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ORTHODONTIC LITERATURE, SELECTED AND
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Mandibular expansion through finite element analysis

Singh P, Wang C, Ajmera DH, Xiao SS, Song J, Lin Z. Biomechanical effects of novel osteotomy approaches on mandibular expansion: a three-dimensional finite element analysis. J Oral Maxillofac Surg 2016;74:1658.e1-15.

Mandibular tooth size-arch length discrepancy is a common problem that orthodontists encounter. Many times, this is associated with a mandibular transverse discrepancy. The purpose of this study was to compare 3 osteotomy approaches, as well as 3 biomechanical force applications, using finite elemental analysis to select the optimal approach for expansion of the mandible for future clinical use. A cone-beam computed tomography scan of an adult mandible was obtained, and with Mimics software, a 3-dimensional geometric model was created. Then, using the Rapidform software, the teeth, mucosa, trabecular bone, periodontal ligament, and cortical bone were generated. The final finite elemental model was then generated from the geometric model (ANSYS, Swanson Analysis System). Three osteotomy approaches were used: midline symphyseal (traditional), angulated midline symphyseal (novel approach), and parasymphyseal step (novel approach) osteotomies. Tooth-borne, hybrid-borne, and bone-borne pure horizontal forces were applied to each osteotomy approach. The simulation called for a 10-day latency period, followed by a 6-day distraction period. Stress (with the von Mises stress score), strain, and displacement (x-axis of the coordinate system) of the crown, root, and bone

were all analyzed. The conclusion drawn from this study was that changing the design of the osteotomy can affect the mechanical response of the alveolar structures. The authors found that the parasymphyseal step osteotomy using the hybrid-borne force system produced the most significant expansions of the alveolar bone, basal bone, and teeth. This was most likely because the appliance was supported by the teeth and bone, and the osteotomized alveolar bone was supported by the basal bone. The authors recognized the need for further clinical studies to address potential issues such as stability, effects on the temporomandibular joint, and physiologic bone response to such surgical procedures in the mandible.

Reviewed by Michael Capogna

Premolar extractions and esthetics

Janson G, Junqueira CH, Mendes LM, Garib DG. Influence of premolar extractions on long-term adult facial aesthetics and apparent age. Eur J Orthod 2016;38:272-80.

Facial esthetics is often considered one of the most important outcomes of orthodontic treatment. In this study, photographs were taken of 63 full Class II Division 1 patients and evaluated for attractiveness and age by 83 laypeople and 76 orthodontists. The patients were divided into 3 groups including nonextraction, 2 premolar extraction, and 4 premolar extraction. These patients were compared by age, treatment time, sex, and posttreatment outcomes 15 to 18 years later. Dolphin software was used to evaluate soft tissue profiles. The authors found no statistically significant difference in facial attractiveness or age between 2 premolar extraction, 4 premolar extraction, and nonextraction patients. Interestingly, they also found no significant correlation between any soft tissue cephalometric variable and facial attractiveness.

Reviewed by Matthew Cassera

Stress distribution in peri-miniscrew areas

Choi SH, Kim SJ, Lee KJ, Sung SJ, Chun YS, Hwang CH. Stress distributions in peri-miniscrew areas from cylindrical and tapered miniscrews inserted at different angles. Korean J Orthod 2016;46:189-98.

The aim of this study was to analyze the stress distributions of cylindrical and tapered miniscrews

placed at different angles on roots, periodontal ligaments, and surrounding bones using a 3-dimensional finite element analysis. With a computer-generated maxilla model with first premolar extraction sites, 2 types of miniscrews (cylindrical and tapered) were inserted at 30°, 60°, and 90° angles with respect to the bone surface. The miniscrews were inserted in the interradicular space between the maxillary second premolar and first molar. A horizontal force of 2 N of pulling mesially parallel to the occlusal plane was applied to the miniscrew simulating the orthodontic force used for en-mass retraction of anterior teeth. The von Mises stresses were then measured in the roots and periodontal ligaments of the maxillary second premolars, first molars, cortical bone, and cancellous bone during miniscrew insertion and after orthodontic force loading. The analyses showed that the stresses were primarily absorbed by the cortical bone both in insertion and after force application. Little stress was transmitted to the root, periodontal ligament, and cancellous bone. Based on the findings, it is recommended that miniscrews, regardless of type, be placed perpendicular to the bone surface, to maximize anchorage and minimize stress levels in the surrounding bone. Additionally, cylindrical miniscrews are recommended because they resulted in lower stresses in the surrounding bone than do tapered miniscrews during insertion, but no difference was seen after force application between the 2 groups. Because the study used 3-dimensional finite element analysis, several limitations should be considered when interpreting the data. Further research is needed to determine the effects of changes with cortical bone thickness and cancellous bone density.

Reviewed by Issac Chung

Direct versus indirect anchorage during distalization

Cozzani M, Fontana M, Maino G, Maino G, Palpacelli L, Caprioglio A. Comparison between direct vs indirect anchorage in two miniscrew-supported distalizing devices. *Angle Orthod* 2016;86:399-406.

The use of pendulum and distal jet appliances and superelastic nickel-titanium wires has become popular for correcting dental Class II malocclusions. However, they have 2 main negative effects: (1) anchorage loss in reaction to molar distalization, and (2) the high risk of relapse to the Class II molar relationship

while retracting the anterior teeth. To increase anchorage resistance and prevent undesirable side effects on anchoring teeth, the use of temporary skeletal anchorage devices was introduced. However, comparisons between interradicular (MGBM System [MGBM]) and paramedian (Distal Screw [DS]) miniscrew insertion techniques are still lacking. The aim of this study was to compare the 2 techniques in dental Class II patients. Pretreatment and postdistalization lateral cephalograms of 53 white patients were retrospectively obtained. They were divided into 2 groups: 29 patients (16 boys, 13 girls) with a mean age of 12.3 ± 1.5 years were treated with the MGBM, and 24 patients (11 boys, 13 girls) with a mean age of 11.3 ± 1.2 years were treated with the DS appliance. The MGBM resulted in less distalization time (MGBM, 6 ± 2 months vs DS, 9 ± 2 months) and greater amounts of molar distalization (MGBM, -5.5 mm vs DS, -3.2 mm). However, the main difference between them was represented by the premolar movement. MGBM could not provide absolute anchorage because of the low rigidity of the metallic ligatures, so that the premolar showed a small mesial movement of 1.4 mm (DS, 2.2 mm distal movement) and the incisors showed a slight proclination of 1.6° (DS, no substantial changes) after distalization. There were no significant vertical changes in either group.

Reviewed by Kensuke Matsumoto

Early Class III protraction and need for surgery

Mandall N, Cousley R, DiBiase A, Dyer F, Littlewood S, Mattick R, et al. Early class III protraction facemask treatment reduces the need for orthognathic surgery: a multi-centre, two-arm parallel randomized, controlled trial. *J Orthod* 2016;43:164-75.

Orthopedic treatment for Class III skeletal problems is aimed at reducing or redirecting mandibular growth or enhancing maxillary growth. The primary aim of this study was to prospectively evaluate whether early Class III protraction facemask treatment reduces the need for orthognathic surgery. The secondary aims were to evaluate long-term skeletal and occlusal changes, self-esteem, and the esthetic impact of malocclusion. This study was a multi-center 2-arm parallel, randomized controlled trial. Patients were randomly allocated, stratified for sex, and grouped into an early Class III protraction facemask group

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