinical and instrumental examinations were statistically assessed using Pearson's Chi-square test.
RESULTS: Helkimo's clinical index: TMJ dysfunction was present in 76 per cent of group 1 and 45 per cent of group 2; instrumental examination: in group 1 dysfunction was 91 per cent and in group 2, 73 per cent. TMJ dysfunctions in both groups were diagnosed less than in the clinical examination. The discrepancy of characteristics was evaluated in both groups. Independence of the dysfunction, assessed clinically and instrumentally, was analysed separately for the two examined groups. The difference was statistically significantly similar in both groups ($P$ < 0.001). TMJ dysfunction occurred more frequently in group 1.

CONCLUSION: Instrumental examination may be helpful in the objective evaluation of TMJ function and is a valuable addition to clinical evaluation. Young adults with malocclusions and co-existing TMJ dysfunctions should be treated orthodontically.

**149** VERTICAL FACE HEIGHT AND RAPID PALATAL EXPANSION: A LONGITUDINAL STUDY

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AIM: To analyse the skeletal effects produced by rapid palatal expansion (RPE), provided by an original appliance to control some undesired secondary effects.
SUBJECTS AND METHOD: Thirty patients were treated by RPE. During therapy the appliance was supported by continuous use of posterior bite blocks, except at mealtimes. A second group of 30 subjects were treated with RPE without bite blocks. Various cephalometric variables were compared between the two groups at the 5 per cent level of significance.
RESULTS: Analysis of the cephalometric data showed that there were no significant variations of the skeletal vertical dimension; vertical stability on the sagittal plane was balanced by upward rotation of the occlusal plane and backward rotation of the bispinal plane relative to the Frankfort plane. Variation in the position of point A compared with the SN plane and basal class according to Steiner and Cervera, were negligible.
CONCLUSION: Posterior bite blocks can control undesired secondary effects caused by RPE.

**150** CHANGES OF OCCLUSAL CONTACT RELATIONSHIPS DURING THE RETENTION PERIOD

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AIM: Monthly investigation of occlusal contact changes during the first six months of the retention period.
SUBJECTS AND METHOD: Fifty-two subjects with an Angle Class I and/or Class II molar relationship, treated with the straightwire appliance technique. Four groups were composed according to the type of retention appliance (Hawley and Osamu) and extraction or non-extraction: group 1 (13 subjects, average chronological age 181 months), Hawley extraction cases; group 2 (14 subjects, average chronological age 190 months), Hawley non-extraction cases; group 3 (14 subjects, average chronological age 203 months), Osamu extraction cases; group 4 (11 subjects, average chronological age 193 months), Osamu non-extraction cases. During monthly visits the occlusal records were obtained with silicon based impression material. Variance analysis was used for statistical evaluation of the occlusal contact changes.
RESULTS: There was no statistically significant difference in occlusal contact points in any group during the six-month observation period. Comparison of occlusal contact changes between the groups also did not show any significant difference.
CONCLUSION: The type of orthodontic treatment, whether extraction or non-extraction, and the type of retention appliance did not demonstrate any effect on changes in occlusal contact relationships.

## 151 CHANGES IN THE GINGIVAL MARGIN DURING PROTRUSION OF THE UPPER INCISORS

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AIM: Evaluation of gingival margin change (GMC) of the upper incisors and correlation with the amount of incisor protrusion.
SUBJECTS AND METHOD: Twenty subjects (average age 155.17 months) with Angle Class I occlusion and mild anterior crowding. Crowding was resolved with incisor protrusion. Elastics and stripping were not used during treatment (16.55 months). To evaluate GMC, the distance between the incisal edge and gingival margin was measured. As comparison of right and left centrals and right and left laterals did not show a significant difference, the study was carried out on 40 central and 40 lateral incisors. The amount of incisor protrusion was measured on photocopies of the casts. To observe the effect of lateral position on GMC, the subjects were divided into two groups. Group A consisted of 20 palatally located laterals and group B 20 normally positioned laterals, i.e., at the level of the centrals. For statistical analyses, Wilcoxon and the Mann-Whitney *U* tests were used.
RESULTS: The GMC of laterals (0.68 mm), protrusion of centrals (1.73 mm) and laterals (2.41 mm) were found to be significant ($P < 0.001$). GMC and the amount of lateral protrusion were found to be higher than that of the central ($P < 0.01$). Correlation between GMC and the amount of protrusion was not observed. GMC of the laterals did not demonstrate any significant difference between group A (0.75 mm) and group B (0.62 mm). The amount of lateral protrusion was found to be significant between group A (3.18 mm) and group B (1.65 mm) ($P < 0.001$).
CONCLUSION: Incisor protrusion affects GMC, particularly lateral GMC. A lateral position has no affect on GMC.

## 152 REPRODUCIBILITY OF SKELETAL MEASUREMENTS ON LATERAL CEPHALOGRAMS

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AIM: Lateral cephalometric radiographs have been used for examining dentofacial structures, nasal airway, and related areas. Although concerns have been raised concerning the precise measurement of hyoid position by cephalometric means, some authors believe that this lack of precision is exaggerated. The aim of this study was to evaluate the reproducibility of airway dimensions and tongue and hyoid position on lateral cephalometric radiographs.
MATERIALS AND METHOD: Lateral cephalograms of 15 female and 15 male patients (mean age: 20.4 years) were taken twice with a one-hour interval in the natural head position (NHP). NHP was determined with an inclinometer device outside of the cephalometry room and transferred to the cephalostat, again with the inclinometer. Twelve measurements including pharyngeal airway dimensions and tongue and hyoid position, were measured. The relationship between the first and second set of measurements were evaluated using a *t*-test and Dahlberg's method error formula.
RESULTS: No significant differences were found between the first and second set of measurements ($P > 0.05$). Method error values ranged between 0.52 mm (soft palate width) and 2.16 mm (horizontal distance of hyoid bone to retrognathion). The average method error value was 1.22 mm.

CONCLUSION: Within the limitations of this study, the results suggest that airway dimension and tongue and hyoid position measurements are highly reproducible on NHP cephalograms.

**153** EFFECT OF LIGHT SOURCE ON THE DEGREE OF CONVERSION OF LINGUAL RETAINER ADHESIVES

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AIM: To evaluate the degree of conversion (DC) of two lingual retainer adhesives, Transbond Lingual Retainer (TLR, 3M Unitek) and Light Cure Retainer (LCR, Reliance), cured with a fast halogen, plasma arc or light emitting diode (LED) at various curing times. A conventional halogen light served as the control.
MATERIALS AND METHOD: One hundred adhesive samples were cured for 5, 10 or 15 seconds with the fast halogen, for 3, 6 or 9 seconds with the plasma arc, or for 10, 20 or 40 seconds with the LED. The samples cured for 40 seconds with a conventional halogen were used as the controls. Absorbance peaks were recorded using Fourier transform infrared spectroscopy. DC data were subjected to Kruskal-Wallis and Mann-Whitney tests.
RESULTS: For TLR, the highest DC values were achieved in 6 and 9 seconds with the plasma arc. These were followed by curing with the fast halogen for 15 seconds and LED for 40 seconds. These light exposures yielded a statistically significantly higher DC than the controls. The highest DC value for the LCR was achieved with 15 seconds fast halogen curing followed by 6 seconds plasma arc curing. These two combinations produced statistically significantly higher DC compared with the controls. The lowest DC for LCR was achieved with 10 seconds of LED curing. The overall DC of the LCR was significantly higher than that of the TLR.
CONCLUSION: A similar or higher DC than the control values could be achieved in 6-9 seconds with the plasma arc, in 10-15 seconds with the fast halogen or in 20 seconds with the LED.

**154** SKELETAL AND FUNCTIONAL EFFECTS OF SYMPHYSEAL DISTRACTION AND RAPID MAXILLARY EXPANSION

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AIM: To evaluate the effects of symphyseal distraction osteogenesis (SDO) followed by rapid maxillary expansion (RME) on pharyngeal and nasal airway dimensions, and tongue and hyoid position.
MATERIALS AND METHOD: Lateral and postero-anterior cephalometric radiographs of 13 females and seven males (mean age: 20.1 ± 2.1 years). The records were taken before treatment (T1), after distraction (T2), after RME (T3) and 16 months after completion of SDO (T4). SDO was performed with a tooth and bone-borne custom made device. RME was carried out with a full coverage acrylic bonded device. The average amount of mandibular and maxillary expansion was 8.1 ± 1.8 and 5.4 ± 2.1 mm, respectively.
RESULTS: No significant pharyngeal or transverse nasal airway changes occurred with SDO only. However, tongue length was significantly decreased with SDO. RME produced no significant changes in nasal airway dimensions. However, a

combination of the two treatment modalities resulted in a decrease in vertical airway length and elevation of the hyoid bone.
CONCLUSION: SDO alone does not significantly affect pharyngeal airway dimensions or hyoid position in adult patients, while SDO followed by RME causes significant enlargement of the oropharynx, a decrease in tongue and vertical airway length and an elevated hyoid bone.

**155** RELATIONSHIP BETWEEN DENTAL AND SKELETAL MATURITY IN TURKISH SUBJECTS

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AIM: To investigate the relationships between the stages of calcification of various teeth and skeletal maturity among Turkish subjects.
MATERIALS AND METHOD: Dental panoramic and hand-wrist radiographs of 500 subjects (215 males, 285 females). Calcification of the mandibular canines, first and second premolars, and second and third molars was rated according to the system of Demirjian. To evaluate the stage of skeletal maturation of each hand-wrist radiograph, nine ossification events were assessed according to the systems of Björk, and Grave and Brown. Statistically significant relationships were determined between dental calcification and skeletal maturity stages using Spearman rank-order correlation coefficients.
RESULTS: Correlations between dental development and skeletal maturity ranged from 0.490 to 0.826 for females and 0.414 to 0.706 for males ($P < 0.01$). The second molar showed the highest correlation, and the third molar the lowest correlation for female and male subjects. For both sexes, root formation of the canine as well as the first premolar was completed in the majority of the subjects at the MP3cap, PP1cap, and Rcap stages.
CONCLUSION: Because of the high correlation coefficients, assessment of tooth calcification stages from panoramic radiographs might be clinically useful as a maturity indicator of the pubertal growth period. It is appropriate to put these skeletal and dental maturation relationships into daily orthodontic diagnostic practice when treating a patient of Turkish origin.

**156** COMPARISON OF EXTRACTION TREATMENT ON SOFT TISSUE MEASUREMENTS IN CLASS I AND CLASS II SUBJECTS

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AIMS: To compare the changes in soft tissue measurements of orthodontic patients treated with extraction of four first premolars in Class I and extraction of two upper first premolars in Class II division 1 subjects, to identify possible gender differences between pre- and post-treatment values in both groups, and to compare post-treatment values of Class I and Class II extraction groups with soft tissue Turkish norms.
SUBJECTS AND METHOD: Thirty-eight Class I patients (12 boys, 26 girls) with a mean age of 17.07 ± 1.08 years, and 32 Class II division 1 subjects (15 boys, 17 girls) with a mean age of 17.00 ± 1.06 years. Lateral cephalograms of all patients were evaluated pre- and post-treatment.
RESULTS: Comparison of the two groups showed that there were statistically significant differences in the measurements of soft tissue subnasale to H line and H

angle ($P < 0.05$). The difference between the means of the pre- and post-treatment measurements of these two parameters was high in the Class II extraction group. In the Class II extraction group, statistically significant differences were found in nose prominence ($P < 0.01$) and H angle ($P < 0.05$), with greater differences in H angle for male patients. Comparison of the post-treatment values with Turkish norms showed that six measurements for the Class I and four for the Class II extraction group were statistically different. The subjects in this sample commenced treatment with a greater facial imbalance but their facial aesthetics improved during treatment.

**157** CEPHALOMETRIC COMPARISON OF ANCIENT AND CONTEMPORARY ANATOLIAN POPULATIONS

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AIM: There have been a limited number of paleocephalometric studies on Anatolian populations. Therefore, the aim of this investigation was to compare cephalometrically the facial skeletal norms of the 13th century Anatolian population with the contemporary Anatolian population.
MATERIALS AND METHOD: Lateral cephalograms of the skulls of 25 adults from the late Roman period were investigated and the cephalometric data were compared with that generated from 25 contemporary Anatolian adults. The skulls had been previously excavated at the Roman Amphitheatre in Iznik (Nicea).
RESULTS: Statistically significant differences ($P < 0.001$) were found in Cc-Na (mm), Xi-Pm (mm), NaPog/FH (º), NaPog-A (mm) and NaPog/FH (º) ($P < 0.01$), and ANS-Xi-Pm (º) ($P < 0.05$). There was no significant difference in dental measurements.
CONCLUSION: The 13th century Iznik population had more protrusive and brachyfacial features compared with the contemporary population.

**158** ORTHODONTIC TREATMENT NEED FROM 8 TO 15 YEARS OF AGE IN A FINNISH PUBLIC HEALTH CARE SYSTEM

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AIM: To study changes in orthodontic treatment need during growth and dental development, and to evaluate the long-term effect of early orthodontic intervention on treatment need.
SUBJECTS AND METHOD: All children born in 1987 in one rural geographic area of Finland. At the beginning of the study the subjects (n = 87) were 8 years old (mean 8.3, SD 0.35), and at the last examination their age was 15 years (mean 15.4, SD 0.28). Treatment need was assessed on study models using a modification of the Dental Health Component (DHC) of the Index of Orthodontic Treatment Need. After the first examination, interceptive treatment was started in subjects with DHC scores 4-5 (definite treatment need), if their malocclusion was considered to benefit from early treatment. No multibonded appliances were used before 12 years of age.
RESULTS: The number of subjects with DHC scores 4-5 reduced from 29 (33%) at 8 years of age, to nine (10.5%) at 15 years of age. After the 8-year examination, interceptive treatment was started on 26 of the 29 subjects with DHC 4-5. At the 15-year examination, 38 subjects (44%) had received treatment with some active

orthodontic appliance. At 8 years of age, 38 children presented with DHC score 1 or 2 (no treatment need), and 27 of them (77.1%) scored similarly at 15 years of age, while three subjects had changed to DHC score 4-5.
CONCLUSIONS: Early treatment may effectively reduce orthodontic treatment need in the permanent dentition.

## 159 AGE-DEPENDENT CEPHALOMETRIC STANDARDS FOR CAUCASIANS BY MULTILEVEL MODELLING

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AIM: To construct age-dependent cephalometric standards for Caucasians using three longitudinal cephalometric craniofacial data sets.
MATERIALS AND METHOD: The longitudinal cephalometric craniofacial databases included the Fels longitudinal, and the Michigan and Nijmegen growth studies. To create the standards, the sample size should be as large as possible; so if there are no significant differences between the three data sets the data could be pooled to form one large data set to form the Caucasian standards. The three databases, which contained a total of 242 boys and 232 girls in the same age period from 9 to 14 years, were analysed to find sample differences. The three samples were compared for a set of four craniofacial angular cephalometric measurements: SNA, SNB, ANB and SN-GoMe. Statistical analysis using multilevel modelling was carried out.
RESULTS: The sample differences were statistically significant for six growth velocities and one size measurement for girls and five growth velocities and two size measurements for boys between some of the samples. Pooling of the three data sets for some of the craniofacial angular cephalometric measurements cannot be recommended, but the clinical relevance of these differences has to be determined.

## 160 A COMPUTED TOMOGRAPHIC SCAN IMAGING STUDY EVALUATING THE INSERTION SITES IN THE PALATUM DURUM

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AIM: Primary stability of an orthodontic implant anchor requires a surgical condition with complete and intimate circumferential contact between the implant and the bony site. To evaluate the ossification of the sutura palatina mediana in patients using computed tomography (CT), in order to improve the currently available tools for insertion of an orthodontic implant anchor.
MATERIAL AND METHOD: One hundred CT scans of the head, performed for a variety of diagnostic purposes, were collected at random. A reconstruction programme was used to analyse the images. These were divided into three groups: group I consisted of growing patients (n = 33); group II young adults (n = 25) and group III adults > 40 years (n = 42). Seven consecutive measurements were carried out in the mid and lateral palatal region.
RESULTS: In the growing group the mean height of the bone at the SPM was 4.79 mm (spread 3.0-5.6), and at the lateral region 6.89 mm (5.6-7.5) and 8.61 mm (7.5-9.1), respectively. For the young adults the bone at the SPM measured 4.93 mm (2.9-5.4) and lateral 10.6 mm (9.2-10.8) and 9.8 mm (7.3-10.6), respectively. In group III

the measurements were not consistent because of the wide age range and the loss of teeth.
CONCLUSIONS: The bone level in the parasagittal area was significantly higher ($P < 0.01$) compared with the mid palatal region. Bone height in these regions increases with age, unless there is loss of teeth, and as such is a preferable area for implant insertion.

## 161 IMPLANT ANCHORED-MOLAR DISTALISATION: CLINICAL AND RADIOLOGICAL OBSERVATIONS

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AIM: To analyse clinical and radiological effects of an implant anchor distaliser (IAD) for distalisation in growing patients and adults.
SUBJECTS AND METHOD: Fifteen patients (11 females, 4 males) between 12 and 43 years of age (minimum: 18 years) with a Class II molar relationship in whom an OIA (Orthosystem, Straumann, Switzerland) was placed mid- or parasagittally. The IAD was inserted after 10 weeks (± 2 weeks). Type I (n = 5) consisted of bands on the molars, and tubes. For Type II (n = 10), an additional transpalatal arch was added. The direction of force of the IAD was placed at the level of the trifurcation to provide bodily movement. At the end of distalization the IAD was left in place to deliver perfect anchorage for sliding mechanics to retract the anterior section.
RESULTS: Class II correction occurred within 6 to 12 months. The mean amount of distalization was greater with type II, probably due to the frictionless design of the IAD. Control of transverse dimension was maintained with both types, whereas 'round tripping' was absent. Radiographic analysis showed a mean distalisation of 3.03 mm at the first molar. After 6 months of active treatment a slight reduction of the ANB angle of 1 degree was noticed in seven patients. The inclination of the anterior teeth remained unchanged in six patients, seven showed a decrease, and two an increase. Transversal control was better with the Type II IAD. The SN-MP angle remained the same or diminished slightly.
CONCLUSION: Both appliances were shown to be capable of distalising molars. No mandibular posterior rotation was observed.

## 162 IS MANDIBULAR GROWTH PREDICTION RELIABLE?

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AIM: To answer the question whether or not a predicted hyper- or hypodivergent growth pattern in orthodontic patients actually takes place.
MATERIALS AND METHOD: Lateral head films from 106 orthodontically treated subjects, exhibiting either a hyperdivergent (ML/NSL >38°; n = 79) or a hypodivergent (ML/NSL <26°; n = 27) skeletofacial morphology, were evaluated considering the changes in the ML/NSL angle. To assess whether or not the predicted growth rotation occurred, head films from before (T1) and after (T2) treatment as well as after retention (T3) were analysed
RESULTS: For the hyperdivergent subjects the average pre-treatment ML/NSL angle was 41.4 degrees and it remained relatively stable during treatment (T2: 41.7°) and during retention (T3: 41.3°). During the total observation period (T3-T1) the ML/NSL angle did not change to a clinically significant degree in 20 (25%) of the 79

subjects, it decreased in 35 (44%) and increased in 24 (30%). For the hypodivergent subjects the average pre-treatment ML/NSL angle was 23.4 degrees, which decreased during treatment (T2: 22.8°) and during retention (T3: 22.1°). During the total observation period (T3-T1) the ML/NSL angle did not change to a clinically significant degree in six (22%) of the 27 subjects, it decreased in 17 (63 per cent) and increased in four (15%).
CONCLUSION: Mandibular growth prediction was more reliable in hypo- than in hyperdivergent subjects.

**163** PRINCIPLES OF INTRAORAL MONITORING OF ORAL FUNCTIONS

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AIM: It has been proposed that many children habitually swallow incorrectly and that if this could be addressed early in the child's development a more normal growth pattern may be established. This study aims to present the findings of an intraoral monitoring system (SensOral), designed to analyse tongue position.
SUBJECTS AND METHOD: Two subjects with an anterior open bite were evaluated. Miniaturized sensors were integrated into a maxillary thermoplastic appliance, from which the data was transferred to a hand-held computer using photosensors, light emitting diodes (LED) and thermosensors. The following parameters were assessed: distance and movement of the tongue to palate (photosensor); mouth opened or closed (photo sensor) and oral or nasal breathing (thermosensor). Tongue position was analysed by reflection of pulsed light signals from the LED monitor. Four sensors identified the distance between tongue and palate. In addition, the following oral functions were assessed e.g. mouth opening, mouth breathing and tongue movement. A nose-clip with a thermosensor identified nasal breathing.
RESULTS: The intraoral system described permitted comfortable monitoring of tongue position.
CONCLUSIONS: SensOral makes oral dysfunction easy to diagnose and in combination with feedback, is an effective tool to determine oral dysfunctions.

**164** AGE-RELATED CHANGES IN ADAPTABILITY AND STRUCTURE OF JAW MUSCLE SPINDLES

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AIM: Information on changes in muscle status resulting from orthodontic treatment is transmitted to the central nervous system via jaw muscle spindles. Adaptability of the muscle to accommodate itself to the new dimension depends partly on the integrity of this receptor throughout life. The present study aimed to investigate age-related changes in morphology and adaptive potential of the receptors.
MATERIALS AND METHOD: Muscle spindles of the temporal and masseter muscles from rats of various ages were investigated by transmission electron microscopy (TEM) and immunohistochemistry for growth associated protein GAP-43.
RESULTS: GAP-43, normally up-regulated in growing nerve fibres, rarely showed immunoreactivity in sensory nerve endings of fully developed muscle spindles in 10-week old rats. However, immunoreactions reappeared in the spindles of 12- and 18-month old rats, but disappeared again by 24 months where severe attrition of the

molars, and hence, a decrease in occlusal vertical dimension were noted. TEM observation revealed some structural changes in intrafusal muscle fibres of animals aged 12 months and above. The degree of degenerative/atrophic alterations increased with age and involved the nerve element by 24 months.
CONCLUSION: The adaptive potential of rat jaw muscle spindles, as judged by the expression of GAP-43 in nerve endings, is preserved until middle age, but diminishes in older animals. This is supported by the evidence that morphological abnormalities were confined to the muscle fibres and did not encroach on the nerve element until the very late stages of life.

**165** EVALUATION OF OCCLUSION IN 5-YEAR-OLD CHILDREN WITH A COMPLETE UNILATERAL CLEFT PALATE

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AIM: Growth and development of the face in children with cleft palates depends on the cleft and inborn growth types on the one hand, and on the other, the type of surgical treatment. According to the studies by Atack, early treatment results may be estimated on the basis of occlusion even in 5-year-old children. In 1995 the surgical treatment scheme was changed in the Medical University of Gdansk. The aim of this work was to compare children operated on according to these two methods.
SUBJECTS AND METHOD: One hundred and seven 5-year-old children were investigated. The casts were divided into two groups: the first contained 56 casts of children operated on before 1995, and the second 51 casts of patients who had the later surgery. Two trained orthodontists assessed the occlusions using the 5-stage Goslon scale. The casts of the maxilla were then scanned with a three-dimensional scanner, and the scanned pictures were digitised with a specially designed program that measured the length and width of the dental arches, and the surface and curvature of the palate.
RESULTS: In the group treated using Scoog's method, 23.2 per cent children were graded 1 or 2, 26.8 per cent 3, and 50 per cent 4 or 5. The change in the surgical technique resulted in the following figures: 47 per cent children were graded 1 or 2, 33.2 per cent 3, and 19.8 per cent 4 or 5. In the Scoog's group a decrease in maxillary dental arch size was found, especially in the anterior segment.
CONCLUSION: Improved results were found following the modification in primary surgery.

**166** EXPRESSIONS OF VEGF, BMP-2 AND CBFA IN STATIN-INDUCED OSTEOGENESIS

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AIMS: To study the expressions of VEGF, BMP-2 and Cbfa1 in statin-induced osteogenesis.
MATERIALS AND METHOD: Thirty bone defects were created in the parietal bone of 15 New Zealand White rabbits. The rabbits were divided into statin (9) and collagen matrix (6) groups for further assessment. In the statin group, the defects were grafted with collagen matrix carriers mixed with statin solution. These rabbits were sacrificed on day 1, 2, 3 (2 rabbits), 4 (2 rabbits), 5 (2 rabbits) and 6 after surgery. In the collagen matrix group, the defects were grafted with collagen matrix carriers mixed with water for injection, sacrificed on day 1, 2, 3, 4, 5 and 6 after

surgery. The bone defects and surrounding tissues were prepared for histological assessment.
RESULTS: Immunolocalization studies on the defects grafted with statin showed VEGF was expressed on day 3 after surgery, BMP-2 on day 4, Cbfa1 on day 5 and new bone was formed on day 5. These events occurred one day earlier than those grafted with the carrier alone.
CONCLUSION: Statin both induced and accelerated bone formation locally. It triggered the early expression of growth factors that regulate angiogenesis, differentiation of bone cells and osteogenesis during osteoinduction.

**167** BIOLOGY OF STATIN-INDUCED OSTEOGENESIS

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AIMS: To study histologically, ultrastructurally, quantitatively, and immunologically the biology of statin-induced osteogenesis.
MATERIAL AND METHOD: Forty-five bone defects were created on the parietal bone of 24 New Zealand White rabbits. In the quantitative study, five defects were grafted with statin together with the carrier, five defects were left empty (passive control) and five defects were grafted with the carrier alone (active control). After 14 days, all rabbits were sacrificed and serial sections were histologically analysed. The passive control group showed no bone formation across the defects. Quantitative analysis on area of new bone formation was performed on 100 sections of the experimental and positive control groups using an image analyser.
RESULTS: In the experimental group new bone could be seen spanning across the defect. Three hundred and eighty per cent more new bone was formed in defects grafted with statin than those grafted with the carrier alone ($P < 0.001$). Immunolocalization studies on the early healing of the defects grafted with statin, showed that growth factor expression occurred one day earlier than those grafted with the carrier alone. Ultrastructurally, bone cells were identified in the newly formed bone.
CONCLUSIONS: Statin induces and accelerates bone formation locally. It triggers the early expression of growth factors that regulate osteogenesis.

**168** MEASUREMENT OF CANINE DISTALIZATION AND REACTIVE MOLAR MOVEMENT WITH A SYMMETROGRAPH

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AIM: Different methods can be used to determine the amount of canine and molar movement after canine distalization. This can be undertaken either indirectly by measuring photographs or photocopies of study models, or directly on study models with a symmetrograph. This study was performed to evaluate the symmetrograph while making direct measurements on study models.
MATERIALS AND METHOD: Study models and standardized lateral cephalometric radiographs of 16 patients treated with premolar extractions were taken at the start (T1) and after (T2) canine distalization. Study models were prepared so that the occlusal planes were parallel to the horizontal plane and the median raphes had a right angle with the rear base of the study models. Distal canine movement and mesial molar movement were measured by both the symmetrograph on the study models, and lateral cephalometric radiographs.

RESULTS: The rate of canine distalization measured on the study models with the symmetrograph was 5.2 ± 1.7 mm and 5.0 ± 1.2 mm for the upper and lower canines, respectively, and loss of molar anchorage was 0.6 ± 1.1 mm and 1.1 ± 1.1 mm for the upper and lower molars, respectively. There was no statistically significant difference between the symmetrograph and lateral cephalometric measurements.
CONCLUSION: Measurement of canine distalization and reactive molar movement directly on study models with the symmetrograph was carried out faster and as reliably as with indirect methods.

**169** A COMPARATIVE STUDY OF THE EFFECTS OF AN ACTIVATOR VERSUS A TWIN BLOCK APPLIANCE IN SKELETAL CLASS II SUBJECTS

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AIM: To compare the activator and Twin Block appliance in the treatment of subjects with a skeletal Class II division 1 malocclusion.
SUBJECTS AND METHOD: The subjects were 10-14 years of age with a skeletal Class II malocclusion divided into two groups. The first group comprised 18 subjects (8 boys, 10 girls) treated with an activator and the second 22 subjects (10 boys, 12 girls) treated with a Twin Block appliance. Lateral cephalograms were obtained before and after treatment. All the subjects were treated to a Class I dental relationship, although the mean treatment time varied among the groups. SNA, SNB, ANB, 1 to SN, mandibular length (ANS-PNS) and upper anterior face height to lower anterior face height were measured and compared by *t*-test.
RESULTS: Comparison of the treatment results revealed that both appliances were effective in the treatment of Class II malocclusions. Both functional appliances stimulated growth of the lower jaw and correction of the Angle Class II relationship. In both groups SNB, mandibular length and IMPA increased and 1 to SN, overjet, overbite and upper anterior face height to lower anterior face height decreased.
CONCLUSION: There was no difference in the skeletal and dental changes between the groups treated with an activator or a Twin Block appliance.