Cranial base foramen location accuracy and reliability in cone-beam computerized tomography


Introduction: The purpose of this study was to evaluate the reliability and accuracy in locating several different foramina in the cranial base by using cone-beam computerized tomography (CBCT) images for future use in establishing reference coordinate systems. Methods: CBCT images from 10 dry skulls were taken with and without the foramina ovale, spinosum, and rotundum, and the hypoglossal canals filled with radiopaque gutta-percha (gold standard). Three evaluators identified the foramen landmarks in the CBCT images without gutta-percha. Mean differences and main researcher intraexaminer and interexaminer reliability were measured by using intraclass correlation coefficients for all landmark coordinates. Descriptive statistics were calculated with respect to the landmark coordinates and distances to the reference points. Results: Intraexaminer and interexaminer reliability values for the x-, y-, and z-coordinates for all landmarks were greater than 0.9 with the exception of 4 (of 72) points that still had acceptable interexaminer reliability (>0.75). Mean measurement error differences obtained in the principal investigator’s trials were primarily less than 0.5 mm. When comparing the mean distance differences of the same examiner and between the 3 examiners with the gold standard, the highest difference obtained was 1.3 mm. Conclusions: Foramina spinosum, ovale, and rotundum, and the hypoglossal canal all provided high intraexaminer reliability and accuracy, and can be considered acceptable landmarks to use in establishing reference coordinate systems for future 3-dimensional superimposition analysis.

Permutation method for evaluating topographic craniofacial correlations


Introduction: Correlations between cephalometric measurements are frequently assumed to represent biologic associations. However, a significant portion of such correlations might arise from purely geometric dependencies, when measurements share common landmarks. Analytic calculation of this topographic component is difficult. The purpose of this study was to propose a permutation method for evaluating the topographic component of cephalometric correlations. Methods: The method consisted of creating a virtual sample of cephalometric tracings (landmark configurations) from the original biologic sample under investigation. Each novel landmark configuration was constructed by assigning coordinates to the cephalometric points; the coordinates of each point were taken randomly from the original sample, each from a potentially different subject. Correlation analysis was performed separately on both samples and the results compared. Biologic meaning was ascribed only when there was a significant difference in correlation values between the samples. Confidence intervals for assessing statistical significance were calculated by using a randomization approach. The method was tested on a sample of 170 radiographs to evaluate the correlation between cranial base angle (NSBa) and angles SNA and SNB, as well as between ANB angle and the Wits appraisal. Results: No biologic association was found between ANB and Wits, or between NSBa and SNA. The biologic correlation between NSBa and SNA was statistically significant but low ($r^2 = 12\%$). Conclusions: Topographic associations between cephalometric measurements are ubiquitous and difficult to assess. The proposed method enables evaluation of their relative strength without the need for analytic solutions.

Mechanical strain at alveolar bone and circummaxillary sutures during acute rapid palatal expansion


Introduction: Palatal expansion can potentially affect alveolar bone and circummaxillary sutures. In this study, we characterized their mechanical strain during acute expansion. Methods: Eight 3- and 6-month-old fresh pig heads received acute palatal expansion with hyrax expanders. Strain gauges were used to measure strain at the buccal alveolar bone of anchor and adjacent nonanchor teeth, and at maxillary-premaxillary, maxillary-zygomatic, and zygomatic-temporal sutures during expansion. Intermolar width changes...
were measured from dental casts. **Results:** Intermolar width increased less than expander activation, and the midpalatal sutures were only opened slightly. Alveolar bone strain increased linearly with expander activation and decayed by 20% to 30% during postactivation intervals. Compressive strain at anchor-tooth alveolar bone locations was directed occlusally and apically, related to tooth tipping, and significantly higher than that at nonanchor tooth locations. With expander activation, suture strains increased monotonically and tended to plateau. Suture strain magnitude was generally similar to physiologic (masticatory) strains reported in the literature. The dominant strain polarity was compression at the maxillary-zygomatic and zygomatic-temporal sutures, but there was tension at the maxillary-premaxillary suture. **Conclusions:** In these pigs, palatal expansion can cause significant occlusal-apical compression at buccal alveolar bone and physiologic-level strains at circummaxillary sutures.

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**Effect of rapid maxillary expansion and transpalatal arch treatment associated with deciduous canine extraction on the eruption of palatally displaced canines: A 2-center prospective study**

Lauren M. Sigler, Tiziano Baccetti, and James A. McNamara, Jr. *Am J Orthod Dentofacial Orthop 2011;139:e235-e244.*

**Introduction:** Our aim was to investigate the effect of rapid maxillary expansion and transpalatal arch therapy combined with deciduous canine extraction on the eruption rate of palatally displaced canines (PDCs) in patients in the late mixed dentition in a 2-center prospective study. **Methods:** Seventy subjects were enrolled based on PDCs diagnosed on panoramic radiographs. The treatment group (TG, 40 subjects) underwent RME followed by TPA therapy and extraction of the deciduous canines. The control group (CG, 30 subjects) received no orthodontic treatment. At the start of the trial, panoramic radiographs and dental casts were compared between the TG and the CG with the Mann-Whitney U test (*P* < 0.05). At the second observation (cervical vertebral maturation stage 5 or 6), all subjects were reevaluated, and the eruption of the maxillary permanent canines was assessed. The rates of success in the TG were compared with those in the CG by means of chi-square tests (*P* < 0.05). The association of PDCs with other dental anomalies was reported. **Results:** No statistically significant difference was found for any measurement at the start of the trial between the 2 groups. The prevalence rates of eruption of the maxillary canines were 80% for the TG and 28% in the CG, a statistically significant difference (chi-square = 16.26, *P* < 0.001). The prevalence rate at the start for the pubertal stages of cervical vertebral maturation (63%) was significantly greater in the unsuccessfully treated subjects than in the successfully treated ones (16%). In the CG, all successful subjects had PDCs that overlapped the corresponding deciduous canine or the distal aspect of the lateral incisor. Eruption of PDCs in both groups was associated significantly with an open root apex. **Conclusions:** Rapid maxillary expansion therapy followed by a transpalatal arch combined with extraction of the deciduous canine is effective in treating patients in the late mixed dentition with PDCs. Pretreatment variables indicating success of treatment on the eruption of PDCs were less severe sectors of displacement, prepubertal stages of skeletal maturity, and open root apices.
Introduction: The aim of this study was to evaluate the morphologic differences in the mandibular arches of Egyptian and North American white subjects. Methods: The sample included 94 Egyptian subjects (35 Class I, 32 Class II, and 27 Class III) and 92 white subjects (37 Class I, 29 Class II, and 26 Class III). The subjects were grouped according to arch form types (tapered, ovoid, and square) to compare their frequency distribution between ethnic groups in each Angle classification. The most facial portions of 13 proximal contact areas were digitized on scanned images of mandibular casts to estimate the corresponding clinical bracket point for each tooth. Four linear and 2 proportional measurements were taken. Results: In comparing arch dimensions, intermolar width was narrower in Egyptians than in the whites ($P = 0.001$). There was an even frequency distribution of the 3 arch forms in the Egyptian group. On the other hand, the most frequent arch form was ovoid followed by tapered and square in the white group; the square arch form was significantly less frequent than the tapered and ovoid arch forms ($P = 0.029$). Conclusions: The arch forms of Egyptians are narrower than those of whites. The distribution of the arch form types in Egyptians showed similar frequency, but the square arch form was less frequent in whites. It is recommended to select narrower archwires from the available variations to suit many Egyptian patients.

Comparison of arch forms between Egyptian and North American white populations


Introduction: The purposes of this study were to examine the amounts of overjet in the anterior and posterior segments of 3 arch forms by using facial axis points on 3-dimensional virtual models and to verify the minimum posterior extension required for classification of the arch form in normal occlusions. Methods: Facial axis points were digitized on 97 virtual models with normal occlusion, classified into 20 tapered, 25 ovoid, and 52 square arch forms. Intercanine and intermolar arch width and depths were measured. The best-fitting curves were created, and overjet was measured at each facial axis point. Two-way analysis of variance (ANOVA) was performed to assess the relationship between arch form and overjet in different areas. The minimum posterior extension to determine arch type was analyzed with the chi-square test. Results: Subjects with a tapered arch form had larger overjet compared with those with ovoid and square forms, except at the central incisor. A significant difference in overjet among different areas was found in subjects with a square arch form ($P < 0.0001$). No significant difference ($P = 0.864$) was found among the first and second premolar and the first molar groups for classifying arch-form types. Conclusions: A significant difference was found in anterior and posterior overjet according to arch types. The extension to the first premolar was sufficient to classify arch form type. It might be beneficial to consider more coordinated preformed superelastic archwires according to variations in overjet of different arch types.

Comparison of overjet among 3 arch types in normal occlusion


Introduction: The aim of this study was to investigate the effect of nicotine on orthodontic tooth movement in rats. Methods: Thirty-two adult male Sprague-Dawley rats were randomly divided into 3 experimental groups and 1 control group. With the rats under general anesthesia, 5-mm nickel-titanium closed-coil springs were placed between the maxillary right first molars and first incisors. Injections of nicotine were administered daily for 13 days: group A, 0.5 mg per kilogram; group B, 0.75 mg per kilogram; and group C, 1 mg per kilogram. Group D, the control group, received injections of 0.1 mL of normal saline solution. At the end of the experimental period, the rats were killed, and interproximal tooth movements

Effect of nicotine on orthodontic tooth movement in rats


Introduction: Although the detrimental health effects of cigarettes are well known, many people, including some orthodontic patients, continue to smoke. Nicotine can affect bone resorption and apposition. Therefore, the aim of this study was to investigate the effect of nicotine on orthodontic tooth movement. Methods: Thirty-two adult male Sprague-Dawley rats were randomly divided into 3 experimental groups and 1 control group. With the rats under general anesthesia, 5-mm nickel-titanium closed-coil springs were placed between the maxillary right first molars and first incisors. Injections of nicotine were administered daily for 13 days: group A, 0.5 mg per kilogram; group B, 0.75 mg per kilogram; and group C, 1 mg per kilogram. Group D, the control group, received injections of 0.1 mL of normal saline solution. At the end of the experimental period, the rats were killed, and interproximal tooth movements
were measured. **Results:** The mean amounts of tooth movement were 0.47 mm in group A, 0.62 mm in group B, 0.78 mm in group C, and 0.21 mm in group D. Statistical analysis with analysis of variance (ANOVA) test showed significant differences between all groups. The most movement occurred in group C, and group D had the least movement. **Conclusions:** Nicotine accelerates orthodontic tooth movement, and this effect is dose-dependent. Nicotine’s role in accelerating tooth movement might be related to its effect of accelerating bone resorption.

### Physical properties of root cementum: Part 16. Comparisons of root resorption and resorption craters after the application of light and heavy continuous and controlled orthodontic forces for 4, 8, and 12 weeks


**Introduction:** Orthodontic force duration can affect the severity of root resorption. The aim of this clinical study was to investigate the amounts of root resorption volumetrically after the application of controlled light and heavy forces in the buccal direction for 4, 8, and 12 weeks. **Methods:** The sample consisted of 54 maxillary first premolars in 36 patients (mean age, 14.9 years; 21 girls, 15 boys) who required first premolar extractions as part of their orthodontic treatment. The teeth were allocated into 3 groups that varied in the duration of force application: 4, 8, or 12 weeks. The right or left first premolars were randomly selected to receive 2 levels of forces. A light buccally directed orthodontic force of 25 g was applied to the experimental tooth on 1 side, while a heavy orthodontic force of 225 g was applied on the contralateral premolar. At the end of the experimental period, the teeth were extracted and scanned with the microcomputed-tomography x-ray system. Resorption crater analysis was performed with specially designed software for direct volumetric measurements. **Results:** Significant differences in the extent of root resorption were found between 4, 8, and 12 weeks of force application (P <0.001), with substantially more severe resorption in the longer force duration groups. The light force produced significantly less root resorption than did the heavy force. **Conclusions:** After 4, 8, or 12 weeks of buccally directed orthodontic forces applied on the maxillary first premolars, the volumes of root resorption craters were found to be related to the duration and the magnitude of the forces.

### Effects of risedronate on cortical and trabecular bone of the mandible in glucocorticoid-treated growing rats


**Introduction:** This study was performed to estimate the effects of risedronate on mandibular bone density, bone structure, and bone metabolism in established glucocorticoid-induced osteoporosis in growing rats. **Methods:** The rats were given oral risedronate at 0, 0.5, or 1.0 mg per kilogram per day for 4 weeks after the administration of oral prednisolone at 30 mg per kilogram per 2 days for 6 weeks. Trabecular and cortical bone masses were analyzed by using peripheral quantitative computed tomography, and bone structure and bone formation were measured by using static and dynamic histomorphometry. **Results:** In trabecular bone, risedronate improved the prednisolone-induced decreases in bone cross-sectional area and bone mineral content. Risedronate increased bone density and also formed dense bone microarchitecture by reducing the bone turnover rate. In cortical bone, risedronate improved the prednisolone-induced decreases in bone cross-sectional area and bone mineral content without affecting bone density by increasing the mineralizing surface. **Conclusions:** Risedronate improved prednisolone-induced retardation of trabecular and cortical bone growth, but the bone turnover in these 2 sites was regulated differently in the growing rat mandibles.

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