

# **Marquette University**

## **School of Dentistry**



# **Research Day 2010**

## **Abstracts**

# POSTER PRESENTATIONS

## CATEGORY PREDOCTORAL STUDENTS

### **1. Assessment of Digital Radiography Image Quality Using a Visual Analog Scale (VAS).**

Emily Bugger D2,

Project Advisors: Sherry Ortiz M.A., RT, Tom Wirtz M.S., Dr. Arthur F. Hefti

Objective: To investigate whether a visual analogue scale (VAS) can be used for the assessment of the image quality of digital radiographs.

Methods: 360 digital images of an ex-vivo periapical lesion were prepared as previously described (see Schultz). Experimental variables included plate storage duration before scanning (0, 24, 48, 96, 192 hrs), and lighting conditions (dark, light). Image assessment was by 5 examiners who were previously instructed in the proper use of the VAS. ANOVA was used to analyze the data of the factorial experiment.

Results: Statistically significant reductions in image quality were observed when exposed plates were stored for longer than 24 hrs at daylight versus in a dark container.

Conclusion: The VAS could potentially be used for assessing the quality of radiographic images.

### **2. Tongue Spurs: A Review of the Literature.**

Gina Corrado D3, Michael Payne D3, Nicholas Valeri D3

Project Advisor: Dr. José A. Bósio

Malocclusions characterized by anterior open bites have traditionally been troublesome. Frequently discounted in conventional therapy, tongue spurs have been effectively utilized to modify tongue behavior and maintain stability of treated open bites. The aim of the study was to determine the efficacy of tongue spurs in anterior open bite cases with a literature review. Three separate scholarly search engines were used to search for journal articles detailing the use of tongue spurs. Tongue spurs are indicated for anterior open bites caused by both chronic thumb-sucking habits and anterior tongue rest posture/thrust. Spurs have been used to effectively train the tongue in the orthodontic treatment of anterior open bite and prevent relapse. The current literature concludes that the use of spur appliances is an effective treatment option for certain cases of anterior open bite. However, more long-term research needs to be done on tongue spurs in order determine the best appliance designs, treatment lengths, and long-term stability.

### **3. A Binary Analysis in Quality of Delayed Scanning of Soredex Photostimulable Phosphor Plates (PSPs) Stored in Different Lighting Conditions.**

Lauren Schultz D3,

Project Advisors: Sherry Ortiz MA, RT, Tom Wirtz MS, Dr. Arthur Hefti

An improved CR system, OpTime<sup>®</sup>, was introduced (Soredex, Milwaukee, WI) recently. The manufacturer claimed that OpTime<sup>®</sup> is less sensitive to light exposure and therefore permits longer storage periods before scanning than its predecessor Digora<sup>®</sup>. The purpose of this study was to verify this claim. The quality of digital images obtained of an ex-vivo artificial periapical lesion was assessed as a function of plate storage time and light exposure. Examiners judged the quality of 72 images at 0, 24, 48, 96, and 192 hours. The study showed the plates can be stored up to 192 hrs if kept in the dark, however, image quality dropped significantly ( $P < 0.0001$ ) after 96 hours if stored unprotected.

### **4. Complex Oral Facial Pain: A Case Study.**

Laura White D3, Beth Hoge D3, Dr. Kelly Beck (Resident in Advanced Prosthodontics)

Project Advisor: Dr. Francisco Alencar

A patient presents with oral facial pain manifesting as Burning Mouth Syndrome, TMD, and myofascial pain. Specific symptoms include a burning sensation in the anterior palate, facial pain in the masseter muscles, headaches, and ringing in the ears. This patient was treated according to current evidence based techniques including pharmacological, occlusal, and behavioral modifications. This patient improved steadily over the course of treatment to a tolerable level and is still active in therapy.

### **5. Diagnosing and Treating Sjögren's Syndrome in the Dental Office.**

Erin Haugen D3

Project Advisors: Drs. Denis P. Lynch, Joseph M. Vitolo

The dentist plays a critical role in the diagnosis of Sjögren's Syndrome (SS), as well as the management of its oral complications. Up to 1% of the U.S. population is affected by SS and dental practitioners are often the first health care providers sought for treatment by affected patients. Early diagnosis and appropriate treatment are essential in minimizing the complications associated with SS. Diagnosis of SS is made by multiple clinical and laboratory findings. Treatment consists of a variety of palliative, pharmacologic and immunologic therapies.

## **6. Custom Total Temporomandibular Joint Prostheses: A Review of the Literature.**

Eugenia Prokopets D3, Paul Covello D3

Project Advisors: Dr. James Gloré

The purpose of this study was to evaluate patient-fitted total temporomandibular joint prostheses as a reasonable solution for patients with severe, debilitating temporomandibular joint disorders in light of past failures with total replacement systems. A thorough review of the literature published from 1993-2009 was conducted. It was found that the custom prosthesis proved to be superior to previous designs due to joint stability, materials and design.

## **7. The Air Turbine and Hearing Loss: Are Dental Students at Risk?**

Samantha Olbrys D4, Carolyn Strash D4, and Jennifer Groeneveld (Speech Pathology and Audiology)

Project Advisors: Drs. Albert Abena, Edward W. Korabic (Speech Pathology & Audiology)

Objective: The purpose of this study was to determine whether dental students experience changes in hearing sensitivity/function during four years of schooling.

Methods: D1, D4, and non-dental students with no prior hearing difficulties or defects were recruited to participate in the study. Subjects underwent three hearing tests – tympanometry (to ensure no middle ear system problems already existed), traditional and high frequency pure tone air conduction (PTAC) threshold test, and otoacoustic emissions test (OAE). High frequency PTAC and OAE testing were used because of their sensitivity to early changes in auditory sensitivity and function that we may see in D4 students.

Results & Conclusion: Traditional PTAC and OAE testing did not reveal a significant difference between D1s and D4s. However, high frequency PTAC testing revealed that the D4s' hearing sensitivity is diminished compared to the D1s', suggesting that the possibility for noise induced hearing loss during dental school exists.

## **8. A Comprehensive Review of Early Childhood Caries Treated under General Anesthesia.**

David M. Burrus D4

Project Advisor: Dr. Brian D. Hodgson

Purpose: Determine the burden of disease and dental financial reimbursement for children who require dental rehabilitation under general anesthesia prior to the age of 6 years.

Methods: Records of pediatric patients who underwent general anesthesia for the restoration of their dentition were reviewed. The decayed, missing, and filled teeth (dmft) scores were recorded as well as billing and reimbursement rates for these patients.

Results: The mean dmft for these 31 children was 10.6 (4-19). The mean fee billed for these treatments was \$2169.23, with a mean reimbursement of \$795.85 (37.8%). Re-restoration due to recurrent decay or failed restoration was 73% after 5 years.

Conclusions:

- Greater parental attention to recall appointments needs to be emphasized.
- Increased Medicaid reimbursement rates may improve the number of providers willing to utilize GA for full mouth rehabilitative care.
- Promotion of early preventive education and care through the Dental Home may reduce the burden of disease in this population.

## **9. Associations between Asymmetric Smile and Malocclusion.**

Eve van Harpen D4

Project Advisors: Drs. Dawei Liu, Mingan Yang

In contemporary orthodontics, the treatment goals include occlusion, function and esthetics. Smile is considered an important contributor to esthetics. Previous studies focused on the relationship between soft tissues (lips, gum) and hard tissues (teeth) on an assumption that the smile is symmetrical. However, it is quite common to find that facial expressions are asymmetrically exhibited during smiling. Little is known about the lip-teeth (gum) relationship in an asymmetrical smile. "Teeth showing" problems can be different between a symmetrical smile and an asymmetrical smile, which may lead to totally different treatment modalities, e.g. unilateral midline correction and unilateral extraction. To investigate the prevalence of asymmetrical smile and its relation to dental features, we examined the posed smile pictures of 319 university students and the dental features of 76 of them. Our hypothesis was that asymmetrical smile might correlate with some of the dental features such as molar relationship.

## **CATEGORY RESIDENTS CLINICAL**

### **1. Gingival Hyperplasia with Co-administration of Cyclosporine and a Calcium Channel Blocker: A Case Report.**

Drs. N. Bahramian<sup>†</sup>, K. Byerly<sup>†</sup>, M. Duserte<sup>†</sup>, T. Platikanova<sup>†</sup>

Project Advisor: Dr. Joseph M. Vitolo

<sup>†</sup>Advanced Education in General Dentistry

Here we present a case of gingival hyperplasia in a cardiac transplant patient taking two medications that have been shown to stimulate gingival overgrowth, namely the immunosuppressant cyclosporine as well as the calcium channel blocker diltiazem. The potential for each medication to stimulate gingival overgrowth has been reported in the literature. A gingivectomy was performed along with osseous recontouring to re-establish

physiologic form. Pre-treatment and post-treatment clinical assessments were compared in order to determine the effectiveness of therapy. We found that the surgical intervention was successful based on clinical exam parameters. However, as expected relapse occurred due to patient continuance on meds.

## **2. Effects of Rapid Maxillary Expansion on Upper Airway: 3-Dimensional Cephalometric Analysis.**

Dr. Yoon Chang<sup>+</sup>

Project Advisors: Drs. José A. Bósio, T. Gerard Bradley, Lisa Koenig, Dawei Liu

<sup>+</sup>Advanced Education in Orthodontics

Rapid maxillary expansion (RME) is one of the techniques most frequently used for the correction of maxillary width deficiency, posterior cross bite or expanding the arch perimeter to alleviate dental crowding. The expansion is accomplished by a heavy force originated from a RME appliance resulting in maximum orthopedic mid-palatal suture expansion with minimum orthodontic tooth movement. Evaluation of the upper airway has become an important diagnostic test in orthodontics, in part due to the potential impact of high resistance airways contributing to an abnormal growth of the naso-maxillary complex and increases in the vertical facial dimensions in children. The advent of cone beam computerized tomography (CBCT) has made 3-dimensional depiction of the craniofacial structures readily accessible using lower radiation than conventional CT scans. Our research project aims to use CBCT images to study the airway changes before and after RME in children undergoing RME as part of their orthodontic treatment.

## **3. Bondable Lingual Spur Therapy to Treat Anterior Open Bite.**

Dr. Elissa J. McRae<sup>+</sup>; Amanda M. Clifford D3

Project Advisors: Drs. José A. Bósio; T. Gerard Bradley; Arthur F. Hefti

<sup>+</sup>Advanced Education in Orthodontics

Objective: To evaluate the effect of bondable tongue spurs on measures of overbite in anterior open bite patients who had an anterior tongue posture problem.

Materials & Methods: Bondable lingual tongue spurs were placed on all incisors of 12 patients. Models and lateral cephalograms were taken pre-treatment (T1) and after 6 months of spur treatment alone (T2). Overbite and overjet of the anterior teeth were measured and compared on pre- and post-treatment study models. Differences in the cephalometric analyses between T1 and T2 were also assessed. Questionnaires were completed monthly to evaluate acceptance of the spurs.

Results: There was a statistically significant increase in overbite on all 6 anterior teeth measured on the models. This observation was corroborated by the statistically significant

increase in anterior overbite and uprighting of the incisors observed on cephalograms. The tongue spurs were well-tolerated.

Conclusion: Bondable tongue spurs resulted in a significant reduction of anterior open bite.

#### **4. Congenitally Missing Maxillary Lateral Incisors and the Relation to Tooth Size.**

Dr. Jane Wight

Project Advisors: Drs. José A. Bósio, T. Gerald Bradley

\*Advanced Education in Orthodontics

It has been anecdotally suggested that patients who are congenitally missing their permanent maxillary lateral incisors may have a generalized tooth size discrepancy. The suspicion is due to the difficulty in obtaining Angle Class I occlusion and opening enough space for an implant while maintaining proper overbite and overjet. This study aims to evaluate plaster dental casts of patients who are congenitally missing one or both maxillary lateral incisors by measuring the mesio-distal width of maxillary and mandibular teeth from first molar to first molar. The hypothesis is that patients who are congenitally missing one or both maxillary lateral incisors have tooth-size discrepancy.

A minimum of thirty maxillary and mandibular archived dental casts are being collected from orthodontists in the greater Milwaukee area. Only plaster casts are being included in this study, because minimal difference between the sizes of teeth are found when measured digitally or on a plaster cast. The models collected should comply with the inclusion criteria: 1)Caucasian patients, 2) either gender, 3) missing one or both maxillary lateral incisors, 4) not missing any other teeth (except wisdom teeth), and 5) without extreme wear or restorations. Subjects age at the time of the cast acquisition was also recorded. The mesio-distal dimensions of all teeth (maxillary and mandibular first molar to first molar) are being measured with a high precision digital calipers. Once the final number of test casts is established, a control group of casts will be collected and matched for race, gender and age. These control casts will be gathered from Marquette University's Orthodontic Department. The measurements will be recorded in an Excel spreadsheet and analyzed.

#### **5. Application of Mechanical Vibration to Move Teeth Faster in Orthodontic Patients.**

Dr. Mark Foster

Project Advisors: Drs. Dawei Liu, José A. Bósio, T. Gerald Bradley

\*Advanced Education in Orthodontics

Orthodontic treatment provides patients with better occlusion, improved oral functions, and harmonized facial esthetics. However, the total treatment time usually takes 2-3 years and can cause iatrogenic root resorption because of the long treatment time. Therefore, how to shorten treatment time and reduce the risk of root resorption becomes a focused area of research in orthodontics. Orthodontic tooth movement is a mechanical force induced process of modeling

and remodeling of periodontium consisting of alveolar bone, periodontal ligament and cementum – the outer layer of tooth root. The speed of tooth movement is mainly influenced by bone remodeling, with resorption of the alveolar bone on the compressed side of periodontal ligament (PDL), and formation of new bone on the tension side of PDL. When orthodontic forces are applied, three distinct phases of tooth movement are observed on the compressed side of PDL, i.e., the immediate squeezing of PDL, the lag phase where tooth movement appears to stop due to hyalinization (cell death) of the PDL, and the fast tooth movement through undermining resorption of the adjacent alveolar bone. Recent study showed that mechanical vibration could help move teeth faster in rats, however no clinical evidence has been reported.

## **6. Using Molloplast B as a Retentive Mechanism for a Treatment Partial Denture.**

Dr. Mohammad Aljadi\*

Project Advisors: Dr. Gerald Ziebert, Masaaki Izumi

\*Advanced Education in Prosthodontics

In this case, the heat cured permanent soft denture relining system MolloPlast B, was used as the retention mechanism for a treatment partial denture. This innovative idea was used to avoid the repeated de-cementation of the patient's temporary when clasps were used. In this poster the technique and laboratory procedures are presented.

## **7. An Interdisciplinary Treatment Approach for Full Mouth Reconstruction: A Case Report.**

Dr. Deo Pun\*

Project Advisors: Drs. Gerald Ziebert, Michael Karczewski

\*Advanced Education in Prosthodontics

The etiology of tooth wear is multifactorial. The tooth wear quite often reduces tooth surface and height of the crown and sometime over all vertical dimension of face compromising function and esthetics. Preservation of tooth structure is an essential. This case presents full mouth rehabilitation of 59 years old male who lost tooth structure with erosion and attrition. The patient was restored using full coverage porcelain fused to metal crown and bridge. To achieve this treatment goal, an interdisciplinary approach was used.

## **8. The Biometrics of Mastication Using BioPAK™ .**

Dr. Manminder Sethi\*

Project Advisor: Dr. Gerald Ziebert

\*Advanced Education in Prosthodontics

BioPAK™ can be used to record dynamic jaw movements, muscle activity and temporomandibular joint vibrations in real time. With-in this subject we found some moderate level of dysfunction in the right TM Joint suggestive of mild degeneration. The movement pattern of chewing gum on the right side was less normal than chewing on the left side. Likewise, the muscle pattern of chewing gum on the right side was less normal than chewing on the left side.

## **CATEGORY RESIDENTS LABORATORY**

### **1. Biomechanical and Histomorphometric Evaluation of Titanium Implants Augmented with rhBMP-2.**

Dr. Akshi Arora<sup>+</sup>,

Project Advisors: Drs. Jeffrey M. Toth<sup>†‡</sup>, Mei Wang<sup>†</sup>

<sup>+</sup>Graduate Program in Dental Biomaterials, <sup>†</sup>OREC, Biomedical Engineering, <sup>‡</sup>School of Dentistry

Recombinant human bone morphogenetic protein (rhBMP-2) was delivered on an absorbable collagen sponge (ACS) within and around a novel titanium screw implant in an IACUC approved ovine spine model. Biomechanical pull-out tests, undecalcified histology, microradiography, and quantitative histomorphometry were used to assess augmentation with rhBMP-2 on the holding power and peri-implant bone formation. rhBMP-2 did not significantly improve the biomechanical pull-out properties (stiffness, force, and energy to failure). rhBMP-2 was associated with early transient bone resorption and formation of hypodense osteopenic bony trabeculae at the early time period. These were replaced by remodeled bone at the later time period.

### **2. Composite Resin Wear.**

Dr. Raghav Puri<sup>†</sup>

Project Advisor: Dr. David W. Berzins

<sup>†</sup>Graduate Program in Dental Biomaterials

Composite resins contain filler particles bonded to a polymer matrix (generally dimethacrylates) by a coupling agent and are used as restorative materials because of their excellent esthetic appeal, among other properties. However, occlusal wear is one of the leading causes of failure in dental composite restorations. Various factors affect the wear of dental composites. There has been no precise test to exactly simulate clinical wear but several studies have evaluated the in vitro wear of composites and have extrapolated those results into clinical use.

### **3. Friction Testing of a New Ligature.**

Dr. Alison Mantel\*

Project Advisor: Dr. David W. Berzins

\*Advanced Education in Orthodontics

A new ligature has been developed by American Orthodontics that is not yet on the market. The company has claimed that the ligature's coating has a very low level of friction. This study will determine the amount of friction that it creates compared to several other ligatures currently on the market. The new ligature will also be tested after being treated with saliva for 24 hours to determine if the coating can last in vivo.

### **4. The Effect of Light Cure Initiation Time on Orthodontic Bond Strength With a Resin-modified Glass Ionomer.**

Dr. Jess Hell\*

Project Advisors: Dr. David W. Berzins, T. Gerard Bradley, Dawei Liu

\*Advanced Education in Orthodontics

This study will analyze a dual cured resin modified glass ionomer cement (GC Fuji Ortho LC) and its properties with respects to mixing to cure time, and bond strength of the bracket to tooth interface. This material is a dual cured cement, meaning it will cure both chemically upon mixing, as well as through light cure. On This experiment is set out to determine if the amount of chemical set versus setting via light polymerization affects the properties and therefore the bonding strength of the cement. We will first utilize DSC analysis of the material at different light cure times to determine how much of the material is set via chemical cure versus light cure, and therefore how much of the material will act like a resin versus a glass ionomer. We will then bond brackets onto virgin surfaces of extracted premolar teeth, and again, light cure at different intervals. We will then measure the amount of force needed to debond the brackets from the teeth, thus testing the strength of the cement bond strength at that specific cure time. This will hopefully allow us to conclude whether or not this material should be cured more immediately than delayed upon mixing, and specifically what amount of time lapse from mixing to light cure gives the material an optimal bond strength. We can then take this to the clinical setting to be used to reduce bond failures for this product.

### **5. Bonding with Self-etching Primers – Pumice or Pre-etch? An in vitro study.**

Dr. Ian Fitzgerald\*

Project Advisors: Drs. T. Gerard Bradley, José A. Bósio, Arthur F. Hefti, David W. Berzins

\*Advanced Education in Orthodontics

Objective: To compare the shear bond strengths (SBS) of orthodontic brackets bonded with self-etching primer using different enamel surface preparations.

Method: Sixty human premolars were harvested, cleaned and randomly assigned to four groups (n=15/group). Teeth were bathed in saliva for 48 hours to form a pellicle.

Results: The SBS values ( $\pm 1$  SD) for Groups 1-4 were  $22.9 \pm 6.1$  MPa,  $16.1 \pm 7.3$  MPa,  $36.2 \pm 8.2$  MPa, and  $13.1 \pm 10.1$  MPa, respectively. Two-way ANOVA and subsequent contrasts showed statistically significant differences among treatment groups.

Conclusions: Pre-etching the bonding surface for five seconds with 37% phosphoric acid, instead of pumicing, when using self-etching primers to bond orthodontic brackets, results in greater shear bond strengths

## **6. Bracket Bond Strength Effects of Incorporation of NovaMin into an Orthodontic Bonding Resin.**

Dr. J. Waterhouse<sup>+</sup>

Project Advisors: Drs. David W. Berzins, Dr. T. Gerard Bradley

<sup>+</sup>Advanced Education in Orthodontics

White spot enamel demineralization around orthodontic brackets can compromise the finished result of treatment. This study explores a potential new application of a known remineralizing material, NovaMin, by incorporating it into a commercially available bonding resin. Ion release of calcium will be tested at levels varying from 0 to 22.5 weight percent NovaMin. Resin discs 1.6x8mm in size will be molded and allowed to soak in deionized water (pH 7) or a lactic acid solution (pH 5). The solution will be changed every 24 hours for 7 days, then once every 7 days for another 2 weeks. Calcium ion release will be measured at each exchange. Initial results have shown continuous slow release of calcium ions in both solutions, but significantly higher amounts in acid solution. Bracket shear bond strength will be measured for the resin alone and for NovaMin levels of 15 and 22.5 wt%.

## **7. Cementoblastic Response to High vs. Low Level of Mechanical Force *in Vitro*.**

Dr. Nicole Mullally<sup>+</sup>

Project Advisor: Dr. Dawei Liu

<sup>+</sup>Advanced Education in Orthodontics

External apical root resorption (EARR) is one of the few side effects resulting from orthodontic treatment. A complex network of molecular signals orchestrates numerous cellular events to resorb the alveolar bone and possibly the cementum. As the external layer of the tooth root, cementum bears the majority of the mechanical load of orthodontic force and may trigger or participate in the resorption process. To study the role of cementoblasts in external apical root resorption, we examined changes in molecular bone biomarkers in OCCM-30 cells (mouse cementoblast cell line) following application of mechanical loading by fluid shear stress (FSS) for 1 hour at two different force levels. We found a significant decrease in osteopontin (OPN) at 12 dynes/cm<sup>2</sup>. OPN serves to attach osteoclast cells to bone matrix to begin resorption.

## **8. Effects of Mechanical Vibration on Orthodontic Tooth Movement.**

Dr. Andrew Rummel<sup>+</sup>

Project Advisor: Dr. Dawei Liu

<sup>+</sup>Advanced Education in Orthodontics

Purpose: To determine whether mechanical vibration (MV) changes the rate of orthodontic tooth movement (OTM) in mice.

Methods: Thirty-six mice were randomly allocated to four treatment groups: OTM/MV, OTM only, MV only, control. An orthodontic expander spring was placed bilaterally between maxillary 1<sup>st</sup> molars to provide OTM. Under anesthesia, the springs and MV were inserted and applied. MV (4Hz, 20 $\mu$ m displacement, 5 mins per session) was applied to the left maxillary 1<sup>st</sup> molar every three days for 3 consecutive weeks. Fluorescent dyes were injected at 6<sup>th</sup> and 12<sup>th</sup>, and 18<sup>th</sup> day to reveal the dynamic changes of bone modeling. Every week, anterior-posterior x-rays were taken to evaluate the structural changes. At completion of the experiment, the mice were euthanized and evaluated by histological, histomorphometric and CT analyses.

## **9. A Technique Used for a Screw Retained Prosthesis in the Aesthetic Zone.**

Dr. Kathryn Ryan<sup>+</sup>

Project Advisors: Drs. Charles Pechous, Gerald Ziebert

<sup>+</sup>Advanced Education in Prosthodontics

The use of a screw-retained implant prosthesis<sup>4</sup> in the aesthetic zone is often required for cases where implant placement is less than ideal and there are soft tissue deficiencies, lost posterior support, as well as missing teeth. The use of a traditional screw retained prosthesis is complicated when the screw access holes project through the facial and incisal surfaces of teeth. By incorporating a substructure<sup>1</sup>, screw access openings can be placed in a more ideal position and the superstructure provides complete coverage of the access openings. The superstructure can be modified to proper patient specifications for an ideal functional and aesthetic outcome. In a patient where implant position compromises the restorative treatment, a technique has been established with the use of the Tube and Screw System from Attachments International.

## **10. Elemental Release of CoCr and NiCr Castings Alloyed with Palladium.**

Dr. Kelly A. Beck<sup>+</sup>

Project Advisors: Drs. David W. Berzins, Gerald Ziebert, Thomas Smithy

<sup>+</sup>Advanced Education in Prosthodontics

Recently introduced to the market was a new subclass of casting alloy composition whereby palladium is added to traditional base metal alloys.

Objective: Evaluate the elemental release of new CoPdCr and NiPdCr alloys and compare them to traditional CoCr and NiCr alloys.

Methods: Five casting alloys were investigated: CoPdCr-A (NobleCrown NF, Argen), CoPdCr-I (Callisto CP+, Ivoclar Vivadent), NiPdCr (NobleCrown, Argen), CoCr (Argeloy N.P. Special, Argen), and NiCr (Argeloy N.P. Star, Argen). Specimens were prepared according to ISO 10271 and immersed in a lactic acid/NaCl solution. Solutions were analyzed with ICP-AES to determine elemental release. The concentrations of major ions were compared using a generalized linear model.

Results: CoPdCr alloys released a significantly greater amount of cobalt, palladium, chromium, and molybdenum ions compared to the traditional CoCr alloy. No significant differences were noted between NiPdCr and NiCr.

Conclusion: Corrosion resistance measured via elemental release is compromised when CoCr is alloyed with palladium.

# ORAL PRESENTATIONS

## FACULTY

### 1. Quantification of Mandibular Flexion: A Pilot Study.

Dr. H. Aggarwal

Department of General Dental Sciences - Prosthodontics

Mandibular flexion during jaw opening is a phenomenon recognized and demonstrated for several years. Numerous studies have been conducted to quantify this flexion and its various clinical implications on prosthodontic procedures. The concept, the values and the clinical implications suggested, still are inconclusive.

Our study is a clinical study of 20 healthy subjects. It provides insight into the nature of Mandibular flexion. We measured flexion in the molar and pre-molar areas in all the border movements of the mandible, i.e. open, protrusive, left and right excursive. Compiled together we see some expected and some unusual trends in the nature of flexion.

### 2. Phase Transformation Changes in Thermocycled Nickel-Titanium Orthodontic Wires.

Drs. David W. Berzins<sup>+</sup>, Howard W. Roberts<sup>†</sup>

<sup>+</sup>Department of General Dental Sciences – Dental Biomaterials, <sup>†</sup>USAF Dental Evaluation and Consultation Service

Objective: In the oral environment, orthodontic wires will be subject to thermal fluctuations. The purpose of this study was to investigate the effect of thermocycling on nickel-titanium (NiTi) wire phase transformations.

Methods: Straight segments from single 27°C and 35°C Copper NiTi (Ormco), Sentalloy (GAC), and Nitinol Heat Activated (3M Unitek) archwires were sectioned into 5 mm segments (n=20). A control group consisted of five randomly-selected non-thermocycled segments. The remaining segments were thermocycled between 5 and 55°C with five randomly-selected segments analyzed with differential scanning calorimetry (DSC; -100↔150°C at 10°C/min) after 1,000, 5,000, and 10,000 cycles. Thermal peaks were evaluated with results analyzed via ANOVA ( $\alpha = 0.05$ ).

Results: Nitinol HA and Sentalloy did not demonstrate qualitative or quantitative phase transformation behavior differences. Significant differences were observed in some of the Copper NiTi transformation temperatures, as well as the heating enthalpy with the 27 °C Copper NiTi wires ( $p < 0.05$ ). Qualitatively, with increased thermocycling the extent of R-phase in the heating peaks decreased in the 35°C Copper NiTi, and an austenite to martensite peak shoulder developed during cooling in the 27°C Copper NiTi.

Significance: Repeated temperature fluctuations may contribute to qualitative and quantitative phase transformation changes in some NiTi wires.

### **3. Inhibition of *Candida albicans* Biofilms on Antimicrobially Loaded Phosphated Poly(methyl-methacrylate).**

Drs. Andrew Dentino<sup>+</sup>, Donghwa Lee, Guojiang Wen, Arthur F. Hefti, Fred Sutkiewicz, April Harkins<sup>†</sup>

<sup>+</sup>Department of Surgical Sciences - Periodontology, <sup>†</sup>College of Health Sciences

*Candida albicans*' ready adhesion to poly(methyl-methacrylate) (PMMA) denture base material is considered a major factor in the etiology of *Candida*-associated denture stomatitis. Exhibiting a negative charge, carboxylated PMMA derivatives inhibit *C. albicans*' adhesion and enhance adsorption of cationic salivary antimicrobial peptides (Edgerton 1995; Park 2003, 2008).

**Objective:** To assess the effects of phosphate addition to PMMA on *C. albicans* biofilms, and to further examine biofilm metabolism on PMMA surfaces after loading antimicrobials (cetyl pyridinium chloride [CPC], KSL-W, Histatin 5 [His 5]) on the naked as well as salivary pre-conditioned PMMA surfaces prior to *C. albicans* adherence.

**Methods:** Four polymers with varying amounts of phosphate were synthesized by monomer substitution using Lucitone 199 denture base polymer beads and mixtures of methyl methacrylate (MMA) and ethylene glycol methacrylate phosphate (EGMP) monomers (PMMA control), 95:5 (5% PO<sub>4</sub>), 85:15 (15% PO<sub>4</sub>), and 75:25 (25% PO<sub>4</sub>) respectively. Disks were heat processed and polished (Ra, 0.35-0.45µm). *C. albicans* isolated from a denture stomatitis patient and grown overnight in YNB supplemented with 50 mM glucose was used to inoculate disks and allowed to adhere for 90 min. Biofilms developed over 24 hours were assessed for metabolic activity using an XTT assay (Chandra 2005). Statistical significance of treatment effects was assessed using ANOVA.

**Results:** Biofilm metabolism was reduced as phosphate increased (15%: P=0.004 ; 25% P=0.001). Loading 100 µg/ml of CPC on 15% phosphate disks showed a decrease (P=0.001) in biofilm metabolism in the presence or absence of a salivary pellicle, His 5 (P=0.01) showed less activity on the naked surface and lost activity on the pellicle surface while KSL-W showed no activity (P>0.05).

**Conclusion:** Phosphate containing EGMP-PMMA co-polymers affected *C. albicans* adhesion and/or biofilm metabolism. CPC showed substantial antifungal activity in the presence or absence of a pellicle. Supported by NIDCR Grant # DE016925.

### **4. Senior Dental Students' Experience with Cariogram in a Pediatric Clinic**

Drs. Cesar D. Gonzalez<sup>+</sup>, Christopher Okunseri<sup>†</sup>

<sup>+</sup>Department of Developmental Sciences – Pediatric Dentistry, <sup>†</sup>Department of Clinical Services – Dental Public Health

The study objective was to assess predoctoral dental students' experience with a caries risk assessment computer program in the pediatric dentistry clinic at Marquette University School of Dentistry. In 2005, spring semester sophomore dental students (class of 2008) were introduced to the caries risk assessment computer program "Cariogram." The students received a fifty-minute lecture on caries risk assessment and a demonstration on how to use Cariogram

in the clinic. After two years of clinical exposure to Cariogram, sixty-six out of eighty senior dental students completed an anonymous eleven-item questionnaire on their experience with the tool. Each item on the questionnaire was scored on a five-point Likert scale with the exception of two questions. Forty-five percent of the students who participated in the study agreed that Cariogram was easy to understand, and 18 percent disagreed. Thirty-six percent felt that it was easy to apply, and 25 percent reported that it was useful in determining caries preventive procedures. Full- and part-time faculty members in the pediatric dentistry clinic were involved in teaching and supervising students in the use of Cariogram for caries risk assessment after their training and calibration. The students reported that 60 percent of full-time and 33 percent of part-time faculty were knowledgeable about Cariogram use. A majority of the students felt that Cariogram was not easy to understand, and eighty-two percent of them reported that they would not be using Cariogram in their private offices. Future studies should explore reasons why students do not feel inclined to use Cariogram as a caries risk assessment tool in their private practices even after being exposed to the tool in dental school.

### **5. Amelioration of Oral Mucositis Pain by NASA Near Infra Red Light Emitting Diodes in Bone Marrow Transplant Patients.**

Drs. Brain D. Hodgson<sup>++</sup>, David M. Margolis<sup>‡</sup>, Williams LD<sup>4</sup>, Salzman DE<sup>4</sup>, Sande JE<sup>4,5</sup>, Vaughan WP<sup>4</sup>, Harry T. Whelan<sup>‡</sup>

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Purpose: To investigate the use of extra-orally applied near infra-red (NIR) phototherapy for the reduction of oral pain secondary to cancer therapy induced mucositis in hematopoietic stem cell transplant (HSCT) patients.

Methods: 80 patients were randomly assigned to experimental phototherapy regimen group (670 (+/- 10) nm gallium-aluminum-arsinide light emitting diode (LED) device, 80 sec, ~50mW/cm<sup>2</sup>, 4J/cm<sup>2</sup>) or a placebo phototherapy group and further subdivided into regular risk vs. low risk mucositis groups. The final patient groupings used for comparison consisted of experimental-regular risk (ER), experimental-low risk (EL), placebo-regular risk (PR), and placebo-low risk (PL). Patients received the experimental or placebo light therapy once per day starting on the Day 0 and continued through Day +14 resulting in 7 scores per patient. Blinded evaluators examined the patients 3 times per week (M, W, F) and scored their oral tissues and patient-reported pain assessments at each evaluation utilizing the World Health Organization (WHO) mucositis scale, the National Cancer Institute Common Terminology Criteria for Adverse Events (NCI-CTCAE) scale, the Oral Mucositis Assessment Scale (OMAS) and pediatric and adult visual analog scales.

Results: Analysis of the mean scores at each observation demonstrate that the extra-oral application of phototherapy resulted in a significant reduction in patient-reported pain between the ER and PR patients (P<0.05) at Day +14 when graded via the WHO criteria. The ER

and EL patients were improved in almost all other categories and assessment scales, but the differences were not statistically significant.

Conclusion: Phototherapy demonstrated a significant reduction in patient-reported pain as measured by the WHO criteria in the patient population included in this study. This study supports previous studies which indicate a usefulness of phototherapy in cancer treatment patients and also demonstrates that a less invasive extra-oral light device can be effective in delivering this treatment.

## **6. Optimization of Mechanical Force to Enhance Orthodontic Tooth Movement.**

Dr. Liu Dawei

Department of Developmental Sciences - Orthodontics

The goals of orthodontic treatment are to improve patients' esthetics and chewing ability. Despite the obvious success, two challenges continue to puzzle orthodontists: long treatment time and iatrogenic root resorption. How to move teeth faster and at the same time reduce the risk of root resorption are therefore highly significant questions asked by orthodontic practitioners and scientists. Therefore, my team's research is focusing on how to optimize orthodontic force to move teeth fast and at minimal root resorption risk. The objective of our research is to use animal and cell culture models to investigate the effect of mechanical vibration on clinical and molecular parameters of orthodontic tooth movement and root resorption. Our hypothesis is that mechanical vibration enhances orthodontic tooth movement and reduces root resorption. To test this hypothesis, we are currently pursuing the following projects: In a first project, C57BL/6 mice are subjected to mechanical vibration and changes in tooth movement speed are investigated using repeated radiographs and micro-CT scans. In addition, bone modeling changes are assessed by histology. In a subsequent project, insight into the molecular basis of the experimental findings of the first project is gained. In the presence and absence of mechanical vibration, cultures of periodontal cells are exposed to the forces of fluid shear stress (FSS) and vibration. The resulting cellular response, expressed at the level of important bone markers (ALP, SOST, OPN, OPG and RANKL) is then detected by Western Blot analysis. The outcome of this clinical translational project will allow us to move one step closer to implementing mechanical vibration as a tool in the armamentarium of practicing orthodontists and, hopefully, improving the quality of patient care. Research is funded by AAOF and EOS.

## **7. What Does Risk Assessment Mean to You?**

Dr. Paul G. Luepke

Department of Surgical Sciences - Periodontology

The aim of this research day presentation is to offer the benefits of a risk assessment tool (PreViser) to the students and faculty. The PreViser is already in place on AxiUm, but is

underutilized. The goal will to re-establish the value to the student, patient, and use as a research mechanism at MUSoD. The result will be research points needed for graduation, a better student/patient communication with respect to risk factors associated with periodontology and evidence based treatment solutions. The groundwork for potential research questions, future publications, and a sustainable data base will be discussed. The Bottom Line: It will be a win, win, win with respect to the student, patient, and research potential.

## **8. Relationship between Erosive Tooth Wear and Consumption of Beverages among Children in the United States.**

Drs. Christopher Okunseri<sup>+</sup>, Cesar D. Gonzalez<sup>†</sup>, Alexis Dye<sup>‡</sup>, Aniko Szabo<sup>‡</sup>

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Objective: Laboratory studies have identified differences in the physiochemical properties and the effect of dilution of beverages on the etiology of erosive tooth wear (ETW). Not enough is known from epidemiological studies about the relationship between ETW and the consumption of beverages available in the United States. This study examined the association of consumption of different beverages with ETW in children.

Methods: The National Health and Nutrition Examinations Survey data for 2003-2004 was analyzed. Trained and calibrated examiners used the modified Smith and Knight tooth wear index from the 1998 United Kingdom Adult health survey to measure ETW. Beverage consumption collected via a Food Frequency Questionnaire was processed with DietCalc software to obtain average daily consumption frequency for all queried juice categories, milk, and carbonated beverages. Survey-weighted descriptive and multivariable analyses were performed.

Results: Prevalence of erosive tooth wear was highest in 18-19 year olds (56%), males (49%) and among whites (48%). After adjusting for age, gender, and race/ethnicity, more frequent apple juice consumption was found to be associated with a higher likelihood of erosive tooth wear (OR=1.24, 95% CI 1.08-1.43, p=0.003). No association was found for grape, orange/grapefruit, tomato/vegetable juice, juice drinks, soda, or milk.

Conclusions: This study demonstrates that erosive tooth wear was associated with frequent intake of apple juice, thus confirming laboratory studies of the risk of apple juice on ETW.

## **9. A Course in Emergency Dental Treatment for Refugee Health Care Providers: A Program Assessment.**

Dr. Toni M. Roucka

Department of Clinical Services

Although dental diseases and oral pain are highly prevalent among refugee populations, their oral health care needs continue relatively unaddressed. Oral health remains alienated from general health care and is not funded by the United Nations Higher Commissioner for Refugees (UNHCR). The dental needs of refugees in two camps in Western Tanzania had been formally assessed in 2006 and suggested a very high need for preventive and curative interventions. In November of 2007 and August of 2008, a dental team of four dentists, supported by the American Dental Association, Health Volunteers Overseas and the Tanzania Red Cross, provided training in emergency dental care to refugee health providers in two long-term refugee camps in Western Tanzania.

In August of 2009, data was collected on the program to assess its sustainability. The results of this study revealed demographic data from 1961 patient visits which occurred over the 22 month period since the program's inception.

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- Midwest Dental
- Philips Oral Healthcare
- Rocky Mountain Orthodontics, Inc.
- SML Midwest (OHLENDORF CO.)
- The Procter & Gamble Company