Abstracts

The effect of smiling on facial asymmetry in adults: a 3D evaluation
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Background/aims: Mild resting facial asymmetry exists in clinically symmetrical faces, but the
effect of smiling on the magnitude of overall facial asymmetry in adults has not been assessed.
The aim of the present study was to use stereophotogrammetry to quantify the effect of smiling
on overall facial asymmetry in Caucasian adults who presented with Class I incisor relationships
and no history of orthodontic treatment.

Methods: Twenty male and 20 female Caucasians aged 18–30 years with no history of
orthodontic treatment, a clinically symmetrical face and a Class I incisor relationship had 3D
stereophotogrammetric images captured at rest and on natural and maximal smile (T1). The
images were repeated 2–4 weeks later (T2) to assess expression reproducibility. Overall facial
asymmetry scores were produced from 27 landmarks using partial Ordinary Procrustes Analysis
(POA) and assessed by an Analysis of Covariance (ANCOVA) model. A random sample of the
images was re-examined two months later to calculate intraobserver landmark reproducibility.

Results: Mean landmark error was low (0.41 ± 0.07 mm). Mean overall facial asymmetry scores
were not significantly gender different (p = 0.5300); therefore, the male and female data were
pooled. Mean overall facial asymmetry scores for maximal
(0.91 ± 0.16) and natural smile (0.88 ± 0.18) were higher than at rest (0.80 ± 0.17) (p < 0.0001)
and were reproducible across (T1–T2) sessions (p = 0.3204).

Conclusions/implications: Overall 3D facial asymmetry scores for the sampled Caucasian adults
with clinically symmetrical faces increased in magnitude from rest to natural and to maximal
smile. Clinicians should assess overall facial asymmetry at rest and on natural and maximal smile
at baseline, during treatment and as part of a core outcome assessment, particularly for cases
with unilateral posterior crossbite, unilateral cleft lip and palate or skeletal asymmetry.

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A study of Class III treatment: orthodontic camouflage vs orthognathic surgery
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Aim: To evaluate the differences in pretreatment and post-treatment characteristics of Class III patients treated with orthodontic camouflage or orthognathic surgery, and to compare the range of skeletal, dental and soft tissue changes that are likely to occur with treatment, with particular reference to the influence of extractions on the resultant incisor angulations.

Method: Pretreatment and post-treatment cephalograms of 31 Class III orthodontically-camouflaged patients and 36 Class III surgical patients (without genioplasty) were obtained from one specialist practice. From the surgical group, 26 pre-surgical lateral cephalograms were also obtained. Inclusion criteria for the two groups were at least three of the following: (1) an ANB angle of 1 degree or less, (2) a Wits appraisal less than -4 mm, (3) an incisal overjet ≤ 0 mm, and (4) a Class III molar relationship. All lateral cephalograms were traced and digitised and a number of skeletal, dental and soft tissue variables were measured. The camouflage and surgical groups were also divided into premolar extraction and non-extraction subgroups to allow for a specific analysis of extraction effects.

Results: Before treatment, the surgical group demonstrated, on average, a more severe skeletal discrepancy and increased dental compensations, compared with the orthodontically camouflaged group. After treatment, the mean SNA angle was greater, the ANB angle was more positive, the Wits appraisal was closer to ideal and the lower incisors were less retroclined in the surgery group. There was a small mean reduction in horizontal chin projection in the surgery group compared with a small increase in the camouflage group. The mentolabial fold and the lower lip curve were deeper, on average, and the lips less retrusive after surgery. There was a mean increase in upper incisor proclination during treatment in both the surgical and camouflage groups with a greater increase in the camouflage group. There was a significant reduction in upper incisor proclination and a subsequent greater increase in the ANB angle associated with upper premolar extractions in the surgical group compared with the non-extraction group. Lower premolar extractions in the camouflage group resulted only in a deeper mentolabial fold compared with those treated without lower extractions.

Conclusions: Class III patients selected for surgical treatment are likely to have more severe pretreatment dental and skeletal discrepancies than those selected for camouflage treatment. Surgical treatment is associated with significant decompensation of the lower incisors but, ultimately, not the upper incisors. Class III patients treated with either camouflage or surgery treatment are likely to finish with slightly proclined upper incisors. Generally, surgical treatment results in greater skeletal change, involving normalisation of the skeletal base relationship, a reduction in chin prominence, fuller lips, and a more favourable lip and chin contour.

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A multi-centre evaluation of multiple supernumerary premolar prevalence
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Aim: The occurrence of multiple supernumerary teeth is rare and often found in association with syndromes such as cleidocranial dysplasia, Gardner’s syndrome or cleft lip and palate. Few examples of non-syndromal multiple supernumerary teeth have been reported. The aim of this multi-centre study was to investigate the prevalence of supernumerary premolar teeth in non-syndromic patients and to investigate the association between the presence of supernumerary premolar teeth and malocclusion type in a Turkish population.

Materials and methods: The clinical records and panoramic radiographs of 10,700 patients (referred to three different university hospitals) were retrospectively examined for the presence of supernumerary premolars. Age, gender, orthodontic malocclusion type, the number of supernumerary premolars (two or more), the distribution, location, position (vertical, horizontal, inverted, mesio-angular), surgical approach, and related complications (pain, cystic changes, root resorption, or eruption disturbance of adjacent teeth) were recorded.

Results: Forty-two cases (13 Class I, 17 Class II, 12 Class III) of multiple mandibular supernumerary premolars in patients without an associated syndrome were detected. A total of 97 (27 Class I, 41 Class II, 29 Class III) supernumerary premolar teeth were found, with a prevalence of 0.39%. No statistical difference was found related to gender, malocclusion type and supernumerary premolars (p > 0.05). The majority of the extra premolars were located in the mandible, which was statistically significant (p < 0.05).

Conclusion: The present study revealed that the prevalence of multiple supernumerary teeth was 0.39%. The most frequently impacted premolars were found in the mandible and more often associated with Class II malocclusions in the examined Turkish population.

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A comparison of orthodontic treatment outcomes using the Objective Grading System (OGS) and the Peer Assessment Rating (PAR) index

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**Introduction:** The use of objective criteria is essential to uniformly quantify and measure the severity of malocclusions and the efficacy of different treatment modalities. The Peer Assessment Rating (PAR) index and, more recently, the American Board of Orthodontics Objective Grading System (OGS) were developed to fulfill this need.

**Aim:** The aim of this retrospective study was to assess and compare treatment outcomes using the UK and US weighted PAR and the OGS. Materials and methods: The sample consisted of randomly selected records of 50 patients treated by residents in one postgraduate orthodontic clinic. UK and US weightings for the PAR index were applied and compared with OGS.

**Results:** There was no statistically significant association between the OGS and the PAR index grading systems. Neither the UK nor the US PAR weightings showed statistically significant correlation with the OGS. All cases were ‘greatly improved’ or ‘improved’ according to the PAR index, while most cases (62%) failed according to OGS. There was a statistically significant correlation between the unweighted PAR index and the OGS (r = -0.32, p = 0.024). The US and the UK weightings for the PAR were highly correlated (r = 0.90, p < 0.001). Both weighting systems were also highly correlated with the unweighted PAR (p < 0.001). There were no gender differences found in any of the scoring systems.

**Conclusions:** The current PAR index cannot replace the OGS for evaluating treatment outcomes. The current OGS cannot detect the improvement achieved in a treated case.

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Chemical and mechanical characteristics of contemporary thermoplastic orthodontic materials
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Aim: The aim of the present study was to characterise the chemical and mechanical properties of contemporary thermoplastic orthodontic materials.

Materials and methods: Four thermoplastic materials were tested: Clear Aligner (Scheu-Dental), ACE and A+ (Dentsply), and Invisalign (Align Technology). Eight appliances were fabricated from each material and a small portion from each was analysed by ATR-FTIR spectroscopy. The appliances were cut and, following metallographic grinding and polishing, were subjected to instrumented indentation testing (IIT) employing a Vickers indenter. Martens Hardness (HM), Indentation Modulus (EIT), Elastic to Total Work Ratio (elastic index (ηIT)) and Indentation Creep (CIT) were determined according to ISO 14577-1. The mean values of the mechanical properties were statistically analysed by one way ANOVA and Tukey Kramer multiple comparison test at a = 0.05.

Results: ATR-FTIR analysis identified that Invisalign was a polyurethane-based material, whereas the others were based on polyester, polyethylene glycol terephthalate (PETG). Invisalign showed higher hardness and modulus values, a slightly higher brittleness and lesser creep resistance compared with the PETG-based products.

Conclusions: The materials tested showed significant differences in their chemical structure and mechanical properties and therefore differences in their clinical behaviour are anticipated.

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**Comparative evaluation of pulpal blood flow during incisor intrusion**
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**Aim:** The aim of the present study was to evaluate and compare changes in pulpal blood flow (PBF) as a result of maxillary incisor intrusion achieved by one of two methods (utility arches or mini-implants).

**Materials and methods:** Thirty subjects were divided into three groups, the first of which underwent maxillary incisor intrusion using utility arches (UA) and a second group, intrusion via mini-implants (MI). The third group acted as a control. An intrusive force of 100 g was applied to the upper incisors in the treatment groups, whereas no force was applied to the anterior teeth in the control group. A laser Doppler flowmeter (LDF) was used to measure PBF at baseline (T0) and during incisor intrusion at 24 hours (T1), three days (T2), seven days (T3) and three weeks (T4). Statistical changes in PBF were assessed by the Wilcoxon Signed Rank and Mann-Whitney U tests, with significance set at p < 0.05.

**Results:** The mean PBF in the UA and MI groups decreased significantly from T0 to T1 (p < 0.001), slightly increased at T2 and continued to increase gradually at T3. PBF attained levels similar to those measured prior to intrusion at T4. No significant changes in PBF were observed in the control group over the course of the study. The only statistically significant difference between the UA and MI groups were at T1 and T2, at which time the MI group had lower PBF values (p < 0.001).

**Conclusions:** Despite slight regressive changes in pulpal tissue observed over the short term, PBF values tended to return to initial levels within three weeks, indicating that changes observed in PBF with the UA and MI intrusion methods are reversible. Although the changes in PBF could not be directly related to the method of intrusion employed, in general, a more severe drop in PBF was observed in the MI group during the first three days of intrusion.

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Shear bond strength of different fixed orthodontic retainers
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Objective: To compare the shear bond strength of different fixed retainer wire diameters bonded using a conventional composite resin or a specific retainer composite.

Materials and methods: One-hundred-and-twenty extracted human premolar teeth were divided into six groups. After conventional acid etching with a 37% phosphoric acid gel for 30 seconds, twist flex wires of various diameters (0.0175”, 0.0215”, 0.032”) were bonded as fixed retainers. Conventional bracket adhesive (Filtek Z250) or retainer specific adhesives (Transbond LR) were used. After curing, the specimens were stored for 24 hours in distilled water at 37°C and, thereafter, subjected to 500 thermal cycles. The specimens were then debonded using a Universal Instron machine. The site of failure was recorded for each specimen and the shear bond strength calculated. Statistical analyses were provided using a Chi-square test for failure site and a two-way ANOVA test to assess shear bond strength.

Results: The site of failure was predominantly at the wire composite interface in all groups. The specific retainer composite showed a significantly higher shear bond strength compared with conventional composite (p < 0.001). There was a statistically significant difference between the three wire diameters (p < 0.001); the 0.0215” wire had the highest shear bond strength, whereas the 0.032” wire had the least shear bond strength.

Conclusions: The site of failure was unrelated to wire diameter or adhesive. The optimal combination to maximise the bond strength of fixed retainers appeared to be a specific retainer adhesive and a wire diameter of 0.0215”.

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Skeletal effects of the alteration of masseter muscle function
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Aim: To investigate the effects of muscle denervation and the introduction of the β2-adrenoceptor agonist, formoterol, on the relationship between muscles and underlying skeletal growth.

Method: Thirty-one (4-week-old) male Sprague-Dawley rats were assigned to four groups: Surgical Sham; Denervated; Denervated + β2-agonist; and β2-agonist only. The Surgical Sham group had the left masseteric nerve exposed but not sectioned. Both of the denervated groups had the left masseteric nerve exposed and sectioned. The groups receiving the β2-agonist had formoterol directly injected into the left masseter muscle every three days for eight weeks. Sixteen angular and linear skeletal measurements were assessed in the overall craniofacial region and the mandible via standardised digital radiography in three views: lateral head, submentovertex and right and left disarticulated hemi-mandibles.

Results: The findings indicated that, following surgical denervation of the masseter muscle, there were significant changes in the muscle and in the subsequent development of the underlying skeletal structures. The post-surgical changes were largely offset by the administration of a β2-agonist, formoterol, which attenuated muscle atrophy. However, the administration of the β2-agonist only, without surgical denervation, did not lead to changes in skeletal facial form.

Conclusions: Denervation atrophy of the masseter muscle results in statistically significant changes in the development of the underlying skeleton. The changes, however, are localised to areas of muscle attachment. The administration of the β2-agonist, formoterol, despite its effect on muscle anabolism, does not have a significant effect on underlying skeletal growth.

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The effect of the buccal corridor and tooth display on smile attractiveness
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Aims: The aim of the present study was to evaluate the lay perception of the effect of the buccal
corridor and amount of toothgingival display on the attractiveness of a smile in different facial
types.

Materials and methods: Using Adobe Photoshop CS3 software, frontal facial images of two
smiling Iranian female subjects (one short-faced and one long-faced) were altered to create
different magnitudes of buccal corridor display (5, 10, 15, 20 and 25%) and tooth-gingival display
(2 mm central incisor show, 6 mm central incisor show, total central incisor show, total tooth
show with 2 mm gingival show and total tooth show with 4 mm gingival show). Sixty Iranians (30
males and 30 females) rated the attractiveness of the pictures on a 1–5 point scale.

Results: Narrower smiles were preferred in long-faced subjects compared with short-faced
subjects. Minimal tooth show was more attractive than excessive gingival display in short-faced
subjects. There were no gender specific, statistically significant differences found in the ratings
given by the lay assessors.

Conclusions: Harmonious geometry of the smile and face in both the vertical and transverse
dimensions influences smile attractiveness and this should be considered in orthodontic
treatment planning.

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Bond strength and micro-computed tomographic evaluation of pre-coated brackets
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Objectives: The aim of the present study was to assess and compare the shear bond strength (SBS) of metal pre-coated orthodontic brackets bonded to fluorotic and non-fluorotic teeth treated with three different etching techniques. A second aim was to determine the volume of adhesive remaining on the tooth at debond using micro-computed tomography (μCT).

Methods: Ninety extracted premolars were selected to include 45 fluorotic (test group) and 45 non-fluorotic (control group) teeth. Each group was divided into three subgroups of 15 each, which were treated as follows: 1) micro-etched; 2) acid-etched; and 3) both micro-etched and acid-etched. A bonding agent was applied to the prepared surfaces; pre-coated and light-cured brackets were attached to all teeth. An Instron universal testing machine was used to record the debonding force. Specimens were then scanned using a microCT to evaluate the amount of adhesive remaining on the teeth. The significance of the statistical tests was pre-determined at p < 0.05.

Results: Two-way ANOVA showed that fluorosis of teeth had no influence on the SBS (p = 0.165) whereas the volume of adhesive remnants was significantly higher in the control group compared with the test group (p < 0.001).

Conclusions: Fluorosis had no influence on the SBS of brackets, whereas it had a negative influence on retaining adhesives onto the tooth surfaces.

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Closure of an open bite using the ‘Mousetrap’ appliance: a 3-year follow-up
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Recently, skeletal anchorage devices have been used as anchorage units for upper molar intrusion as a way of correcting an anterior open bite malocclusion. To avoid the surgical procedures associated with the placement of miniplates in the zygomatic area, mini-implants may be inserted palatally or buccally in the alveolar process. However, consideration must be given to the potential risks of root damage and a higher failure rate associated with the placement of temporary anchorage devices (TADs) in the interradicular area. The anterior hard palate provides a safer and more stable alternative for TAD placement. The current paper describes the biomechanical principles and the clinical procedures of ‘Mousetrap’ mechanics using mini-implants in the anterior palate for upper molar intrusion. The stomatognathic response of maxillary molar intrusion is an autorotation of the mandible and so the sagittal implications for each patient must be considered. The presented patient demonstrates successful correction and stability of the treatment result at a three-year review.

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Multi-disciplinary management of a patient with a post-traumatised incisor presenting concurrent replacement and inflammatory resorption: a case report

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This case report describes the multidisciplinary management of a young male who presented with a Class I incisor relationship and bi-maxillary dento-alveolar protrusion on a Class I skeletal base. The occlusion was complicated by an ankylosed and moderately infra-positioned upper left permanent central incisor, an anterior crossbite, crowding, a reduced overbite and centreline discrepancy. The incisor was traumatised and avulsed when the root was immature and the tooth was reimplanted with delay. On referral for orthodontic treatment at age 11.5 years, the upper left central incisor was experiencing ankylosis-related (osseous replacement) resorption and external root resorption simultaneously. Aside from the orthodontic aims, it was important to address the disrupted alveolar development to facilitate later prosthodontic replacement of the upper left permanent central incisor by idealising the inter-coronal and inter-radicular spaces. Treatment consisted of fixed orthodontic appliances in conjunction with the extraction of all second premolars and the upper left permanent central incisor with episodic surgical curettage. An upper Hawlix retainer was provided immediately at debond and a cantilevered resin-retained bridge was placed four months later.

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Class III orthognathic surgical cases facilitated by accelerated osteogenic orthodontics: a preliminary report
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Objectives: To describe a multidisciplinary treatment approach that includes corticotomy, orthodontic force and orthognathic surgery for the management of skeletal Class III surgical cases. The main advantage of the combined techniques is a reduction in treatment time for young adult patients.
Method: Accelerated Osteogenic Orthodontics (AOO) was delivered to three young adult patients during their pre-surgical orthodontic treatment. After aligning and levelling the dental arches, a piezoelectric surgical corticotomy was performed to the buccal aspect of the alveolar bone. Bone graft materials were used to cover the decorticated area and soft tissue flaps were replaced.
Results: The mean time for extraction space closure was 5.4 ± 1.3 months and the mean time for pre-surgical orthodontic treatment was 12.0 ± 0.9 months. The average total treatment time was 20.4 ± 2.4 months. A pre-existing bony fenestration in the buccal cortex adjacent to the right lateral incisor root apex of Case 1 was corrected.
Conclusion: The facial aesthetics of three patients improved following multidisciplinary treatment. This approach may be an efficient method for the orthognathic patient who desires a reduced treatment time, but further clinical research is required.

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An aesthetic approach towards the temporary restoration of missing upper lateral incisors during orthodontic treatment
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This clinical hint demonstrates an aesthetic method for masking spaces due to missing lateral incisors during orthodontic treatment.

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