ABSTRACTS

OF POSTERS

EUROPEAN ORTHODONTIC SOCIETY

73rd Congress, Valencia 1997
9–14 June

1 THE DEVELOPMENT OF THE NASAL CAVITY IN CHILDREN WITH CLEFTS

I P Adamidis, M N Spyropoulos, G G Angelopoulos, Department of Orthodontics, Dental School of the University of Athens, Greece

AIM: To investigate the long-term development of the width and anterior height of the nasal cavity in children with clefts treated with a commonly used orthodontic and surgical protocol.
SUBJECTS: The experimental sample consisted of 48 Caucasians. More specifically four groups of patients were investigated:
Group A: Unilateral cleft palate, 11 subjects (3 males, 8 females).
Group B: Left unilateral cleft lip and cleft palate - 4 females.
Group C: Right unilateral cleft lip and cleft palate, 18 persons (9 males, 9 females).
Group D: Bilateral cleft lip and cleft palate, 15 persons (9 males, 6 females).
Nine more Caucasians (4 males, 5 females) exhibiting Class I malocclusions treated with the extraction of four premolars and matching the sample in age and sex served as the controls.
METHODS: All cleft children were treated with the same surgical and orthodontic protocol. Anteroposterior cephalometric radiographs were taken once before orthodontic treatment at the age of 7–11 years, and once after completion of treatment at the age of 12–16. Five landmarks on the anteroposterior cephalograms were identified from which 10 measurements, including the total height, the total width and the total surface area of the anterior nasal cavity were taken. Paired *t*-tests were performed.
RESULTS: The width of the anterior nasal cavity in patients with clefts was found to be larger than the controls at earlier ages but not later. The anterior height of the nasal cavity was smaller in patients with all types of clefts in both age groups. The developmental difference of the nasal cavity between cases with clefts and controls was more exaggerated in girls than in boys.
CONCLUSIONS: Children with clefts treated with a commonly used orthodontic/surgical protocol exhibit altered developmental potential of their nasal air cavity.

2 INCISOR AND PREMOLAR HYPODONTIA: EXCLUSION OF CANDIDATE GENES

S Arte, P Nieminen, S Pirinen, L Peltonen, I Thesleff, Institutes of Dentistry and Biotechnology, University of Helsinki and Department of Human Molecular Genetic, National Public Health Service, Helsinki, Finland

AIM: To find the gene or genes that cause incisor and premolar hypodontia.
SUBJECTS: Eight Finnish three-generation families where incisor–premolar hypodontia is inherited as an autosomal dominant trait with reduced penetrance.
METHODS: Gene mapping of hypodontia using linkage analysis method has been started. PCR-amplifiable microsatellite loci were analysed from the blood DNA of the family members. The LOD scores of hypodontia with microsatellites were estimated with the linkage package.
RESULTS: Gene expression in developing murine dental tissues, as well as experimental evidence, has suggested many genes as candidates that might cause hypodontia. Using amplifiable polymorphic marker loci, MSX1, MSX2, EGF, EGFR, FGF3, FGF4, 13MP-2, BMP-4 and DLX2 as candidate genes in eight Finnish families have been excluded. The pairwise LOD scores were less than –2 in all these cases. No linkage of hypodontia and microsatellites in the vicinity of other candidate genes has been found.
CONCLUSION: As part of the research into the development of teeth, we are interested to find the gene or genes that cause incisor and premolar hypodontia. Many candidate genes in eight Finnish three-generation families where hypodontia is inherited as an autosomal dominant trait have been excluded. A random search with a selection of microsatellites that are located with approximately 25 cM intervals in the human genome is being undertaken.

3 EVALUATION OF TREATMENT OUTCOME BY ORTHODONTIC SPECIALISTS

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KEYNOTE ADDRESS
This presentation reports an empirical study in which clinical instructors, in a US graduate training programme in orthodontics, retrospectively evaluated treatment outcome in 48 adolescent patients.
Five instructors independently evaluated the records of each patient. Based solely on the examination of the pre-treatment records, each clinician indicated his preference for extraction or non-extraction treatment and stipulated the reasons for this decision. Then, based on examination of the pre- and post-treatment records taken together, the clinicians ranked the cases, using study models, on the basis of quality of occlusal results from photographs of the final facial appearance and an overall estimation of the improvement during treatment based on all the records taken together.
The judges' reasons for their decisions will be discussed and the associations between qualitative clinician preferences and quantitative measurements on lateral cephalograms will be reported.

4 CORRECTION OF CLASS III MALOCCLUSION IN CHILDREN USING A FACE MASK

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AIM: To evaluate the short- and long-term effects of face mask therapy in the correction of Class III malocclusion due to maxillary retrognathism in the primary and early mixed dentition periods.

SUBJECTS AND METHODS: The sample comprised 29 consecutive patients (aged 4–11 years) with a Class III malocclusion due to a maxillary retrognathism and a negative overjet. The patients who presented with a pseudo-Class III were excluded from the study by clinical examination. All the patients were treated by the same orthodontist using a face mask with protraction forces exerted by elastics for 14–18 hours a day. Standardized lateral cephalometric radiographs were taken immediately before treatment (T0), at the end of treatment (T1) and at the end of the retention period (T2). The cephalometric skeletal and dental changes in a sagittal and in a vertical direction were calculated using linear and angular cephalometric measurements. Paired *t*-tests and graphs illustrating the individual changes were used to determine the differences between pre- and post-treatment, and post-treatment and follow-up.
RESULTS: The negative overjet was successfully corrected in all patients. Soft tissue convexity, ANB, AN–Pog and SNA statistically significantly increased during treatment ($P < 0.001$), but decreased in the follow-up period. The increase was larger the earlier the treatment was initiated. Correspondingly SN–Pog significantly decreased during treatment ($P < 0.001$) and caught up when the face mask was discontinued. These changes are related to an opening of the mandibular plane during treatment. The inclination of the upper incisors increased during treatment while the lower incisors were retroclined, and these changes continued after treatment.
CONCLUSIONS: Application of a face mask to children with a Class III malocclusion caused by maxillary retrognathism is an effective means to solve negative overjet and to normalize facial aesthetics. Improvement in facial convexity can, in part, be accounted for by an increase in the vertical dimension and changes in the sagittal jaw relationship, due to a retropositioning of the mandible and a forward displacement of the maxilla. The dental effect was limited. Changes in the neuromuscular pattern and young age at the start of treatment interact and were of importance for the long-term stability.

5 STANDARDIZED EVALUATION OF MAGNETIC RESONANCE IMAGES USING A METRIC TMJ-ANALYSIS

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AIM: Metric TMJ-analysis for standardized evaluation of magnetic resonance images (MRI) allows a quantitative assessment of the temporomandibular joint (TMJ) structures without the use of any contrast. For the orthodontic practitioner this analysis permits the adjustment of neutral occlusion by physiological relationship of the TMJ structures. Therefore, the objective of this paper is to demonstrate the measurement of the various variables of the metric TMJ-analysis and to provide 'normative values' for physiological joints.
MATERIALS AND METHODS: From a sample of 2816 MRIs of human TMJs, 115 (82 female, 33 male) were selected as 'physiological joints' after visual evaluation by at least two examiners. The selection process consisted of strict structural criteria for each MRI selected. The age of the patients was between 10 and 69 years (average 35.8 years). From all images, a metric analysis consisting of 31 reference points and 43 variables was performed. Subsequently eight clinically important variables were selected to describe each of the following relationships: 'disc position in relation to the fossa', 'condyle position in relation to the fossa' and 'disc position in relation to the condyle'. Based on the normative values and standard deviations, eight variables were placed in a specific norm value table (MRI-Box), which allows for an evaluation of the above-mentioned relationships. In addition, this MRI-analysis was applied to MRIs from clinically diagnosed cases with partial disc displacement, total disc displacement, disc repositioning with a splint, and joint remodelling during orthodontic treatment.
RESULTS: The results indicated that verification of disc, condyle and fossa relationships revealed a good correlation between predicted MRI diagnosis and clinical diagnosis.
CONCLUSION: This new MRI-analysis allows for an objective and reproducible evaluation of the relationships between condyle, disc and fossa. Moreover, the analysis is also capable of differentiating between the condyle or the disc as the potential cause for an anterior disc displacement.

6 DENTAL AESTHETICS—THE DENTOFACIAL PARAMETER

J Canut, Madrid, Spain

AIM: To correlate dental aesthetics with facial aesthetics in adolescent patients.
SUBJECTS AND METHODS: In order to determine the aesthetic relationship between denture position and facial harmony in successfully treated orthodontic adolescent patients, 100 subjects from the three Angle classes were selected, with particularly attention to the 'aesthetic facial triangle' (nose–denture–chin), and the upper denture position as related to the 'aesthetic sigma' (nasolabial area).
RESULTS: There seems to be a definite relationship between the degree of prominence of the denture and its aesthetic effect on the overall profile. Adult norms seem to be of doubtful value when analysing growing individuals.
CONCLUSIONS: From this study sample the following were observed: (i) Contemporary orthodontics requires correlation of the dental occlusion and tooth position with aesthetic harmony and balance of the face. (ii) Both the dental malocclusion and the concurrent aesthetics of the teeth should be analysed taking into consideration the effects on the facial profile. (iii) A new aesthetic dentofacial assessment for adolescent patients requiring orthodontic treatment will be presented.

7 MANDIBULAR HYPERPROPULSION AND SURGICAL PERIOSTEOMY IN ANIMALS: CONDYLAR CARTILAGE GROWTH ACTIVITY

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AIM: To elucidate the role played by the periosteum in regulating growth of the mandible, its condylar process and the condylar cartilage.
MATERIALS: Forty Sprague–Dawley growing rats.
METHODS: A bilateral surgical periosteomy around the neck of the condylar process was conducted in growing rats and a hyperpropulsion device was bonded onto the upper incisors in order to achieve an anterior repositioning of the mandible. The two procedures (surgery and appliance) were combined in group I in order to determine whether the experimental manipulation of the periosteal envelope surrounding the mandibular condylar process modifies, in a significant manner, growth in animals undergoing experimental mandibular hyperpropulsion. In group II only the surgical procedure was performed. In group III only the hyperpropulsion device was utilized. A fourth group (IV), in which only a bilateral sham surgery was performed, served as a control.
RESULTS: In each animal, a quantitative evaluation of the dimensional features of the layers forming the condylar cartilage was performed and cell counts were carried out for each layer, at the end of the first 2 weeks and 5 weeks of the experimental period. At the end of the first phase, no significant differences in dimensional features were found among groups and control groups cell count values were significantly greater. At the end of the second phase the hyperpropulsion-only group exhibited dimensional values significantly greater than the rest, whereas the surgery only group presented with the greater figures for the cell counts.
CONCLUSION: The results of our study indicate that the surgical manipulation of the periosteum induce a significant change in the growth parameters evaluated in animals under physiological or experimental conditions. Therefore, it is conceivable to support the notion that a correlation exists between the periosteal and the cartilaginous component in mandibular growth.

8 MOLAR DISTALIZATION WITH THE PENDULUM APPLIANCE IN CLASS II DIVISION 2 MALOCCLUSIONS

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KEYNOTE ADDRESS
AIM: To increase arch length and, at the same time, disengage the mandible with non-compliance appliances in uncooperative patients.
SUBJECTS AND METHODS: The Pendulum appliance was used to treat 12 patients with a mean age of 11.9 ± 2.1 years with a Class II division 2 malocclusion. All patients had a type B malocclusion according to van der Linden's classification and were treated non-extraction. After five months of active treatment the position of the upper first molars was evaluated on lateral cephalograms, orthopantomograms and occlusograms using Bjerklin and Kurol's criteria.
RESULTS: At the end of treatment the molars were in a Class I relationship. This result was obtained in all subjects by a distal tipping movement with a mean value of 30 degrees as assessed on the teleradiographs. There was a shortening of the 6 PTV distance of 3 ± 0.6 mm and a derotation of the first molars of 28 degrees.
CONCLUSIONS: The Pendulum appliance is very effective in the treatment of Class II division 2, type B malocclusions, especially in uncooperative patients. The increase in arch length was produced by maxillary molar distalisation that has a double component of distal tipping and disto-vestibular rotation, which is a factor that frequently accompanies Class II malocclusions.

9 DISTRIBUTION OF FACIAL TYPES AND MALOCCLUSIONS

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AIM: To determine the prevalence of facial types and malocclusions and their possible relationships
MATERIALS AND METHODS: The full records of 500 orthodontic patients were randomly selected. The only criterion for selection was full records of good quality. After full orthodontic diagnosis, each patient was classified according to facial type previously published and compared with the classification of facial types according to other authors. The Angle Class of malocclusion was established for each patient and the relationships with the facial types and subtypes according to several authors were studied.
RESULTS: Different methods of determining facial type show different results. They measure different facial characteristics. The prevalence of each malocclusion among each facial type varies depending on the method used. Some malocclusions are related to specific facial types, others are not. Relationships between malocclusions and facial subtypes are also evident and of great clinical interest. Within the same facial type and malocclusion, posterior facial height differentiates the indicated treatment planning
CONCLUSIONS: The distribution of facial types and subtypes is very irregular in the orthodontic population studied. Certain malocclusions are related to certain facial types and subtypes but unusual combinations are also possible and of great clinical significance. If there is no agreement in the determination of facial types then agreement cannot be reached on treatment planning, treatment results and retention.

10 AUTOTRANSPLANTATION OF PREMOLARS IN PATIENTS WITH MAXILLARY ALVEOLAR CLEFTS

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AIM: To evaluate tooth transplantation as a treatment modality in the rehabilitation of the anterior dentition of alveolar cleft patients.
SUBJECTS: Six patients, with previously bone-grafted clefts and autotransplanted developing premolars to the upper anterior region, were examined. The premolars were reshaped to incisor morphology using composite build-up (four teeth) and porcelain veneers (two teeth). For comparison, transplanted premolars (40) to the upper anterior segment in non-cleft patients were used.
METHODS: Clinical examination, dental casts, radiographs and photographs were obtained. The patient's opinion was recorded using questionnaires considering satisfaction with various aspects of the treatment result. For the professional aesthetic assessment, a scoring method was applied including both dental (six) and soft tissue (two) parameters. The cut-off values of this method were established from the non-cleft transplants. The association between professional assessment and patient opinion were analysed, as well as differences between cleft and non-cleft patients.
RESULTS: The clinical and radiological healing of the transplanted teeth was uneventful and there were no indications that their prognosis differed from those of transplanted teeth in general. The patients were generally satisfied with the transplanted teeth. Good dental conditions were obtained with acceptable aesthetics in the cleft region. The professional assessment of the restored areas was less satisfactory when compared with transplanted teeth in non-cleft patients because of somewhat poorer gingival conditions due to the scar tissue left after surgical closure of the cleft and the bone-grafting procedure. There was no association between patient's opinion and the professional assessment of the aesthetic result.
CONCLUSIONS: Autotransplantation of the premolars can be a valid method in patients with bone grafted maxillary alveolar clefts and missing upper incisors on specific indications. Transplanted teeth have a capacity to preserve continuity of the alveolar process and, after reshaping can serve as permanent restoration thus reducing the need for prosthodontic solutions.

11 THE VALUE OF THE CENTRE OF ROTATION IN THE DISPLACEMENT OF TOOTH AND BONE STRUCTURES

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AIM: To compare the position of the centre of rotation with the displacement vectors of the object (tooth or bone) after force application.
MATERIALS AND METHODS: Different experiments were carried out to improve the skull as a model for orthopaedic and orthodontic research. A total of 18 dogs were used and 200 measurements on tooth and bone displacement were carried out. The forces were applied on teeth and the maxilla of the dogs, resulting in orthodontic and orthopaedic movements. The bone and tooth displacements immediately after force application were very small, and limited to initial or primary movements. These initial displacements were measured by means of speckle interferometry, a laser measuring technique.
The longitudinal or secondary displacements representing the biological response of force application after a period of time were measured by superimposition of pre- and post-experimental radiographs. Due to the construction of the centres of rotation of these initial and longitudinal displacements, the different orthodontic and orthopaedic displacements can be evaluated.
RESULTS: The results of the different studies show that the measuring procedures to describe displacement using the centre of rotation are very sensitive. A large discrepancy in the position of the centre of rotation does not necessarily indicate a major change in the displacement of the object. A significant difference in the position of the centre of rotation can result in no difference when the displacement vectors of the tooth or bone are considered.
CONCLUSION: The use of the centre of rotation to describe a displacement can be confusing and a positional change in the centre of rotation demands an appropriate interpretation. Displacement vectors describe much better the initial displacement than the centres of rotation.

12 ATTITUDES TOWARDS FACIAL AESTHETICS AND FACIAL PROFILE AMONG VARIOUS ETHNIC GROUPS

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AIM: This study was designed to evaluate differences in conceptions of facial profile aesthetics in various ethnic groups living in multicultural societies.
SUBJECTS AND METHODS: Two hundred people, less than 30 years of age, of African, East Asian, Arabic, Mediterranean and Mid-European cultural and ethnic origin answered questions on their attitude towards orthodontic treatment, the importance of an aesthetic facial profile for them, and their choice of partners and colleagues. In addition they were asked to shape a pleasing male and female facial profile as well as an ugly face with a specially constructed profile demonstration device. Photographs were taken of the particular features and the images analysed by means of orthodontic soft tissue profile analyses.
RESULTS: There were great differences in the variability of all parameters. Ugly profiles obtained 3–4 times higher variances than beautiful profiles. Beauty seems to be identified around central average profile values. Male profiles

were shaped with more marked features, stronger convexities or concavities. The differences of aesthetic conception were more individual than based on cultural concepts of common origin.
CONCLUSION: If orthodontic treatment involves alteration of the facial profile, then the effects on and the wishes of the patient have to be regarded very individually, irrespective of ethnic origin and cultural background.

13 DENTAL AESTHETICS AND THE SPREAD OF EXCELLENCE

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KEYNOTE ADDRESS
Historically the perception of dental aesthetics as an essential element of the human face has been strongly under the influence of Edward H Angle, the father of modern orthodontics. From his work originate precise idealizations of occlusion and dental aesthetics. Present-day orthodontists are confronted with the ambivalence between these precise aesthetic concepts and the widespread biological variation of normal healthy dentitions.
Under the influence of unprecedented changes in the perception of the human body in Western civilisation, combined with fast developing medico-dental technology, the traditional perception of orthodontics as a health profession seems to have drifted towards one where the individual social environment and its cosmetic requirements primarily determine the treatment indication and result. Normal variation and normal ageing tend to become subjected to early and continuous treatment and care.
Available studies on the development of the dentition demonstrate that continuous positional changes to a variable degree normally occur in almost every dentition. There is, however, a lack of studies demonstrating long-term beneficial effects of treatment of minor malocclusions. This raises doubts if the development indicated above is to be encouraged. Developments in some countries with problems in the structure of social healthcare indicate that the strong emphasis on dental aesthetics may, as a side-effect, result in inaccessibility of proper care for those with handicapping malocclusions. The spread of excellence in orthodontics should, inasmuch as orthodontics is able: (i) provide adequate treatment for those with handicapping malocclusions and (ii) promote acceptance of normal variation and normal ageing of the dentition.

14 RELATIONSHIPS BETWEEN EXCITATION PATTERNS IN THE MASSETER MUSCLE BEFORE AND AFTER ORTHOGNATHIC SURGERY AND POST-OPERATIVE STABILITY

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AIM: To investigate the topographic changes in the electromyographic activity of the masseter muscle after combined orthodontic and surgical treatment in relation to post-operative stability.
SUBJECTS: Sixty-two adult patients participated in the study. Forty-two dysgnathic patients aged 21.2 years (SD = 3.5) were subjected to combined orthodontic and surgical treatment. Nineteen of the patients had a Class II malocclusion and 23 a Class III malocclusion. Twenty eugnathic adult patients aged 23.1 years (SD = 2.1) with a Class I occlusion served as controls.
METHODS: All patients had monopolar surface electromyograms of the masseter muscle taken prior to presurgical orthodontic treatment and after removal of their orthodontic appliance. Readings were based on simultaneous measurements from 16 electrodes during pressing, chewing and protrusion against a defined force. In patients with a Class II malocclusion advancement of the mandible was performed by a retromolar sagittal split osteotomy after Obwegeser–Dal Pont. In Class III cases bite correction comprised bimaxillary repositioning osteotomies after Le Fort of the maxilla and Obwegeser–Dal Pont procedure in the mandible.
RESULTS: Class II: No statistically significant correlations were found between post-operative stability and changes in the excitation pattern of the masseter muscle. Class III: The correction of a Class III malocclusion was more unstable than in Class II cases. Patients, especially those with a high pre-operative activity in the pars profunda and anterior part of masseter muscle, showed a post-operative relapse.
CONCLUSIONS: Electromyographic investigations enable the detection of risk factors for the post-operative stability of surgical bite correction. Class III cases with a predominance of presurgical activity of the pars profunda showed a post-operative instability. In such cases a surgical overcorrection of the malocclusion may be required. In addition long-term retention is necessary.

15 MANDIBULAR INCISOR EXTRACTION: INDICATIONS AND RESULTS

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AIM: To objectively record treatment outcome and changes in mandibular incisor position after extraction of one single incisor in adult orthodontic cases with combined Class III and open bite tendencies, and minor anterior crowding.
SUBJECTS: Twelve male and 19 female patients with an average age of 25.9 years (SD 12.7) at the start. Fixed 0.018 inch Edgewise appliances were used in both arches in 23 subjects and in the mandibular arch only in eight patients. Average treatment time was 17.8 months (SD 7.6). Pre-treatment ANB was 0.8 degrees (SD 1.0) overbite 1.3 mm (SD 1.0) and overjet 1.0 mm (SD 1.6). The lower incisors were 3.4 mm (SD 2.9) in front of the APog-plane, and the Irregularity Index was 1.1 mm (SD 0.6).
METHODS: Records, representing pre-treatment (T1), post treatment (T2), and minimum 2 years of retention (T3), included cephalograms, panoramic films, intra- and extra-oral photographs, and plaster models. The vertical position

of the lower incisors was assessed both according to McNamara (1985) and to Riedel *et al.* (1992). All cast measurements were made using digital calipers.
RESULTS: Most treatment results were clinically excellent or satisfactory. Interdental gingival recessions were largely avoided. On the cephalograms, the lower incisors moved posteriorly 1.8 mm (SD 2.2) and occlusally 1.5 mm (SD 1.9) from T1 to T2. Relative to the *x*-axis, they tipped lingually 5.6 degrees (SD 6.0). On the cast analysis, overbite increased 0.6 (SD 1.3) and 1.0 mm (SD 1.5) for the maxillary central and lateral incisors respectively. The intercanine width was reduced by 3.2 mm (SD 2.0), whereas the intermolar width was unchanged. The Irregularity Index was reduced from 1.1 to 0.2 mm. Arch-length was reduced 3.5 mm from T1 to T2, and another 0.5 mm from T2 to T3. Other changes from T2 to T3 were slight.
CONCLUSION: The extraction of one single mandibular incisor can lead to satisfactory treatment results in adult cases with a combined Class III and open bite tendency, particularly when coupled with a large intercanine width and some mandibular tooth size excess. However, the treatment times approached more conventional extraction therapy.

16 ULTRASTRUCTURE OF TISSUE REACTIONS AFTER CONTINUOUS INTRUSION IN HUMANS: AN INTRA-INDIVIDUAL STUDY

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AIM: Ultrastructural analysis of the cementum and periodontal ligament reaction after continuous intrusion with two different and controlled forces.
MATERIALS AND METHODS: Twelve first upper premolars (stage 10 of Nolla), orthodontically indicated for extraction from six patients (13–16 years of age), were divided into three experimental groups, distributed intra-individually as follows: control (not moved), continuously intruded for 4 weeks with 50 or 100 cN force. This utilized a precise biomechanical model with superelastic wires (NiTi–Se), which were developed and calibrated individually. The teeth were extracted, fixed, decalcified and conventionally prepared for examination in a Jeol 100 CXII transmission electron microscope.
RESULTS: Evident signs of degeneration of cell structures, vascular components and extracellular matrix of cementum and periodontal ligament were observed in both forms of intrusion, with more severity in the apical direction and in proportion to the magnitude of force applied. Resorptive areas and an irregular root surface of the intruded teeth were noticed according to the same pattern described above. Although the magnitude of force remained the same throughout the experimental period, areas of repair were also revealed in the cementum and periodontal ligament of the continuously intruded teeth.
CONCLUSION: Major reorganization in the histophysiological pattern of the cementum and periodontal ligament was induced by application of continuous intrusive forces, exhibiting clear signs of regeneration even with the maintenance of the force levels applied.

Grant from FAPESP no. 95/5024–5.

17 ANALYSIS OF UPPER PERMANENT CANINE ERUPTION

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AIM: To determine the normal eruptive pattern of the permanent upper canine.
MATERIALS: Five hundred and fifty-four maxillary canines in the oral pre-emergence phase of eruption were analysed from the panoramic radiographic records of 305 children aged 4–12 years.
METHODS: The variables studied were sex and age, inclination of the canine (CI), relation of the canine to the lateral incisor (RCLI) and development of the lateral incisor (DLI). CI was measured as a reference line passing through both suborbital points. RCLI was recorded as 'distal' or 'mesial', the later when the two teeth were overlapping. DLI was recorded as 'incomplete' or 'complete'. The data were statistically analysed and the method error measured.
RESULTS: The upper canine erupts increasing its inclination mesially until a maximum point is reached, at about 9 years of age, from which time the tooth begins to progressively upright. The RCLI is most frequently overlapping in the initial stages of canine eruption, and distal in the final stages. The DLI effectively discriminates both periods, for when DLI is incomplete more than half of cases present a mesial RCLI, even among the oldest subjects. In contrast, when DLI is complete, the overlapping image is seen in only 7–11 per cent of cases.
CONCLUSION: The overlapping relationship of the canine to the lateral incisor on panoramic radiographs when the incisor has completed its development may be a sign of eruptive disorders of the canine, indicating the adoption of preventive measures to avoid impaction (e.g. extraction of the primary canine). This advice is particularly applicable when the overlapping situation is associated with other signs, such as the inability to palpate the canine bulge, dental malformations, agenesis, ankylosis or ectopic eruptions.

18 ORTHODONTIC FORCES ON OSSEOINTEGRATED IMPLANTS IN THE RABBIT—A HISTOLOGICAL STUDY

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AIMS: Osseointegrated implants can constitute valid anchorage during the application of orthodontic forces. This study was designed to confirm their efficacy, assessing the

peri-implant bone modifications occurring as a consequence of the application of forces. An attempt was also made to evaluate the optimal timing for applying forces after performing the surgical positioning of the implants.

MATERIALS AND METHODS: Forty titanium screw implants were positioned 15 mm apart on the calvarium of 16 rabbits (five animals had two implants, ten had three, and one animal was used as a control). When osseointegration was achieved, two and a half months after the surgical procedure and application of the abutment, an attempt was made to distalize the implants with NiTi coil springs, supported by a segment of orthodontic wire, applying a continuous force of 150 g for 21 days (group A), 60 (group B) and 120 (group C), respectively in the three groups of rabbits. Terramicin first and alizarin were injected into each animal in the three groups, to mark the various phases of bone modification. Ten days after the last injection the animals were killed, and block-sections, including the implants and peri-implant bone tissue, were carried obtained.

RESULTS AND CONCLUSIONS: Good clinical stability was obtained and the distance between the implants where force was applied and the controls remained unchanged. Spectroscopic analysis showed that the mineralization (Ca and P) in group B was similar to normal bone, with slightly higher values (0.7–1 per cent) on the compression side compared with the tension side. In group C there was no difference between the two sides, with a slight increase in Ca and P. Optical neuroscopic examination showed progressive and rapid maturation of bone tissue on the compression side. This side was always poorer in osteogenic tissue from group A to B to reach the 120 days when the characteristics of mature bone tissue were present with clearly defined lamellae, parallel to the implant, and Haversian canals. The tension side, however, was rich in medullar spaces, also in direct contact with the implant. The results would seem to suggest that adequate orthodontic stresses and carefully applied forces might facilitate bone maturation in the implant area, thus possibly reducing treatment time when the use of implants to support anchorage are needed.

19 SHAPE-COORDINATE ANALYSIS OF SKELETAL CHANGES INDUCED BY FACE MASK THERAPY

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AIM: To evaluate maxillary and mandibular shape/size changes by means of Bookstein's shape-coordinate and tensor analyses in Class III children treated with rapid maxillary expansion (RME) and face mask, in order to define optimum timing for this type of therapy.

SUBJECTS: The treated group (TG, 46 subjects: 26 females and 20 males) was divided into two subgroups according to the stage of dental development. The early-treated group (ETG) consisted of 23 subjects treated in the early mixed dentition (mean age at time 1, 6 years 9 months ± 7 months); the late-treated group (LTG) included 23 subjects treated in the late mixed dentition (mean age at time 1, 10 years 3 months ± 1 year). The mean treatment period was about 11 months. Control group (CG, 32 subjects with untreated Class III malocclusion: 18 females and 14 males) was also divided into two subgroups (early control group, ECG, 17 subjects in the early mixed dentition, and late control group, LCG, 15 subjects in the late mixed dentition). Control groups matched treated groups as to race, stage of dental development, Class III occlusal and skeletal signs at time 1, gender distribution, age at times 1 and 2, and observation period.

METHODS: Maxillary triangles (point T, the most superior point of the anterior wall of sella turcica, point FMN, the fronto-maxillary-nasal suture, and point A) and mandibular triangles (point condylion, point gonion, and point pogonion) were digitized on cephalograms in both groups at times 1 and 2. Shape-coordinate changes for point A using T–FM–N as baseline and for point Co using Go–Pg as baseline were calculated, tensor analysis was performed, and centroid size changes were analysed (Hotelling t^2 and F-statistics, $P < 0.05$).

RESULTS: As to shape changes, face mask and RME therapy was able to produce a significant enhancement of the forward growth of the maxilla and a significantly more upward-forward direction of growth of the mandibular condyle (leading to smaller increments in mandibular total length Co–Pg) in the early-treated group when compared with controls and to the late-treated group. Both maxillary size and mandibular size were significantly affected by treatment in the early mixed dentition.

CONCLUSIONS: Orthopaedic treatment of Class III malocclusion is able to induce favourable size and shape changes both in the maxilla and in the mandible and is more effective in the early than in the late mixed dentition.

The authors wish to thank Professor J A McNamara who provided treated cases for the study.

20 LONGITUDINAL PERIOPERATIVE MESIAL FORCE EVALUATION AFTER THIRD MOLAR REMOVAL

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AIM: Measurement of the mesial force before and after surgical removal of the third molars over a period of one year in comparison with a non-treated control group. Control of the reproducibility and validity of the used measurement technique in a human specimen.

MATERIALS: One human specimen; 44 adult patients; control group 40 adults.

METHODS: The technique used to assess the mesial force was based on the measurement of the interdental frictional force in complete dentitions. A 0.04 mm thick stainless steel strip, 5 mm wide and 15 mm long, was slipped between the canine, premolars and molars in order to measure the frictional force with a mechanical tension gauge. In the specimen the correlation between interdental frictional force, a distally applied force of 1–5 N and the influence of an

angulated (1–35 degrees) steel strip was evaluated. In the patient group the interdental force was measured in four interdental spaces before and 1, 2, 3, 7, 12 weeks and 1 year after removal of the third molars on both sides of the upper and lower arch. Additional clinical and radiological criteria were investigated. In the control group the influence of 5 minutes chewing and 60 minute placement in a supine position at the level of interdental frictional forces were assessed.
RESULTS: In the specimen the interdental frictional force correlated significantly to the distally applied force. An angulated steel strip of greater than 15 degrees had a significant influence on the measurements. The validity and reproducibility of the measurement technique used to assess the mesial force was acceptable for the clinical investigation. After removal of the third molars the interdental force levels were reduced on average in the upper dental arch about 16.1 per cent, and in the lower about 18.0 per cent. One year after removal the reduction of the interdental force level in the upper dental arch was approximately 10.3 per cent, and in the lower about 10.9 per cent could be evaluated. In cases with mesially angulated third molars a reduction of the force level about 40.7 per cent after removal and about 27.4 per cent one year later could be measured. In the control groups, after 5 minutes chewing, a reduction of the frictional force level of 12.4 per cent and after 60 minutes in a supine position a reduction of 18.1 per cent could be evaluated.
CONCLUSION: The longitudinal reduction of the mesial force level after removal of third molars is extremely variable between individuals. A general indication to remove all third molars in order to reduce the mesial force level and to avoid frontal crowding is not advisable.

21 PALATAL GROWTH IN BCLP FROM BIRTH UNTIL 4 YEARS OF AGE

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AIM: To study longitudinal palatal growth in children with a complete bilateral cleft lip and palate (BCLP) as compared with a non-cleft control group during the first 4 years of life.
SUBJECTS: The sample consisted of 26 boys with a complete bilateral cleft lip and palate from the Cleft Palate Centre of Nijmegen, which was compared with 34 non-cleft boys from Amsterdam at 12 fixed time intervals. All children in the BCLP group received presurgical orthopaedic treatment prior to lip repair. Lip closure was performed at a mean age of 7 months, and soft palate closure at 12 months.
METHODS: Dental casts from birth until 4 years of age were digitized and palatal arch dimensions were calculated. Medians with percentiles P25 and P75 were computed for each age. The Mann–Whitney test was applied to identify differences between the two groups.
RESULTS: At birth anterior and posterior arch widths as well as arch depth were significantly larger in BCLP. After 7 months (time of lip closure) anterior arch width and arch depth diminished considerably in the cleft group. After 12 months of age (time of palatoplasty) a small decrease in posterior arch width was observed. Arch depths showed a slight catch-up in growth. At 4 years of age anterior arch width was significantly narrower and mean arch depth significantly shorter in BCLP as compared with the controls. A significant midline deviation was apparent over the observation period.
CONCLUSION: During the first 4 years of life palatal growth in BCLP children never shows a growth curve comparable with non-cleft children. At birth most maxillary arch dimensions are larger in children with BCLP than in non-cleft children. At 4 years of age the opposite is true. Distinct changes, probably related to surgical lip closure, occur. In our sample the influence of soft palate closure appeared to be less important.

22 LONG-TERM STABILITY OF DENTAL ARCH FORM IN NORMAL OCCLUSION

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AIM: Several authors state, based on observations of longitudinal changes in dental arch dimensions, that an individuality of arch form and an integrity of this form exist. However, longitudinal studies evaluating dental arch form changes have rarely been reported in the literature. The purpose of this study was to use a computer-assisted mathematical method to describe dental arch form in a sample with untreated normal occlusion, and to evaluate the long-term stability in dental arch form from 13 to 31 years.
MATERIALS AND METHODS: The sample consisted of 30 untreated normal occlusion cases of Scandinavian origin, documented at a mean age of 13.6 years and at a follow up at 31.1 years. Anatomic landmarks of dental casts were digitized from photographs. The coordinate data points of each dental arch served as a base for a computerized mathematical description of the arch form with conic sections and for calculation of arch dimensions. The variation of arch form was quantified by eccentricity (e), a value determined by a geometrical ratio of a conic section.
RESULTS: The study verified earlier observations of variability in maxillary and mandibular dental arch forms but no specific arch form could be found to represent a normal occlusion sample. Three arch forms were described: rounded ($e < 0.783$, 20 per cent), tapered ($e > 0.882$, 33 per cent), or between ($0.783 \leq e \leq 0.882$, 47 per cent). Marked spontaneous change in arch form was observed to occur in several cases, but no significant change in pattern with age could be demonstrated, nor could any significant differences be found with regard to sex. Significant intercanine width and arch depth reductions occurred which were in agreement with earlier reports.
CONCLUSION: Lack of a pattern in age changes in dental arch form in untreated individuals emphasizes difficulties in predicting treatment stability in subjects with malocclusions.

23 DOES STABILITY OR RELAPSE OF THE INCISOR POSITION CORRESPOND TO FUNCTIONAL THERAPY?

U Hirschfelder, Department of Orthodontics, University of Halle/Wittenberg, Germany

AIM: To determine the sagittal and vertical stability or the relapse of incisor position in growing adolescents, who had been treated by functional appliances.
METHODS: In order to study the effect of bionator therapy on the vertical and sagittal incisor position, plaster casts and lateral cephalograms of 55 adolescents with Angle Class II malocclusions were evaluated at the beginning (T1), at the end of the therapeutic period (T2) and at the time of the follow-up observation (T3). The dento-facial changes occurring during the treatment period (T2–T1) and post-therapy (T3–T2) were analysed statistically using the *t*-test at a level of significance of $P < 0.05$. Furthermore, the dental results of the Class II division 1 cases and the Class II division 2 cases were compared.
RESULTS: The results demonstrated that the changes in the vertical and sagittal position of the incisors were responsible for the good treatment results and additionally to the skeletal changes. During the treatment period a significant reduction in overjet of –3.8 mm on average was registered for the whole Class II group. In the post-treatment period an increase of the overjet of 0.15 mm was observed, which was different in Class II,1 and Class II,2 malocclusions. The average overbite reduction amounted to –2.2 mm, with, on average, a post-therapeutic deepening of 0.7 mm. The change in sagittal incisor inclination during the treatment phase was significantly higher in the Class II,1 group than in the Class II,2 group. With regard to post-therapeutic changes in incisor inclination, a certain relapse could be verified in both subgroups, which was less in patients with Class II division 1 malocclusions than in Class II division 2 cases.
CONCLUSIONS: It is concluded that the therapeutically induced protrusion of the mandibular incisors and their relapse should be critically viewed.

24 DENTAL ERUPTION CONTINUES AFTER THE Ru STAGE OF SKELETAL MATURATION

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AIM: The appropriate age for insertion of osseointegrated implants in children and adolescents is currently being discussed. In a follow-up study with fixtures, Thilander *et al.* (1994) concluded that skeletal maturation, not the chronological age of the patient, must be taken into consideration to avoid infra-occlusion of the fixture crown. The purpose of this study was to provide information regarding the continued eruption of the maxillary incisors and molars in relation to skeletal maturation.
MATERIALS: The material was obtained from the files of the growth study of Björk and comprised 14 series of lateral cephalometric films of girls in the range of 5 years before to 7 years after the Ru stage. The criteria for selection were the presence of bilateral posterior maxillary implants and one or two anterior maxillary implants. The sample presented various types of malocclusion, but records during orthodontic treatment and retention were excluded.
METHODS: Curves representing the growth tracks of upper central incisors and first molars were made for each subject, and the time of the occurrence of the skeletal stage of maturation Ru was marked on each curve. Average growth curves for the 12 1-year age intervals were prepared by superimposing the curves on the Ru stage.
RESULTS: About 3–4 mm downward and 1–1.5 mm forward eruption of maxillary incisors and molars was found from the beginning (MP3cap stage in 10 out of 14 individuals) to the end of the observation period. From the Ru stage, which occurred at about 18 years, to the stage Ru +7 years, the average cumulative eruption of the upper incisors and first molars was about 1 mm down and 0.2 forwards; no maxillary growth was seen during that period.
CONCLUSION: The findings of the present study indicate that a marked amount of eruption occurs during the period of late adolescence and that the eruption continues even after the stage of Ru. Therefore, the late eruption related to late mandibular growth changes should be taken into consideration by the clinician, before insertion of osseointegrated implants with artificial teeth.

25 THE VALUE OF INFORMATION AND THE COST OF UNCERTAINTY: WHO PAYS THE BILL?

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KEYNOTE ADDRESS

There are so many ways to regulate malocclusion that it is necessary for each practitioner, during the course of his or her career, to choose a small subset of treatment options for use on a day-to-day basis. In 1997 some choose edgewise, others opt for Begg, bioprogressive, functional or straightwire appliances. Given the disparate nature of the various alternatives, it would be remarkable if all were equally effective. If some treatments work better than others then it is clear that the make-up of each orthodontist's treatment armamentarium can have a major impact on the treatment outcome for a given patient.
Given the significance of the basic decision to be, say, a 'Begg' or an 'edgewise' or a 'non-extraction' orthodontist, there is surprisingly little in the way of demand for data upon which to base this important choice. Thus one is forced to the conclusion that 'scientific data'—the rubric under which this session is being conducted—generally are not seen as having practical clinical value. Indeed, orthodontists seem to have been professionally/financially successful in jumping the bite 100 years ago, as they were extracting premolars 50 years ago, or as they are today using functional and straightwire

appliances. Perhaps because there is no obvious penalty for being wrong, decision-making in the face of uncertainty is a time-honoured orthodontic tradition. In the end, however, this uncertainty often has a price that can be measured. Stated simply, it is the difference between what the patient actually gets and what he or she could have received from the best available treatment. This cost always becomes due and is borne in full by the patient. In the end, however, the value of information to the orthodontists is exactly the same as the cost of its absence to the patient. Both parties should be equally concerned; I would argue that they are not. It will be the purpose of this presentation to explore the significance of this apparent conflict of interest.

26 BIOMECHANICAL AND HISTOLOGICAL EVALUATION OF BONE HEALING USING OSTEOPROMOTIVE SUBSTANCES

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AIM: To compare the mechanical strength and histological findings of healed adult rat calvarial defects 6 months after implantation with three different osteopromotive substances.
MATERIALS AND METHODS: Trephined bilateral bone defects, of a critical size, were produced in the posterior part of the parietal bone of 20 adult male Wistar rats. Three commonly used osteopromotive substances in maxillofacial and craniofacial surgery were implanted into the defects: hydroxyapatite (HA), demineralized bone matrix (DBM) and autogenous bone (BC). Unfilled defects served as controls. The healed defects were evaluated 6 months after implantation by a three-point bending test, until destruction, to determine the strength of bone healing, and by histomorphometry to quantify the histological components. An analysis of variance and a modified LSD (Bonferroni) test were used to evaluate the differences between the four groups.
RESULTS: Biomechanical test: The maximum load to fracture for DBM (43.03 N) was statistically significantly higher than the groups implanted with BC (28.78 N), HA (15.42 N), and unfilled control (17.39 N). Autogenous bone chips fractured at higher loads than the hydroxyapatite and control groups, but the difference was not statistically significant. None of the control sites demonstrated any clinically significant bone healing. Histological results: DBM stimulated complete closure of the defect and showed a pattern of remodelling and reorganization of the newly formed bone. HA remained unresorbed and was surrounded by fibrous tissue and a limited amount of bone. The control defects healed by connective tissue and new bone formation was limited to the margins of the defect.
CONCLUSIONS: Bone defects implanted with demineralized bone matrix demonstrated a significantly higher strength than defects implanted with HA, BC or left unfilled. HA did not resorb after 6 months and presented a lower strength than controls, and seemed to impede achievement of normal bone strength. The biomechanical strength of osteopromotive materials and their interaction with bone healing should be taken into consideration when they are chosen to stabilize bone segments in orthognathic surgery procedures that require mechanical strength.

27 AN ANALYSIS OF THE MULTIFACTORIAL NATURE OF POST-RETENTION CHANGE

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AIM: To analyse long-term (mean 15.7 years) post-retention changes of former orthodontically treated patients and to reveal factors (initial and end-of-active treatment alignment, type and amount of therapy, presence of third molars) which may play a role as predictors for long-term prognosis.
SUBJECTS: Two hundred and twenty-six patients with various anomalies treated with removable appliances, and an additional 23 by the edgewise technique. Mean pre-treatment age: 11.3 years; mean age at the time of follow-up: 31.2 years.
METHODS: Three-dimensional model analysis of all cases, and cephalometric evaluation of 133 cases. The total sample was divided into two groups (cases with post-retention changes within an acceptable range 'stability group' and those outside 'relapse group') and different subgroups according to the pre-treatment anomaly, type of therapy, amount of tooth movement, end-of-treatment alignment and presence of third molars. One-way analysis of variance was used to discern differences of the model variables between the subgroups. A two-way analysis of variance was used to search for interactions between the 'type of therapy' and the 'destiny' of the third molar. Comparison of mean values was made by means of a Student's *t*-test for independent samples. The influences of the other factors were investigated by means of the χ^2 -test.
RESULTS: Post-retention changes of nearly all variables occurred more frequently in the lower arch. Intercanine width decreased more than 2 mm in 13.8 per cent of upper and 23.9 per cent of lower jaws. A distinct reduction of intermolar width occurred in the maxilla in 25.8 per cent, and in the mandible in only 19.0 per cent. Maxillary crowding increased by 3 mm or more in 46.9 per cent and mandibular crowding in 62.8 per cent of cases. An increase in the number of rotated teeth was found in the upper jaw in 23.1 per cent, and in the lower jaw in 49.3 per cent. Pre-treatment variables such as increased mesio-distal incisor dimension, severe crowding, incisor irregularity, arch length deficiency, arch constriction and increased overbite as well as post-treatment variables (residual Class II or III molar relationship) were found to be associated factors in the process of post-retention tooth movements and arch changes. Over-expansion was shown to be an influencing factor. Extraction was not, on the other hand, found to be a relapse preventing factor. Third molars may play a role in post-retention stability. Where they were missing, mandibular teeth showed significantly less relapse than cases with impacted or erupted third molars.
CONCLUSION: The conclusion of the 'Cologne' study is

that the definition of stability should be revised, bearing in mind that original anomaly, type and amount of treatment, and end-of treatment alignment were found to be associated factors in the process of dentoalveolar and skeletal post-treatment changes. Severe malocclusions require extensive treatment strategies, involving significant changes in arch shape, tooth position, the interrelationship between the arches, and the relationship between the arches and the cranial structures, thus creating the potential for increasing relapse. Orthodontists should be fully aware of the fact that relapse of a single parameter leads to post-retention changes in other variables.

28 CHANGES IN THE SHAPE OF THE SOFT TISSUES AT THE ANGLE OF THE MANDIBLE FOLLOWING ORTHOGNATHIC SURGERY

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AIMS: To assess the differences in shape of the soft tissues at the angle of the mandible pre- and post-operatively in groups of Skeletal II and Skeletal III patients who had undergone different operations, and to compare these with an un-operated skeletal Class I group of patients.
SUBJECTS AND METHODS: A total of 46 patients (23 Skeletal II and 23 Skeletal III) were examined and recorded pre-operatively and at least 1 year post-surgery using the non-invasive, three-dimensional optical surface scanning technique. Each group of patients was subdivided by the nature of the operation used to correct the skeletal discrepancy. The operations on all patients were performed following the protocol of one operating team. Three-dimensional analysis of the optical scans was undertaken using a registration technique.
RESULTS: Analysis of the optical scans indicated that the angle of the mandible was widest and most prominent both pre- and post-operatively, in bimaxillary osteotomy with sagittal split osteotomy of the mandible, in both Skeletal II and Skeletal III patients. The angle narrowed following bimaxillary osteotomy with mandibular inverted L-osteotomy for Skeletal II correction. No differences were seen at the angle following bimaxillary osteotomy with sagittal split osteotomy for Skeletal II patients. In the Skeletal III patients the angle became wider following bimaxillary osteotomy with sagittal split osteotomy and vertical subsigmoid osteotomy but narrowed following subcondylar osteotomy of the mandible.
Comparison with unoperated Skeletal I patients showed that the angle was narrower pre-operatively in the Skeletal II patients and remained narrower post-operatively in all the operation groups of Skeletal II patients. The angle was wider pre-operatively in Skeletal III patients and remained wider following surgery in the groups which had the bimaxillary surgery with sagittal split osteotomy and vertical subsigmoid osteotomy, but was narrower following bimaxillary osteotomy with subcondylar osteotomy of the mandible.
CONCLUSION: The effect of different types of surgery on the mandible and maxilla had a considerable effect on the angle of the mandible.

29 ANTERIOR DENTAL AESTHETICS: THE ROLE OF THE ORTHODONTIST

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KEYNOTE ADDRESS
Orthodontics has always been associated with dental aesthetics. By 'straightening' anterior teeth, orthodontists significantly enhance a patient's smile. But anterior tooth alignment is only one aesthetic factor influenced by orthodontics. Now that orthodontists are treating adults with missing anterior teeth, inadequate anterior pontic space, short abraded incisors and old failing restorations, our role in providing ideal aesthetics in these compromised situations must also be recognized.
This presentation will identify the four keys to anterior dental aesthetics and discuss the orthodontists' role in achieving aesthetic excellence.

30 OBSTRUCTIVE SLEEP APNOEA SYNDROME TREATED WITH A NOCTURNAL REMOVABLE APPLIANCE

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AIM: To study the long-term tolerance, acceptance and effect of wearing a functional appliance.
SUBJECTS: One hundred consecutive snoring and sleep apnoea patients referred from the ENT department. The mean age at the start of treatment was 52.2 years (range 26.1–76.2). The mean observation time was 17.3 months (range 6–38 months).
METHODS: History-taking examination (including polysomnography) and treatment followed a standardized protocol in the ENT and the orthodontic departments.
RESULTS: Group A: 53 patients used the appliance every night and reported no snoring or apnoea and considerably less tiredness during the daytime. Three of the patients were also using nCPAP, in combination with their mandibular protraction device. Group B: 16 patients used the appliance occasionally; 13 patients used the appliance some hours every night and three patients used the appliance sporadically. Group C: 31 patients had stopped using the appliance for different reasons: 23 patients did not like to use the appliance; three patients were recommended osteotomies; two patients were taken ill; and three patients developed increased craniomandibular problems, which were already present at the start of treatment.
CONCLUSION: There seemed to be long-term acceptance and tolerance of wearing a nocturnal removable functional appliance every night in 53 per cent of the patients. Very few negative side-effects were found.

31 HEAD POSITION AND CRANIOFACIAL MORPHOLOGY

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AIM: To evaluate the relationship between Natural Head Position (NHP) and craniofacial morphology.
MATERIALS: Lateral facial photographs and cephalograms of 284 young adult males (18–25 years of age).
METHODS: Two standardized lateral facial photographs, taken at an interval of 10–15 minutes, were recorded with the subject in the NHP. This position was determined with the help of a small mirror placed at eye level, 120 cm in front of the subject's face. In addition to the photographs, lateral cephalograms were taken. The angle between the E-line and the vertical (represented by a metal chain suspending a plumb object) was measured on each photograph. The average measurement between the two photographs was transferred to the cephalogram to draw a true vertical. The tracings were digitized, and a total of 101 measurements were made. Cases with differences between the two photographs greater than 4 degrees were considered too inconsistent in their NHP, and were excluded. This resulted in 284 cases being studied. Paired *t*-tests between the four pairs of groups of extreme positions (± 1 SD), as assessed by the positional variables NSL/VER, FH/VER, PPNER and Pmvert/VER, were performed.
RESULTS: Eliminating all the topographical associations, 20 variables were different in at least two of the four pairs of groups, but only three variables—facial axis (NBa/PmGn), lower face height (ANS–Me) and facial ratio (N–ANS/ANS–Me)—were significantly different in all the groups, having the largest values for the facial axis and lower face height, and smaller for the face height ratio. Besides these three measurements, there was a tendency for the 'extenders' to have increased anterior-vertical values, distal-sagittal relations, with smaller and retrognathic mandibles. Correlation coefficients between postural and morphological variables tended to confirm these observations.
CONCLUSION: After eliminating all the confusing topographical associations, it was clear that there was a pattern of association between NHP and certain craniofacial characteristics. In general, subjects belonging to groups with significant posterior extension of the head tended to have longer and more retrognathic faces, and smaller mandibles.

32 THE AXIS OF INERTIA AS A NEW TOOL TO ASSESS THREE-DIMENSIONAL MAXILLOFACIAL BALANCE

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AIM: The coincidence of two observations led to the creation of a new three-dimensional cephalometry: the excellent visibility on the CT cuts and on the three-dimensional reconstructions of the infraorbital foramen, the mental foramen and porion and the fact that more of these points are exiting orifices of the trigeminal nerve and are situated on the neural growth axes described by Moss.
SUBJECTS: Fifty-three men and 42 women ranging in age from 14 to 72 years (mean 35 ± 1.8), without facial pathology, formed the sample.
METHODS: The two porions and the two infraorbital and mental foramens were selected on axial sections (Elscint 2400 Elite plus®). *x, y, z* values of the landmarks were calculated by the software. The software then built, for each subject, a pintahedron and calculated the following parameters: nine distances, 18 angles, five areas, one geometrical centre and three axes of inertia, and six opening angles for every vertex. Secondly the six-point construction was improved by an eight-point construction with the addition of the two supraorbital foramens. The porions were replaced by the head of malleus.
RESULTS: The preliminary six points studied led to the elaboration of the anatomical concept of the maxillo-mandibular frame to create, from the mean values of the parameters, a theoretical model of reference and to propose a new facial typology. The three-dimensional mathematical tools allow assessment of the dimension and general balance of the three-dimensional cephalometric construction. The selection and segmentation of teeth and the calculation of the axis of inertia of each tooth and group of teeth create several levels of integration. The main result is that in a dentulous person the principal axes of inertia of the mandibular and maxillary dental arches are strictly parallel. This result is also confirmed when the deciduous teeth of a child are selected.
CONCLUSION: These results show that the biological balance in maxillofacial growth is constantly initialized and directed by the trigeminal system. This method, based on the selection of anatomical landmarks and volumes, has already been applied in orthognathic surgery.

33 THE MANDIBULAR STIMULATOR AND THE LINGUAL MANDIBULAR STIMULATOR: A NEW PHILOSOPHY OF MANDIBULAR ADVANCEMENT WITH FIXED APPLIANCES

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INTRODUCTION: The classic Herbst appliance has regained acceptance into the orthodontic profession, and since its revival many variations have been proposed by different authors. Nevertheless, some mechanical proclination of lower incisors and retroclination of upper incisors, often undesirable, has been observed in cases treated with the conventional Herbst type of appliance.
AIM: To test a new methodology of utilizing the Herbst rods, directly applied to a full multibracket appliance, in order to enhance the muscular advancing activation of the mandible (pure functional advancement) versus passive mechanical repositioning.

SUBJECTS: Nineteen patients (13 adolescents and six adults), treated for an average period of 18 months with unconventional Herbst appliances, were tested: 17 with the Mandibular Stimulator and two with the Lingual Mandibular Stimulator.
CLINICAL PROTOCOL: On the basis of the postulated hypothesis of the efficacy of the noxious stimuli reflex to advance the mandible by muscular activation only, a substantial modification of the method of application of the Herbst appliance was designed at two levels of intensity: level one, the Mandibular Stimulator (Herbst rods buccally applied) producing a clear stimulation of the pain, tension and pressure receptors in the periodontal ligaments of some teeth; level two, the Lingual Mandibular Stimulator (Herbst rods lingually applied plus gingival spurs) producing, in addition to the previous effects, the stimulation of the touch and pain receptors in the soft tissue of the oral mucosa on the lingual side.
RESULTS: Final results are available for 17 of the 19 patients, because the two Lingual Mandibular Stimulator cases are still in treatment. In growing patients the fastest growth acceleration with correction of the Class II malocclusion was obtained. In adults an advanced position of the mandible, which appears stable and not only postural, was achieved. With both types of appliances the proclination of the lower incisors at the end of treatment was very small when compared with conventional Herbst treatment. The two cases with the Lingual Mandibular Stimulator (level 2) have not shown any measurable lower incisor proclination.
CONCLUSION: This presentation shows the advantages of this approach, which seem to justify the name 'Mandibular Stimulator' for the buccal, and 'Lingual Mandibular Stimulator' for the lingual application of the appliance.

34 THE EFFECT OF CHLORHEXIDINE CHEWING-GUM ON PLAQUE AND GINGIVITIS IN PATIENTS WITH FIXED ORTHODONTIC APPLIANCES

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AIM: The aim of this double-blind parallel randomized longitudinal study was to assess the clinical efficacy of the use of a chewing gum containing chlorhexidine in the control of gingivitis associated with fixed orthodontic appliances in young adolescents, and to evaluate the compliance and possible deleterious effects of this therapy both on the orthodontic appliances and on the patients.
SUBJECTS: Forty patients were entered in the study and after professional prophylaxis and a baseline evaluation, the subjects were randomly assigned to use either the chewing gum containing chlorhexidine, or a placebo chewing gum.
METHODS: The efficacy in the control of gingivitis was assessed by the following outcome measurements: plaque index (PI), gingival index (GI) and bleeding on probing (BOP). Compliance was assessed by means of a questionnaire and the side-effects were evaluated by means of standardized clinical photography and a pre-established orthodontic protocol. Both groups were evaluated at 1, 3 and 6 months. During the entire study patients used the chewing gum twice a day. Differences in the outcome measurements were compared between baseline and follow-up visits, and between experimental and placebo groups.
RESULTS: Plaque and gingivitis were significantly reduced from baseline to 3 and 6 months in the chlorhexidine group. This experimental group showed a significantly greater reduction in the GI when compared with the placebo group at 3 months. BOP was significantly reduced in both groups at 3 and 6 months, but the differences were not statistically significant between groups. The likely deleterious effect of the continuous use of the chewing gum on braces and bands was assessed by establishing a ratio of decemented braces/bands divided by the total number of braces/bands in three time periods, before, during and after the use of the chewing gum. Differences between the period of use of the chewing gum and before or after were not statistically significant.
CONCLUSIONS: These results indicate that the use of a chewing gum containing chlorhexidine by adolescents undergoing fixed orthodontic therapy is efficacious in the control of gingivitis, and the continuous use of this chewing gum does not alter the orthodontic appliances.

35 MOTOR AND SENSORY CHANGES OF JAW MUSCLES AFTER ORTHODONTIC DISCOMFORT

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AIM: To evaluate the effects of orthodontic discomfort on pressure pain threshold (PPT) and electromyographic activity (EMG) of jaw elevator muscles.
SUBJECTS: Fifteen healthy subjects (median age 26 years, range 23–28 years).
METHODS: The subjects were randomly assigned to experimental or control sessions in a double-blind crossover study. EMG activity during clenching and while chewing, and PPT, by means of an algometer, were assessed for masseter and interior temporal muscles. During experimental sessions, after baseline recordings, orthodontic separators were placed between the upper and lower first molars in each subject to induce periodontal pain; during control sessions, after baseline recordings, the separators were placed and removed after 10 minutes (placebo). Occurrence of subjective pain on chewing was rated on 10 cm visual analogue scales (VAS), Subjects returned after 24 hours, separators were removed (experimental sessions) and measurements were performed again. Experimental and control sessions were separated by a one-week wash-out period.
RESULTS: Pain perceived after experimental sessions was highly variable (3.6 ± 3.7 cm VAS). PPT was significantly reduced after experimental sessions for both masseter (–13.4 per cent) and anterior temporal muscles (–19.8 per cent)

$0.001 < P < 0.01$ paired *t*-test. No significant differences were found during control sessions ($P > 0.05$). EMG activity during maximal clenching and while chewing was significantly reduced after experimental sessions (–33 and –26.5 per cent respectively for masseter and –24.9 and –18 per cent for anterior temporalis ($0.001 < P < 0.01$ paired *t*-test). No significant differences were found during control sessions.
CONCLUSIONS: The decrease of EMG activity associated with dental pain appears consistent with the pain adaptation model proposed by Lund *et al.* (1991) The decrease of pressure pain threshold of masseter muscle may be mediated in the central nervous system and might account for the muscle pain complained of by patients undergoing orthodontic treatment.

Lund J P, Donga R, Widmer C G, Stoler C S 1991 The pain-adaptation model: a discussion of the relationship between chronic musculoskeletal pain and motor activity. Canadian Journal of Physiology and Pharmacology 69: 683–694

36 A NEW STOMATOGNATHIC FUNCTIONAL ANALYSER

F Miura, Tokyo, Japan

KEYNOTE ADDRESS
This new device can analyse critical diagnostic functional information directly from the patient. It can precisely trace the three-dimensional pathways of any landmark of the mandible, such as the condylar or mandibular incisor point, by utilizing six light-emitting diodes and two charge-coupled device cameras.
In addition the device can record electromyographic data from the masticatory muscles, as well as recording, simultaneously, the amplitude of temporomandibular joint clicking and occlusal sounds.

37 OPTICAL SCANNING AND CEPHALOMETRIC ASSESSMENT OF THE SOFT TISSUE EFFECTS OF FUNCTIONAL APPLIANCES

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AIM: To determine the effect of the Bass and Twin Block appliances on the soft tissues as evaluated cephalometrically and by optical scanning.
SUBJECTS AND METHODS: In this prospective study, 62 subjects were originally randomly allocated to Bass and Twin Block groups. High-pull headgear was also randomly assigned within the Twin Block cohort to assess the effect, if any, on the vertical dimension. The period of study was 10 months. Lateral cephalograms, optical scans and standing heights were recorded. A total of 42 subjects completed the study. Patients were excluded on failure to return for appointments or refusal to wear the appliance. ANOVA was used to evaluate the cephalometric findings. Optical scans were superimposed and a colour registration system used to assess differences.
RESULTS: Soft tissue pogonion was positioned forward by 4.1 mm in the Bass sample compared with 3.1 mm in both Twin Block groups (in relation to a constructed vertical line through the S point), but this difference was not statistically significant. The soft tissue face height increased most in the Twin Block + Headgear sample (5.2 mm). The optical scans correlated well with the cephalometric findings in the horizontal dimension, with 1–3 mm retraction of the upper lip being produced in the Twin Block + Headgear group. There was, however, some discrepancy in the vertical dimension, with the optical scans recording larger increases than the cephalograms.
CONCLUSIONS: Both Bass and Twin Block appliances produced an improvement in position of soft tissue pogonion. The addition of headgear to the Twin Block without acrylic coverage of the incisors did not control the vertical dimension. Optical scanning and cephalometric findings were similar for horizontal but not vertical measurements.

38 PERIORAL FORCES AND DENTAL CHANGES WITH MANDIBULAR LIP BUMPER TREATMENT

R S Nanda, S A O'Donnell, J Ghosh, Department of Orthodontics, University of Oklahoma, USA

AIM: This prospective study compared pre- and post-treatment forces produced by a lip bumper on the mandibular first molars and determined its dental effects after 1 year of treatment.
SUBJECTS: Twenty-five patients (15 females and 10 males), aged 10–17 years.
METHODS: Fixed 0.045 inch passive stainless steel lip bumpers were positioned at the level of the gingival margin, 2 mm from the labial surface of the teeth, as the only form of treatment in the mandibular arch. Lower lip forces were measured with specially designed strain gauges mounted bilaterally in lip bumper tubes, before and after 1 year of treatment. Cephalometric radiographs and dental casts were taken to evaluate dental changes.
RESULTS: Resting forces before treatment were 14.37 ± 7.09 g on the left side and 12.39 ± 6.92 g on the right, whereas after treatment they were 12.24 ± 7.06 g on the left and 13.18 ± 8.37 g on the right. Differences before and after treatment were not statistically significant. Mean increases in arch length and perimeter were found to be 1.25 and 4.18 mm respectively ($P < 0.001$). Intercanine width, measured from the cusp tips, increased an average of 1.65 mm ($P < 0.001$). Arch width also increased at the first premolars 2.46 mm and at the second premolars 2.27 mm, both of which were statistically significant at $P < 0.001$. The amount of force exerted by the lower lip on the molars was not correlated to the degree of tooth movement recorded in this sample.
CONCLUSIONS: There was no statistical difference between pre- and post-treatment forces measured at the mandibular permanent first molars using a lip bumper. Muscular adaptation to the appliance did not occur. The main dental effects included incisor proclination and protrusion, molar

distalization and tipping, increases in arch width, length and perimeter, and a decrease in anterior crowding.

39 FACIAL GROWTH AND LONG-TERM STABILITY

I L Nielsen, Department of Growth and Development, University of California, San Francisco, USA

KEYNOTE ADDRESS

The major concern of the orthodontist is the long-term stability of the occlusion and space conditions following orthodontic treatment. Numerous studies have reported that post-treatment changes, especially of the space conditions, routinely occur in the years following treatment. These studies have primarily focused on changes in the lower dental arch where increasing crowding has been considered almost inevitable. Some studies have also described changes in the occlusion, i.e. overjet and overbite, that take place post-treatment.

Although the problem of long-term stability has long been recognized as a multifactorial problem and much research has gone into investigating the possible causes, it is still unclear to what extent individual factors are responsible for the observed changes. The possible influence on the occlusion and space conditions of changes of the perioral tissues, with changes in lip strength and tone with age, as well as changes of jaw muscle strength over time, is still unknown. In addition the role of late facial growth, in particular late growth of the mandible as a contributory factor to the lack of stability, has not, to a large extent, been investigated.

Orthodontic treatment is generally carried out during the most active growth period of the facial structures, i.e. the puberal growth spurt, and is routinely followed for only 1–2 years of retention, after which the patient is dismissed. However, as there is still a considerable amount of residual growth left, in particular in the mandible, it is not surprising that major changes can occur not only in the occlusion but also in the space conditions. Furthermore, this late growth of the jaws takes place with different velocities in the maxilla and mandible and as a consequence considerable dentoalveolar changes need to take place for the occlusion to remain unchanged. In addition, the mandibular growth changes vary in intensity and direction from patient to patient and may require more individualized retention planning than orthodontists normally use.

This presentation will review the long-term stability problems, discuss the possible association between late growth changes, changes in occlusion and space conditions and propose an individualized retention protocol based on the patient's facial growth pattern.

40 CRANIOFACIAL MORPHOLOGY IN PATIENTS WITH OLIGODONTIA

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AIM: To examine, in a group of children with oligodontia, the relationship between craniofacial morphology and the number of congenitally missing teeth (CMT) in the maxilla and the mandible.

MATERIALS: Rotational panoramic radiographs and lateral cephalometric radiographs of 118 children (61 girls and 57 boys, aged 7–15 years) with CMT ranging from 5 to 21.

METHODS: CMT was determined from the panoramic radiographs. The craniofacial morphology was assessed by cephalometric variables calculated from digitized reference points on the cephalometric radiographs.

RESULTS: On comparing children who had more than 12 CMT with children who had 5–12 CMT, the mandibular plane inclination (NSL/ML), the vertical jaw relation (NL/ML) and the sagittal jaw relation (ss–n–pg) ($P < 0.01$), as well as the alveolar prognathism in the mandible (CL/ML) ($P < 0.001$), were smaller, while the mandibular prognathism (s–n-pg) was greater ($P < 0.05$) in children with more than 12 CMT. Assessed by regression analyses, mandibular prognathism (s–n–pg) increased and mandibular inclination (NSL/ML) and alveolar prognathism (CL/ML) decreased with increasing CMT in the mandible. The cranial base angle (n–s–ba, n–s–ar) was more obtuse, and the maxillary prognathism (s–n–ss), as well as the sagittal jaw relation (ss–n–pg) were reduced in subjects with increasing difference in CMT between the maxilla and the mandible.

CONCLUSION: The craniofacial morphology of children with many CMT differs from average craniofacial morphology. It is therefore advisable to take craniofacial development into account at an early stage in the planning of long-term treatment for children with oligodontia.

41 NATURAL HEAD POSTURE, UPPER AIRWAY MORPHOLOGY AND OBSTRUCTIVE SLEEP APNOEA

M M Özbek, K Miyamoto, A A Lowe, J A Fleetham, Department of Orthodontics, University of Ankara, Turkey, and Departments of Clinical Dental Sciences and Medicine, University of British Columbia, Vancouver, Canada

AIM: Recently it has been demonstrated that adult patients with obstructive sleep apnoea (OSA) syndrome tend to exhibit a craniocervical extension (CCE) with a forward head posture (FHP). This study was designed to search for some characteristics of OSA patients that may be related to these adaptive changes in Natural Head Posture (NHP).

MATERIALS: Overnight polysomnographic, demographic and cephalometric records of 252 adult male subjects with various types of skeletal patterns and dental conditions were examined.

METHODS: Apnoea Index (AI) and Apnoea + Hypopnoea Index (AHI) variables were assessed to separate the non-apnoeic snorers ($n = 35$), and mild ($n = 101$), moderate ($n = 63$) and severe ($n = 53$) OSA groups. Analysis of variance (ANOVA) was used to determine if the differences between NHP variables were statistically significant in the four groups.

Tukey's tests were performed to calculate the level of OSA severity at which significant changes in postural variables occurred. Pearson's *r* correlation coefficients were used to find out if any cephalometric measurements, severity of OSA and/or obesity may be related to changes in NHP of OSA patients.
RESULTS: Severe OSA patients had a greater tendency to exhibit a CCE with a FHP ($P < 0.05$–0.001). CCE and FHP in adult OSA patients were associated with a higher disease severity, a longer and larger tongue, a lower hyoid bone position, a smaller nasopharyngeal and a larger hypopharyngeal cross-sectional area, and a higher body mass index ($P < 0.05$–0.001).
CONCLUSION. It was concluded that a CCE and FHP is more likely to be seen in severe and obese OSA patients with certain morphological characteristics of the upper airway and related structures.

42 RESPONSES OF MOUSE PERIODONTAL MECHANORECEPTORS TO EXPERIMENTALLY INDUCED ANTERIOR CROSSBITE

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AIM: To test whether there are any changes or abnormalities in the morphology of Ruffini nerve endings, the periodontal mechanoreceptor in the periodontal ligament (PDL), of mouse incisors following an experimentally induced anterior crossbite.
MATERIALS AND METHODS: Anterior guiding planes were attached to the mandibular incisors of C3H/HeSic 3-week-old mice. At 2, 4, 6 and 8 weeks post-insertion of the appliance, the mice were killed by perfusion fixation. Frozen sagittal cryostat sections of decalcified maxillary incisors were processed for immunohistochemistry of protein gene product 9.5, followed by histochemical incubation of tartrate-resistant acid phosphatase activity to reveal the sites of alveolar bone resorption,
RESULTS: Despite the absence of bone resorption in the lingual PDL of control mice, distinct resorption sites appeared in the respective regions of the experimental animals at 2–8 weeks post-insertion. Unlike the controls, a large number of Ruffini endings showing vague and swollen contours with numerous microprojections and various shapes were observed in the affected lingual PDL of the incisors in all experimental groups. Rugby ball-shaped, club-shaped and two- to three-storeyed expanded terminations were also observed and their numbers increased as the experimental period was prolonged. Some difference in the distribution of Ruffini endings was also observed.
CONCLUSION: The results imply that the alteration of force direction to the periodontal ligament leads to rapid change in the morphology, as well as the distribution of Ruffini-like mechanoreceptors.

43 ISO-CERTIFICATION—FACT OR FICTION?

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Continuous quality development is a must in orthodontic services in Europe. Harmonization of quality measures and consensus on the quality criteria is essential. The usefulness of certification under the international standard series ISO-9001 has been studied within the EURO-QUAL project in the orthodontic department in Amsterdam. The ISO certification was obtained in October 1966.
The reality of certification is that it is both a positive and a proactive process. The advantage of ISO-9001 becomes obvious when an ISO-based quality system has been designed and put into operation. An ISO quality system was designed for orthodontics. The translation of ISO-9001 into orthodontic language was like the opening of a magic door that led to a new understanding of the management of orthodontic care. It offers: transparency in design; joint effort (two heads are better than one); measured and calm deliberation (not panic and rush); pre-planning of the design process; learning from mistakes (and not repeating them); increased dialogue and mutual co-operation and a new awareness of quality.
The quality manual is, among other things, an implementation of patient-orientated orthodontic treatment. External auditors do not test orthodontic treatment results; they concern themselves with the application of the quality system. The process is different from site visits, peer reviews or internal audits. It alters an orthodontic practice.
New habits do not come readily, lack of understanding creates unwarranted resistance, but a quality system should be based on experience and common sense. The benefits far exceed the effort.
Quality improvement systems are here to stay and will be vital to the survival of orthodontics in Europe.

44 A PATTERN OF CRANIOFACIAL MORPHOLOGY IN OBSTRUCTIVE SLEEP APNOEA

S Raskin, M Limme, R Poirrier, Departments of Children's Dentistry and Orthodontics and Neurology, University of Liège, Belgium

AIM: To understand the craniofacial morphology in subjects with sleep disorders, excessive daytime sleepiness and an abnormal respiratory disturbance index, and to determine skeletal abnormalities.
MATERIALS AND METHODS: Lateral cephalometric radiographs of 180 adult patients with obstructive sleep apnoea diagnosed by overnight polysomnographic studies, were compared with eight control subjects, matched according to age. A 'cephalometric architectural analysis'

(Delaire compiler analysis) was used in addition to cephalometric landmarks traditionally used for this type of study. One hundred and sixty-five observations were analysed with univariate and multivariate statistical analysis.
RESULTS: In the test group, the anterior angle of the cranial base as well as the cranial height proved to be larger than in the controls. As a result the craniofacial tendency can be defined as 'transfrontal'. In the sagittal plane, a retro-positioning of the maxilla relative to the cranial base and a large skeletal anteroposterior discrepancy, principally related to a smaller mandibular corpus, were observed. However, the other mandibular measurements were also disturbed. In the vertical plane a large gonial angle, a shorter ramus, an excessive incisor-chin height and a high/low facial height were confirmed by a steep mandibular plane and a vertical growth axis. A displacement of the hyoid bone to a lower position and a smaller posterior airway space were also significantly different; the length of the soft palate and the posterior angle of the cranial base, however, were not. The discriminant analysis clinically extracts the posterior airway space, the position of the hyoid bone, the height, the incisor–chin height, the skeletal anteroposterior discrepancy between maxilla and mandible, the soft palate, the mandibular corpus, the ramus width relative to the cranial base, the nasion–sella–basion angle and the weight, and permits correction classification of 93.2 per cent of the test patients.
CONCLUSION: The principal findings allow us to conclude that craniofacial dysmorphosis occurs in relation to functional disturbances. Our knowledge of cranio-cervico-facial growth leads us to believe that oral respiration and cervical posture, coupled with physiopathological disturbances of superior airways, still unknown, can produce obstructive sleep apnoea syndrome. Unfortunately, lateral cephalometry does not facilitate the determination of the respiratory-disturbance index, but remains important in assisting diagnoses of the aetiology.

45 OSTEOCLASTS IN DEVELOPING CALVARIAL BONE

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AIM: To investigate the role of osteoclasts in developing calvarial bones and sutures.
MATERIALS: Sectioned and whole-mount tissue of mouse calvaria aged between embryonic day 16 and postnatal day 6.
METHODS: The expression of the gelatinase B gene [a matrix metalloproteinase (MMP-9) produced by osteoclasts] was localized by *in situ* hybridization, and also tartrate-resistant acid phosphatase (TRAP) activity (an osteoclast marker), by enzyme histochemistry.
RESULTS: Phenotypic differences between osteoclasts associated with calvarial bone were noted. Some cells expressed gelatinase B mRNA but were TRAP negative, while others exhibited both TRAP activity and expressed gelatinase B mRNA. During more advanced development, most osteoclasts exhibited TRAP activity but did not express gelatinase B mRNA. The distribution of these cells differed: TRAP-positive cells were detected in a widespread pattern at all ages while gelatinase B transcripts were increasingly concentrated to areas of new and rapid bone growth, notably around the sutures. TRAP-positive osteoclasts were noted in the coronal suture, on the endocranial surface of the parietal bone opposite the encroaching frontal bone osteogenic front. Osteoclasts in this position may well act to maintain suture patency.
CONCLUSIONS: It is concluded that gelatinase B expression can be used as a marker for osteoclasts and that the population of gelatinase B-positive osteoclasts may go unnoticed when only TRAP activity is localized. The abundance of gelatinase B-positive osteoclasts during early calvarial development suggests a key role for gelatinase B in rapid growth and early bone remodelling and indicates that resorption is an integral part of calvarial bone formation at an early stage, and perhaps also in the maintenance of suture patency.

46 VERTICAL CONTROL AND PREDICTABILITY OF POST-RETENTION LOWER INCISOR CROWDING

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AIM: To evaluate the post-retention predictability of lower incisor crowding.
SUBJECTS: A unique sample (n = 114) treated by one clinician who used a consistent diagnostic and treatment protocol.
METHODS: Subjects with unacceptable post-retention (mean 11.97 years) incisor alignment (more than 3.5 mm, Group 1), were matched and compared to subjects with acceptable post-retention incisor alignment (less than 3.5 mm, Group 2). Numerous dental, skeletal and soft tissue variables which described the craniofacial environment were measured at each time period T1 (pre-treatment), T2 (post-treatment) and T3 (post-retention) as well as longitudinally (T1–T2, T2–T3, T1–T3). Statistical analysis included independent and pairwise comparisons. Pearson product–moment correlation coefficients and multiple regression analysis was performed to identify any clinically useful pre- and post-treatment predictors of the post-retention mandibular incisor alignment. Significance was set at $P < 0.01$, $r > 0.06$.
RESULTS: Mandibular incisor irregularity and crowding increased following treatment, with females experiencing greater increases than males. However, unlike previous studies (Little *et al.*, 1988), 79 per cent of subjects showed good long-term stability and no subjects exhibited severe incisor irregularity (more than 3.5 mm) at post-retention. The relationship of the lower incisor to the A–pogonion plane at the end of treatment was found to be the most significant predictor of the post-retention deterioration in incisor alignment. Four other variables were also found to be useful predictors of the post-retention incisor alignment and

included posterior face height (T2), SN–GoGn (T2), anterior crowding (T2) and age (T1).
Other post-retention findings included: good stability of inter-first molar width and a statistically and clinically significant reduction in mandibular arch length. Despite minimal expansion during treatment, mandibular intercanine width decreased to less than its original value following active treatment. No difference was shown between extraction and non-extraction subgroups.
CONCLUSION: Satisfactory long-term stability following orthodontic treatment can be expected provided correct and excellent treatment principles are employed. However, developmental changes in the dentition, especially lower incisor crowding, occur as part of the ageing process in most individuals.

47 TEMPOROMANDIBULAR JOINT ADAPTATION IN HERBST TREATMENT: A PROSPECTIVE MRI AND CEPHALOMETRIC ROENTGENOGRAPHIC STUDY

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AIM: To analyse three possible adaptive TMJ growth processes contributing to the increase in mandibular prognathism accomplished by Herbst appliance therapy: (i) condylar remodelling, (ii) glenoid fossa remodelling and (iii) condylar–fossa relationship changes.
SUBJECTS: Fifteen consecutive patients with Class II malocclusions (4 males, 11 females, aged 11.5–17.5 years) treated with the Herbst appliance for an average period of 7 months.
METHODS: Condylar remodelling, glenoid fossa remodelling and condylar–fossa relationship changes were analysed by means of magnetic resonance imaging (MRI). From each subject four MR images were evaluated: before treatment, start of treatment (when the Herbst appliance was placed), during treatment (6–12 weeks after appliance placement) and after treatment (when the appliance was removed). 'Effective' TMJ growth changes (the sum of condylar remodelling, fossa remodelling and condylar–fossa relationship changes) were analysed with the aid of lateral cephalometric roentgenograms from before and after treatment, using a modified method of Creekmore (1967).
RESULTS: In all subjects Herbst therapy resulted in an increase in mandibular prognathism. After 6–12 weeks of Herbst treatment signs of condylar remodelling were seen at the posterior–superior border in 29 of the 30 condyles. Signs of articular fossa remodelling at the posterior border were noted in 22 of the joints. The condyle–fossa relationship was, on average, unaffected by Herbst therapy. 'Effective' TMJ growth changes during treatment were, on average, about five times larger in the Herbst group than in an untreated group with ideal occlusion (Bolton Standards). Furthermore, the direction of the growth changes was relatively more horizontal in the Herbst group.
CONCLUSIONS: Condylar as well as articular fossa remodelling seem to contribute significantly to the increase in mandibular prognathism resulting from Herbst treatment, while condylar–fossa relationship changes are of less importance. MRI offers the possibility of visualizing the TMJ remodelling growth processes.

Creekmore T D 1967 Inhibition or stimulation of the vertical growth of the facial complex—its significance to treatment. Angle Orthodontist 37: 285–297

48 CAN ROOT RESORPTION BE AVOIDED, STOPPED, REPAIRED?

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KEYNOTE ADDRESS
After a brief outline of the histological data indicating the possible mechanisms of the root resorption (Rr) process, and tissue reactions incident to some different experimental conditions, the clinical situations which influence the development of Rr will be presented. Data on individual susceptibility will be reported.
Questions on which conditions (i) start Rr, (ii) influence the transition from active resorption to repair and (iii) determine continued resorption will be discussed. Observations indicating some ways of reducing the occurrence of Rr will be presented.

49 A METHOD TO CORRELATE AESTHETIC RATINGS AND CEPHALOMETRIC VARIABLES

D Segner, Orthodontic Department, Hamburg University, Germany

AIM: While hard tissue based cephalometric analyses have proven to be indispensable in orthodontic treatment planning, the analysis of soft tissues has lacked direct and clear treatment implications. Part of the problem is the lack of scientific evidence regarding aesthetic profile preferences. While means and standards have been set up, it has been difficult to use them in correlation analysis or regression models because both too small or too large values lead to aesthetic impairment. It is the aim of the present study to present a method to analyse profile preferences and correlate them to cephalometric measurements.
MATERIALS: The material for the investigation consisted of lateral cephalograms of two groups of patients. One group contained 55 adult UCLP patients, while the other consisted of 52 non-cleft adult females. These patients accounted for a large variability of skeletal and dental situations. In addition, groups of ten laymen and five trained professionals were used to score the pictures of the patients with regard to their perception of a pleasing appearance using standardied shadow profiles.
METHODS: The shadow profiles were scored using a method where the profiles were ranked and then assigned scores according to a normal distribution. Intra- and inter-individual consistency was tested using correlation

analyses. The scores were then correlated with the cephalometric measurements of the same individuals using linear and non-linear models.
RESULTS: Good consistency between the judges could be shown. Highly significant correlations were noted between the sagittal and vertical cephalometric measurements and the attractiveness scores when non-linear regressions were employed.
CONCLUSIONS: The results clearly show that the subjective evaluation of profiles and the application of suitable non-linear analyses can lead to definite treatment objectives with regard to skeletal and dental morphology. It also becomes clear how much impact slight deviations from the ideal have on the aesthetic perception.

50 OPEN BITE: STABILITY OF SURGICAL VERSUS NON-SURGICAL TREATMENT

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KEYNOTE ADDRESS
It is well known that open-bite malocclusions treated with conventional orthodontic therapy have a high susceptibility to relapse. In severe open-bite cases or where there is a significant skeletal component to the problem, a combination of orthodontic treatment and jaw surgery is recommended.
How stable are open bites treated with these different treatment methods? Do we have the ability to predict the long-term outcome of treatment based on the severity of the initial problem or the type of treatment rendered?
This presentation will discuss the long-term stability of open-bite malocclusions treated by different therapies and evaluate other factors which may affect stability.

51 FACIAL APPEARANCES AND SEXUAL DIMORPHISM

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AIM: To distinguish the principal differences in appearance which might be visible between masculine and feminine facial profiles.
SUBJECTS AND METHODS: One hundred and ninety-eight patients divided into two groups. Group 1: 60 males, 38 females with spontaneous Class I normocclusions; group 2: 50 males, 50 females with non-selected occlusions. All were aged between 18 and 35 years. Metric studies and facial surface ratios (ANOVA and Student's *t*-test) were undertaken.
RESULTS: The nasofrontal angle is more open in women. The feminine nose, which is often dominant, shows a relationship between external and internal depth, which is also dominant. The chin is a dominant attribute which is typically masculine. The lips, whose relative values are particularly vulnerable in women, are nearly equivalent in both sexes.
CONCLUSIONS: Even though each face is a mosaic, with features of both sexes, an exact perception of the sexual facial dimorphism allows better evaluation of orthodontic, orthopaedic and surgical treatments, to the particular aesthetic needs of each personality.

52 AESTHETICS AND INDIVIDUALITY IN ORTHODONTICS

M N Spyropoulos, Department of Orthodontics, University of Athens, Greece

KEYNOTE ADDRESS
Objectivity in aesthetic evaluation of orthodontic needs and achievements has been a major concern of our profession. However, and in spite of numerous and important attempts at standardization of all possible parameters that contribute to 'beauty', it is often evident that individuality remains an important adversary to mathematical equations and proportions.
After a brief review of the aesthetic ideal concept through the ages and in various civilizations, the factors constituting the sense of individuality and its role in our profession will be discussed. Individuality is assessed from the point of view of the patient's self-image, as well as from the orthodontist's orientation and preference. The implications will be discussed and clinical cases, which include surgical cases and patients with clefts of the lip and palate, will be presented.

53 THREE-DIMENSIONAL ANALYSIS OF GROWTH CHANGES IN COMPLETE UNILATERAL CLEFT LIP AND PALATE (UCLP) PATIENTS

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AIM: To determine presurgical growth changes with Hotz's plates considering birth weight, birth height and gender, and to compare growth changes of these infants with patients reported in the literature without presurgical orthopaedic treatment.
MATERIALS: Plaster casts of 34 complete UCLP patients at the time of 8 days and at 6 months (just before cheiloplasty) of age.
METHODS: Using a three-axis, computer-controlled, highly accurate digitizing system (Micromeasure 70, Linden, Germany) the plaster casts were scanned by a laser. With a surfacer program (Imageware Inc., 1995) a wire frame model was constructed on computer display. Seven landmarks were digitized twice on separate occasions by one examiner (Mazaheri *et al*., 1971).
RESULTS: On average, intra-examiner error amounted to 0.21 mm for linear measurements and 1.4 degrees for angular measurements. No causal correlation between birth weight, or birth height and growth development could be found. In contrast, a significant difference in growth changes between

boys and girls was noticed. In female infants, there was a more distinct reduction of anterior cleft width as well as a greater expansion in canine distance. In comparison with untreated UCLP patients, anterior cleft width of our patients was significantly more reduced. In addition, no sagittal and transverse growth inhibition could be proved using Hotz's plates.
DISCUSSION: The results indicate that there is a significant sexually determined difference in growth and that passive presurgical orthopaedic treatment improves maxillary arch conditions in UCLP patients. A guidance of growth can be noticed, facilitating cheiloplasty. In order to enable a certain prediction of anterior cleft reduction dependent on initial cleft width, a longitudinal multilevel model is presented.

54 THE USE OF THE JASPER JUMPER FOR THE CORRECTION OF CLASS II MALOCCLUSION IN THE YOUNG PERMANENT DENTITION

N Stucki, B Ingervall, Department of Orthodontics, University of Bern, Switzerland

AIM: To elucidate the effects of the correction of Class II malocclusion in the young permanent dentition with the Jasper Jumper, and the stability of these effects.
SUBJECTS AND METHODS: Twenty-six consecutive patients, 13–25 years of age, with Class II division 1 malocclusions, were treated with the Jasper Jumper for 2–11 months (median 5 months). The Jumper therapy was discontinued when a Class I molar relationship was attained. Profile cephalograms were made when the Jumpers were inserted and removed, as well as 4–12.5 months (median 7 months) after the removal of the Jumpers.
RESULTS: All the subjects adjusted rapidly to the Jumpers. The great majority of the patients had one or two Jumpers per side. The fracture rate was 9 per cent. The median improvement of the overjet and of the molar relationship at the end of the active Jasper therapy was 4.7 and 3.4 mm respectively. After the active treatment a partial relapse occurred so that a 3.0 mm improvement of the overjet and 2.6 mm improvement of the molar relation was maintained at the end of observation. At the end of the active treatment the correction of the overjet was achieved to about equal parts by retroclination of the upper incisors, proclination of the lower incisors and an increase of the mandibular prognathism. The correction of the molar relationship was achieved by distal movement of the upper, mesial movement of the lower molars, and increased mandibular prognathism. All or most of the dento-alveolar effects relapsed so that the remaining treatment effect at the end of observation was mainly skeletal and due to the increased mandibular prognathism, Thus, at the end of observation, 64 per cent of the correction of the overjet and 78 per cent of the molar correction was due to skeletal improvement.

55 DENTAL IMPLANTS IN ORTHODONTICS

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KEYNOTE ADDRESS
An experimental study has shown that titanium implants do not move the eruption of adjacent teeth in the growing jaws of pigs, nor do they become secondarily displaced in the sagittal and transverse dimensions. A clinical study in adolescents has verified these results. Forty-eight patients with 75 implants in the upper incisor region were followed during a period of 7–13 years. The ages of the patients at the time of insertion was 13–37 years.
A fixed chronological age is no guide for fixture placement. The dental age must indicate fully erupted teeth and the skeletal maturation must be complete. However, the results in the follow-up study have provided information that changes in the occlusion may occur even in adulthood and that stability of the occlusion at placement of the fixture is of utmost importance in the long-term result. Thus the orthodontist has to be involved in the treatment planning *before* the installation of single implants.
Due to the stability of the fixtures they can be used as excellent orthodontic anchorage for the following tooth movements: tipping, torquing, rotation, intrusion, extrusion and those associated with bodily movements. The tissue reaction to these implants has been analysed in a 10-year follow-up study in nine adult patients.

56 CORRECTION OF ANTERIOR TEETH IN ADULTS

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KEYNOTE ADDRESS
Malpositions of anterior teeth that result from loss of periodontal structures in later years can create severe aesthetic problems. Usually one or more maxillary incisors protrude and overerupt. These movements are usually associated with the development of diastemas and the over-eruption of mandibular incisors.
In considering the correction of these malpositions it has to be realized that orthodontic treatment of adults is associated with a larger risk of iatrogenic effects than in children. Adults are more vulnerable to root resorption, inflammation of the periodontium and loss of marginal alveolar bone than children. These iatrogenic effects can be avoided or reduced when the orthodontic treatment is not comprehensive but is limited in the use of appliances and treatment time. In addition, by shortening the crowns of the mandibular incisors, and occasionally also the maxillary ones, the overeruption can be compensated. This approach leads to a more favourable ratio between the attached part of the tooth and the non-attached part than is the case when intrusion is performed.
Many of these malpositions can be treated adequately in a

simple way, in a short period of time, and in an almost invisible way. That particularly applies when such treatments are combined with strategic removal of tooth material. The use of a removable maxillary appliance with elastics that run over the labial surfaces of the incisors is advocated. However, controlled movements are difficult to perform without placing composite build-ups on the labial surfaces to guide the elastics. In addition, the proper adaptation of the acrylic of the plate is essential to achieve the desired results.
The treatment procedure will be outlined in detail and demonstrated on patients followed for many years after treatment. Finally retention aspects and methods will be dealt with.

57 PALATAL IMPLANT ANCHORAGE REINFORCEMENT OF POSTERIOR TEETH: A CLINICAL STUDY

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AIM: To evaluate the anchorage capacity of palatally inserted Orthosystem implants for anchorage reinforcement of posterior teeth.
SUBJECTS AND METHODS: Orthosystem implants (one-piece titanium screws with abutment and clamp-cap), a sample of nine Class II patients (aged 15–35 years). The treatment plan included extraction of the first maxillary premolars and retraction of the anterior teeth based on maximum anchorage of the posterior teeth without compliance-dependent anchorage aids (headgear, Class II elastics) being used. For this purpose each of the patients received one implant inserted into the midsagittal palatal region. After 12 ± 2 weeks of unloaded implant healing, transpalatal bars (TPB) were inserted and fixed with clamp-caps to the implant in order to reinforce the posterior anchorage teeth. Measurements on the casts and lateral cephalograms (defined reference points) from before treatment and after canine retraction and normalization of overjet (mean treatment duration: 11 months) allowed the mean amount of anchorage loss, and canine and incisor retraction to be assessed.
RESULTS: The mean anchorage loss measured on the casts was 0.7 on the right and 1.1 mm on the left side ($P < 0.05$). Radiological measurement revealed a mean anchorage loss of 0.9 mm ($P < 0.05$). The mean amount of canine retraction measured on the casts was 6.6 mm on the right and 6.4 mm on the left side, $P > 0.05$). Radiologically, a mean canine retraction of 6.7 mm was recorded ($P > 0.05$). The mean reduction of overjet was 6.2 mm for cast, and 6.5 mm for radiological assessment ($P > 0.05$).
CONCLUSIONS: As clinical assessment and initial histological results of the removed implants revealed stability of the fixtures, small anchorage loss of the implant/TPB reinforced posterior teeth may be due to slight deformation of the TPB under orthodontic force. Nevertheless, the treatment goal was achieved in all patients without compliance-dependent anchorage aids being used.

58 NEW MATERIALS FOR UPRIGHTING MOLARS AS PROSTHETIC AND PERIODONTAL-PROPHYLACTIC MEASURES

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AIM: Uprighting tipped molars for space closure or for prosthetic care is a measure often effected in practice. Besides the uprighting moment, the uprighting spring must exert an intrusive force to avoid traumatic occlusal contacts during molar uprighting. Conventional uprighting mechanics do not fit the requirements, or are difficult to adjust due to their material properties. The application of a NiTi–steel uprighting spring shows considerable advantages over the application of conventional uprighting mechanics.
MATERIALS AND METHODS: Forces and moments were measured in all three dimensions of space with the help of two elastic, six-component measuring sensors in the case of conventional mechanics and the NiTi–steel uprighting spring. Further analysis of data followed using a specially designed computer program.
RESULTS: The results of conventional uprighting mechanics show a linear behaviour due to their material properties. In addition, there is an extrusive force component at the molar. An intrusive force component can only be produced using the Burstone uprighting spring. The results of the NiTi–steel uprighting spring show an uprighting moment between 5 and 15 Nmm, dependent upon the construction of the uprighting spring. In the case of these uprighting mechanics an additional intrusive force of 0.2–0.5 N can be produced during the entire process of molar uprighting.
CONCLUSION: Definite forces and moments can be achieved by applying the NiTi–steel uprighting spring. Because of the more favourable material properties, these uprighting mechanics are more suited for the treatment of adult patients. Even molars tipped horizontally can be uprighted and aligned.

59 FUNCTIONAL APPLIANCE THERAPY IN COMBINATION WITH EXTRAORAL TRACTION AND UP-AND-DOWN ELASTICS

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AIM: The poor response to functional appliance therapy in the treatment of Class II division 1 malocclusions was the reason for using the Bionator appliance combination with extraoral traction to keep the appliance in a fixed position relative to the maxilla and with up-and-down elastics. By using up-and-down elastics at night, the mandible is fixed in the therapeutic position, allowing better conditions for condylar growth stimulation/adaptation.
METHODS: The treatment progress was documented by the comparison of cephalometric radiographs, radiographs of

the condyles, the dental casts and pictures of the patient's profile. A bite plane was used for deprogramming the neuromuscular system to ensure that the corrected position of the mandible was stable. The patient group consisted of 25 patients (average age of 10 years ± 6 months at the beginning of treatment). Three different patient groups, each of them consisting of 25 patients, were used as control groups. Patients in one control group did not receive any treatment; in the second control group only a Bionator was used; and in the third control group the patients were treated with a Bionator in combination with extraoral traction and up-and-down elastics.

RESULTS: For the evaluation of treatment progress different clinical examinations and cephalometric records were used. Preliminary results suggest a significant improvement in therapeutic efficacy compared with controls (reduction of overjet $x = -5.3 + 3.1$ versus $-2.1 + 2.0$ mm, $P < 0.1$; reduction of ANB angle $x = -1.05 + 0.80$ versus $-0.75 + 1.2$ degrees, $P < 0.05$). The enhanced mean efficacy is due to an additional effect exerted on the mandible in most cases (increase of SNB angle $x = 0.5 + 0.4$ versus $-0.26 + 3.20$ degrees, $P < 0.05$).

60 GENE MAPPING OF CLEFT LIP AND PALATE

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AIM: To map the gene(s) causing human cleft lip and palate (CL/P).

SUBJECTS: Forty-four multiplex (220 individuals) and 121 nuclear (363 individuals) CL/P families.

METHODS: National records for congenital malformations and hospital records were searched to ascertain CL/P patients. Pedigrees were constructed from interviews with family members. Physical examinations were performed and blood samples were collected from participants. DNA was obtained by modified phenol extraction and quantified by ethidium bromide staining. Genetic analysis was performed by polymerase chain reaction (PCR) amplification of the DNA using 400 microsatellite markers spanning every 10 cM along the genome. The microsatellite markers were fluorescent labelled for electrophoresis on an ABI 377 sequencer. Linkage analysis was used to calculate the maximum LOD scores in the multiplex families. A transmission disequilibrium test was used to test candidate genes in the nuclear families.

RESULTS: The methods of recruiting CL/P families were successful in collecting a substantial number of participants. Methods for DNA extraction, PCR and electrophoresis were established and functioning. PCR and electrophoresis of 17 multiplex families on chromosome 6 and 19 containing the candidate loci ofcl and ofc2 has been completed. Preliminary analysis of chromosome I on a subset of families inheriting cleft palate has mapped one family with Van der Woude syndrome to the published region on chromosome lq32.

CONCLUSION: A highly efficient strategy for generic analysis of complex diseases has been developed and is being applied to a large group of CL/P families. CL/P is a genetically heterogeneous disease estimated to be caused by 4–6 genes. The materials and methods established by us will enable the mapping of both the major and minor generic components causing this congenital malformation.

61 THE SEARCH FOR EXCELLENCE IN ORTHODONTICS—IS IT REALLY NECESSARY?

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SHELDON FRIEL MEMORIAL LECTURE

This lecture will discuss the rationale for attempts to obtain excellence in contemporary orthodontic treatment. Three different aspects will be dealt with, namely (i) provision of long-term stability of treatment results, (ii) optimizing aesthetics with regard to the facial profile and smile, and (iii) controlling iatrogenic damage, most notably apical root resorption.

Stability: Several influential studies have indicated that it is difficult to obtain long-term stability of many orthodontic treatment results. This has lead to the development of concepts that permanent retention may be necessary for all patients. As a general treatment policy this attitude is not practical. This lecture will discuss some recent studies which demonstrate that cases treated to excellent results appear to be more stable than cases which, upon closer examination, were apparently undercorrected or expanded. In particular the following will be commented upon: (i) full correction of *all* rotations (10/10 orthodontics); (ii) avoiding expansion of mandibular 3–3 distance if within 'normal' range at the start of treatment; (iii) avoiding excessive lower incisor retrusion and providing adequate crown torque of maxillary (and mandibular) incisors; and (iv) the use of prolonged retention periods with fixed and/or removable retainers.

Aesthetics: A frequent comment heard in criticism of orthodontic treatment results comes from parents of prospective patients who do not like the changes in upper lip position that they have observed in some orthodontically treated patients. A simplified visualized treatment objective for the upper lip may be of self-teaching value and help avoid unnecessary flattening of patient profiles. It is also easy to make several mistakes when patients display the dentition in the rest position and when fully smiling. This will undoubtedly reduce the benefits from an otherwise successful orthodontic treatment result. Concepts and guidelines on how to analyse tooth display from a frontal perspective will be presented. The need for age- and sex-related goals, and individual variation in different facial types will be emphasized. To avoid an aged appearance, over-intrusion of maxillary incisors must be avoided in patients with normal and low smiles. New concepts with regard to the most aesthetic crown torque for maxillary canines and premolars will be discussed so as to achieve a fullness of smile without lateral expansion.

Iatrogenic damage: A recognized minimum goal of all

medical services is not to harm the patient. For orthodontics this implies avoiding the introduction of marked detrimental effects, such as apical root resorption. The reasons for the occurrence of excessive root shortening associated with orthodontic fixed appliance therapy will be reviewed. Guidelines for limiting or elimination of marked resorption will be presented based upon experiences of using a 'traffic signal' system.

In conclusion, the present lecture will demonstrate that malocclusions treated to excellent results according to sound orthodontic principles provide more stability and aesthetically superior outcomes than other forms of orthodontic therapy. This basis should be a source of inspiration in our continued strive towards excellence in clinical orthodontics.

The following abstracts were omitted from those published previously. They were presented as posters at the 72nd Congress of the European Orthodontic Society

62 VARIATION IN TORQUE PLAY BETWEEN DIFFERENT BRACKET TYPES AND MANUFACTURERS

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AIMS: Bodily movement of teeth requires the application of definite moments, and in particular bucco-lingual root torque. The aim of this study was to evaluate torque play in different bracket types from different manufacturers.

MATERIALS AND METHODS: Eighteen different bracket types (0.0.18 inch, standard edgewise and straight-wire brackets, different construction and sizes) from four manufacturers (GAC, Dentaurum, Ormco, Unitek) were tested with a 0.018 × 0.025 inch stainless steel wire (Dentaurum, Extrahart) in a torque measuring-machine described by Ødegaard *et al*. to evaluate accurately the amount of torque play.

RESULTS: The results showed that a significant difference existed between the tested brackets. The range of play was between 0 and 10.28 degrees, which is relevant clinically because of significant differences in applied torque moment.

CONCLUSIONS: To apply specific amounts of torque moments it seems necessary either to use a known bracket–wire combination, or use techniques that are less dependent on the exact geometry, i.e. superelastic archwire systems.

63 HAS THE HERBST APPLIANCE A ROTATIONAL EFFECT ON THE MANDIBLE?

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AIM: To assess the individual reaction pattern and the long-term effects of Herbst appliance treatment on the vertical jaw base relationship, as expressed by the mandibular plane angle (ML/NSL). In the evaluation special reference was given to the pre-treatment vertical jaw base relationship (hypo-, normo- or hyper-divergent).

MATERIALS AND METHODS: Lateral head films of 80 patients (47 males and 33 females) were analysed before, at the start (when the appliance was placed) and at the end of Herbst treatment (when the appliance was removed), as well as 6 months and 4.5–5 years post-treatment.

RESULTS: The ML/NSL angle was on average unaffected by Herbst therapy. Post-treatment a continuous decrease in the ML/NSL took place. Male subjects exhibited a larger angular decrease than female subjects. However, a large inter-individual variation existed. No differences were found between hypo-, normo- and hyper-divergent subjects.

CONCLUSION: Herbst treatment does not result in a backward rotation of the mandible.