Abstracts

Morphological effects of mesenchymal stem cells and pulsed ultrasound on condylar growth in rats: a pilot study
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Aim: The aim of this study was to assess and describe the morphological effects of an intra-articular injection of Mesenchymal Stem Cells (MSCs) and/or Low Intensity Pulsed Ultrasound (LIPUS) stimulation on the mandibular condyles of growing rats, using cone beam computed tomography (CBCT) and histology.

Methods: Twenty-six young (23-day-old) rats were divided into 5 groups identified as LIPUS-stimulated (20 minutes daily using 50 mW/cm2, 1MHz, 0.2 millisecond pulses), MSCs injected (1 x 105 cells/kg), LIPUS + MSCs, medium injected, and untreated controls. All treatments were performed in the left temporomandibular joint of each rat (TMJs). At day 21, CBCTs were obtained for cephalometric analysis and 3D reconstructions. After animal sacrifice, left and right TMJ sections were histologically prepared and examined. The Wilcoxon sign rank test and the Kruskal-Wallis 2 test were applied for statistical comparison.

Results: Imaging results showed that left condyles were wider in all LIPUS-treated groups (p < 0.05), while the LIPUS-only group had a greater left sagittal condylar length. LIPUS-treated groups displayed a lower midline shift to the right (p < 0.02). No significant differences were observed in the MSC group. Bone marrow morphology and vascularity differed between the groups as LIPUS-treated groups exhibited increased vascularity in the erosive cartilage zone.

Conclusion: It was established that LIPUS and MSC application to the TMJ region of growing rats favoured transverse condylar growth, while LIPUS application alone may enhance sagittal condylar development. The MSC injection model had little effect on sagittal condylar growth.

(Aust Orthod J 2013; 29: 3-12)
Received for publication: May 2012 Accepted: March 2013

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Colour stability of aesthetic brackets: ceramic and plastic
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Background: The colour stability of aesthetic brackets may differ according to their composition, morphology and surface property, which may consequently influence their aesthetic performance.

Aims: To assess the colour stability of aesthetic brackets (ceramic and plastic) after simulating aging and staining.

Methods: Twelve commercially manufactured ceramic brackets and four different plastic brackets were assessed. To determine possible colour change (ΔE*ab) and the value of the NBS (National Bureau of Standards) unit system, spectrophotometric colour measurements for CIE L*, a* and b* were taken before and after the brackets were aged and stained. Statistical analysis was undertaken using a one-way ANOVA analysis of variance and a Tukey multiple comparison test (α = 0.05).

Results: The colour change between the various (ceramic and plastic) materials was not significant (p > 0.05), but still varied significantly (p < 0.001) between the brackets of the same composition or crystalline structure and among commercial brands.

Conclusion: Colour stability cannot be confirmed simply by knowing the type of material and crystalline composition or structure.

(Aust Orthod J 2013; 29: 13-20)
Received for publication: September 2011
Accepted: March 2013

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Surgically-assisted rapid maxillary expansion of narrowed maxillae: a case-cohort study
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Aims: The aim of this study was to investigate a consecutive cohort of surgically-assisted rapid maxillary expansion cases to determine the indications, results and relapse associated with the procedure.

Methods: The records of 21 cases of SARME treated by the Oral and Maxillofacial Surgery and Orthodontic units at the University of Adelaide were examined. Overall expansion and subsequent relapse were compared on study models and posteroanterior cephalometric radiographs against the variables of age, gender, surgeon, surgical technique, final occlusion and the retention period. Statistical analysis was performed on paired variables.

Results: Maximum expansion was gained across the intermolar width and the most relapse identified across the canines. Male patients showed statistically greater stability across the intercanine width. There were otherwise no significant relationships between the treatment variables, stability or relapse.

Conclusions: SARME is a safe surgical technique for narrowed maxillae requiring intermolar expansion of 6 mm or more. Overexpansion of up to 60% is required to compensate for relapse.

Received for publication: August 2012
Accepted: January 2013

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On the augmented reproducibility in measurements on 3D orthodontic
digital dental models and the definition of feature points

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Objective: The objective of this study was to explore digital measurement methodology on 3-dimensional (3D) dental models. Standardised manipulation and practices have lead to reliable measurements on plaster casts. Identifying landmarks on digital models or digitised plaster casts is fundamentally different from actual measurements. Three-dimensional models are represented on flat screens and landmarks are individually indentified. A procedure is proposed that resolves the deficiencies associated with a 2-dimensional (2D) display through an appropriate model representation and through local optimisation.

Methods: Fifteen models (OrthoProof) were exported to a locally developed 3D point indication software package, in which two measurement approaches were implemented involving standard projection with and without local search. Nine linear measurements were obtained from plaster casts and digital models. Statistical analysis included correlation and Friedman’s nonparametric analysis of variance (ANOVA).

Results: For five out of nine linear measurements, digital indications yielded results significantly different from manual measurements (p = 0.05). Local search considerably improved measurement accuracy and reliability.

Conclusions: Measurements on plaster casts can differ significantly from those obtained through digital identification methods. These differences prove to be clinically relevant. Standardisation and optimisation resulted in improved and extremely reliable digital measurements.

(Aust Orthod J 2013; 29: 28-33)
Received for publication: January 2012
Accepted: February 2013

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The application and correlation of Pont’s Index to the facial framework of three main ethnic groups in Malaysia

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Objective: To assess the applicability of Pont’s Index in a Malaysian population by obtaining baseline measurements of dental arch shape based on premolar arch width, molar arch width and the combined width of the maxillary incisors. A secondary aim was to determine whether a correlation exists between arch widths, Pont’s Index and the facial framework.

Methods: Ninety subjects of mixed racial backgrounds had maxillary dental casts made, measured and selected craniofacial anthropometric measurements taken. Arch widths were compared between the measured and the predicted values derived from Pont’s formula. A comparative analysis was performed between inter-premolar and inter-molar widths and the craniofacial anthropometric measurements. Comparative statistics were applied.

Results: The average interincisal measurement, inter-premolar and inter-molar widths were 30.31 ± 2.49 mm, 36.67 ± 2.50 mm and 45.21 ± 2.90 mm respectively. No significant differences were detected between the races. The interincisal measurement in males was significantly lower than for females but male intermolar width was significantly higher than for females. The average predicted inter-premolar width (37.89 ± 3.11 mm) and inter-molar widths (47.36 ± 3.89 mm) were higher than the actual measured means, suggesting that Pont’s Index overestimated inter-premolar and inter-molar widths in the majority of Malaysians. The premolar index (83.34) and molar index (67.71) of the Malaysians were higher than the original Pont’s Indices. Significant correlations were noted for intermolar width with facial width, mandibular width, mandibular depth and mouth width.

Conclusion: The findings suggest that Pont’s Index should not be applied to the Malaysian population. (Aust Orthod J 2013; 29: 34-42) Received for publication: July 2012 Accepted: February 2013

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Evaluation of dental and basal arch forms using cone-beam CT and 3D virtual models of normal occlusion

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Objectives: To evaluate the relationship between the mandibular dental and basal arches using CBCT, and to assess the correlation between basal arch dimensions derived from CBCT and 3-dimensional (3D) virtual models in a cohort sample exhibiting normal occlusions.

Methods: The facial axis (FA) and root centre (RC) points of mandibular teeth were identified on 32 CBCT images. FA and WALA points were digitised on 3D models of 28 mandibular casts from the same sample. The relationships between dental and basal arch dimensions, and between the two basal depth dimensions derived from RC and WALA points were statistically assessed by Pearson’s correlation.

Results: Strong correlations were found between dental and basal intercanine and intermolar arch widths. Also, the basal intercanine width showed a moderate correlation with dental intermolar width and depth. The basal intercanine and intermolar widths measured on 3D models showed moderate correlations with those measurements on CBCT, whereas the basal canine and molar depths showed no correlations.

Conclusions: The dental and basal anterior and posterior arch widths were strongly correlated in normal occlusion. No correlations were found between the arch depths measured from WALA points and RC points. Hence, RC points may represent more useable landmarks compared to WALA points in the evaluation of basal arch forms. It is recommended that the relationship between the dental and basal arches is evaluated during treatment planning in order to improve arch co-ordination.

(Aust Orthod J 2013; 29: 43-51)
Received for publication: May 2012
Accepted: February 2013

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Effect of chlorhexidine varnish application on Streptococcus mutans colonisation in adolescents with fixed orthodontic appliances
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Objective: The aim of this prospective study was to evaluate the re-colonisation pattern of Streptococcus mutans (MS) in high level MS-colonised patients with fixed orthodontic appliances following 40% chlorhexidine varnish application prior to bracket placement.

Materials and methods: The subjects of this single-blinded clinical trial were 13-14-year-old adolescents (N = 14) with significant orthodontic treatment need, a high salivary MS count but without any carious lesions. Baseline MS levels were determined by the cultivation of saliva collected from each subject using strips developed for this purpose (Strip-mutans, Orion Diagnostica, Espoo, Finland). Prior to the bonding of orthodontic brackets, 40% chlorhexidine varnish (EC 40, Explore, Nijmegen, Netherlands) was applied to all teeth for 10 minutes. The re-colonisation of MS was assessed at one, two, four and six week time periods. The data obtained were subjected to a repeated measures design.

Results: Chlorhexidine varnish reduced salivary MS significantly at the first, second and fourth weeks compared to baseline values. Significant MS suppression lasted less than six weeks and MS colonisation gradually returned to baseline level.

Conclusion: Repeated application of chlorhexidine varnish in orthodontic patients with high MS levels may be beneficial throughout fixed appliance orthodontic treatment.

(Aust Orthod J 2013; 29: 52-57)
Received for publication: June 2012
Accepted: February 2013

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Reproducibility of facial soft tissue landmarks on facial images captured on a 3D camera
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Objective: Fast and non-invasive systems of the three-dimensional (3D) technology are a recent trend in orthodontics. The reproducibility of facial landmarks is important so that 3D facial measurements are accurate and may be applied clinically. The aim of this study is to evaluate the reproducibility of facial soft tissue landmarks using a non-invasive stereo-photogrammetry 3D camera.

Material and methods: Twenty-four soft tissue landmarks on 3D facial images captured using a VECTRA-3D dual module camera system for full face imaging (Canfield Scientific Inc, Fairfield, NJ, USA) were viewed and analysed using Mirror software on 30 adult subjects (15 males and 15 females, in the age range of 20–25 years). The landmarks were identified, recorded and measured twice on each 3D facial image by one examiner after a 2-week interval. Intra-class correlations and paired t-test or Wilcoxon Rank test were performed for each landmark to assess intra-examiner reproducibility.

Results: Intra-class correlation coefficients for all 24 landmarks ranged from 0.68 to 0.97, indicating moderate to high reliability and reproducibility of all facial soft tissue landmarks. Paired t-tests and Wilcoxon Rank test also revealed that there were no significant differences in all 24 facial soft tissue landmarks measurements (p = 0.17 – 0.99).

Conclusion: The results indicated that the reproducibility of identification of landmarks by one operator on facial images captured using a VECTRA-3D camera was acceptable. This device may be useful in treatment planning and may provide accurate information in making clinical decisions. However, it is suggested that further studies on inter-examiner reproducibility should be undertaken.

Received for publication: September 2012
Accepted: March 2013

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Occlusal variation in the Zuni: a pre-contact North American population
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Background: Reports of occlusal variation in ancient populations consistently show a low prevalence of malocclusion coupled with heavy attritive wear.

Materials and methods: The dentitions of 28 individual remains from a pre-contact native North American population were examined and the extent and nature of occlusal variation recorded.

Results: The prevalence of malocclusion was low (mean IOTN = 2.14) and where crowding existed, was limited to intraarch variability as opposed to inter-arch discrepancies. Increased overbites, overjets and other classical features of Class II malocclusions were almost entirely absent. These findings suggest that the ideal mutually protected Class I occlusion occurs only as a transient juvenile arrangement in nature, where, due to rapid attrition following establishment of the occlusion, there is an increasing tendency towards mild Class III, edge-to-edge incisor and buccal segment relationships.

Conclusion: Whilst of limited therapeutic benefit, an understanding of the anthropology of malocclusion provides an insightful perspective, and suggests that function may be of more importance than heredity in its aetiology. It is suggested that future occlusal studies in ancestral populations would benefit from the use of a standard methodology.

(Aust Orthod J 2013; 29: 66-75)
Received for publication: October 2012
Accepted: March 2013

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Influence of a mandibular fixed orthodontic retainer on periodontal health
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Objective: To investigate the impact of bonded mandibular orthodontic retainers on local periodontal health.

Methods: Two groups of subjects were recruited and designated Group F+, individuals who were provided with a fixed wire lingual retainer in the mandibular anterior area following orthodontic treatment and Group F−, individuals with no fixed wire and no clear sign of mandibular anterior malalignment. A clinical examination, a biochemical analysis, and a bacteriologial analysis were performed at commencement baseline (BL) and at 1 week (T1), 4 weeks (T2), and at 8 weeks (T3) following retainer placement. The vertical position of the fixed wire relative to the clinical crown height in Group F+ was recorded and the subjects assigned to Subgroups Wi or Wg (the wire nearer or farther from the incisal edge, respectively).

Results: Significant increases were found in gingival crevicular fluid (GCF) quantity, elastase activity, and protein content between T1 and T3 for both Group F+ and Group F−. A significant increase in F-Hb concentration was also found in Group F+. A comparison of the two groups identified significant differences for T3–BL in elastase activity and protein content. A Group Wi and Wg comparison showed significant baseline changes only in the F-Hb concentration at T2 and T3.

Conclusions: There was no difference in the status of the periodontal tissue between individuals with and without fixed retainers. In addition, the vertical position of the fixed retainer wire did not appear to influence periodontal health. The result, however, was obtained in subjects who possessed good oral hygiene. Attention should be paid to a patient’s oral hygiene when employing the fixed retainer.

(Aust Orthod J 2013; 29: 76-85)
Received for publication: November 2011
Accepted: March 2013
The validity of transverse intermaxillary analysis by traditional PA cephalometry compared with cone-beam computed tomography

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Aim: To assess the validity of using Jugale (J) and Antegonion (Ag) on Posterior-Anterior cephalograms (PAC) as landmarks for transverse intermaxillary analysis when compared with Cone Beam Computed Tomography (CBCT).

Material and methods: Conventional PAC and CBCT images were taken of 28 dry skulls. Craniometric measurements between the bilateral landmarks, Antegonion and Jugale, were obtained from the skulls using a microscribe and recorded as the base standard. The corresponding landmarks were identified and measured on CBCT and PAC and compared with the base standard measurements. The accuracy and reliability of the measurements were statistically evaluated and the validity was assessed by comparing the ability of the two image modalities to accurately diagnose an arbitrarily selected J-J/Ag-Ag ratio. All measurements were repeated at least 7 weeks apart. Intra-class correlations (ICC) and Bland-Altman plots were used to analyse the data.

Results: All three methods were shown to be reliable as all had a mean error of less than 0.5 mm between repeated measurements. When compared with the base standard, CBCT measurements were shown to have higher agreement (ICC: 0.861-0.964) compared with measurements taken from PAC (ICC: 0.794-0.796). When the arbitrary J-J/Ag-Ag ratio was assessed, 18 per cent of cases were incorrectly diagnosed with a transverse discrepancy on the PAC compared with the CBCT which incorrectly diagnosed 8.7 per cent.

Conclusion: CBCT was shown to be more reliable in assessing intermaxillary transverse discrepancy compared with PAC when using J-J/Ag-Ag ratios.

(Aust Orthod J 2013; 29: 86-95)
Received for publication: January 2013
Accepted: April 2013

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Aesthetic perception and factors associated with dentofacial midline awareness

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Aims: To examine orthodontic patients’ aesthetic perception and factors likely to influence the detection of a dentofacial midline discrepancy.

Methods: An electronic questionnaire was designed to invite an orthodontic population to evaluate and select an ideal value, a detectable value and a tolerable value from a series of images exhibiting a dentofacial midline discrepancy. A binary logistic regression analysis was performed to evaluate possible influencing factors.

Results: A barely discernable dentofacial midline discrepancy ranged between -0.020 ± 0.38 mm. The personal characteristics of the evaluators appeared to have no appreciable effect at this level. A detectable value was 1.33 ± 0.63 mm and the education level, orthodontic history and malocclusion severity were influencing factors amongst the assessors. A tolerable value was 2.63 ± 0.94 mm and influencing factors included the education level and the malocclusion severity of the evaluators.

Conclusion: The barely discernable value, detectable value and tolerable value could be used to quantify the aesthetic perception of orthodontic patients regarding a dentofacial midline discrepancy. The aesthetic perception was influenced by observer education level, orthodontic history and personal malocclusion severity, but not by age, gender, and subjective evaluation of dentofacial appearance.

(Aust Orthod J 2013; 29: 96-104)
Received for publication: July 2012
Accepted: April 2013

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Treatment of a high angle Class II malocclusion with severe crowding and enlarged adenoids: a case report
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Aim: The aim is to present the treatment of an 11-year-old, hyperdivergent, Class II division I, female patient with a history of enlarged adenoids and severe arch length discrepancies.

Methods: The malocclusion was treated by upper right molar distalisation and first premolar extractions. Accurate diagnosis, meticulous treatment planning and an unexpectedly favourable growth pattern lead to a highly satisfactory outcome.

Results: There was a significant improvement in facial profile, overjet and occlusion. A significant decrease in the mandibular plane angle was recorded, without the use of any extra-oral appliance.

Conclusion: The treatment results remained stable after six years of retention following maintenance of the favourable growth pattern.

(Aust Orthod J 2013; 29: 105-114)
Received for publication: July 2012
Accepted: February 2013

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Asymmetric deep bite with a canted occlusal plane: a case report
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Introduction: Asymmetry and deep bite malocclusions provide management difficulties for clinicians and the combination invites special concern.

Aim: The purpose of the present paper is to describe a clinical case presenting with an asymmetric deep bite, a canted occlusal plane, a Class II canine relationship on the right side and a Class III canine relationship on the left side, with deviations of both dental midlines to the right. A lower right premolar impaction contributed to the asymmetry and a left first maxillary molar extraction was required for endodontic reasons.

Methods: A straight-wire technique was used for eighteen months to achieve second molar mesialisation, as well as dental levelling and alignment. To unravel the mandibular arch, resolve the deep bite and manage the canted lower occlusal plane, two bite turbos were attached to the palatal surface of the maxillary central incisors. In addition, a sectional Multiloop Edgewise Arch-Wire (MEAW) was placed on the left side and maintained for nine months. Different lower MEAW activation (lateral left lower extrusion) and tip-back control on the posterior teeth were essential mechanics to increase vertical dimension on the lower left side and allow for Class III dental correction. Short Class II vertical elastics on the right side and Class III elastics on the left side were applied.

Conclusion: The asymmetric mechanics allowed the case to be treated to a stable sagittal and vertical occlusal result.

(Aust Orthod J 2013; 29: 115-122)
Received for publication: July 2012
Accepted: February 2013

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