
Lazari


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Dutra

2017 AAO Annual Session Milo Hellman Research Award, Harry Sicher Research Award, Thomas M. Graber Awards of Special Merit

The Milo Hellman Research Award, Harry Sicher Research Award and Thomas M. Graber Awards of Special Merit lectures will be held on Saturday April 22 and Monday April 24 in the San Diego Convention Center. Consult the listing below for room number and time of lecture. Continuing education credit is available for attending these lectures.

Milo Hellman Research Award

Secretory microRNA-29 in Gingival Crevicular Fluid during Canine Retraction
Paul Lazari, DDS, MS
University of Illinois-Chicago
Lecture Information: Saturday, April 22; 8:35am-8:55am; Room 6B

Introduction: Gingival crevicular fluid (GCF) has been widely investigated as a potential source of biomarkers for an individual's oral and general health information. Various molecules presented in GCF were reported as potential biomarkers for orthodontic tooth movement (OTM). MicroRNAs (miRNAs) are small non-coding RNAs that are involved in post-transcriptional gene regulation. Recently, secretory miRNAs are being investigated as diagnostic as well as therapeutic tools. In this study, we investigated secretory miRNA-29 as a potential biomarker for detection of periodontal remodeling during OTM. The aim of the study was to confirm the presence of secretory miRNAs in GCF and investigate the temporal expression profiles of secretory miRNA-29 during canine retraction.

Methods: Healthy subjects aged 10-17 years old were recruited at the University of Illinois at Chicago's orthodontic clinic. The recruited subjects practiced good oral hygiene and required extraction of maxillary first premolars as part of their comprehensive orthodontic treatment. GCF was collected using Periopaper strips (OraFlow, Smithtown, NY) at six time points during canine retraction. Agilent 2200 Tapestation (Agilent Technologies, Santa Clara, CA) and quantitative miRNA RT-PCR were used to assess the presence of miRNA in GCF and changes in miRNA- 29 family expression.

Results: There were presence of secretory miRNAs in GCF and statistically significant changes ($p<0.05$) in expression levels of miRNAs-29 during the course of canine retraction.

Conclusions: We concluded that secretory miRNAs are present in GCF and the expression levels of miRNA-29 family change during orthodontic tooth movement.

Harry Sicher Research Award

The Effects of Micro-Osteoperforations on Tooth Movement and Bone in the Beagle Maxilla
Chris Cramer, DDS, MS, MBA
Texas A&M University
Lecture Information: Monday April 24; 8:40am-9:00am; Room 6C

Purpose: The purpose of this study was to determine how micro-osteoperforations (MOPs) affect tooth movements, bone turnover, bone density, and bone volume.

Materials and Methods: A split-mouth experimental design with 7 beagle dogs was used to evaluate bone surrounding maxillary second premolars that had been retracted for 7 weeks. One month after the maxillary third premolars were extracted, 8 MOPs (1.5 mm wide and 7 mm deep) were created with the PROPEL device (6 were placed 3 mm distal to the second premolar and 2 were placed in the premolar furcation). The MOPs were created without flaps on one randomly selected side. The same sites on the opposite side served as controls. The maxillary second premolars were retracted bilaterally with 200 g nickel-titanium closed coil springs. Tooth movements were measured intraorally and radiographically. MicroCT was used to evaluate the material density and volume fraction of bone distal to the premolars. H&E and fluorescent sections were used to examine the bone remodeling.

Results: Neither the intraoral ($p=0.866$) nor radiographic ($p=0.528$) measures of tooth movement showed statistically significant side differences in tooth movements. There also were no statistically significant differences in the density ($p=0.237$) or volume fraction ($p=0.398$) of bone through which the premolars were being moved. Fluorescent and histologic evaluations showed no apparent differences in osteoblasts, osteoclasts, or mineralization of bone near the tooth being moved. Bone healing was evident in and near the MOP sites, which had nearly but not completely repaired after 7 weeks. Regions of acellular bone were evident extending approximately 0.8 mm from the MOP sites.

Conclusions: MOPs placed 3 mm away from teeth do not increase tooth movements and have little or no effect on bone adjacent to the tooth being moved.

Thomas M. Graber Awards of Special Merit

Altering Osteoclasts In Utero Leads to Changes in Mandibular Lengths in Adult Mice
Matthew Cozin, DDS, MS
University of California – San Francisco
Lecture Information: Monday April 24; 9:10am-9:30am; Room 6D

Introduction: Correcting class II and class III skeletal discrepancies (e.g., mandibular retrognathism or prognathism, respectively) is challenging and frequently requires invasive procedures such as extractions and/or orthognathic surgery. Currently, the etiology of skeletal malocclusions is unclear. A better understanding of the cellular and molecular mechanisms involved in skeletal malocclusions may lead to improvements in their diagnosis and prevention. In avians, changes in lower beak lengths were observed when the number of bone-resorbing osteoclasts was altered in ovo.1 Specifically, alendronate-induced inhibition of osteoclasts in quail before initial mineralization of craniofacial bones led to an increase in lower beak length. Conversely, an increase in osteoclast number led to a decrease in lower beak length. From these results, we hypothesize that altering osteoclast number in utero will lead to changes in mandibular lengths in adult mice.

Methods: To test this hypothesis, we altered the number of osteoclasts using 2 distinct methods. First, we injected pregnant mice with the bisphosphonate alendronate to decrease osteoclast number. Second, we generated and analyzed CtskCre;DTAfl/+ mice. In these mice diphtheria toxin (DTA) is expressed wherever cathepsin K (Ctsk) is expressed thereby affecting osteoclast number. Specimens were analyzed using micro-computed X-ray tomography (μCT) and cephalometric measurements.

Results: Alendronate treatment in utero resulted in reduced osteoclast number and increased sagittal lengths of the adult mandible. Conversely, adult CtskCre;DTAfl/+ mice possessed shorter mandibles due to a surprising increase in osteoclast number compared to controls.

Conclusions: Our data demonstrate for the first time, the importance of osteoclasts in the determination of mammalian mandibular lengths and in potential development of skeletal malocclusions.

Three – Dimensional Quantification of Post-Surgical Condylar Displacement
Paula Zabalegui, DDS, MS
University of Southern California
Lecture Information: Monday April 24; 10:25am-10:45am; Room 6A

Background: Condylar displacement following orthognathic surgery has been related to post-surgical relapse. Although postoperative changes in condylar position have been reported in previous studies, no study has quantified these variations in three dimensions (3D). The development of cone beam computed tomography (CBCT) allows for accurate measurement of changes in condylar position in three planes of space (x, y, z).

Purpose: To develop a method and to quantify in three-dimensions the amount and direction of condylar displacement relative to the glenoid fossa after bi-maxillary surgery. Materials and Methods: The sample consisted of 17 consecutive patients undergoing orthognathic surgery by one surgeon. The pre-surgical and 2-week post-surgical CBCT images were collected for each patient. The regions of interest in the temporomandibular joint complex were segmented and the pre- and post surgical condyles were superimposed using the glenoid fossa as the reference structure. Condylar translation and rotation were computed in three planes of space.

Results: The average condylar displacement was 0.78 mm on x plane, -3.80 mm on y and 0.14 mm on z plane. As for rotation, the average movement was 0.06 º on x plane, 0.30º on y and -0.27 on z. The only statistically significant movements were translation on Y plane and rotation on Z plane.

Conclusion: A method was developed to precisely measure condylar displacement in 3 dimensions for rotation and translation in three planes of space. Changes in condyle position do occur immediately after bimaxillary surgery and it is possible to accurately assess the amount and direction of this displacement and rotation in 3D.

Accuracy of Cone Beam Computed Tomography in Assessing the Internal Trabecular Structure of the Mandibular Condyle
Fouad-Hassan Ebrahim, DDS, MSc
University of Michigan
Lecture Information: Monday April 24; 1:45pm-2:05pm; Room 6A

Introduction: Osteoarthritis of the temporomandibular joint (TMJ) is a prevalent and debilitating disease that is characterized by chronic degradation of articular cartilage, bone and surrounding structures of the joint which can lead to pain and loss of function. Since TMJ osteoarthritis (TMJ OA) typically develops over years, the slow progression offers a long window of opportunity to potentially alter its course. Advances in radiographic imaging may allow for early characterization of TMJ OA, which could have future implications for development of effective early treatment strategies.

Methods: Sixteen resected condyles of individuals undergoing TMJ replacement were collected and used as a sample. These condyles were then radiographically imaged using a clinically oriented dental cone beam computed tomography (CBCT) and a research oriented micro-computed tomography (micro-CT). The CBCT scans were then compared to the gold standard micro-CT scans in terms of 21 bone imaging parameters. Descriptive histological investigation of the specimens was also performed.

Results: Significant Pearson correlations were found for several imaging parameters between the CBCT and micro-CT images including trabecular thickness (r=0.92), trabecular separation (r=0.78), bone volume (r=0.90), bone surface area (r=0.79), and degree of anisotropy measurements (r=0.77).

Conclusions: Measurements of trabecular thickness, trabecular separation, bone volume, bone surface area, and degree of anisotropy obtained from high resolution dental CBCT radiographs may make for suitable bone imaging biomarkers which than can be utilized clinically and in future research.

Cellular and Matrix Response of the Mandibular Condylar Cartilage to Botulinum Toxin
Eliane H. Dutra, DDS, MSD, PhD
University of Connecticut
Lecture Information: Monday April 24; 3:30pm-3:45pm; Room 6A

Objectives: To evaluate the cellular and matrix effects of botulinum toxin type A (Botox) on mandibular condylar cartilage (MCC) and subchondral bone.

Materials and Methods: Botox (0.3 unit) was injected into the right masseter of 5-week-old transgenic mice (Col10a1-RFPcherry) at day 1. Left side masseter was used as intra-animal control. The following bone labels were intraperitoneally injected: calcein at day 7, alizarin red at day 14 and calcein at day 21. In addition, EdU was injected 48 and 24 hours before sacrifice. Mice were sacrificed 30 days after Botox injection. Experimental and control side mandibles were dissected and examined by x-ray imaging and micro-CT. Subsequently, MCC along with the subchondral bone was sectioned and stained with tartrate resistant acid phosphatase (TRAP), EdU, TUNEL, alkaline phosphatase, toluidine blue and safranin O. In addition, we performed immunohistochemistry for pSMAD and VEGF.

Results: Bone volume fraction, tissue density and trabecular thickness were significantly decreased on the right side of the subchondral bone and mineralized cartilage (Botox was injected) when compared to the left side. There was no significant difference in the mandibular length and condylar head length; however, the condylar width was significantly decreased after Botox injection. Our histology showed decreased numbers of Col10a1 expressing cells, decreased cell proliferation and increased cell apoptosis in the subchondral bone and mandibular condylar cartilage, decreased TRAP activity and mineralization of Botox injected side cartilage and subchondral bone. Furthermore, we observed reduced proteoglycan and glycosaminoglycan distribution and decreased expression of pSMAD 1/5/8 and VEGF in the MCC of the Botox injected side in comparison to control side.

Conclusion: Injection of Botox in masseter muscle leads to decreased mineralization and matrix deposition, reduced chondrocyte proliferation and differentiation and increased cell apoptosis in the MCC and subchondral bone.