The AAO is the only organization solely dedicated to orthodontic specialists. Membership leaders work to develop tools and support needed to succeed in practice.

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AAO Donated Orthodontic Services (DOS) Program

All that is missing is You!

• Introduced in 2009, the DOS program provides access to care for children in need. Access to quality orthodontic care is missing in many children’s lives. The AAO DOS program mission is to serve indigent children without insurance coverage or that do not qualify for other assistance in their state of residence.
• The program has expanded and offers care to children nationwide in addition to the recognized state programs in Illinois, Indiana, Kansas, Michigan, New Jersey, North Carolina, Rhode Island, Tennessee, Texas and Virginia.
• In order to expand further, we need you to help us by volunteering to serve as a provider orthodontist or help identify orthodontists willing to lead efforts to establish a DOS chapter in your state.
• Stop by the DOS booth here in San Diego to learn more about the program or contact Ann Sebaugh at asebaugh@aaortho.org with questions.
• Private practice with Dr. Michael Meyer and Dr. Paul Kasrovi for 40 years in Berkeley California
• Co-Founder with Dr. Meyer - Orthodontic evening clinic at La Clinica de la Raza, Oakland, CA
• UCSF teaching positions since 2002
• Editor-in-Chief PCSO Bulletin for 21 years
• Editorial Board AJO-DO 21 years
• AAO House of Delegates 21 years
• Married to Pamela Grove, six children - all adults thank heavens!
ALVEOLAR HOUSING AND ORTHODONTIC TREATMENT

Gerald Nelson, DDS
HS Clinical Professor
UCSF Division of Orthodontics
AAO Annual Session April 2017
CBCT is expanding our opportunities for better diagnosis and treatment planning in orthodontics
CBCT is changing our ability to make more appropriate treatment plans

• We can incorporate plans for occlusal cant or mandibular asymmetry

• We get a clear picture of the effect of CR-MI discrepancies

• We can plan for the correct root position in the alveolus

• We can evaluate the quality of the airway

• We can identify TMJ problems that could affect our plan
A proposal for Orthodontic Imaging

Our standard for years has been a good quality Cephalogram and Panogram
Our proposal: CBCT medium FOV + 2D headfilm

- A field of view from condyle to chin provides useful information on the dentition and support, the airway, the TMJ, alveolar housing, and any unexpected findings not noted in the clinical exam.

- The exposure can be less (<20 microsieverts) than a Pano plus a few periapicals (~40 microsieverts) and provide adequate resolution (voxel 0.3-0.4mm).

- A standard 2D cephalogram is ~5 microsieverts.
A robust combination

- Medium field CBCT from condyle to chin - in Centric Occlusion
- 2D HF in Centric Relation
- <24 microsieverts
Panogram
Anterio-posterior and CVS
TMJ scans both frontal and sagittal Airway (taken in CO)
Alveolar housing x-sections
Can CBCT read cortical bone plate?

- Bone height is under-represented 0.6mm
- Cortical bone thickness ~1mm
Accuracy of cross sections of the alveolar housing

- Pig study comparing images with mandibles show that at the typical ortho CBCT resolution underestimates bone thickness by ~ 1.0 mm.

- Dry human skulls compared to CBCT images showed bone height was underestimated by ~0.6 mm.

- Cadaver skulls looked at slices with soft tissue - underestimates plate thickness ~1.0 mm

Accuracy and reliability of CBCT for measuring alveolar bone height and detecting bony dehiscence and fenestration, Leung et al; Am J Orthod Dentofacial Orthop 2011;139:e117-e127)

Effect of bone thickness on alveolar bone height measurements from CBCT; Sun, et al; Am J Orthod Dentofacial Orthop 2011;139:e117-e127)

Accuracy of cone-beam computed tomography at different resolutions assessed on the bony covering of the mandibular anterior teeth; Raphael Patcas, et al; Am J Orthod Dentofacial Orthop 2012;141:41-50)
How does this help us clinically?

- Review slices of the bone housing, and assume there is 1mm more bone than we see.

- Teeth clear out of the housing don’t have bone coverage.
Can we return the root to housing?

- Monkey study - translated teeth out of the buccal wall, held 4 mo. then back in.
- The root lost cortical plate on the buccal.
- Adjacent bone apposition thickened the bone over adjacent teeth.
- Root surface resorption occurred on buccal and apical on the way out and lingual on the way in.
- Back in the housing, the perforation site completely repaired, and cortical plate was slightly thicker. Minor cementum repair as well.

Michael Wainwright Faciolingual movement: Its influence on the roots and cortical plate; AJO 64:3; Sep 1973
Can we put a root back into the housing?

Out of housing

Returned to housing

Severe complication of a bonded mandibular lingual retainer; Pazera et al; Am J Orthod Dentofacial Orthop 2012;142:406-9)
The housing may not be as big as it was before orthodontics

Sarikaya, Changes in alveolar bone thickness due to retraction of teeth, AJODO; July 2002
Alveolar housing and facial type

High Angle Cases have a risk of violating the alveolar borders

How common is root exposure in untreated patient?
Prevalence

- Examined 146 skulls, 17-87 yo
- 4.1% of all teeth had dehiscences
- 9.0% of all teeth had fenestrations
- 40.4% of skulls had a dehiscence
- 61.6% of skulls had a fenestration

Teeth can be moved out of the housing

Encountering the cortical plate risks EARR
Procline or retrocline

- Retraction of teeth that are already retroclined requires careful control of the root angulation.

• Retraction of the incisor creates a Moment that creates uncontrolled tipping
Biomechanical challenge

- Retraction of the incisor creates a moment that creates uncontrolled tipping and could cause the apex to perforate the cortical plate
Biomechanical challenge

The clinician must plan a moment of the couple (torque) that controls the root. You must consider the size of bracket and wire (slot play), wire type, force level and vector. This makes your work very interesting!
How should we plan in cases of limited alveolar bone housing?

I highly recommend viewing the presentations by Dr. Jeffrey Miller at


Three treatment choices to preserve bone housing in risk situations

- Corticotomy and bone grafting
- Bone borne expansion
- Bone block movement (Anterior Sectional Osteotomy)
Corticotomy Assisted Decompensation
First advance the incisors and then set back the mandible
Corticotomy and bone graft

Morphologic evaluation of dentoalveolar structures of mandibular anterior teeth during augmented corticotomy-assisted decompensation

Hyo-Won Ahn, Dong-Hwi Seo, Seong-Hun Kim, Young-Guk Park, Kyu-Rhim Chung, and Gerald Nelson
Seoul, Korea, and San Francisco, Calif

Introduction: Our aim in this study was to evaluate the effect of augmented corticotomy on the decompensation pattern of mandibular anterior teeth, alveolar bone, and surrounding periodontal tissues during presurgical orthodontic treatment. Methods: Thirty skeletal Class III adult patients were divided into 2 groups according to the application of augmented corticotomy labial to the anterior mandibular roots: experimental group (with augmented corticotomy, n = 15) and control group (without augmented corticotomy, n = 15). Lateral cephalograms and cone-beam computed tomography images were taken before orthodontic treatment and before surgery. The measurements included the inclination and position of the mandibular incisors, labial alveolar bone area, vertical alveolar bone height, root length, and alveolar bone thickness at 3 levels surrounding the mandibular central incisors, lateral incisors, and canines. Results: The mandibular incisors were significantly proclined in both groups (P < 0.001); however, the labial movement of the incisors was greater in the experimental group (P < 0.001). Significant vertical alveolar bone loss was observed only in the control group (P < 0.001). The middle and lower alveolar thicknesses and labial alveolar bone area increased in the experimental group. In the control group, the upper and middle alveolar thicknesses and labial alveolar bone area decreased significantly. There were no significant differences in dentoalveolar changes between the 3 kinds of anterior teeth in each group, except for root length in the experimental group (P < 0.05). Conclusions: Augmented corticotomy provided a favorable decompensation pattern of the mandibular incisors, preserving the periodontal structures surrounding the mandibular anterior teeth for skeletal Class III patients. (Am J Orthod Dentofacial Orthop 2016;150:659-69)

Presurgical orthodontic treatment is typically necessary to correct compensated tooth positions that result from undesirable jaw growth. Correcting the dental compensations allows the most favorable positioning of the jaw segments during surgery and permits a more accurate and stable occlusion after surgery. In the correction of Class III malocclusion, decompensation of the mandibular anterior teeth labially to an ideal relationship to the supporting bone will allow the best improvement of facial esthetics after surgery. However, labial incisor movement can be limited by the alveolar bone. A previous study has shown that excessive labial incisor movement is associated with dehiscence of the labial bone. The authors found a high correlation between the labial lingual inclination of the teeth and the frequency of dehiscence or gingival recession. Recently, cone-beam computed tomography (CBCT) has been an indispensable diagnostic imaging tool for dentoalveolar evaluation. CBCT studies of skeletal
Fig 1. Augmented corticotomy in the mandibular anterior area: A, after a full-thickness flap using a sulcular incision, with a vertical releasing incision added at the premolar area, circumscribing the corticotomy cut with low speed (number 2 round bur) or a piezoelectric surgical device; B, bone augmentation by xenograft; C, after suture with 5-0 or 6-0 nylon.
Control Group,
A - pre treatment

B - Post proclination,
no corticotomy

Augmented Corticotomy Group
A - pre treatment

B - post corticotomy
Expansion and buccal bone

- Hyrax significantly expanded maxilla, decreasing in magnitude from Anterior to Posterior, and inferior to superior.

- High incidence of fenestration and dehiscence

Natalie Miller DDS MS UCSF Master’s Thesis, 2007
Maxillary Expansion and Buccal Bone

Jury still out on the definable risks of maxillary expansion, but some buccal bone loss can be expected.
Tooth borne v Bone borne expanders

- RCT (2010) showed similar quality of expansion but did not address bone levels.

- Our 2015 study showed less bone loss on buccal with bone borne expanders
Camouflage treatment of skeletal Class III malocclusion with asymmetry using a bone-borne rapid maxillary expander
Yu-Jin Seo; Kyu-Rhim Chung; Seong-Hun Kim; Gerald Nelson
Angle Orthod. 2015;85:322–334
Bone Borne            Tooth Borne

Figure 6. The examples of rapid maxillary expansion with bone-borne (A–D) and tooth-borne (E–H) expanders, compared between pretreatment period and after expansion at the first premolar (A and E), the second premolar (B and F), the first molar (C and G), and the second molar (D and H).
Bone Block Movement - Anterior Segmental Osteotomy (ASO)

The anterior segment is detached apical to roots and manually repositioned.

Bone Block Movement with ASO
Planning phase

15 months
treatment
time
Bone to Bone MX retraction

The next step is retracting the bone/tooth block against bone anchors. This as yet unpublished study gives us an example.
Final thoughts

• Alveolar Bone Housing presents a boundary to tooth movement that we must respect and include in treatment planning

• The use of CBCT is the appropriate way to analyze the housing prior to and during treatment

• CBCT radiation exposure to the patient is less than 2D alternatives if used properly, and adds much more useful diagnostic information
ORTHODONTICS IS MY PASSION...

“That’s why I support the AAOF.”
Pacific Ocean meets San Francisco Bay