



INDIANA UNIVERSITY SCHOOL OF DENTISTRY

RESEARCH DAY

04
15 2013

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Congratulations!

Delta Dental of Indiana would like to congratulate dentistry students on their Research Day presentations. Your hard work and dedication to dentistry is an inspiration to us all.

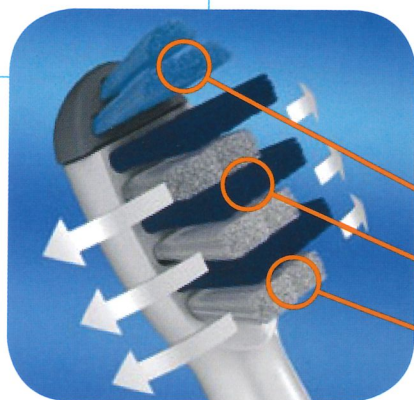
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**IUSD Research Day Proceedings
Volume 21, 2013**

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A special welcome to our guest presenters:

**University of Detroit Mercy
School of Dentistry**

**University of Louisville
School of Dentistry**

On the Cover: The principles of tissue engineering for regeneration involve the combination and interplay of three major elements such as scaffolds, regenerative cells or stem cells, and cell signaling molecules or growth factors. The scanning electron microscopy image demonstrates murine osteoblasts (MC3T3-E1) after culturing for 3 days on a biodegradable polymer-based nanofibrous scaffold, which is being investigated as a potential novel scaffold for periodontal bone tissue regeneration.

Image provided by Marco C. Bottino¹, DDS, PhD, Kornchanok Wayakanon², BDS, PhD and Angela Bruzzaniti³, PhD (¹Assistant Professor, Department of Restorative Dentistry/Dental Biomaterials Division, ²Graduate Operative Program, and ³Assistant Professor, Department of Oral Biology, Indiana University School of Dentistry.)

Cover design by Mark Dirlam. Research Day monograph prepared by Barbara A. Gushrowski

Research Day Organizing Committee

Angela Bruzzaniti, Chair

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William Babler
Marco Bottino
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American Association for Dental Research

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Councilor: Sean Shih-Yao Liu

Officers

IUSD Student Research Group

President: Devin Shone
Vice President: Austin Starr
Secretary: Hani Ahdab
Faculty Adviser: Richard Gregory

Future Research Day Event:

April 14, 2014



April 15th, 2013

Dear Participants and Guests,

It is with the great pleasure that we welcome you to the 21st Annual Research Day of the Indiana University School of Dentistry.

Since 1993, this annual research event has provided a forum for IUSD researchers, faculty, staff, and students, including undergraduate, predoctoral and graduate students, to come together to present their research findings and clinical case studies to members of the School and the broader community. We also welcome student representatives from dental schools at University of Detroit Mercy, and University of Louisville who will share their research discoveries with us and participate in the inter-school research competition.

This year, we are delighted to have Dr. Nasser Paydar, Executive Vice Chancellor, Chief Academic Officer, IUPUI provide opening remarks. We are also honored to have as our keynote speaker, Dr. Mary MacDougall, Ph.D., President, International Association for Dental Research, James R. Rosen Chair in Dental Research, School of Dentistry, University of Alabama at Birmingham. Dr. MacDougall will present a talk entitled, "Probing the Lessons Learned from Dental Genetic Disorders."

We would like to offer a special word of thanks to our sponsors; Shofu, Delta Dental, Procter & Gamble, Johnson & Johnson, Indiana Dental Association, and, for the first time, the American Student Dental Association. We also wish to thank all the exhibitors for their participation year after year. The success of this annual research event depends on the continued support of our sponsors and exhibitors. We encourage everyone to visit with our exhibitors and acquaint themselves with the dental products and services they have to offer.

On behalf of the organizing committee, the Indiana Section of the American Association for Dental Research (IN-AADR) and the Student Research Group (SRG), we thank you all for participating in our Research Day event and sincerely hope that you will enjoy our scientific program.

Sincerely,

A handwritten signature in black ink, appearing to read "Angela Bruzzaniti".

Angela Bruzzaniti, Ph.D.
President
Indiana Section of the AADR

A handwritten signature in black ink, appearing to read "Devin Shone".

Devin Shone
President
Student Research Group, IUSD



INDIANA UNIVERSITY

SCHOOL OF DENTISTRY

Office of the Dean
IUPUI

April 15, 2013

Indiana University School of Dentistry Colleagues,

Welcome to Research Day 2013! As IUSD continues its contributions to the research agenda of Indiana University, I commend our faculty, students and staff for their diligent commitment to supporting the vital activity of “scientific discovery” by hosting this annual event. Since 1993, Research Day has been an opportunity for the School of Dentistry to highlight the substantial collaborative research that is under way through programs sponsored by and affiliated with the school.

The Research Day monograph you are holding includes each researcher’s full abstract, and we are confident you will find it a valuable resource. The printed monograph helps preserve the educational experience unfolding here today, and inspires us to learn from the promising work of our colleagues. After the event has concluded and the posters have been taken down, the research continues. This monograph is a way to make sure we keep in mind the extraordinary variety of research in progress at our dental school, and the many ways this pursuit helps the practice of dentistry continually evolve.

In this publication you will find much creativity and innovation directed toward improving human life and the world in which we live. Let’s congratulate our colleagues for their hard work and also offer them an encouraging word. Scientific discovery is a journey, not just a destination.

We are pleased to welcome Dr. Mary MacDougall, President of the International Association for Dental Research (IADR), as our featured keynote speaker. Her outstanding career attests to the innovation, hard work and tenacity that are the underpinnings of excellent research. I know you will embrace her messages as well as attend the other events the Research Day planning committee has helped make possible. I sincerely thank the committee and the IN-AADR for their special efforts in organizing this event. I also thank our many sponsors who assist us in underwriting Research Day each year.

Thank you for being a part of this celebration and for the many ways you contribute to the Indiana University School of Dentistry’s missions of education, research, patient care and service. Our vision is to be “one of the best dental schools of the 21st century” – an active research program is one marker and measure of progress to achieve this vision.

With best wishes to all Research Day participants,

John N. Williams
Dean

Program

Campus Center 3rd and 4th Floor

Thursday, April 11

5:00 p.m. – 8:30 p.m. Poster Judging (Dental School)

Monday, April 15

8:00 a.m. – 11:00 a.m. Interschool Student Research Competition (CE 406)

12:00 p.m. Registration (4th floor lobby)
Commercial Exhibitions (CE 450C)

12:45 p.m. Welcome Remarks **Dr. John N. Williams Jr.**
(CE 450A-B) Dean, IUSD

12:50 p.m. Opening Remarks **Dr. Nasser Paydar**
Executive Vice Chancellor,
Chief Academic Officer, IUPUI

1:05 p.m. Introduction of Keynote Speaker **Dr. Domenick T. Zero**
Director, Oral Health
Research Institute, Associate
Dean for Research, IUSD

1:10 p.m. Keynote Address **Dr. Mary MacDougall**
President, International
Association for Dental Research

2:10 p.m. Announcement of Faculty Awards **Dr. John N. Williams Jr.**

2:15 p.m. Announcement of Poster Awards **Dr. Angela Bruzzaniti**
President
Indiana Section, AADR

2:30 p.m. – 4:30 p.m. Commercial Exhibitions (CE 450C)

Interschool Poster Presentations (CE 406)

Research Presentations (CE 305-310, 405, 409)

2:30- 3:30 p.m.: Odd-numbered Posters and Clinical Case Reports

3:30 p.m.-4:30 p.m.: Even-numbered Posters and Clinical Case Reports

4:30 p.m. Removal of Posters

Introducing the Keynote Speaker

Dr. Mary MacDougall, the James R. Rosen Chair in Dental Research, is the Associate Dean for Research and Director of the Institute of Oral Health Research at the University of Alabama at Birmingham School of Dentistry. She earned her Ph.D. in Craniofacial Biology at the University of Southern California (USC), School of Dentistry and her B.A. in Biochemistry at the University of California at San Diego, Revelle College. She received National Institute of Dental Research Fellowships during both her pre-doctoral and post-doctoral studies. In 1986, she joined the faculty at USC School of Dentistry as a Research Assistant Professor at the Center for Craniofacial Molecular Biology. In 1993, she joined the faculty at University of Texas Health Science Center in San Antonio (UTHSCSA), in 1998 she was promoted to Professor with tenure, and in 1999 became the Dental School's first Associate Dean for Research. In 2005, she joined the faculty of UAB School of Dentistry as the first appointed NIDCR U-25 Research Infrastructure magnet investigator. Dr. MacDougall's research centers on the molecular mechanisms associated with tooth formation, dental tissue-specific cytodifferentiation, extracellular matrix formation, tooth stem cells and tissue regeneration as well as related human genetic dental diseases. Her research in craniofacial genetics and biomimetics has been funded continuously since 1985 by the NIH/NIDCR with total career federal funding in excess of 15 million dollars.



Dr. MacDougall has served as President of the American Association for Dental Research (AADR) in 2005-2006. In 2001, Dr. MacDougall received the International Association for Dental Research (IADR) Distinguished Scientist Pulp Biology Research Award and in 2005 the IADR Distinguished Scientist Mineralized Tissue Research Award. In 2003, she was awarded the AADR National Student Research Group Mentor of the Year Award for her efforts to foster student research training. In 2005, Dr. MacDougall began an outreach program called "PreDoctoral Dental Student Training in Academics and Research (Pre-DART)" an early intervention program targeting minority students to careers in dental academics funded by the William Gies Research Award. She is director of the School of Dentistry's DMD/PhD and training program "Dental Academic Research Training" (DART). In 2006, she was honored as an American Association for the Advancement of Science (AAAS) Fellow. In 2008, she served as Chair of the Dentistry and Oral Health section of the AAAS. In 2010, she was elected to the Board of Directors of the International Association for Dental Research (IADR). In 2011, she received the AADR Distinguished Mentorship Award and in 2012 the Burton C. Borgelt/SCADA Faculty Advisor Award from the Student Clinician of the American Dental Association. She is currently serving as President IADR. Her research has been featured in several publications including *Reader's Digest* and *Men's Health* as well as several TV programs including Discovery Health Channel's "The Painless Dentist".

Presentation

Probing the Lessons Learned from Dental Genetic Disorders

Recognizing Excellence

2013 List of Awards

Dental Hygiene

Elizabeth A. Hughes Dental Hygiene Case Report Award

Undergraduate Students

Johnson & Johnson Undergraduate Student Award

Predoctoral Dental Students

American Dental Association/Dentsply International Student Clinician Award

Cyril S. Carr Research Scholarship

INAADR Interschool Dental Student Research Award

ASDA-sponsored IUSD Student Research Group Award

Procter & Gamble Award for Excellence in Preventive Oral Health Care

Graduate Dental Students

Delta Dental Award for Innovation in Oral Care Research

Indiana Dental Association Best Clinical Case Report Award

Maynard K. Hine Award for Excellence in Dental Research

Postdoctoral Fellows

Shofu Dental Post-Doctoral Fellow Award

Staff

INAADR Research Staff Award

Faculty

Indiana University Trustees Teaching Awards

IU School of Dentistry Alumni Association Distinguished Faculty Award for Teaching

IU School of Dentistry Alumni Association Distinguished Faculty Award for Research

Poster Presentations

All posters will be available for viewing from 2:30 – 4:30.

Presenters will be at their posters to discuss their research at the following times:

2:30 p.m. to 3:30 p.m. Odd-numbered Posters and Clinical Cases

3:30 p.m. to 4:30 p.m. Even-numbered Posters and Clinical Cases

BEHAVIORAL SCIENCE

- P1 Secondary Analyses of Locus of Control Dimensions in a Survey.** G. GOMEZ^{1*}, O. AGUIRRE-ZERO¹, C. WESTERHOLD¹, S. DAI², A. OHMIT², R. MARINO³, G. MAUPOMÉ¹. (¹Indiana University School of Dentistry, ²Indiana Minority Health Coalition, Indianapolis Indiana, ³University of Melbourne, Australia)

Oral health among Mexican American (MA) immigrants is poor and the factors that mediate disparities are ill defined. The influence of greater acculturation/assimilation levels on oral health behaviors, norms, barriers and facilitators is also not well understood. The present study (DentNet) is validating a survey instrument, the Psychologic-Behavioral Acculturation Survey (P-BAS) that was originally designed to gauge the acculturation of Vietnamese immigrants in Australia. In the present interim report we examine the internal and external loci of control (LOC) utilizing P-BAS for samples of MAs and European-Americans (EAs). P-BAS was translated and back-translated and modified for appropriate reading level. P-BAS was administered to 500 EAs and MAs affiliated with community organizations or churches in Indiana. The LOC construct in Trotter's Social Learning Theory postulates that people who believe consequences are based on their own actions have high internal LOC, whereas people who believe events are controlled by external forces have high external LOC. These beliefs are based on thoughts, feelings, upbringing, culture and other factors, and influence behavior. Such dimensions are important in designing interventions aimed at changing health behaviors. So far, we have analyzed internal and external LOC of EAs through a sample of 5 Likert-type scale questions selected from P-BAS; the poster will present contrasts across EAs and MAs. Data for 250 EAs (mean age 52 years, 97.2% born in the USA and 43.2% born in Indiana) showed that 53.1% believed humans should try to find out why natural disasters occur and develop ways to control and overcome them; 23.6% disagreed. Another 11.6% agreed that people have the ability to control forces of nature; 48% disagreed. A further 84.4% believed it is best to make sacrifices in the present so that the future will be better; 3.6% disagreed. Another 49.2% stated that new discoveries will be able to further overcome damaging forces of nature; 20% disagreed. 47.6% stated they would avoid depending on others, and 88.8% agreed with defining their goals and achieving them through mutually supportive relationships. These results will be contrasted with those for MAs. High internal LOC persons can attain a stronger external LOC under varying circumstances. Careful delineation of the expectations and socio-psychological make-up of population groups along LOC dimensions may help in designing health interventions seen as acceptable and relevant to attain better health-related behaviors and outcomes. (Funded by the Networks, Complex Systems & Health PDT and by the Indiana University CTSI. Indiana University-Purdue University Indianapolis IRB Study #1210009746)

P2 Evaluating the Motivation for Dental Volunteerism Among Dental Students T.KIMMEL^{1*}, K. YODER¹, G. ECKERT² (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

This survey sought to test the hypothesis that a student's motivation to volunteer will, on average, be related to their perception that the volunteer activity is helping them to learn skills that will aid them in developing themselves professionally. Also, the more the student is satisfied with the benefits of the volunteer work, the more likely they will be to volunteer in dental school and in their post-graduation career. Results of the survey can be used by admission committees at dental schools to predict the likelihood that a student will continue to engage in civic engagement type activities in dental school and beyond. An electronic survey was developed and distributed through REDCap to 411 D.D.S. students enrolled at IU School of Dentistry during the 2012-2013 academic year. A total of 116 responses were collected. Survey responses were summarized using frequencies and percentages. Spearman correlation coefficients were used to evaluate the associations among the volunteer satisfaction and volunteer hours survey items. Associations among motivations for volunteerism during undergraduate and dental school programs were analyzed using McNemar's tests for paired binary responses. Results of the statistical analysis showed that undergraduate satisfaction with volunteering was significantly correlated with total undergraduate volunteer hours (correlation=0.36, $p=0.0001$). Undergraduate satisfaction with volunteering was not associated with total dental school volunteer hours (correlation=0.04, $p=0.70$). Dental school satisfaction with volunteering was moderately correlated with dental school volunteer hours (correlation=0.58, $p<0.0001$). Dental school satisfaction with volunteering was not associated with expected post-graduate volunteer hours (correlation=0.12, $p=0.19$). In terms of motivation for performing volunteer work, the top three most frequently reported categories were concern for others, allow for new learning experiences, and career/school related benefits. Thus, we concluded that students do tend to be motivated to volunteer to gain benefits in the area of professional development. While satisfaction that they have received these benefits does correlate positively with the student's number of volunteer hours within any one stage of their life, satisfaction with volunteer work in one stage of their life does not correlate positively with the number of hours that they volunteer in any other stage of their life. Admission committees cannot assume then that a student's satisfaction with volunteer work in their undergraduate program will make them more likely to participate in volunteer work in dental school or in their post-graduation careers. (Supported by a grant from the Indiana University School of Dentistry Student Research Fund. Indiana University-Purdue University Indianapolis IRB #1207009140)

CARIOLOGY

P3 An In-Vitro Study to Determine Anti-Caries Efficacy of Fluoride Varnishes. L. AL DEHAILAN*, E.A. MARTINEZ-MIER, F. LIPPERT (Indiana University School of Dentistry)

Fundamental research on fluoride varnishes (FV) and how different formulations affect adherence to teeth, fluoride release into saliva and uptake by teeth is virtually non-existent. The objective of this in vitro study was to investigate the anti-caries efficacy of five commercially available FV: Enamel Pro® Varnish Clear, Flor-Opal® Varnish White, MI Varnish™, PreviDent® and Vanish™. Ninety bovine enamel specimens (4x4mm) were prepared and assigned to five groups ($n=18$). Early caries lesions were created in the specimens and characterized using Vickers microhardness (VHN). FV was applied to each group of specimens. Immediately afterwards, 7.5ml of artificial saliva (AS) were pipetted over each group, collected and renewed every 15min for 6h. AS samples were analyzed for fluoride using a ion-specific electrode and meter. FV was removed using chloroform and part of the specimens protected to determine enamel fluoride uptake (EFU) using the acid etch technique. Each group was then subjected to pH cycling consisting of a 4h/day acid challenge and two, one-minute treatments with Crest Cavity Protection. Post-pH cycling microhardness was measured and compared to baseline values to determine the ability of the FV to enhance remineralization/prevent demineralization. One-way ANOVA was used

for data analysis ($p < 0.05$). Specimens treated with Enamel Pro® revealed an increase in VHN that was significantly higher than all other groups. There was no significant difference in Δ VHN for Flor-Opal® compared to MI Varnish™, PreviDent® and Vanish™. Specimens treated with MI Varnish™ showed significantly higher Δ VHN than Vanish™ only. No significant difference in EFU was found among groups. Total fluoride release over 6h was MI Varnish™ (303µg/ml) > Enamel Pro® (217µg/ml) > Flor-Opal® (153µg/ml) > PreviDent® (84µg/ml) > Vanish (28µg/ml). In conclusion, anti-caries efficacy (measured through EFU, fluoride release and VHN) differs among FV products and this difference may be attributed to different composition, fluoride source and other active ingredients.

P4 Influence of Dentifrice Abrasivity and Remineralization Time on Enamel Toothbrushing Abrasion. S. BUEDEL^{1*}, F. LIPPERT¹, G. ECKERT², D. ZERO¹, A. T. HARA¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Remineralization of eroded dental surfaces has shown to decrease their susceptibility to toothbrushing abrasion. The influence of dentifrice abrasivity on this protection is not well known and was therefore studied. The following experimental factors were considered: dentifrice slurry abrasivity, at 3 levels (L-low: RDA 69, M-medium: RDA 147, and H-high: RDA 208); remineralization time, at 4 levels (0, 30, 60 and 120min); and dental substrate, at 2 levels (enamel and root dentin), generating 24 testing groups. Experimental units consisted of slabs of bovine enamel and root dentin cut, embedded in acrylic resin and polished (n=8). They were submitted to a cycling protocol including demineralization with 0.3% citric acid (pH 2.6) for 5min, remineralization at the test times (0, 30, 60 or 120min) followed by brushing with the tested slurries (L, M and H) in automated brushing machine for 15s (45 strokes), 2x/day, for 5 days. Surface loss (SL, in micrometers) was determined by optical profilometry. Data was analyzed using mixed-model ANOVA and Fisher's PLSD tests ($\alpha = 0.05$). Remineralization protection was shown for some but not all groups and varied by time. On enamel, it was observed after 30min for M [SL: 6.5 (standard-deviation: 0.7) vs. 8.3 (1.0) at 0min] and H [8.8 (2.8) vs. 10.7 (1.3) at 0min], and after 120min for L [5.1 (0.8) vs. 7.2 (1.4) at 0min]. For dentin, it was shown only for L after 30min [6.3 (2.6) vs. 8.8 (1.3) at 0min]. Root dentin had significantly higher SL than enamel for most of the study groups. Less abrasive dentifrice slurries were able to reduce the toothbrushing abrasive wear on both enamel and root dentin. This protection was enhanced by remineralization for all abrasive levels on enamel, but only for L on root dentin.

P5 Analysis of Bovine Enamel Subjected to Artificial Demineralization. C.W. DUHN*, D. ZERO, A.T. HARA (Oral Health Research Institute Institute). Bovine enamel is frequently used in dental research due to the more readily available supply of bovine teeth compared to human teeth. While there are some differences, the two are similar enough to provide a viable model for the study of carious lesion progression. Like human enamel, bovine enamel is susceptible to acid demineralization and lesion formation though the metabolic processes of *S. mutans* as well as through the use of artificial demineralization solutions. The purpose of this study was to examine the progression of artificially induced carious lesions over a wide range of exposure times to lactic acid demineralizing solution. Extracted bovine teeth were prepared by sectioning into 4x4x2 mm slabs and polished with successively finer silicon-carbide paper and finally with 1 µm diamond polish. The enamel specimens were screened for initial hardness via Knoop Surface Microhardness (SMH) testing. Acceptable specimens had Knoop indents measuring $43 \pm 3 \mu\text{m}$. Specimens were then immersed in a lactic acid demineralization solution for increasing times of 4.5, 9, 16, 18, 22, 27, and 32 hour. Samples were again SMH tested to determine quantitative lesion progression and then imaged under a high-resolution scanning electron microscope to provide qualitative analysis. SMH results demonstrated a linear progression of carious lesions as acid exposure time increased. Lesion progression was indicated by increased Knoop indent length (decreased hardness), with $y = 2.3204x + 74.629$ and coefficient of determination = 0.9481. Lesion progression was as predicted except for the 16-18 hour exposures, where SMH means were reversed. Morphological surface changes to the enamel prisms as well as the individual hydroxyapatite rods were also observed.

Scanning Electron Microscope images taken post-immersion at magnifications of 5,000x, 30,000x, and 100,000x showed varying sizes of inter-prism spaces as well as roughening of the enamel rods at high magnifications. The size of inter-prism spaces as well as the surface roughening did not appear to closely coincide with lesion progression. Bovine enamel follows a linear progression of lesion formation following immersion in lactic acid as time increases except for the 16-18 hour period, indicating possible remineralization during this period. Microscopic changes in surface morphology may not be reflective of the sub-surface lesion progression.

P6 Effect of Staining and Stain Removal on Dental Sealant Microleakage. A. JOURAVLEV*, A.E. SOTO-ROJAS (Indiana University School of Dentistry)

Sealant is an organic polymer (resin) that flows on the tooth surface and bonds to the enamel mainly by micromechanical retention following the acid etching process. Several evidence-based studies support the effectiveness of correctly placed and monitored sealants in prevention of caries for both primary and permanent teeth. To ensure proper sealant placement, the area of the tooth should have maximum surface area, deep, irregular pits, and be absolutely dry and clean before etching. Some studies suggest mechanically cleaning the surface of the tooth prior to sealant placement while others do not; therefore, the objective of this study is to assess microleakage in sealants placed on stained teeth. The hypothesis of this study is that sealants placed on stained teeth will lead to increased microleakage when compared to the sealants placed on non-stained teeth and that mechanical removal of the stain prior to sealant placement will decrease sealant microleakage. 9mm x 9mm x 2mm bovine teeth specimens (45) were prepared and divided randomly in three groups, sound, stained, and stained/cleaned. Specimens were stained with a solution containing coffee, tea, deionized water, ferric chloride, *Micrococcus luteus* BA13. Specimens were etched using 35% phosphoric acid for 20 sec, sealed (Delton, York, PA), thermocycled (48hrs), immersed in 1% methylene blue (24 hrs) and sectioned for microleakage analysis using a 20x magnification Nikon SMZ1500 microscope. Microleakage measurements were made from the edge of the sealant. Statistical analysis showed significant ($p < 0.05$) increase in sealant microleakage in stained specimens with 0.530 mms mean dye penetration when compared to that mean of unstained control with 0.0932 mms; moreover, significant decrease in sealant microleakage was identified in specimens stained and mechanically cleaned with 0.178 mms mean dye penetration. Stained specimens showed higher incidence of failure. The results suggest that mechanical cleaning of the staining prior to sealant placement may improve sealant adhesion to the tooth surface. A second part of this study is currently being conducted using human specimens. (Indiana University-Purdue University Indianapolis IRB #0306-64)

P7 Relative Susceptibility of Human and Bovine Enamel to Cariogenic Challenges. K. JUTHANI*, F. LIPPERT (Indiana University School of Dentistry)

An in vitro study on deciduous human and bovine enamel was conducted in an effort to determine the impact of incremental fluoride doses on caries lesions. Initial lesions of different mineral saturations were formed on the enamel surfaces with Carbopol, Hydroxyethylcellulose, and Methylcellulose. After creating artificial caries, the teeth were subjected to a pH cycling model. The model, in an attempt to reproduce variables of the natural caries process, required transferring the enamel samples through a cycle of acid solutions, fluoride solutions, and saliva. After exposing the enamel surfaces to a cariogenic acid bath and rescuing them with doses of fluoride, an analysis on the remineralization and demineralization processes that the teeth underwent was made with hardness testing. A Vickers (VHN) and Knoop (KHN) test were used to measure the enamel surfaces. For ΔVHN ($p = 0.675$) and ΔKHN ($p = 0.417$), enamel type was not a significant factor. For ΔVHN , the interaction between fluoride concentration and lesion type was significant ($p < 0.001$), whereas those between enamel type and fluoride concentration ($p = 0.121$) and enamel and lesion types ($p = 0.718$) were not. The three-way interaction between all variables was approaching significance ($p = 0.081$). For ΔKHN , the two-way interactions between fluoride concentration

and lesion type ($p=0.044$) and between enamel and lesion types ($p<0.001$) were significant, whereas the fluoride concentration enamel type interaction was not ($p=0.287$). The three-way interaction between all factors was significant ($p=0.019$). The results suggest that the lesions showed varying degrees of differences in response to the fluoride treatments with an overall trend of greater hardening with higher fluoride concentrations. (Indiana University-Purdue University Indianapolis IRB # NS 0911-07)

P8 The Effect of Fluorosis on the Microleakage of Sealants. T. KULA III*, A.E. SOTO-ROJAS, T. MYINT, M. KULA (Indiana University School of Dentistry)

Dental fluorosis has increased in the American population with increased fluoride exposure. Although a correlation between dental fluorosis and microleakage in resin bonding systems is reported, this correlation between fluorosis and dental sealants has not been studied. Based on observations done by Seal Indiana, many children in Indiana with dental fluorosis have decreased sealant retention. Increased etching times has been suggested, but not proven, as a way to improve dental sealant retention on fluorosed teeth. The objective of this study was to determine if there is an increase in microleakage of sealants in teeth with fluorosis and the influence of different etch times on microleakage of sealants. 90 extracted molars were obtained with incipient to no decay (International Caries Detection and Assessment System 0-1) and were assigned into 4 groups with different levels of fluorosis (Tooth Surface Index of Fluorosis (TSIF) 0-3) ($n=36$ molars TSIF 0; $m=18$ molars each TSIF 1-3). Teeth were cleaned with a toothbrush and explorer and were kept in 0.1% thymol or distilled water at all times except when procedures were performed. Teeth were dried with compressed air and randomly selected for etching with 35% phosphoric acid (Ultra-Etch) using either 20, 40, or 60 second time intervals. A dental sealant (Delton DDS, York, PA) was subsequently placed using a microbrush and light cured for 20 seconds. The specimens were thermocycled for 5000 cycles (2 baths with 30 second dwell times, $48^{\circ}\text{C}+2^{\circ}\text{C}$ and 6°C) to simulate intraoral conditions and then stained with 1% methylene blue for 24 hours. The fissure systems in 5 buccal-lingual sections of each tooth were evaluated at 7x magnification using a Nikon SMZ1500 microscope for presence of stain indicating microleakage at the bottom of the fissure because only 2 teeth showed stain at the sealant margins. 27 (30%) teeth showed microleakage; most microleakage was found on teeth etched for 20 seconds (15 teeth). As fluorosis levels increased more teeth showed microleakage: 19.4% (TSIF 0) vs. 22.2% (TSIF 1) vs. 27.8% (TSIF 2) vs. 61.1% (TSIF 3). The results suggest that sealant microleakage is greatest at 20 second etching times as compared with 40 and 60 second etching times and in teeth with moderate fluorosis vs. mild to no fluorosis. Another methodology needs to be developed to assess retention of sealants on fluorosed teeth. (Indiana University-Purdue University Indianapolis IRB #0306-64)

P9 In Vitro Anti-Erosive Properties of Phosphates and Fluoride in Saliva. T. SCARAMUCCI^{1*}, D. CHIDICHIMO², F. LIPPERT¹, A.T. HARA¹ (¹Indiana University School of Dentistry, ²Wm. Wrigley Jr. Company)

Chewing gums can lead to an increase in salivary flow, enhancing the buffering, clearance and remineralizing properties of saliva. They have also been considered as a vehicle for the delivery of potential anti-caries and anti-erosive agents, such as fluoride. The objectives of this study were 1. to evaluate in vitro the anti-erosive properties of phosphates and fluoride as potential additives for chewing gum; 2. to verify the influence of different salivary flows in the development of erosive lesions. Bovine enamel slabs (4 x 4 mm) were embedded in acrylic resin, ground flat and polished. Adhesive tapes were placed on the enamel surface, leaving an exposed area of 4 x 1mm. The specimens were randomly allocated into 4 experimental groups ($n=8$), according to the different remineralizing treatment protocols (artificial saliva flows and additives): A. fixed flow-rate: 0.5 ml/min (for 60 min), modeling unstimulated salivary flow; B. variable flow-rate: 4 ml/min (for 4 min), 2 ml/min (for 6 min), 1.5 ml/min (for 10 min) and 1 ml/min (for 40 min), modeling stimulated salivary flow by gum chewing; C. variable flow-rate plus fluoride (1.5 ppm) and D. variable flow-rate plus Na_2HPO_4 (470ppm; 3.3 mM Pi) and KH_2PO_4

(125ppm; 0.91 mM Pi). The specimens were submitted to erosion-remineralization cycles, consisting of 5 min immersion in 0.3% citric acid (pH=2.6), followed by 1 h of remineralization, according to the different protocols (A-D). This cycle was repeated 4x/day, for 5 days. Enamel surface loss was determined by optical profilometry, and expressed in μm . Data were analyzed with ANOVA and Tukey test, at 5% significance level. The means (SD) of enamel surface loss (μm) were: A: 8.14 (1.15)b; B: 8.49 (1.69)b; C: 4.92 (1.04)a; D: 4.23 (0.62)a, where different superscript letters denote statistically significant differences ($p<0.05$). Fluoride and phosphates were able to reduce enamel erosion lesion development. The experimental model was unable to differentiate erosive lesion progression between the fixed and variable flow rates. (Supported by Wm. Wrigley Jr. Company. Indiana University-Purdue University Indianapolis IRB # 1105005588)

CIVIC ENGAGEMENT

P10 A Retrospective Case-Study of Community Acquired Healthcare: Indiana University Student Outreach Clinic. B. ROCHFORD^{1*}, J. FARLOW², C. PIRON², R. HESKETT², K.M. CHAN³, R. RAMMAHA³, C. HAWTHORNE³, K. BANAS⁴, M. CAPPEL⁴ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine, ³Indiana University School of Social Work, ⁴Indiana University School of Health and Rehabilitation Sciences)

Rome was not built in a day. The old saying holds true because a community is defined by more than just the proximity of its people. A community is bound together by a sense of trust that its members are working together for some sort of common good. And this trust is harder to construct than any building. Healthcare is a part of any complete community and, regardless of the community it is in, it needs to give and take in the communal trust if it is to flourish. The Indiana University Student Outreach Clinic (IU-SOC) is an entirely student-run free clinic on the Near Eastside of Indianapolis. The average household income in this community is barely half of that from surrounding counties, with 24% of households living below the federal poverty level. It was started in 2009 by a group of medical students and it has since blossomed into a unique multi-professional clinic where medical, pharmaceutical, dental, social work, legal, and physical therapy services are provided free of charge. A recent study by IU Health, which operates two 100,000+ visit Emergency Departments in Indianapolis, has shown disproportionately low visit rates from the IU-SOC's zip code, which historically had a much higher visit rate. In less than four years, a mere idea transformed into a primary care and community institution serving over 40 people each Saturday. During the original feasibility study, the IU-SOC board was introduced to Jim Strietelmeier, the pastor of the Neighborhood Fellowship Church. Upon hearing the purposes of the IU-SOC and its desire to become a permanent fixture in the neighborhood, Pastor Jim opened his doors to the IU-SOC. Church members were the first patients at the IU-SOC, but word soon spread to those outside the church. The community's trust of the Neighborhood Fellowship Church was extended to the IU-SOC by virtue of location and association. The IU-SOC and Neighborhood Fellowship Church continue to work together each week. While the IU-SOC does offer a wide variety of social services, the church can often assist people with getting food, clothing, or other resources beyond the IU-SOC's current capabilities. Furthermore, members of the church attend operational and planning meetings to provide feedback and guide the strategic direction of the clinic. It is a true symbiosis, with both sides benefiting from the other's presence. The IU-SOC is a successful model of a true community-campus partnership that can be implemented in other underserved communities.

DENTAL MATERIALS

P11 Mechanical Properties of a New Zinc-Reinforced Glass Ionomer Restorative Material. S.S. AL-ANGARI*, A.T. HARA, T.G. CHU, J.A. PLATT, N.B. COOK (Indiana University School of Dentistry)

Objective: Zinc-reinforced glass ionomer restorative material (ZRGIC) has been proposed as an improved restorative material. The study compared the mechanical properties of a ZRGIC restorative material (ChemFil Rock, (Dentsply)), with three commercially available glass ionomers (GICs); Fuji IX GP Extra (GC America), Ketac Molar (3M ESPE) and EQUIA Fil (GC America). A resin composite, Premise (Kerr), was included as a control group except for fracture toughness. **Methods:** Fracture toughness (KIC) testing was done according to ISO 13586, using single edge notched-beam specimens (n=10), loaded until failure in a three-point bending test device. Specimens (n=9) for the hardness, roughness and abrasive wear testing were made by mixing and inserting the restorative materials into individual stainless steel molds followed by flattening and polishing. Knoop microhardness (KHN) was performed (25 g, 30 s), on pre-determined areas of the polished surfaces. For toothbrushing wear resistance and roughness, specimens were brushed in an automated brushing machine (200 g) with a suspension of dentifrice and water (1:1, w/v) for 20,000 strokes. Specimen surfaces were scanned in an optical profilometer before and after brushing to obtain surface roughness (Ra) and mean height (surface) loss using image subtraction and dedicated software. Data were analyzed using Wilcoxon Rank Sum tests ($\alpha=0.05$).

Results: The means \pm standard deviation for all tests are given below in the table.

Material	Knoop Hardness (KHN, kg/mm ²)	Surface Loss (μ m)	Roughness Change (Ra, μ m)	Fracture Toughness (K _{IC} , MPa-m ^{1/2})
ChemFil Rock	52.39 \pm 2.67 ^c	4.69 \pm 1.23 ^a	0.79 \pm 0.14 ^a	0.99 \pm 0.07 ^b
Fuji IX	66.86 \pm 5.36 ^a	5.21 \pm 1.48 ^a	0.10 \pm 0.98 ^b	0.80 \pm 0.04 ^c
Ketac Molar	62.53 \pm 2.91 ^a	3.79 \pm 2.82 ^{ab}	0.62 \pm 0.60 ^b	0.85 \pm 0.09 ^c
EQUIA Fil	58.64 \pm 2.01 ^b	5.72 \pm 1.04 ^a	0.14 \pm 0.46 ^b	1.21 \pm 0.23 ^a
Premise	45.44 \pm 2.87 ^d	3.07 \pm 0.93 ^b	0.68 \pm 0.97 ^{ab}	—

Superscript letters indicate statistically similar groups per column.

Conclusion: The new ZRGIC restorative material showed intermediate fracture toughness, high change in surface roughness, and low microhardness compared to three other commercial GICs. All materials were supplied by respective manufacturers.

P12 Microtensile Bond Strength and Microleakage of HEMA-Free One-Step Self-Etch Adhesive. A. ALZAIN^{1*}, G. ECKERT², J.A. PLATT¹. (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

This study evaluated the microtensile dentin bond strength (m-TBS) and microleakage of a one-step HEMA-free self-etch adhesive (G-aenial Bond-GB) compared to a 2-step self-etch (Clearfil SE-SE) and a 3-step etch and rinse (OptiBond FL-OB) adhesive with and without pre-etching with phosphoric acid (PE). Human molars were divided randomly into 5 groups (n=15), GB and SE (without PE), GB+ and SE+ (with PE), and OB. Eight beams were obtained from each tooth and half of the beams were subjected to m-TBS testing after 2d. The remaining beams were thermocycled, aged for 40d and subjected to m-TBS testing using a universal testing machine. Failures were analyzed using light microscopy and SEM.

Similar groups were used for the microleakage test (n=11). Class V cavities were prepared on the buccal and lingual surfaces of each molar. Teeth were thermocycled, aged for 40d, soaked in 1% methylene blue dye for 24h, and sectioned longitudinally from the facial to lingual surface. The dye penetration was scored using light microscopy and an ordinal scale from 0-3. Data was analyzed using Weibull, GEE, and Wilcoxon Rank Sum tests ($\alpha=0.05$). Phosphoric acid pre-etching significantly increased dentin bond strength. After 40d, the mean bond strength ranged from 28.6-45.7 MPa with a statistical significance of GB, SE<GB+, SE+ & OB. The Weibull Characteristic Strength ranged from 31.5-51.0 MPa and the Weibull Modulus ranged from 2.3-4.1. Cohesive failure ranged from 16%-57% with a significance of GB<SE+&OB, but GB+&SE<OB. PE-PA had no significant effect on microleakage. However, significant differences were found between coronal and gingival surfaces for all groups except GB. Pre-etching with phosphoric acid significantly increased dentin bond strength of GB and SE and had no significant effect on microleakage. (Materials supplied by GC America and Ultradent. Indiana University-Purdue University Indianapolis IRB # 1108006607)

P13 Novel Nanofibrous Drug Delivery Systems for Regenerative Endodontics. K. KAMOCKI*, R.L. GREGORY, G. YASSEN, M. VAIL, Y. EHRLICH, K.J. SPOLNIK, J.A. PLATT, and M.C. BOTTINO (Indiana University School of Dentistry)

Objective. To synthesize/characterize and evaluate the antimicrobial activity of drug-containing (ciprofloxacin-CIP or metronidazole-MET) biodegradable drug-delivery systems against 2 endodontic-infection-related bacteria: *E.faecalis* and *P.gingivalis*. **Methods.** Nanofibrous mats were fabricated from a polydioxanone/PDS solution via electrospinning. Drug-containing solutions were prepared to obtain four groups: G1-PDS+5wt.%MET, G2-PDS+25wt.%MET, G3-PDS+5wt.%CIP, G4-PDS+25wt.%CIP. G5-PDS-no-drug/control. Scanning electron microscopy/SEM, microtensile testing and Fourier-transform infrared spectroscopy/FTIR were used to assess fibrous morphology, mechanical properties and chemical structure, respectively. Agar diffusion (n=4) was used to assess the drugs microbial effect, and inhibition zones were determined after 2 and 5 d. In the biofilm assays (n=3), bacteria were inoculated on the PDS-based mats at determined conditions and biofilm bacteria were enumerated by plating. SEM was used to evaluate biofilm formation. **Results.** SEM imaging indicated a submicron fibrous morphology, while the characteristic peaks for the polymer and drugs were confirmed by FTIR. From the mechanical testing, it was found that tensile strength decreased significantly ($p<0.05$) after drug addition. In the agar diffusion test CIP-containing mats inhibited growth of *E.faecalis*, with minimum effect on *P.gingivalis*. Further, MET demonstrated an inhibitory effect on *P.gingivalis*, with the largest inhibition zone seen at 25wt.% and it was statistically significant ($p<0.05$) for both CIP concentration and 5wt.%MET. Plating revealed clear trends in biofilm reduction, confirming the agar diffusion data. SEM analysis suggested that the presence of specific bacteria was critically decreased according to the drug used. **Conclusions.** The incorporation of antibacterial drugs into nanofibrous electrospun scaffold may serve as a potential drug-delivery system to control root canal disinfection. (This study is based on research that was partially funded by an outside source: American Association of Endodontists/AAE (M.C.B.))

P14 Microstructural Evolution and Physical Behavior of a Lithium Disilicate Glass-Ceramic. W. LIEN*^{1,2}, D. LI², W.C. LIU², A.L. CAMPBELL³, T.G. CHU² (¹United States Air Force Institute of Technology, ²Indiana University School of Dentistry, ³United States Air Force Research Laboratory, Wright Patterson Air Force Base)

Introduction: Dental glass-ceramic restorations have now become popular due to their better esthetic outcomes and satisfactory mechanical properties. Though it is known that clinical success of glass-ceramic of dental prosthesis often depends on its processing conditions, a systematic study correlating the processing conditions to the resulted microstructures and their physical properties is still lacking. **Objective:** To investigate the effects of heating conditions on the microstructure of a popular dental glass-ceramic, lithium disilicate (LS2, IPS e.max® CAD), and to relate the microstructure in each stage to its

physical properties. Methods: Seven groups of IPS e.max® CAD samples (n = 5/group) were prepared and treated with a unique annealing condition per group (Table 1). For each group, the crystalline phase, flexural strength & fracture toughness, nanoindentation, and crystalline morphology were measured by X-ray diffraction (XRD), a universal testing machine, nanoindenter, and scanning electron microscope (SEM) respectively. XRD data were collected using a monochromatic radiation ($\lambda K\alpha = 1.789 \text{ \AA}$) in bulk over the 2θ range ($0^\circ - 40^\circ$) with an angular resolution of 0.1° . Flexural strength with beam specimens ($2 \times 2 \times 18 \text{ mm}^3$) and fracture toughness with beam specimens ($3 \times 4 \times 18 \text{ mm}^3$, having single-edge notch depth of $1.0 \text{ mm} \pm 0.2 \text{ mm}$), were created and tested using 3-point bending. A MTS Nanoindenter® XP fitted with a tetrahedral Berkovich diamond indenter tip imprinted series of nanoindents with corresponding force-displacement curves for calculating elastic modulus using the Oliver-Pharr methods. The microstructures for each annealing group were investigated using SEM. A mean and standard deviation (SD) were determined per group. A 1-way ANOVA/Tukey was performed per property ($p < 0.01$). Results: XRD and SEM revealed two distinct phases during LS2 crystallization. Significant differences were found between groups per property ($p < 0.01$). The 820-840°C (H14) group showed fine needle-shape microstructure with the highest fracture toughness. Conclusion: the phase assemblage, microstructure, and the amount of LS2 crystals, governing the physical properties of LS2 glass-ceramic restoration, could be tailored through annealing

Table 1

• Groups	σ_{FS} (MPa)	EFS (GPa)	E _{Nano} (GPa)	K _{IC} (MPa m ^{0.5})
820-840°C (H14)	342.69+/-25.42	40.02+/-0.56	95.6+/-3.3	4.469+/-0.415
820-840°C	354.87+/-48.84	40.67+/-2.27	95.9+/-5.2	4.457+/-0.435
750-840°C	357.03+/-23.04	55.20+/-4.84	98.9+/-3.7	4.432+/-0.464
590-750°C (H14)	226.67+/-44.32	38.75+/-4.76	87.2+/-3.2	2.492+/-0.105
590-750°C	182.54+/-18.60	34.91+/-3.52	87.3+/-4.3	2.793+/-0.179
530-590°C	130.97+/-15.81	31.84+/-3.61	82.1+/-1.7	2.692+/-0.282
Not Fired	155.92+/-18.58	37.42+/-5.40	84.2+/-4.2	2.402+/-0.212

P15 Polymerization Through Single Apertures: Curing-Front Profiles and Degree of Conversion. M.E. MACPHERSON*, J.A. PLATT, T.G. CHU (Indiana University School of Dentistry)

We hypothesized that use of a single aperture mask (SAM) as part of the light curing protocol could enhance bottom/top degree of conversion ratio (B/T DC) and Knoop hardness (KHN) along the top surface of dental composites. Curing-front profiles (CFPs), degree of conversion (DC), and KHN resulting from polymerization of a model resin-composite (MRC) through single apertures of varying diameters were investigated. For the MRC, Bis-GMA, TEGDMA, and UDMA (equal mass ratios) was mixed with camphorquinone (0.5wt%), dimethylaminoethyl methacrylate (0.25wt%), and butylhydroxytoluene (0.5wt%). 70wt% of $0.7 \mu\text{m}$ silanated dental glass filler was added. For the SAMs, a central hole (diameter=0.5mm, 0.4mm, or 0.25 mm) was fabricated in aluminum discs (thickness=0.4mm). To evaluate CFPs, Delrin® molds (n=5/mode; h=5mm, ID=6mm) were filled with the MRC and polymerized through the SAM for 10, 20, 30, or 40s with a QHL75 (Dentsply, York, PA) halogen light curing unit. Unpolymerized MRC was removed with acetone, the remaining cured MRC dried, and the “bullet” diameter and depth measured. Control, standard, and plus modes of polymerization

were investigated for selected SAM-time with mask combinations. To evaluate DC and KHN, specimens were similarly created; however, polymerization of a specimen was according to its respective mode. DC was measured by FTIR in ATR mode and KHN with a hardness tester. Group differences were analyzed using a one-way ANOVA at a 5% significance level. CFPs of the cured resin for all SAM-time combinations resembled an ellipsoid dome and a linear regression analysis of bullet width and depth v. mask time revealed R2 values >0.9 indicating excellent fit of the lines for all three SAMs. Overall, the enhancement of B/T DC ratios and top surface KHN of a MRC whose polymerization protocol incorporated a SAM was met with caveats. Utilization of a 0.25mm SAM for either 10s or 30s with a 60s follow-up cure does result in a significant increase in both KHN and B/T DC without sacrificing DC at either surface. The effect of a SAM on additional curing properties of this model dental composite will need to be investigated further.

P16 Mechanical Property Evaluation of Porous 13-93 Bioactive Glass and GL1550 Borate Glass 3D Scaffolds. A. SCULLY*, D. LI, T.G. CHU (Indiana University School of Dentistry)

Reconstructing large craniofacial defects is clinically challenging and current engineered scaffolds are inadequate in either mechanical or biologic properties. Borate bioactive-glass (BBG) is a promising material for scaffolds due to its higher solubility compared to traditional 13-93 bioactive glass. Objectives: to compare mechanical properties (σ_{failure} , Pb) of scaffolds made from 13-93 bioactive-glass (A) and GL1550 borate bioactive-glass (B) powders, at different sintering temperatures, and with/without polymer coatings. Methods: In this paper, dense scaffolds are made via dry-pressing while porous scaffolds are made via a sol casting method using polymers to promote porosity (d=6mm, t=3-4mm). All the scaffolds were sintered in a tube furnace. The temperature increased 10°C/min until reaching the sintering temperature which varied from 500°C and 700°C. All the samples were cooled in the furnace. The mechanical properties were measured using a diametral test on a Universal Testing Machine (MTS Sintech Renew, Model 1123, Minnesota, USA). For each group and temperature, at least 3 samples were tested. The mechanical properties (σ_{failure} , Pb) of scaffolds made from 13-93 bioactive-glass and GL1550 bioactive-glass powders are compared. Samples are then coated with 1% or 5% PLLA. Effects of porosity, sintering temperature, and polymer coating are related to mechanical properties to find the optimal heat treatment procedures and polymer concentration. Results: The relative porosity of Borate glass varied from 65.27% to 69.38% with sintering temperature. That of 13-93 bioactive glass varied from 44.29% to 50.38%. When the sintering temperature reached 540°C for BBG, both σ_{failure} and Pb increase dramatically due to the sintering of the powder. There is another large increase at 590°C, which is likely caused by the melting of the borate. The scaffolds coated with 1% PLLA or 5% PLLA showed an increase in failure stress from 0.49MPa to 1.79 and 6.80 MPa. Conclusion: Balanced with the porosity, the optimal sintering temperature was 540°C for GL1550 bioactive-glass powder and 690°C for 13-93 bioactive glass. At the optimal sintering temperature, Pb=14.516±2.075N, σ_{f} =0.487±0.036MPa for borate glass scaffold with ~67% porosity, and Pb=36.725±5.786N, σ_{f} =1.280±0.276MPa for 13-93 bioactive glass scaffold with ~50% porosity. The 5% coating of PLLA offers a good balance between maintaining a high level of porosity and mechanical property improvement. The processing conditions will be used for their future in vivo evaluations.

EDUCATIONAL RESEARCH

P17 Awareness and Implementation of Evidence-Based Dentistry among Michigan Dentists. K. GOEBEL*, D. HOELSCHER, M. WHEATER (University of Detroit Mercy School of Dentistry)

Evidence-based dentistry (EBD) has gained acceptance as an oral healthcare approach. The objectives of this survey were to measure awareness, attitudes, and implementation of EBD by Michigan dentists. A 19-item online questionnaire (UDM IRB approval 1213-23) was distributed to Michigan Dental Association member dentists with email addresses (n = 3309). Items included multiple choice, Likert-

type, and open-ended responses regarding knowledge, attitudes, and use of EBD. Of 447 dentists who participated (13.5% response rate), 80.1% were general dentists and 19.9% were specialists; 81.9% in private practice, 8.3% academicians, and 6.9% retired. The mean year of graduation was 1986 (1956-2012). 84.1% practiced EBD usually and 11.7% seldom or not at all. 91.5% agreed they are very familiar with EBD, 91.8% agreed that EBD is critical to dental practice 86.3% feel very confident in their ability to evaluate quality of literature. When faced with clinical questions 48.8% always/often, 36.7% sometimes, and 14.6% seldom/never search for scientific literature. 28.8% accessed PubMed, 25.8% the ADA Center for EBD, and 7.6% the Cochrane Collection in the past year. 67.7% have never searched PubMed and 30.2% found it difficult to find information on the internet. 69.8% are interested in continuing education regarding EBD. Comments revealed a lack of understanding and skepticism regarding EBD (24 of 63), including flawed/biased nature of research (6), EBD is hyped/overrated (7), clinical experience does not support evidence (4), and EBD benefits insurance companies (3). Comments supporting EBD (14 of 63) included the need for skill to appraise literature (4) and ability to think critically (3). Michigan dentists in this sample are aware and supportive of EBD and report having integrated it, at least in part, in their practice. However several areas of misunderstanding still exist. There is a disconnect between reported utilization of EBD and behaviors associated with full implementation of EBD. (Supported by a grant from the University of Detroit Mercy School of Dentistry. University of Detroit Mercy IRB #1213-23)

P18 Acceptance And Usefulness of Isolite™ by IUSD Dental Students. C. KRUSHINSKI*, A.E. SOTO-ROJAS, K.M. YODER (Indiana University School of Dentistry)

Objective: The purpose of this study was to assess fourth year dental students' responses concerning the acceptance and usefulness of the Isolite™, a device that enhances isolation and illumination, for sealant placement that is currently being used in the Seal Indiana program at IUSD. Methods: As part of their requirements, fourth year dental students completed a post-rotation assignment via Oncourse following their Seal Indiana rotation where they had an opportunity to use the Isolite™. Thirteen questions concerning use of the Isolite™ were included. Responses were summarized using averages and percentages. Results: From January to December, 2011, ninety-one students completed their post-rotation assignment for Seal Indiana. Eighty-seven (95%) students tried the Isolite™ and reported placing an average of twenty-two sealants. Ninety-three percent preferred the Isolite™ to cotton rolls for placing sealants and found it to be either extremely helpful or helpful. Most students thought the Isolite™ was easy to place (90%) and isolation of and illumination of the field were very good (92% and 97% respectively). Most students thought the Isolite™ enhanced their learning experience (92%) and would like one to be available for use in other clinics at the dental school (97%). There was less agreement with patients' receptiveness (75%), patients' tolerance (82%) of the use of the Isolite™ and students' likeliness to purchase an Isolite™ for their future private practices (82%). Conclusions: Most dental students liked using the Isolite™ in this type of clinical setting and wanted one available to use in other IUSD clinics. Students' acceptance and usefulness of the Isolite™ were reported as very good. Patients' acceptance and tolerance of this device may be an area to perform future research. (Indiana University-Purdue University Indianapolis IRB EX #1203008250)

P19 Assessing Ethical Sensitivity of D1 Students With Standardized Patients. D. ZAHL*, O. AGUIRRE-ZERO, L.P. GARETTO, W. SENOUR. S. SCHRADER (Indiana University School of Dentistry)

Ethical sensitivity is the ability to perceive the ethical dimensions of a situation. (Bebeau, 1985). The purpose of this study was to assess first year dental (D1) students' ethical sensitivity during a ten minute objective structured clinical examination (OSCE) with a standardized patient. The ethical dimension of the scenario involved a patient requesting a specific quantity of a schedule III narcotic for pain relief for a fractured tooth. This analgesic was an inappropriate option as outlined in the treatment plan. The

standardized patients were trained and calibrated to assess ethical action by determining if: 1) students took action in response to the demand for drugs and 2) the action was appropriate. Students' ethical sensitivity and reasoning were evaluated using an immediate post-OSCE question set requiring narrative responses. The study assessed: 1) How many students are sensitive to an ethical issue in a simulated clinical setting? 2) How many students can correctly identify and discuss competing ethical principles/central values to justify a course of action? 3) How many students were able to take correct action? 4) How many students were both sensitive, used correct reasoning, and acted correctly? Standardized patient assessments of ethical action were coded and categorized into three areas: correct action, incorrect action, no action. The ethical sensitivity assessments were reviewed, coded, and categorized into three areas: sensitive with correct reasoning, sensitive with incorrect reasoning, not sensitive. An ethical sensitivity classification matrix was developed to evaluate the nine possible combinations of ethical sensitivity and action. When frequencies for each category were determined the results suggest that 95.2% of students were sensitive to the ethical issue, but only 14.4% used correct reasoning to justify their action. Although few students used correct reasoning, 93.2% of students took appropriate action. The most frequent (75.9%) profile was a student who was sensitive to the issue, used incorrect reasoning, but took the correct action. Only 12.5% of students were sensitive to the issue, had satisfactory ethical reasoning, and took appropriate action. These findings suggest that while most (95.2%) D1 students are sensitive to ethical issues and most (93.2%) have the ability to take appropriate action, few (14.4%) have yet developed the capacity to fully consider the relevant ethical principles and central values factoring into their decisions. This research enables us to fine tune our ethics curriculum and highlights the need to track students' increase in ethical capacity as they progress through the DDS curriculum. (Indiana University-Purdue University Indianapolis IRB # 1303010891)

ENDODONTICS

P20 Short-term Antimicrobial Effectiveness of Ciprofloxacin-Containing Drug-Delivery Systems for Regenerative Endodontics. H. AHDAB*, K. KAMOCKI, R.L. GREGORY, M.C. BOTTINO (Indiana University School of Dentistry)

There are many bacteria responsible for pulpal pathology, including gram-positive *Enterococcus faecalis*. Although *E. faecalis* is not a major player in primary endodontic infections, it can play a critical role in persistent periapical lesions remaining after endodontic treatment has been completed. Ciprofloxacin is one antibiotic that has demonstrated bactericidal effects against *E. faecalis*. A novel method for a delivery of ciprofloxacin into the root canal is through the development of polydioxanone/PDS nanofiber scaffold incorporating a drug. This scaffold can have the potential not only to eliminate the infection but also to aid in the tissue regenerating process that occurs after the infection has been resolved. This study sought to quantify the short-term antibacterial effectiveness of PDS scaffolds with different concentrations of ciprofloxacin against *E. faecalis* after the scaffolds have been subjected to an "aging" process. Nanofibrous scaffolds were fabricated by dissolving PDS sutures in hexafluoroisopropanol. 5 and 25wt. % (in respect to that of the polymer) of ciprofloxacin were added and a 0% cipro PDS (control), 5% cipro PDS, and 25% cipro PDS were electrospun at optimal conditions. Following fabrication, the scaffolds were desiccated in vacuum for 2 days and then stored in 4°C until use. Scanning electron microscopy/SEM and Fourier-transform infrared spectroscopy/FTIR were used to assess scaffold morphology and chemical structure, respectively. Square-shaped (15×15mm²) samples (n=12) were excised from each scaffold and placed in plastic crown in order to standardize the surface that will contact the bacteria. The plastic crowns were placed in 24 well plates (in triplicates). The scaffolds were sterilized with 70% ethanol for 30 min and then rinsed with saline solution. For the aging process, saline was then left in the wells of samples and discarded on days 0, 1, 3 and 7. Non-aged, sterile samples were also tested. Wells were inoculated with *E. faecalis* and cultured for 24 h. Early biofilm formation was analyzed by crystal violet incorporation and measurement of optical density at 490 nm. SEM imaging revealed submicron fibers. Pure PDS showed the highest fiber diameter mean (1158±402nm) followed in

descending order by PDS+5 wt.% cipro (871 ± 309 nm), and PDS+25 wt.% cipro (765 ± 288 nm). Overall a porous, interconnected fibrous network was seen. FTIR confirmed the presence of characteristic peaks for PDS and the incorporated drugs. Results indicate that the addition of ciprofloxacin at various concentrations affects the morphology of the suggested scaffold. Further cell compatibility assessment is currently being pursued.

P21 A Bi-Mix Antibacterial Drug-Delivery System for Regenerative Endodontics. J.

PALASUK*, L. HIPPENMEYER, J.A. PLATT, R.L. GREGORY, K.J. SPOLNIK, M.C. BOTTINO (Indiana University School of Dentistry)

Traumatic injuries to immature teeth have traditionally been managed via apexification therapy with intracanal calcium hydroxide/Ca(OH)₂. Recently, the use of a bi-mix (metronidazole-MET and ciprofloxacin-CIP) paste appears to provide more predictable results, even though cell compatibility issues have been raised about possible adverse effects of high drug concentrations. Thus, the use of drug-delivery systems to control the localized drug-release holds clinical potential. The objective of this study was to fabricate/characterize polydioxanone (PDSII®)-based electrospun bi-mix drug-delivery systems incorporated with the combination of MET and CIP. The antibacterial property of the released media was tested against *Enterococcus faecalis* (*E. faecalis*), *Porphyromonas gingivalis* (*P. gingivalis*), *Aggregatibacter actinomycetemcomitans* (*Aa*). PDSII® was dissolved in HFP to obtain a 10wt.% solution. Either MET (Fluka, Sigma-Aldrich, St. Louis, MO), CIP (Fluka, Sigma-Aldrich, St. Louis, MO), or distinct drug combinations were added into the solution followed by homogenization overnight. Six groups of study were employed: Control-100%PDS, G1-100%MET, G2-75%MET+25%CIP, G3-50%MET+50%CIP, G4-25%MET+75%CIP and G5-100%CIP. Electrospinning was done based on optimized parameters to fabricate the distinct samples. Uniaxial microtensile testing (n=10), Fourier transform infrared spectroscopy/FTIR, scanning electron microscopy (SEM), and agar diffusion assay were used to characterize mechanical, chemical and antibacterial properties. One-way ANOVA (only for fiber diameter), Kruskal-Wallis and Mann-Whitney tests were performed ($\alpha=0.05$). The results showed that uniaxial tensile strength was not significantly decreased compared to the control except G3. Average fiber diameters were in the nano-scaled range and significantly lower than the control. SEM imaging indicated a submicron fibrous morphology. FTIR confirmed the characteristic peaks for PDS as well as for the employed drugs. Agar diffusion assay suggested that the higher the CIP concentration the greater the antibacterial property against *E. faecalis*, *P. gingivalis* and *Aa*. The results indicated that higher amount of CIP (G4 & G5) did not compromise mechanical properties of nanofibers and showed the highest bacterial inhibition against *E. faecalis*, *P. gingivalis*, and *Aa*. Optimization of the physical-mechanical properties, kinetics of drug release, and the effect of released drugs on dental pulp stem cells are currently being pursued. (This study is based on research that was partially funded by an outside source: American Association of Endodontists/AAE (M.C.B.))

P22 Aged Metronidazole-Containing Drug-Delivery Systems–Antibacterial Efficacy Against *P.gingivalis*. A.C. STARR*, K. KAMOCKI, R.L. GREGORY, M.C. BOTTINO (Indiana University School of Dentistry)

Tissue engineering offers the potential to restore natural dentition in substitution of invasive surgical procedures. Regenerative endodontics has been suggested for revitalizing teeth by replacing absent, traumatized or diseased pulp tissue. An important step in this process involves disinfection of infected root canal systems using antibiotic paste to promote revascularization, aided with growth factors, stem cells, and/or electrospun scaffolds. Persistent polymicrobial infections prevent regenerative capabilities and must be eliminated to achieve tooth revitalization. The objective of this study was to fabricate/characterize Metronidazole(MET)-containing electrospun scaffolds while investigating their antibacterial efficacy against *P. gingivalis* over time. Polydioxanone/PDS was dissolved in hexafluoropropanol. Pure PDS solution was electrospun for use as a control. Metronidazole powder was

added and mixed with PDS solution at 5% and 25 wt.% (in respect to that of the polymer) and electrospun using optimized spinning parameters. Next, the electrospun samples were desiccated in vacuum for 2 days and refrigerated until use. Scanning electron microscopy (SEM) was used to analyze fiber morphology and morphological structure, while FTIR was used to assess the chemical structure of the fabricated scaffolds. For the antibacterial assay, twelve square-shaped samples (15×15mm²) were cut from each scaffold. Plastic crowns were used to standardize the distance scaffold-bacteria. All the scaffolds were sterilized with 70% ethanol for 30 min and then rinsed with saline solution. Then, the crowns were placed in 24-well plates (n=3) and immersed in saline solution for 0, 1, 3, and 7 days, following the removal of saline. Next, wells were inoculated with *P. gingivalis* and cultured for 48 h. Early biofilm formation was analyzed using crystal violet incorporation and measurement of optical density at 490 nm. SEM imaging revealed a structure composed randomly oriented non-woven fibers for all groups. A decrease in fiber diameter was observed in the drug-containing scaffolds PDS+5wt.%MET (1108±383nm) and PDS+25wt.%MET (944±392nm) when compared to the control (1158±402nm). Characteristic peaks for polydioxanone and metronidazole were confirmed by FTIR analysis. Further cell compatibility assessment using dental pulp stem cells is currently being pursued.

FLUORIDE RESEARCH

P23 Analysis of Fluoride Levels of Commonly Used Infant Formulas. J. NEESE*, C. BUCKLEY, E.A. MARTINEZ-MIER (Indiana University School of Dentistry)

Ingestion of fluoride in excess amounts during tooth development, especially during the first 2 years of life, can result in dental fluorosis, which is clinically evident by visible changes to the enamel surface of the tooth. The purpose of this study is to investigate the fluoride levels of commonly used powder and ready-to-feed infant formulas in central Indiana in order to compare to the U.S. Food and Drug Administration's regulations. A market survey was accessed in order to determine the most popular brands for both power and ready-to-feed formulas. The brands identified in the top 75% most often purchased in the United States were purchased in duplicate. Eleven types of powdered formulas and five types of ready to feed were included in this preliminary analysis for one store location. Powdered samples were diluted according to manufacturer's instructions and analyzed using a modification of the hexamethyldisiloxane microdiffusion method. Diluted powdered formulas had a mean (+/-SD) fluoride concentration of 0.12 +/- 0.08 ug F/g; while ready-to-feed formulas had a mean (+/-SD) fluoride concentration of 0.14 +/- 0.07 ug F/g. There were no statistically significant differences between formula types. In conclusion, preliminary data showed that both powder and ready-to-feed infant formulas contain negligible fluoride that falls within regulations.

INFORMATICS

P24 Exploring Patient Engagement Based Upon Levels of Health Information Interactions. R. GRADY^{1*}, J. JONES¹, G. GOMEZ², O. AGUIRRE-ZERO², S. DAI³, A. OHMIT³, G. MAUPOME² (¹Indiana University School of Informatics, ²Indiana University School of Dentistry, ³Indiana Minority Health Coalition, Indianapolis Indiana)

Increasing consumer engagement is a strategic move which is aligned with meaningful use and the accountable care initiatives. For a healthier society it would be beneficial for individuals to become more engaged in managing their own health. Patient involvement optimizes the probability of improving overall health outcomes for all individuals. November 2012 the National eHealth Collaborative (NeHC) released its Five Stage model for patient engagement. The objective of the investigation explores the likelihood of achieving the inform and engage stages among Mexican-American (MA) and European-American (EA) groups. The research utilized a population sample with primary data collection via the Psychological-Behavioral Acculturation Scale survey; a hard copy instrument. To represent the health

informatics perspective additional questions were added to survey to query participants for responses. The survey questionnaire was modified to ascertain whether these groups search online for health or dental information; their social networking behaviors; devices used to access Internet; interest in possessing their own health information; preferences for information retention (electronic or paper) and who would they allow to access their health information other than themselves. Institutional Review Board approval was obtained prior to commencement of the research. 250 surveys were administered in Spanish to those of (MA) descent and 250 surveys were administered in English to those of (EA) descent. The surveys were completed at three geographical collection sites throughout central Indiana which concluded mid February 2013. Preliminary results will be analyzed and quantitative data interpreted for essential findings. One objective would be to examine the propensity for e- health behaviors and income levels to determine if a positive covary exists. Analyzing perceptions of health including dental health and health seeking behaviors are valuable psychological trends to measure for contrasts. To become highly effective it is imperative to deploy patient activation tools which can be incorporated cleverly as a component of an individual's routine lifestyle. Adopting seamless mechanisms is a pragmatic concept for patient engagement. The dynamics of cultural behavior must be examined in greater detail to obtain insight on health information interactions among diverse environments. (Funded by the Networks, Complex Systems & Health PDT, part of the Indiana University CTSI. Indiana University-Purdue University Indianapolis IRB # 1210009746)

MICROBIOLOGY/IMMUNOLOGY

P25 Interactions of Human Umbilical Vein Endothelial Cells with Tobacco Treated *Streptococcus mutans*. V. GUPTA*, L.J. WINDSOR, F. SONG, R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans (*S. mutans*) is a major contributor to dental caries. Previous research has shown that there is a positive relationship between smoking and dental caries, however the pathway of *S. mutans* growth is not yet understood. Tobacco use affects the cardiovascular system and increases the rate of cardiovascular disease among smokers. However, the effects of tobacco on the endothelial cells that line blood vessels are not yet fully understood. Thus, the objective of this study was to examine some of the effects that a periodontal pathogen such as *S. mutans* treated with cigarette smoke condensate (CSC) and nicotine have on human umbilical vein endothelial cells (HUVEC's). The *S. mutans* was grown at 37°C and then the planktonic cells were harvested, washed with saline, and then killed with formaldehyde. To standardize the samples, they were diluted to the same OD at 600nm wavelength using a spectroscope. The HUVEC were cultured in Endothelial Basal Medium-2 and plated in 12 well plates and exposed to the *P. gingivalis* cells and supernatants and after 72 hours, lactate dehydrogenase (LDH) assays will be used to cytotoxicity. With increasing concentrations of nicotine and cigarette smoke condensate, the LDH released also increases. Non-toxic amounts of the cells and supernatants will then be used to treat HUVEC cells for 72 hours before the media is collected and analyzed for cytokine/growth factor expression by protein arrays. Second messenger signaling pathways will be analyzed with ERK and JNK antagonists and agonists to determine the pathway of up regulation of *S. mutans*. A better understanding of the detrimental effects that tobacco has on the underlining causes of periodontal disease can advance the quest of controlling the disease. (This study was funded by the Indiana University-Purdue University Indianapolis Multidisciplinary Undergraduate Research Institute)

P26 Nicotine Regulates *Streptococcus mutans* Extracellular Polysaccharide and Related Protein Expression. R. HUANG*, M. LI, R.L. GREGORY. (Indiana University School of Dentistry)

Streptococcus mutans, a gram-positive facultatively anaerobic bacterium, is considered as the primary contributor to caries due to its high acidogenicity and aciduricity. Smoking is one of the risk factors of

periodontal disease and dental caries. Nicotine is one of the alkaloid pharmacologically active agents in tobacco. Previous studies indicated nicotine stimulated *S. mutans* biofilm formation and metabolism. However, the detailed mechanism is still unknown. Thus, the aim of this study is to investigate how nicotine facilitates *S. mutans* biofilm formation focused on extracellular polysaccharide synthesis. *S. mutans* UA159 (ATCC 700610) was used in the present study. Confocal laser scanning microscopy (CLSM) was used to investigate the effect of 0, 1, 2 and 4 mg/ml nicotine on 24 h *S. mutans* biofilm extracellular polysaccharide (EPS) expression (red fluorescent-labeled) and nucleic acid expression (green fluorescent-labeled). Western blot assays were used to investigate the effect of 0, 1, 2 and 4 mg/ml nicotine on the expression of glucosyltransferase (Gtfs), glucan-binding protein A (Gbp-A) and Gbp-B in 24 h *S. mutans* biofilm cells. CLSM results indicated nicotine increased both EPS and nucleic acid, and the ratio of EPS/nucleic acid was also increased. It implied EPS synthesis in single *S. mutans* cells was stimulated by nicotine treatment. Biofilm thickness was thicker in nicotine-treated groups than the non-treated group. Western blot assay results indicated that nicotine stimulated GtfC, Gbp-A and Gbp-B expression, but decreased GtfB expression. The results suggest that nicotine stimulates *S. mutans* cell proliferation and EPS synthesis partially by increasing GtfC, Gbp-A and Gbp-B. (Supported by the Indiana University School of Dentistry Ph.D. Student Research Fund.)

P27 Interactions of Human Umbilical Vein Endothelial Cells With Tobacco Treated *Streptococcus Mutans*. B. LANIER*, L.J. WINDSOR, and R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans (*S. mutans*) and tobacco are risk factors for atherosclerosis. The objective of this study was to determine the ability that a spaP isogenic defective mutant of *S. mutans* UA 159 has on binding to Human Umbilical Vein Endothelial Cells (HUVEC) when treated with tobacco products and what second messenger signals are involved. The study was conducted to examine the effects that various concentrations of cigarette smoke condensate (CSC)- and nicotine have on *S. mutans* cell cytotoxicity and expression of cytokines and growth factors from HUVECs. *S. mutans* was grown at 37°C and planktonic and biofilm cells were separated from the culture supernatant. The supernatant was discarded, the cells were washed, sterilized with formaldehyde, and washed again to remove the formaldehyde. The concentrations of the various *S. mutans* cells were standardized to the same concentration (absorbance of 0.50 ± 0.01) by spectroscopy at a wavelength of 600 nm. The lowest non-toxic levels of the sterilized bacterial cells were used to treat HUVECs for 72 hours and cytotoxicity was determined by lactate dehydrogenase (LDH) assays. The cytokine/growth factor expression will be determined by antibody protein arrays. The results are expected to indicate an increase in cytotoxicity with increasing cell concentrations, along with increased pro-inflammatory cytokine/growth factors expression by the HUVECs treated with tobacco treated *S. mutans* compared to *S. mutans* that was not treated with tobacco products. Second messenger signaling pathways will be analyzed with ERK and JNK inhibitors and specific antibodies to ERK and phospho-JNK. Immunoblots using HUVECs will be done to determine expression of ERK/JNK. A better understanding of the detrimental effects that tobacco has on the underlining causes of atherosclerosis can advance the quest of controlling the disease. (This study was funded by the Indiana University-Purdue University Indianapolis Multidisciplinary Undergraduate Research Institute.)

P28 Antibacterial Activity of Intra-canal Medicaments Used in Pulp Regeneration. A. SABRAH*, G.H. YASSEN, R.L. GREGORY (Indiana University School of Dentistry)

Introduction: Triple antibiotic (TA) and calcium hydroxide [Ca(OH)₂] pastes have been used as intra-canal medicaments in pulp regeneration. Recently, double antibiotic (DA) paste has been suggested to avoid tooth discoloration usually caused by TA. The objective of this study was to compare the antibacterial effect of triple antibiotic paste (TAP), double antibiotic paste (DAP) and calcium hydroxide [Ca(OH)₂] against *Enterococcus faecalis* (*Ef*) and *Porphyromonas gingivalis* (*Pg*) biofilm. Materials and

methods: The minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC), minimum biofilm inhibitory concentration (MBIC) and biofilm formation were measured using microtiter plate methods. The two bacteria were treated with different dilutions of TAP, DAP, and Ca(OH)₂ solutions. The turbidities of the bacterial cultures in the microtiter plate were measured by optical density at 540 and 490 nm using a spectrophotometer. Data were analyzed by two-way ANOVA ($\alpha=0.05$). Results: The MIC values were 1:32000 (for TAP/*Ef*, DAP/*Ef* and DAP/*Pg*), and 1:16000 (TAP/*Pg*). The MBC values were 1:320 for TAP and DAP against both bacteria. MBIC were 1:32000 (TAP/*Ef*, DAP/*Ef*, TAP/*Pg* and DAP/*Pg*). Biofilm formation of the two bacteria was significantly decreased with TAP and DAP at all tested dilutions ($p < 0.00001$) compared to control groups, however, TAP and DAP biofilm formation were not significantly different from each other. Ca(OH)₂ significantly decreased bacterial biofilm formation compared to the control but it was significantly less than TAP and DAP ($p < 0.05$). Conclusion: Both TAP and DAP were more effective than Ca(OH)₂ against *Ef* and *Pg*. With the limitations of this study DAP can be considered as an effective and comparable antibacterial substitute to TAP.

P29 Combined Effects of Nicotine and CSP on Biofilm Formation and Growth in a comC Gene-Deficient Strain of *Streptococcus mutans* (*S. mutans*). B. SCHEER, R.L. GREGORY (Indiana University School of Dentistry)

Objective: Competence Stimulating Peptide (CSP) is a signaling molecule produced by *S. mutans* whose precursor molecule is encoded by the comC gene, and whose uptake, and response to the molecule produced by other bacterial cells are regulated by proteins encoded by the genes comD, comE, and comX. When present in sufficient concentrations, CSP regulates many physiologic functions in *S. mutans* including biofilm formation. The aim of this study was to determine whether the addition of exogenous CSP to *S. mutans* strains deficient in comC, comD, comE, and comX will restore biofilm formation compared to the wild-type UA159 in the presence of nicotine. Methods: *S. mutans* UA159 and *S. mutans* comC, comD, comE, and comX gene-deficient strains were compared by measuring sucrose-dependent adherence (SDA) of each strain in a microtiter-based assay. Each strain was inoculated into tryptic soy broth containing 1% sucrose (TSBS) with nicotine in concentrations of 0, 2, 4, and 8 mg/mL, with and without CSP. By detecting differences in sucrose-dependent adherence (SDA) among these strains in each solution, it can be determined whether the addition of CSP restores the ability of each strain to form biofilm. Results: Data suggests that the addition of CSP did not rescue biofilm formation in comD, comE, and comX gene-deficient strains. In the presence of nicotine at 0, 2, 4, and 8 mg/ml, biofilm formation was greater without the presence of nicotine. Additionally, biofilm formation was significantly greater in comD, comE, and comX gene-deficient strains than the wild-type. Conclusion: These data suggest that in the comD, comE, and comX gene-deficient strains biofilm formation is greater than that of the wild-type with and without the presence of nicotine. In addition, biofilm formation was greater for each strain when incubated in solutions without CSP than those incubated with CSP, with and without nicotine.

P30 Antimicrobial Effects of Drug-Containing Electrospun Mats on Osteomyelitis Associated Biofilms. R.A. WAEISS^{1*}, T.C. NEGRINI², R.A. ARTHUR^{1,3}, M.C. BOTTINO¹ (¹Indiana University School of Dentistry, ²Sao Paulo State University, School of Pharmaceutical Science, ³Federal University of Rio Grande do Sul, School of Dentistry)

Typical antimicrobial treatment of osteomyelitis (OM) involves intravenous antibiotic therapy. The disadvantages of systemic antibiotic treatment have encouraged the development of local drug delivery methods. This study aimed to synthesize a polydioxanone (PDS) based drug delivery device containing vancomycin (VANC) and/or rifampicin (RIF), and investigate the effect on in vitro biofilm growth of OM associated pathogens. Nanofibrous mats were prepared from PDS sutures by electrospinning. The tested drugs were incorporated into the mats as follows: 5% VANC (G1), 10% VANC (G2), 5% RIF (G3), 10% RIF (G4), 5% VANC+RIF (G5) and 10% VANC+RIF (G6). Pure PDS mats were used as control (G7).

Biofilms formed by *Staphylococcus aureus* and *Staphylococcus epidermidis* were grown on the electrospun mats. Dual-species suspensions were inoculated in sterile 2.5 mL cell culture plate wells containing both the mats and glucose supplemented media. Counts of viable cells were assessed after 24 hours of biofilm formation (n=6/group). The electrospun fiber morphology and biofilms were also imaged using a scanning electron microscope. Micrographs revealed an interconnected porous structure of fibers with diameters ranging from 147 nm to 3626 nm. The combination of VANC and RIF produced more compact mats that appeared less fibrous. Small and isolated clusters of bacteria with no mature biofilm identified were found on G6. Variable levels of colonization by *Staphylococcus* were found within the mats with G5/G6 and G7 showing the lowest and highest means of viable cells counts, respectively (p<0.05). The results of the present study provide evidence for the potential use of PDS based mats as an effective local drug delivery system and a promising OM treatment option.

MUSCULOSKELETAL BIOLOGY

P31 Novel Role for Dynamin Phosphorylation and GTPase Activity in Osteoblast Migration. P. ELENISTE, S. HUANG, A. BRUZZANITI (Indiana University School of Dentistry)

Osteoblasts (OBs) migration plays a critical role both during bone healing and bone remodeling. Therefore, understanding the role of key signaling proteins that regulate osteoblast migration is of great importance. Dynamin is a GTP-hydrolyzing mechano-enzyme involved in endocytosis, intracellular vesicle scission, and actin remodeling. We previously reported that inhibition of dynamin reduces osteoclast bone resorbing activity, but its role in OBs is largely unknown. To gain insight into the functional role of dynamin, we examined the effect of a dynamin inhibitor or dynamin activity mutants on OB migration and morphology. Calvaria OBs were plated in migration chambers and treated with or without dynasore, a chemical inhibitor of dynamin GTPase activity. Results showed that OBs migration was reduced by 62% compared to vehicle-treated cells. Consistent with this finding, over-expression of dynamin in the osteoblast cell line, MC3T3-E1, promoted OB migration by 35%. In addition, dynasore altered the morphology of OBs and led to a decrease in lamellipodial membrane extensions, compared to vehicle treated cells. Moreover, in the presence of dynasore, cytoplasmic F-actin was reduced and disorganized, whereas peripheral actin appeared more pronounced. Dynamin undergoes tyrosine phosphorylation but the specific phosphatase involved in dynamin dephosphorylation and the role of dynamin dephosphorylation on OB function is not known. Our data revealed that the tyrosine phosphatase PTP-PEST is involved in the dephosphorylation of dynamin at amino acid residues Y231 and Y597. Importantly, dynamin mutants dynY231F and dynY597F exhibit a 40-60% reduction in GTPase activity and 58-65% reduction in phosphorylation levels. Consistent with this finding, over-expression of the double mutant dynY231F/Y597F significantly blocked MC3T3-E1 migration by 60%. These findings demonstrate for the first time that PTP-PEST is involved in the dephosphorylation of dynamin, which decreases dynamin GTPase activity and consequently leads to inhibition of OB migration. (Indiana University School of Dentistry IACUC # DS00885R.)

P32 Pyk2: Potential Regulator of Post-Menopausal Bone Loss. H.W. LARGURA^{1*}, P. ELENISTE¹, S. HUANG¹, S. LIU¹, M. ALLEN², A. BRUZZANITI¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Osteoporosis is a pathologic condition of bone seen in post-menopausal women, which occurs from an imbalance between bone formation and resorption. Following menopause, the bone resorbing activity of osteoclasts exceeds bone formation by osteoblasts, resulting in decreased trabecular and cortical bone and a subsequent decrease in bone mass. Reduced bone mass increases the risk of pathologic fracture of bones. Due to adverse effects associated with current treatment protocols for bone loss, alternative treatment modalities with reduced adverse effects are needed. Pyk2 is a protein tyrosine kinase that plays an important role in regulating bone resorption by osteoclasts, as well as osteoblast proliferation and

differentiation. Deletion of the Pyk2 gene in mice leads to an increase in bone mass, in part due to dysfunctional osteoclast and osteoblast activity. Hence, Pyk2 may be a potential therapeutic target for the treatment of bone loss. In this study, we examined the interaction of estrogen with Pyk2 in post-menopausal bone loss using ovariectomized (OVX), wild type (WT), and Pyk2 knock-out (KO) mice. To elucidate the role of estrogen on bone geometry, OVX mice received estrogen (E2)-releasing pellets or placebo pellets. Control mice included sham OVX surgery. Micro-CT analysis of the distal femoral metaphysis was performed and analyzed with the SkyScan 1172 high-resolution desk-top micro-CT system. We found that deletion of Pyk2 conferred protective effects against bone loss in ovariectomized (OVX) mice, and that Pyk2 KO mice given estrogen supplementation exhibited markedly increased trabecular bone mass compared to WT mice. Cortical bone in Pyk2 mice was unaffected by hormonal changes. Results of this study further elucidate the role of Pyk2 in regulating bone loss due to estrogen depletion. Understanding the role of Pyk2 in bone could lead to the development of new pharmaceutical targets for the treatment of osteoporosis. (Indiana University School of Dentistry IACUC # DS0000885R)

P33 The Role of Presenilin-1 on Osteoclast Differentiation. S. POSRITONG^{1*}, A. SUNDEEP¹, M. VANG², P. ELENISTE¹, D. WHEATON², A. BRUZZANITI¹ (¹Indiana University School of Dentistry, ²Purdue School of Engineering and Technology)

The balance of osteoblastic bone formation and osteoclastic bone resorption are important factors for the bone remodeling process. Excessive osteoclastic bone resorption or decreased osteoblast function can lead to low bone mass, which may result in osteoporosis. Emerging studies reveal that patients with Alzheimer's disease (AD) may have lower bone mass than similarly-aged individuals. Presenilin-1 (PS1) is the major gene responsible for Familial Alzheimer's disease (FAD) and mutations in the PS1 gene, such as L116P, have been found to be associated with AD. Although the function of PS1 remains uncertain, our studies demonstrated that mice harboring a genetic mutation of L116P in PS1 (PS1-L116P) have lower bone mass than wild type mice. However, the cellular mechanism leading to low bone mass is unknown. The objective of this in vitro study was to investigate the effect of PS1-L116P on osteoclast differentiation. Osteoclast progenitor cells were isolated from the long bones of WT and PS1-L116P knock-in (PS1-KIN) mice (n=2-3 mice/group). Osteoclast differentiation was induced by supplementation with receptor activator NF- κ B Ligand (RANKL) plus macrophage colony-stimulating factor (MCSF) for up to 11 days. The osteoclasts were stained with tartrate-resistant acid phosphatase (TRAP) at day 5, 6, 8, 11 and the number of multinucleated osteoclasts counted. The number of nuclei and the size of osteoclasts were observed and quantified by microscopy. Statistical analysis was performed using two-way ANOVA and Post Hoc Tukey tests ($\alpha = 0.05$). There were significant differences in the number of osteoclasts, osteoclast nuclei and surface area of osteoclasts among different days in both WT and PS1-KIN ($p < 0.05$). Unexpectedly, we found that the differentiation of PS1-KIN osteoclasts was significantly lower than WT osteoclast number on day 5 ($p < 0.05$) of cultures. Although osteoclast number was lower in PS1-KIN bone marrow in vitro, PS1-KIN have lower bone mass than WT mice. These preliminary results suggested that the bone mass of PS1-KIN mice is not solely due to changes in osteoclast differentiation, but bone formation by osteoblasts might also play a vital role to control the bone phenotype of these mice. (Indiana University School of Dentistry IACUC #DS000885R)

P34 The Effects of *Lepidium Sativum* on Osteoblasts. M. SALAMA*, G. BATARSEH, L.J. WINDSOR (Indiana University School of Dentistry)

Lepidium sativum (*L. sativum*), commonly known as garden cress, is an edible herb that belongs to the family Brassicaceae. It is rich in iron, flavonoids, vitamin C, calcium, folate, beta-carotene, phytosterol, and tocopherol. It also contains proteins, amino acids, fatty acids, saponins, glucotropaeolin, benzylisothiocyanate, and alkaloids. *L. sativum* has long been used as a traditional medicine in India, Saudi Arabia, Sudan and other Arabic countries. It is used as an antiscorbutic, laxative, anti-asthmatic, and diuretic, as well as a mediator for bone fracture healing. However, the scientific mechanisms

underlying its ability to enhance bone healing remain unclear. The objective of this study was to examine the effects of the *L. sativum* plant or seeds on osteoblasts, the cells responsible for bone formation. Lactate dehydrogenase (LDH) assays were performed to determine the non-toxic extract concentrations of the *L. sativum* plant or seeds on human-derived osteosarcoma cell line, MG 63. The cells were seeded into 6-well plates and allowed to attach overnight. They were then incubated for 72 hours with various concentrations (0.5, 1.0, 2.5, 5.0, 10, and 20%) of aqueous extracts of the *L. sativum* plant or seeds (crude or processed). Cytotoxicity was determined using the Detection KitPLUS (Roche Applied Science, Mannheim, Germany). Preliminary data indicates that the extracts of the *L. sativum* plant or seeds at 1-20% concentrations have no cytotoxic effects on the MG 63 cells. Additionally, the results show that the high concentrations of the extracts tested in this study may slightly enhance cell growth.

P35 Kalirin: Potential Role in Osteocyte Function. K. WAYAKANON*, P. ELENISTE, S. HUANG, A. BRUZZANITI (Indiana University School of Dentistry)

Communication between bone cells is important for the maintenance of bone mass. An imbalance between bone resorption by osteoclasts and bone formation by osteoblasts can lead to osteoporosis. Although osteocytes are embedded deep within the mineralized matrix, they are also essential in the regulation of osteoblast and osteoclast functions. However, the intracellular proteins that control the morphology and function of osteocytes, and their ability to communicate with other bone cells are largely unknown. The family of RhoGTPases and the GTP exchange factors (GEFs) that activate them control cellular activities such as rearrangement of cytoskeleton, cell migration or synaptic responses. Kalirin is a novel GEF protein, originally identified in the central nervous system. Recently, we have shown that kalirin is essential for the regulation of bone mass and kalirin knock-out (Kal-KO) mice exhibit a 45% decrease in cortical and trabecular bone density, compared to wild-type (WT) mice. However, the role of kalirin in bone cell function is still unclear. The objective of this study was to determine the role of kalirin on the morphology and functions of osteocytes. Primary osteocytes were isolated from long bones (femurs and tibias) from the posterior legs of 10-week WT and Kal-KO mice. The mRNA expression level of important signaling proteins in osteocytes was determined by quantitative real-time PCR (QPCR). The expression of receptor activator of NF- κ B ligand (RANKL) which is important for osteoclast differentiation was increased significantly in female Kal-KO mice compared with female WT mice ($p < 0.05$). On the contrary, the expression of sclerostin, a protein secreted by osteocytes that is important for controlling Wnt signaling and bone formation by osteoblasts was significantly decreased ($p < 0.05$) in Kal-KO mice compared to WT group. Interestingly, there was undetectable expression of fibroblast growth factor 23 (FGF23) in female Kal-KO mice. The results suggest that kalirin may be involved in the control of the osteoclastogenesis functions of osteocytes by controlling RANKL levels and in the balance of bone formation via the Wnt signaling pathway in osteoblasts. In addition, kalirin might play the vital role in the regulation of renal phosphate level through FGF23 which needs further investigation. (Indiana University School of Dentistry IACUC #DS0000885R)

ORAL CANCER

P36 Translocase Activity in Parotid Acinar Cells. M. SOULT*, V. SRIRANGAPATNAM, A. CARENBAUER, D. DARLING (University of Louisville School of Dentistry, Dept. of Oral Health and Rehabilitation)

Salivary glands have a critical role in maintaining the dynamic equilibrium of the oral cavity. Salivary gland cancers occur in approximately 1/50,000 people each year in the United States. Recent studies suggest that translocases (adenine nucleotide translocase2) or flippases /floppases (P-glycoprotein1; MDR11; ABCB11) are factors in eliciting cancer cell death and promising therapeutic targets. Additionally, lipid translocases may play a role in sorting of salivary secretory proteins in the parotid gland. Our objective was to identify which flippases are present in the parotid gland and determine their

location in the acinar cell. Parotid secretory protein (PSP) is an excellent marker for regulated secretion from the parotid gland. Prior work demonstrated that PSP binds to phosphatidylinositol-3,4-phosphate (PI3,4P2) in the secretory granule membrane and thus be potentially sorted into the regulated secretion pathway³. The presence of translocases is critical to flip PI3,4P2 from the granule outer membrane leaflet where it is synthesized to the inner leaflet wherein it binds to the cargo protein. The presence of translocases was determined by PCR and immunocytochemistry. Total RNA was isolated from the parotid glands of healthy adult Sprague-Dawley rats and quantitated. cDNA from the total RNA was synthesized using the High Capacity cDNA Reverse Transcriptase Kit (Applied Biosystems) following the manufacturer's protocol. The cDNA was then used for analytical and quantitative PCR. The analytical PCR products were visualized by agarose gel (1%) electrophoresis. The mRNA levels for the selected proteins were quantitated by real-time PCR using the QuantiTect SYBR Green kit protocol and the expression normalized to GAPDH. A select few proteins were localized by immunofluorescence on paraffin-embedded adult parotid tissue sections. The tissue was then blocked with 10% normal goat serum in phosphate buffer saline, pH 7.3, (PBS) and incubated overnight with primary antibodies either to ABCA1 or ABCG1. Following washes with PBS, the section was incubated with FITC-tagged anti-rabbit IgG, washed and the binding visualized on an Olympus FV500 confocal microscope. The results of IHC revealed localization of ABCA1 near apical and basolateral parotid acinar cell membranes and potentially secretory vesicles. ABCG1 did not localize. ATP11A and CABG1 had the highest mRNA expression. Several translocases that could be potentially involved in the secretory process are found in the healthy parotid gland. ATP11A and CABG1 had the highest levels of mRNA expression of those studied. IHC revealed localization of ABCA1 in the cell membrane and possibly in secretory granule membranes. (Research supported by a grant from the National Cancer Institute grant R25-CA134283. University of Louisville IACUC #11059)

ORAL DISEASE PREVENTION & DIAGNOSIS

P37 Knowledge, Attitudes and Practices Regarding Hand Hygiene. J. JACOBS*, L.M. ROMITO (Indiana University School of Dentistry)

Hand hygiene is a critical component of patient and employee safety. In the U.S., hospital patients get nearly two million infections each year, roughly one infection per 20 patients. Nosocomial infections can be life-threatening and hard to treat. Thus, hand hygiene is one of the most important ways to prevent the spread of disease, and should be the cornerstone of infection prevention. However, observational studies of handwashing compliance report rates averaging less than 40%. The objective of this study was to assess hand hygiene knowledge, attitudes, and practices among students, staff, and faculty at Indiana University School of Dentistry (IUSD). Six-hundred fifty-five individuals were invited to complete a 23-item survey consisting of demographic, knowledge, attitude, and behavior/practice items. A total of 439 completed surveys were collected (67% response rate) from the following groups: dental assisting (DA) students, dental hygiene (DH) students (DH1 & DH2), pre-doctoral students (D1-D4), clinical staff and full-time clinic faculty. Data obtained from the confidential surveys were coded and entered into an electronic database for statistical analysis. On the multiple choice knowledge items, there were significantly fewer ($p < 0.05$) correct responses from staff compared to D2, D3, DH, and DH2 students. DA students had significantly fewer ($p < 0.05$) correct responses compared to pre-doctoral students, D2, D3, D4, DH1, DH2 and faculty. D1 students had significantly fewer correct responses compared to D2, D3, D4 and DH2 students. D3 students had significantly fewer correct responses compared to D2 and DH2 students. DH1 students and faculty had significantly fewer correct responses compared to D2 students. Only 7% (30/439) of the respondents answered all 5 questions correctly. Attitude/assessment results summarized as a mean on a 7-point scale revealed that all groups believe hand hygiene is effective in preventing infection (6.1 ± 0.1). The lowest mean for all groups was for student's regularly receiving feedback (3.0 ± 0.1). Behavior/practice responses revealed that the major reasons for non-compliance with proper hand hygiene protocols were: forgetting (41%), being too busy (27%), product unavailable

(22%), product not conveniently located (20%), unsure of need (12%), skin damage (10%), dislike of available product (4%), unpleasant smell of product (3%), and other (3%). These results suggest clinical experience is not necessarily correlated with proper knowledge about hand hygiene protocols, and that regular feedback about proper hand hygiene is needed. (Indiana University-Purdue University Indianapolis IRB Study #1204008376.)

P38 Effects of Arginine Deiminase-Like Enzymes on *Porphyromonas gingivalis* Biofilm. A. MICHAEL*, K.S. GREGSON, R.L. GREGORY (Indiana University School of Dentistry)

Objective: According to the NIH, upwards of 50% of Americans have periodontal disease. The underlying etiology is biofilm formation. One of the more virulent species involved in periodontitis biofilms is *Porphyromonas gingivalis* (*P. gingivalis*). Previous studies have indicated that arginine deiminase (ADI), purified from the membrane of *Streptococcus cristatus* (*S. cristatus*) inhibits *P. gingivalis* biofilm formation via a cell-to-cell contact mechanism. Since ADI is not present in higher-level eukaryotes, it exhibits potential for drug targets in antimicrobial and antiparasitic therapy. The structure of ADI is similar to other arginine-modifying enzymes such as dimethyl arginine dimethylammonohydrolase (DDAH) and human peptidylarginine deiminase 4 (PAD4). The objective of this study was to test these proteins for biofilm inhibition. Methods: *P. gingivalis* was treated with PAD4 (375, 750, and 1500pg/ul), DDAH (333, 666, and 1332pg/ul), and ADI media (3.6uM) in media alone, in combination, or without protein or bacteria (negative and positive controls, respectively). The ADI protein was obtained by making aliquots of a filter sterilized *S. cristatus* supernatant. Growth of planktonic cells and biofilm formation was measured after a 48h incubation period with a crystal violet dye staining assay. Relative absorbance values were obtained using a microtiter plate spectrophotometer. Results: *P. gingivalis* biofilm exposed to ADI media, PAD4 (1500pg/ul), and DDAH (666pg/ul) demonstrated significantly less growth than the negative control, while there was no significant difference in planktonic bacteria. Conclusions: These results suggest that ADI media, PAD4, and DDAH slowed the growth of *P. gingivalis* biofilm formation at varying concentrations. None of the proteins had a significant effect on planktonic *P. gingivalis*. This study provides evidence for the potentially therapeutic aspects of *P. gingivalis* treated with arginine deiminase-like proteins. (Supported, in part, by the Indiana University School of Dentistry Dental Student Research Fund.)

P39 Retention of Dental Sealants Placed in Rural Areas in Mexico D. SHONE*, A. SOTO-ROJAS, E.A. MARTINEZ-MIER, A. MANTILLA (Indiana University School of Dentistry)

Sealants have been shown to be an effective measure in preventing the establishment of caries as well as preventing its progression. The United States Task Force on Community Preventive Services found through a systematic review that sealants reduced caries rates by 60%. Therefore, they recommended that sealants be placed primarily through school-based programs as part of a plan to prevent/control dental caries in the general population. The effectiveness of the use of dental sealants placed under field conditions versus traditional settings has not been studied extensively. The goal of the current study is to examine one-year and two-year retention rates of sealants placed in a rural community setting as part of an international service learning program in Tahdziu, Mexico. Calibrated examiners traveled to Tahdziu in June of 2012 as part of the Indiana University International Service Learning Program. During routine examination of local children, the investigators observed the buccal, lingual, mesial, distal, and occlusal aspects of each tooth (all permanent premolars and molars). Existing conditions and suggested treatment were recorded for each patient. Information for each patient was stored in a master database. Upon return to the United States, similar databases from 2010 and 2011 were examined and children who had returned for treatment in 2012 were identified. The study population consisted of 197 sealants that were placed during the ISL trip in 2011 in 71 children (one-year retention) and 213 sealants placed in 2010 in 66 children (two-year retention). Children identified as returning in 2012 were examined for the presence or absence of sealants placed in the prior two years. Assessments of sealant retention were summarized

using percentages. Preliminary results show sealant retention of sealants placed in field settings are comparable to those placed in a traditional setting. However, complete results are not yet available. Information obtained from this study will be used to compare sealant survival rates placed in rural settings compared to those placed in an office setting. (Indiana University-Purdue University Indianapolis IRB # 1203008256 - EX1101-23)

P40 A Qualitative Study of Oral Health Behaviors among Mexican Americans. C. WESTERHOLD^{1*}, O. AGUIRRE-ZERO¹, R. GOLDSWORTHY², G. MAUPOMÉ¹ (¹Indiana University School of Dentistry, ²The Academic Edge, Inc., Bloomington, Indiana)

Background: Oral health outcomes among Mexican American (MA) immigrants are often poor; their oral health behaviors, norms, and the barriers and facilitators they encounter while seeking preventive and urgent dental care in the U.S. are not well-understood. Disparities cannot be addressed without a better understanding of the causes. In the present interim report we outline the first phase of a study (DentKnow) that seeks to identify barriers, facilitators, beliefs and norms influencing MA engagement in oral health care, and oral health behaviors – including oral hygiene practices –using a qualitative interview methodology. Methods: A culturally appropriate structured interview was developed and included questions from the NIDCR/CDC Data Resource Center (e.g., about recognizing treatment needs, ascertaining patterns of dental visits, and non-clinical factors mediating dental care seeking), as well as theory-grounded questions designed to elicit knowledge, attitudes, and engagement in the dental care system and in preventive self-care behaviors. Interviews were conducted in English or Spanish, with adult and adolescent MAs living in Indiana. Interviews were recorded, analyzed and cross-analyzed by three investigators. Results: A total of 33 interviews were completed. Analyses of discourse indicated that adult MAs neither consistently adhere to preventive oral health behaviors nor do they consistently seek professional preventive care. When they do access U.S. dental care systems, it is often in response to an emergency clinical situation. MA teenagers reported a different pattern, where they receive preventive care regardless of barriers identified by adults; however, they have rarely experienced the need for urgent dental care. Regarding oral hygiene practices, most MAs reported regular brushing and use of mouth rinses, but not flossing. Norms, beliefs, barriers, and facilitators related to these behaviors were identified and are being analyzed in further detail under a Theory of Planned Behavior framework. Conclusion: Sub-optimal oral health, and health care behaviors among adult and teen MAs are common; therefore it is important to identify the barriers and facilitators to attaining better oral health. Perceived high cost is a key barrier to obtaining dental care, suggesting that intervention efforts be crafted around actual/perceived cost and access to care. Appearance and self-image were also identified as potential motivating factors to performing oral health care behaviors. Future work will refine existing instruments and accrue larger samples to better inform the design of standard surveys and generate a model of MA oral health care engagement to shape future interventions. (This project was supported by a Project Development Team within the Center for Urban Health and ICTSI NIH/NCRR Grant Number RR025761. Indiana University-Purdue University Indianapolis IRB # 1207009118)

P41 Experimental model development for the study of dentifrice abrasion on eroded enamel. M. ARRAGEG*, A. KELLY, F. LIPPERT, A.T. HARA (Indiana University School of Dentistry).

Dentifrices are generally regarded as safe for sound enamel; however they have shown to increase eroded enamel abrasive wear. To investigate the enamel surface loss caused by different abrasive suspensions (simulating different dentifrices), at different brushing times. The following experimental factors were considered: abrasive suspension, at 3 levels (L-low: RDA 69, M-medium: RDA 147, and H-high: RDA 208); and brushing time, at 4 levels (50, 500, 100 and 2000 strokes), generating 12 testing groups (n=8). Experimental units consisted of slabs of bovine enamel cut, embedded in acrylic resin and polished. 1 × 4 mm UPVC tapes have been placed on the surface of the specimens, leaving an area of 1 × 4 mm exposed in the center of the each enamel slab. Erosive lesions was created similarly to all groups, by immersing

the specimens in 0.3% citric acid solution (pH 3.75), for 120 minutes, at room temperature. After the erosive challenge, the specimens were positioned in an automated brushing machine and brushed with standard toothbrushes (Soft Oral-B 40) and the tested suspensions (L, M and H), using 150 g of load. Surface loss (SL, in micrometers) was determined by optical profilometry, after demineralization and each brushing time. Data was analyzed using Two-way ANOVA and Tukey tests ($\alpha=0.05$). No significant interaction was observed between the studied factors ($p=0.917$). Within abrasives, H: (mean [SD]: 6.86 [2.08]) was significantly higher than L (4.24 [1.89]) and none of them differed from M (6.47 [2.14]). Within brushing times, there was a significant increase of SL from 50 (3.54 [1.36]) to 500 (5.41 [1.87]) strokes and from 500 to 2000 (7.05 [2.30]) strokes. No difference was found when comparing 1000 (6.16 [2.01]) to either 500 or 2000 strokes. The experimental model was sensitive to large differences in the abrasive level of the slurries. More eroded enamel SL occurred at the initial strokes.

ORAL/MAXILLOFACIAL ANATOMY

P42 Pterygospinous and Pterygoalar Ligaments Modify CNV3 and Related Bony Structures.

V.P. HALL^{1*}, B.F. HASKELL¹, S.K. GAULT², N.R. HERRING² (¹School of Dentistry, ²Department of Anatomical Sciences and Neurobiology, University of Louisville)

Objectives: Previous investigations of infratemporal fossa have described ossified pterygoalar or pterygospinous ligaments and have speculated that CN V3 branches can become entrapped. To date most studies examining the non-ossified form of these ligaments have only been case reports, thus a lack of information exists describing the ligaments and their relationships to neural structures in the vicinity. This study proposes to characterize the non-ossified ligaments including modifications of chorda tympani and CN V3 branching patterns along with alterations to related bony structures in infratemporal fossa. **Methods:** Ligaments were characterized and grouped into pterygospinous or pterygoalar from 44 cadaveric half heads. Pterygospinous ligaments were subdivided based on attachment to spine of sphenoid into superolateral, superomedial, and directly to spine. CN V3 branching patterns and chorda tympani relationships were described related to ligament. Shape and size of foramen ovale along with distance between foramen ovale and foramen spinosum, foramen Vesalius, spine of sphenoid, and lateral pterygoid plate were recorded. **Results:** CN V3 branching was altered based on type and attachment of ligament. Chorda tympani was significantly longer and passed deep to superolateral pterygospinous ligaments, while it was shorter and traveled lateral to pterygoalar ligaments. Discrete alterations of the dimensions of foramen ovale were observed with different ligament groups. Decreased distance between foramen ovale and lateral pterygoid plate was observed in specimens with superolateral pterygospinous ligaments compared to specimens with no ligament. Increased distance between foramen ovale to foramen spinosum and to spine of sphenoid was observed in specimens with superomedial pterygospinous ligaments compared to specimens with no ligament. **Conclusions:** Alterations to CN V3, chorda tympani, and foramen ovale measurements are altered in the presence of pterygospinous and pterygoalar ligaments. Further investigation with a larger sample size and analysis of the correlation between ligaments and neural-related alterations is necessary.

ORTHODONTICS

P43 POSTN Expression during Maxillary Suture Expansion in Mice. M. ALDOSARI^{1,2*}, S. CHEDELLA¹, R. FUCHS³, S. LIU¹ (¹Indiana University School of Dentistry, ²King Saud University College of Dentistry, ³Indiana University School of Health and Rehabilitation Sciences)

Background: POSTN is a matricellular protein initially identified in the periosteum of bone and periodontal ligaments. It has been suggested that POSTN enhances osteoblast cell adhesion but its role in bone formation is not fully understood. The purpose of this study was to determine the expression of

POSTN in the suture area during maxillary expansion bone formation in mice. Methods: Sixty inbred CB57/6J male mice were randomly assigned into one of three groups. Two groups underwent maxillary expansion using custom made appliances using either 10g or 20g of force and one group served as control. After 14 days the animals were euthanized and skulls were harvested. Maxillary sutures were scanned using a MicroCT scanner and 3D models were reconstructed to determine suture separation and bony changes. Paraffin sections were obtained for POSTN immunohistochemistry and undecalcified plastic sections were obtained for dynamic bone histomorphometry. Results: The mean distance of suture separation in the 20g group was significantly higher ($413 \pm 98 \mu\text{m}$) than the 10g group ($247 \pm 116 \mu\text{m}$), followed by the control group ($92 \pm 8 \mu\text{m}$) using one-way ANOVA ($\alpha=0.05$). Extracellular POSTN was expressed in the maxillary suture area during expansion and the higher amount of force intensified POSTN expression. Although the higher force of expansion resulted in a significantly larger amount of separation, it resulted in unpredictable and excessive bone resorption in the 20g force group. No differences were found between the two force groups in dynamic bone measurements. Conclusions: POSTN is expressed in the maxillary suture area during expansion and is more intense with the higher force. Also, the higher force may not have an advantage in sutural bone formation in mice. (Indiana University School of Dentistry IACUC #DS000916R)

P44 Orthodontic Bond Strength of New vs. Re-used Bovine Teeth. E. CIULA, S. ISIKBAY, T.R. KATONA (Indiana University School of Dentistry)

Bovine teeth are often used to evaluate the bonding strength of orthodontic brackets. This study compared the tensile, torsion and shear-peel bond strengths of new bovine teeth to those of the same teeth after they were de-bonded, resurfaced and re-bonded. The crowns of the upper central incisors were cut off at the cemento-enamel junction with a diamond blade and potted in self-curing acrylic resin within a 0.75 inch diameter acrylic tube. The buccal surface was parallel to and slightly above the cylinder rim. The exposed buccal enamel was flattened with wet 200, 400 and 600 grit sandpaper so that the resulting surface was perpendicular to the sides of the cylinder. The bracket (3M Unitek 0.022" stainless steel Victory series) bases were flattened with a 200 N compressive force. Primer (Transbond Plus Self Etching Primer) was placed on the enamel according to the manufacturer's instructions and bonding (Transbond XT Adhesive Paste) was performed in a temperature and humidity controlled environment. A bonding jig was used to consistently center the brackets relative to the tube and to maintain a 0.15 mm adhesive thickness. The specimen were incubated for 7 days in 37°C distilled water. Debonding was performed on an MTS 858 testing machine in tension (N), torsion (N-mm) and shear-peel (N). After debond, the wet sandpaper series, bonding procedures and debonding were repeated using the same specimens. The results show that strengths decreased significantly (p-value < 0.005) after resurfacing with 16%, 31% and 24% reductions in tension, torsion and shear-peel, respectively, suggesting that reuse of specimens is not a practical option. (Supported by IUSD Student Research Group.)

P45 Effects of Mandibular Advancement Appliances on the Upper Airway Dimensions. B. FINKELMEIER^{1*}, K.S. KULA¹, G. ECKERT², A. GHONEIMA¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Objective: The aim of this retrospective cephalometric study was to investigate dentoskeletal and airway dimensional changes in a group of orthodontic subjects with deficient mandibles who were treated with Herbst or MARA appliances. Methods: Pre-treatment and post-treatment lateral cephalometric radiographs of 34 subjects (15M:19F) with deficient mandibles (aged 9-22 years) were selected from the postgraduate orthodontic clinic archives. The cephalograms were classified into 2 groups. Group 1 (n=17) consisted of cephalograms from individuals treated with a Herbst appliance and group 2 (n=17) consisted of cephalograms from individuals treated with a MARA appliance. Each cephalogram was traced manually and the selected parameters (20 dentoskeletal and 15 airway) were measured for all subjects before and after treatment (mean 3.25 years). Intraclass correlations (ICC) were performed on duplicate

measures of 10 cephalograms to assess reliability. Paired t-tests were used to evaluate differences in the airway parameters from pre-treatment to post-treatment within groups. Statistical significance was set at $P < 0.05$. Results: ICC values were >0.90 for all measurements. Significant decreases were recorded in the skeletal parameters of ANB, N-S, ANS-PNS, Go-Gn, Overbite, Overjet, Co-ANS, Co-Gn, TFH, AFH, and LAFH for both Herbst and MARA groups. Airway parameters such as soft tissue thickness of the posterior pharyngeal wall (Ba-ad1 and Ba-ad2), anteroposterior dimension of bony nasopharynx (Ba-PNS, AA-PNS and AA-ptm), and width of the nasopharyngeal airway space (PNS-ppw1) showed statistically significant decrease in both groups. The Herbst group also showed a statistically significant decrease in the sagittal depth of pharyngeal lumen at the nasopharynx and oropharynx (ptm-ad1, PNS-ad1, and PNS-ppw2) while the MARA group demonstrated a statistically significant decrease in the angle representing the anteroposterior dimension of the nasopharynx (AA-S-PNS). Conclusion: Using a mandibular advancement appliance significantly decreases the upper airway dimensions. The amount of the change in the upper airway size was variable between Herbst and MARA appliances. (Supported by IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship. Indiana University-Purdue University Indianapolis IRB-04, IRB # 0908-55)

P46 Orthodontic Soft Tissue Parameters: A Comparison of CBCT and 3dMD. T. METZGER¹, K.S. KULA¹, G. ECKERT², A. GHONEIMA^{1*} (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Objectives: Orthodontists rely heavily on soft tissue analysis to determine esthetics and treatment stability. Although the reliability of three dimensional photography (3dMD) and cone beam computed tomography (CBCT) is established, little data exists comparing the soft tissue measurements between these two imaging modalities. The aim of this retrospective study is to compare the equivalence of soft tissue measurements between the 3dMD imaging system and the segmented skin surface derived from i-CAT CBCT. Methods: Seventy preexisting 3dMD extraoral photographs and CBCT scans taken within minutes of each other for the same subjects were superimposed using 3dMD Vultus software on soft tissue. Images were registered according to hard tissue planes in three dimensions. Following reliability studies, 28 soft tissue measurements were selected and recorded on both imaging modalities. The measures were then compared between the two images to analyze their equivalence. Intraclass correlation coefficients (all ICCs $>.8$) and Bland-Altman plots were used to assess the inter- / intra-examiner repeatability and agreement. Summary statistics were calculated for all measurements. To demonstrate equivalence of the two methods, the difference needed a 95% confidence interval contained entirely within the equivalence limits defined by repeatability results (twice the within-subject standard deviation of CBCT). Results: Statistically significant differences were reported for the following measurements: vermilion height (Ls-Li), mouth width (CH[R]–CH[L]), total facial width (Tr[R] – Tr[L]), mouth symmetry (Ch[R] to Sup. Facial Plane), ST Lip Thickness (LI to mand CI), and eye symmetry (Exoc R & L to Sup. Facial Plane). Conclusions: There are areas of non-equivalence between the two imaging methods. Differences are clinically acceptable from the orthodontic point of view. (Funding: IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship. Indiana University-Purdue University Indianapolis IRB #1205008626)

P47 The Effect of Arch-Widths and Tooth-Inclinations on Trumpet Performance Quality. H.Z. CILINGIR¹, K.S. KULA², J. DAGG³, A. GHONEIMA² (¹University of Cincinnati, College-Conservatory of Music, Cincinnati, OH, ²Indiana University School of Dentistry, ³Quantitative Methodology and Statistics, University of Cincinnati, Cincinnati, OH)

Objective: Music teachers contend that the arrangement of teeth affects trumpet performance. Since there is little quantitative data to support this claim, the purpose of this study was to determine whether trumpet performance skills are associated with various characteristics of arch width and teeth position. Method: Following IRB approval, 70 trumpet students (55M:15F; aged 20-38.9 yrs.) from 11 universities were

consented to complete a survey concerning dental and trumpet playing history. The students were asked to play a scripted skill performance test (flexibility, range, endurance, and articulation) on a trumpet in a music practice room while being audio and video recorded. A three-dimensional (3D) cone beam computerized tomograph (CBCT) was taken for each student the same day as the trumpet test. A metronome was used to measure flexibility, endurance, and articulation. Following reliability studies, arch-widths and tooth inclinations (first molar arch widths and inclinations, canine arch widths and inclinations) were measured on the 3D CBCT. Non-parametric correlation, accepting $p < .05$ as significant, was used to determine if significant associations existed between arch-widths in the maxillary and mandibular dental arches or tooth inclinations in the maxillary dentition and any of the performance skills. Result: Significant ($p < 0.05$), but weak ($r < 0.30$) associations were found between the mandibular molar width and flexibility (exercise b). Significant, moderate associations ($r > 0.4$) were found between both arch widths (maxillary and mandibular molar widths) and articulation (flutter tongue). No associations were found between tooth inclinations and performance skills. Conclusion: University trumpet students with wider molar arch widths have significantly better performance skills than those with narrower molar arch widths; however, the associations are weak to moderate. The effect of practice on performance skills is still being studied. (Funding: IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship; UC University Research Council; UC CCM Dean's Fund; Anadolu University. Indiana University-Purdue University Indianapolis IRB #1105005362)

P48 The Effect of Anterior Tooth Position on Trumpet Performance. H.Z. CILINGIR¹, A. GHONEIMA², J. DAGG³, K.S. KULA^{2*} (¹University of Cincinnati, College-Conservatory of Music, ²Indiana University School of Dentistry, ³Quantitative Methodology and Statistics, University of Cincinnati, Cincinnati, OH)

Objectives: Music teachers contend that the arrangement of anterior teeth affects trumpet performance by influencing the embouchure. Since there is little quantitative data to support this claim, the purpose of this study was to determine whether trumpet performance skills are associated with malalignment of anterior teeth. Methods: Following IRB approval, 70 trumpet students (55M:15F; aged 20-38.9 yrs.) from 11 universities consented to complete a survey concerning dental history and trumpet playing habits. The students were asked to play a scripted performance skill test (flexibility, range, endurance, and articulation exercises) on their instrument in a soundproof music practice room while being audio and video recorded. A three-dimensional (3D) cone beam computerized tomograph (CBCT) was taken of each student the same day as the skill test. Following reliability studies, overjet, overbite, and degree of anterior tooth irregularity (Little's Index) were measured on the 3D CBCT. Nonparametric correlations, accepting $p < .05$ as significant, were used to determine if there were significant associations between dental measures and any of the performance skills. Results: Intrarater reliability was excellent (Pearson correlations; $r > 0.9$). Significant ($p < 0.05$), but weak ($r < 0.30$) associations were found only between Little's Index of the mandibular anterior dentition and the performance skills: flexibility (exercises a, c and avg) and articulation (double tongue). No other associations were significant. Conclusions: University trumpet students with mandibular anterior teeth that are smoothly aligned had significantly better performance skills than those with misaligned mandibular anterior teeth; however, the association was weak. (Funding: IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship; UC University Research Council; UC CCM Dean's Fund; Anadolu University. Indiana University-Purdue University Indianapolis IRB # 1105005362)

P49 Evaluation of the Airway Dimensions in Subjects with Different Malocclusion. J. OBERLEY^{1*}, K.S. KULA¹, G. ECKERT², A. GHONEIMA¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

The form and dimensions of the airway together with the normal nasorespiratory function has been of interest to orthodontic researchers for many years since it plays a fundamental role in the development of

the dentofacial morphology. Objectives: The aim of this retrospective cephalometric study was to compare the airway and dentoskeletal dimensions among three different classes of malocclusion (Class I, Class II, and Class III). Identifying the differences in dentoskeletal patterns that exist between these different malocclusions can lead to a better understanding of the differences that exist in the airway dimensions, and therefore, allow for successful orthodontic treatment planning aimed at maximizing respiratory function. Materials and Methods: Lateral cephalometric radiographs of 82 orthodontic subjects (43-Caucasian, 39-African American), aged 12-25 years, were pulled from the Orthodontic Clinic at Indiana University School of Dentistry, classified based on the molars relationships into three groups Class I (n= 29: 14F, 15M), Class II (n= 30: 19F, 11M), and Class III (n= 23: 9F, 14M), and manually traced. Following reliability studies, 38 parameters (20 dentoskeletal, 18 airway) were measured and compared using One-way ANOVA, with race, age and gender as covariates. Pearson's correlation coefficients were made to evaluate the associations of the cephalometric parameters with the airway parameters. The level of statistical significance was set at $P < 0.05$. Results: When parameters were adjusted for the classes of malocclusion, significant statistical differences were detected in multiple cephalometric measurements (ANB, Angle of Convexity, Go-Gn, Co-Gn, TFH, AFH, LAFH, overbite, and overjet). The differences in the airway parameters were statistically non-significant except for the soft tissue thickness of the posterior pharyngeal wall (Ad2 \perp S-Ba). Significant correlations ($r \geq 0.6$) existed between Angle of Convexity and both the thickness of soft tissue of the posterior pharyngeal wall and the vertical dimension of nasopharynx (Ba-ad1 and S-Ba-PNS) for Class I malocclusions. Go-Gn and the length of the upper bony nasopharynx (Ba-ptm), overjet and the length of the lower bony nasopharynx (AA-ptm) were correlated at the same level for Class II malocclusion. The length of the upper bony nasopharynx (Ba-ptm and Ba-PNS) was correlated with both maxillary and mandibular length (ANS-PNS, Go-Gn, Co-ANS, and Co-Gn). The vertical dimension of nasopharynx (S-Ba-PNS) was correlated with the LAFH at the same level for Class III malocclusion. Conclusion: There were many differences in the airway dimensions among the classes of malocclusion. Several cephalometric measurements showed significant correlation with the airway measurements. (Supported by IUSD Student Research Program, IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship. Indiana University-Purdue University Indianapolis IRB #0908-55)

P50 Airway Dimensions in Caucasians and African Americans: A Comparative Study. C. TOLODAY^{1*}, A. GHONEIMA¹, G. ECKERT², K.S. KULA¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

The size of nasopharynx and oropharynx play fundamental roles in dentofacial morphology and respiratory function. Objectives: The purpose of this retrospective study was to determine the differences in the dentofacial and airway dimensions between two ethnic groups at ages 12-25 years, through the use of lateral cephalometric radiograph tracing and analysis. Identifying the differences in dentofacial patterns that exist between these ethnic groups can lead to a better understanding of the differences that exist in the airway dimensions, and therefore, allow for more successful orthodontic treatment planning aimed at maximizing respiratory function. Materials and Methods: Lateral cephalometric radiographs for 82 subjects (39 African American: 20F, 19M and 43 Caucasian: 22F, 21M), aged 12-25 years were selected from the archive of the Orthodontic Clinic at Indiana University School of Dentistry. Manual tracing was performed for all cephalograms and 38 parameters (20 dentoskeletal and 18 airway) were measured and compared between the groups using two-sample t-tests, with age and gender included as covariates. Pearson's correlation coefficients were made to calculate the associations of the dentoskeletal parameters to the airway parameters. The level of statistical significance was set at $P < 0.05$. Reliability testing was performed. Results: When parameters were adjusted for race, gender and age, significant statistical differences were detected in multiple cephalometric measurements (SNA, PP-MP, 1/-SN, N-S, Go-Gn, AFH, LAFH) in both groups. Airway measurements such as soft tissue thickness of the posterior pharyngeal wall (Ba-ad1), anteroposterior dimension of nasopharynx and pharynx (AA-ptm and AA-PNS), length of the upper bony nasopharynx (Ba-ptm and Ba-S-PNS), and sagittal depth of the pharynx

(AA-S-PNS) showed statistically significant changes between the groups. Significant correlations ($r \geq 0.5$) existed between SN-PP and sagittal depth of the nasopharynx (PNS-ppw2), SN-PP and anteroposterior dimension of the nasopharynx (Ba-S-PNS and AA-S-PNS), Go-Gn and skeletal dimension of bony nasopharynx (AA-ptm) in African Americans, and N-S and skeletal dimension of nasopharynx (Ba-PNS and Ba-ptm), Co-ANS and length of the upper bony nasopharynx (Ba-ptm) in Caucasians, both ANS-PNS and Go-Gn were correlated with the length of the upper bony nasopharynx (Ba-ptm and Ba-ptm) in both groups. Conclusion: Based on the data, it was concluded that there are some differences in the dentoskeletal and airway dimensions between Caucasians and African Americans ages 12-25 years. These differences may indicate genetic variation in the airway anatomy. (Supported by IUSD Student Research Program, IUPUI 3D Imaging of the Craniofacial Complex Center; Jarabak Professorship. Indiana University-Purdue University Indianapolis IRB - 04, IRB # 0908-55)

PEDIATRIC DENTISTRY

P51 Knowledge and Attitude of Dental Trauma among Mothers in Iraq. G.H. YASSEN¹, J.R. CHIN^{1*}, M.S. YOUNUS², G.J. ECKERT³ (¹Indiana University School of Dentistry, ²Mosul University School of Dentistry, Mosul, Iraq, Directorate of Nineveh Health, Mosul, Iraq, ³Indiana University School of Medicine)

Aim: To evaluate the knowledge and attitude of Iraqi mothers regarding dental trauma prevention and management. **Study design and methods:** Mothers (n=231) that visited two professional dental centers in Mosul, Iraq were interviewed and asked to answer a three-part questionnaire containing questions about demographic variables, attitudes and knowledge of dental trauma. **Statistics:** The relationships of the demographic variables with the total knowledge score of the correct responses were analyzed using two-sample t-tests. The number of correct responses regarding management of avulsed teeth compared to that of fractured teeth was evaluated using a paired t-test. A 5% level of statistical significance was applied for the analyses. **Results:** The mean knowledge score was 5.2 (on a scale of 0–10). No significant difference was found in knowledge score with respect to mothers' age, educational level, working status, personal experience with dental trauma or first aid training ($p > 0.05$). Mothers with either at least a high school education or previous experience with dental trauma were more likely to recommend that their children wear mouth guards during sports ($p = 0.02$ and $p = 0.03$, respectively). Mothers who were 35 years of age and older were more likely to know how to correctly carry an avulsed tooth to a dentist. Mothers' knowledge regarding management of fractured teeth was significantly higher than that of avulsed teeth ($p < 0.0001$). Conclusions: Mothers in Mosul, Iraq did not have sufficient knowledge about the prevention and management of traumatic dental injuries. Intervention programs should be considered to increase mothers' awareness regarding dental injuries. (The authors thank Indiana University Purdue University Indianapolis Center for Service and Learning for their support of this work through the Sam H. Jones Service Learning Scholarship award. The Ethical Committee of the Iraqi Ministry of Health, the Directorate of Nineveh Health in Mosul, Iraq approved this study. Indiana University-Purdue University Indianapolis IRB #1204008384)

PERIODONTICS

P52 Comparison of PGRP mRNA Levels in Chronic Periodontitis Gingival Tissues with Tissue Levels in Periodontal Health. P. SHARMA*, S. MAKKATIL, S. PRAKASAM (Indiana University School of Dentistry)

Chronic periodontitis (CP) is an immuno-inflammatory disease initiated by dental biofilm and propagated by the host response. Although most microbes associated with CP are normal oral commensals, the microbial composition of the dental biofilm changes during the transition from health to disease leading to a predominance of certain Gram-negative bacteria including *Porphyromonas gingivalis*, *Tannerella*

forsythia, *Prevotella intermedia*, and *Treponema denticola*. This shift results in the activation of receptors in the host called pattern recognition receptors (PRRs). These PRRs recognize microbial molecular patterns, such as peptidoglycan, lipopolysaccharide, etc. Peptidoglycan is a part of the bacterial cell membrane, which has been mechanistically linked to periodontal disease. Peptidoglycan recognition proteins (PGRPs) are a novel class of bactericidal PRRs. Independent of their bactericidal activity they are thought to modulate the immune response. Limited studies have looked at the role of PGRPs in relation to periodontal disease. Uehara et al. reported on the inducible expression of PGRPs in oral epithelial cells in response to inflammatory stimuli targeting TLRs, NOD1, and NOD2. Moreover, they reported a lack of inflammatory cytokine response when PGRPs are up-regulated in spite of the inflammatory stimuli, suggesting a protective role for the PGRPs. They further speculate that inducible expression of PGRPs may keep oral epithelial cells hypo-responsive to the diverse oral microbial flora. The objective of this study was to examine PGRP expression in chronic periodontitis. We hypothesized that PGRP expression will be down-modulated in chronic periodontitis, thereby allowing inflammation, as well as bacterial growth, leading to periodontal destruction. Five subjects with at least 20 teeth were recruited for each group. The test group consisted of patients who were scheduled for resective periodontal surgery and had a diagnosis of generalized severe chronic periodontitis as classified by the American Academy of Periodontology (AAP). The control group consisted of clinically healthy subjects, i.e. subjects having minimal to no clinical attachment loss. Gingival samples collected from subjects were used to quantify PGRP mRNA levels through real time PCR. The mRNA levels between the two groups were tested for significance with a T-Test. We expect that our results will show decreased mRNA levels in chronic periodontitis when compared to control subjects. Our results would shed light on the role of PGRPs in the pathogenesis of chronic periodontitis. (Indiana University-Purdue University Indianapolis IRB #1301010412)

P53 Heterogeneity of Gingival Fibroblast Cell Lines in Tobacco-stimulated Collagen Degradation. W. ZHANG*, F. SONG, L.J. WINDSOR (Indiana University School of Dentistry)

Background: MMPs are a large family of zinc-dependent endopeptidases, and their activity is modulated by tissue inhibitors of metalloproteinases (TIMPs). Several MMPs can degrade fibrillar collagens and are implicated in periodontal disease. Smoking is a risk factor for periodontitis. Previous clinical studies have shown some people who smoke, even with a high dental plaque index, did not develop periodontitis. Human gingival fibroblasts (HGFs), one of major cellular components of periodontium, are widely used in vitro studies. Cigarette smoke condensate (CSC) is the particulate matter of cigarette smoke. This project studied the heterogeneity of HGFs to CSC-stimulated collagen degradation and its mechanisms. Methods: HGF cell lines were established from clinical non-inflamed gingival tissues from non-smoker undergoing crown-lengthening surgery. To evaluate the collagen degradation ability of HGFs with CSC, HGFs was seeded in 6-well Type I collagen coated plates and exposed to 100 µg/ml CSC with/without a MMP inhibitor GM6001 (serum free media was used as controls). MMP Antibody Arrays were used to measure multiple MMPs/TIMPs in conditioned media. RT-PCR measured the mRNA levels of multiple MMPs/TIMPs. Analysis of variance (ANOVA) was used to analyze data. Results: HGFs from 25 non-smoking patients were included. CSC increased collagen degradation in 12 HGFs (CSC-susceptible, 5 female and 7 male), but not in 13 HGFs (CSC-non-susceptible). GM6001 inhibited the CSC-stimulated collagen degradation. MMP antibody arrays showed that at the protein level, CSC increased MMP-1 (1.4 fold p=0.02) and MMP-3 (5.7 folds, p<0.002), and decreased MMP-10 (0.6 fold, p=0.001) in CSC-susceptible HGFs. However, CSC decreased MMP-10 (0.7 fold, p<0.001) and TIMP-1 (0.1 fold, p=0.02), in CSC-non-susceptible HGFs. When susceptible HGFs were compared to non-susceptible HGFs, increased MMP-1 (1.5 fold, p=0.04), MMP-3 (5.3 folds, p=0.03), and TIMP-2 (1.2 fold, p=0.04) in susceptible HGFs noted. At the mRNA level, CSC increased the mRNA levels of MMP-1 (1.6 fold, p=0.001), MMP-2 (1.2 fold, p=0.03), MMP-3 (1.7 fold, p=0.002), MMP-14 (1.7 fold, p=0.01), TIMP-1 (1.2 fold, p=0.03), and TIMP-2 (1.1 fold, p=0.02) in CSC-susceptible HGFs. However, the mRNA expression of MMPs/TIMPs basically didn't change in CSC-non-susceptible HGFs, except for MMP-3

(increase 1.4 fold, $p=0.02$) and TIMP-1 (increase 1.2 fold, $p=0.04$). When susceptible HGFs were compared to non-susceptible HGFs, increased MMP-1(1.6 fold, $p=0.02$), MMP-2(1.2 fold, $p=0.03$), MMP-3(1.1 fold, $p=0.04$), and MMP-14(1.5 fold, $p=0.03$) in susceptible HGFs noted. Conclusions: Heterogeneity of HGFs existed in regard to the CSC-stimulated collagen degradation and the altered expression of MMPs/TIMPs may be responsible in part for this heterogeneity. (Indiana University-Purdue University Indianapolis IRB #1203008161)

PROSTHODONTICS

P54 Replica Implant Proof-of-Concept Study. P.S. WULFF*, A.G. FARMAN, W.C. SCARF, T.J. GORNET, G.E. GRAF, L. GETTLEMAN (University of Louisville School of Dentistry)

Objectives: Determine the feasibility of making a replica implant of a periodontal ligament-attached (not osseointegrated) tooth using current technology, in fresh hog mandibles and later humans. Clinical indications a) vertical cracks and horizontal tooth fractures, b) deep caries; c) coronal caries under reusable fixed prostheses; d) root or chamber perforations; e) tooth resorption; f) endodontic failures; and/or. g) lower cost alternative to endodontic treatment of the tooth, post reinforcement and crown. **Methods:** Cone beam computerized tomographic files of individual teeth were generated from a hog mandible using an iCAT 17-19 machine. Using 3DSlicer, a digital file of the lower right second deciduous premolar was generated, blocking out the pulp chamber and manually selecting the contrast level at the exterior of the tooth. The DICOM file was converted to an STL file for replication in an additive manufacturing process in the Rapid Prototyping Center using High Temperature Selective Laser Sintering to generate Nylon 12 replicas of the entire tooth. Futures replicas may be made in metals (CoCrMo, Ti, Ti6Al4V) or ceramics. The tooth was then extracted from the hog mandible and the replica tooth immediately implanted, similar to an avulsed tooth. To confirm, thin sections of the bone/replica tooth were prepared and ground sections observed for soundness of fit. **Results:** After troubleshooting digital file compatibility and precision/accuracy of the CBCT image, the replica was successfully prototyped and implanted. Conclusion: Prototyping replica implant from CBCT was successful. After prototyping a replica implant tooth from Nylon 12, more studies will address the accuracy of this replica implant versus the tooth being replaced. The digital process should be automated. Before clinical trials, animal studies are needed to determine biocompatibility of the replica implant, verified by histological examination. Surface modification for connective tissue attachment and cervical membrane placement in animal models to prevent epithelial migration around the replica implant should be explored.

SALIVARY RESEARCH

P55 Evidence Based Research on Salivary Markers for Type-2 Diabetes Mellitus. A. RABER*, M.L. MEADOWS, M. SRINIVASAN (Indiana University School of Dentistry)

The American Diabetes Association estimates that over 23 million adults and children in the US have diabetes; nearly 95% develop type 2 diabetes mellitus (T2DM). An additional 41 million Americans are believed to be pre-diabetic, according to the American Diabetes Association. The total economic burden of T2DM in the United States is in excess of \$132 billion annually, including \$92 billion in direct medical costs. Dysregulation of many biological pathways precedes the development of overt T2DM characterized by chronic hyperglycemia and reduced β -cell effectiveness. Improvement of risk prediction for T2DM is crucial for identifying high-risk individuals who could benefit from specific preventive measures. Serum proteomic and metabolite profiles suggest significant differences between patients with T2DM and healthy individuals. Proteomic analyses of human saliva show that it possessed greater than 20% of serum proteins and peptides. Several studies have correlated distinct salivary and serum proteins with specific systemic diseases such as cardiovascular diseases, stroke and diabetes. The overall objective of this project is to carry out systematic review of published literature and summarize evidence for T2DM

related salivary biomarkers. The literature search included the following databases: 1) PubMed (1930 to date), using the following words: [salivary (All Fields) OR “saliva” (All Fields)] AND [“proteomics” (MeSH Terms) OR “proteome: (MeSH Terms)] OR [“genomics” (MeSH Terms) OR “genome: (MeSH Terms)] OR [“metabolomics” (MeSH Terms) OR “metabolome: (MeSH Terms)] AND [“diabetes” (All fields) OR “Type-2 diabetes: (all fields) OR Type I diabetes (all fields)]; 2) The Cochrane Oral Health Group’s Trials Register, The Cochrane Central Register of Controlled Trials (CENTRAL) using same search words, 3) ISI Web of Knowledge (1955 to date) using the same search terms and 4) the EMBASE via OVID (1988 to date) with same search terms. Only articles in the English language were selected. Initial search yielded 253 articles in the PUBMED, 102 articles in the Cochrane library, 165 publications in the Web of Knowledge and 52 articles in the EMBASE via OVID databases. Further analysis of the curated data by manual review for the type of study (case control versus cross sectional), correlation between the salivary and serum protein and T2DM disease pathology may advance our utilization of salivary diagnostics as a paramedical diagnostic tool.

TISSUE REGENERATION

P56 Effects of Bioactive Glass Scaffold and BMP-2 in Segmental Defects. W.C. LIU^{1*}, I.S. ROBU¹, M. LEU², M. VALEZ³, T.G. CHU¹ (¹Indiana University School of Dentistry, ²Missouri University of Science and Technology, ³Mo-Sci Corporation)

Reconstruction of segmental defects in the load-bearing area has long been a challenge in orthopedics. In the past, we have demonstrated the feasibility of using a biodegradable load-bearing scaffold fabricated from poly(propylene fumarate)/tricalcium phosphate (PPF/TCP) loaded with bone morphogenetic protein-2 (BMP-2) to successfully induce healing in those defects. However, there is limited osteoconduction observed with the PPF/TCP scaffold itself. Furthermore, a recent review on BMP-2 revealed greater risks in radiculitis, ectopic bone formation, osteolysis, and poor global outcome in association with the use of BMP-2 for spinal fusion. The aim of this study was to evaluate the potential use of a more osteoconductive material - 13-93 bioactive glass as a load-bearing scaffold. We then further investigated the potential side effects of locally delivered BMP-2 on structures of adjacent bones. Tube shaped scaffolds were fabricated from 13-93 glass by indirect selective laser sintering and implanted into a critical size defect created in the right femurs of a rodent model with and without 10 micrograms of BMP-2. The scaffolds and defects were stabilized using a 1.6 mm intramedullary pin. X-ray images of the defects were taken at 3, 6 and 15 weeks post-operatively. Femurs and tibiae of both legs were retrieved at 15 weeks for micro-computed tomography (mCT), quantitative computed tomography (pQCT), biomechanical testing and histological evaluation. The X-ray and micro-CT results showed that bridging callus was found as soon as 3 weeks and progressed gradually in the BMP group while minimal bone formation was observed in the control group. As expected, stiffness, peak load and energy to break of the BMP group were all higher than the control group. Higher healing rates in the 13-93 group was found compared to the healing rate in PPF/TCP group evaluated in the past, indicating a more osteoconductive nature of the 13-93 bioactive glass scaffolds. The scaffolds of both control and BMP groups were partially degraded after 15 weeks as seen in the histological images. For the effects of local BMP-2 delivery to adjacent bones, no statistical difference in the bone area, mineral content and mineral density was found between control and BMP groups in the contra lateral femurs and both tibiae. In conclusion, a 13-93 bioactive glass scaffold with local BMP-2 delivery has been demonstrated for its potential application in treating large bone defects. (Indiana University School of Dentistry IACUC #DS0000920)

P57 Characterization of Shilajit separated by 3000 Daltons Cutoff Centriprep. K. SCHNEIDER*, G. BATARSEH, L.J. WINDSOR (Indiana University School of Dentistry)

Shilajit is a traditional medicine used in many countries such as India for thousands of years to treat many diseases including bone and cartilage disorders. Shilajit is a multi-component natural occurring mineral

exudate that is mainly vegetative, although scientific evidence about its composition remains incomplete. However, some of the active components are believed to be dibenzo-alpha-pyrones, fulvic acids, and humic acids. Recent studies have shown that Shilajit has the ability to enhance, but not initiate the chondrogenic process. Thus, Shilajit may possess anabolic cartilage properties. The purpose of this study was to evaluate the effects of Shilajit after being separated by a 3000 Daltons MW cutoff Centriprep on osteoblasts. After separation, the greater than 3000 MW, less than 3000 MW, unprocessed Shilajit, and control samples were evaluated for their effects on osteoblasts. Western blot analyses of conditioned media from osteoblasts treated with the different samples demonstrated that the unprocessed Shilajit decreased the protein expression of matrix metalloproteinase-1 (MMP-1), as did the less than 3000 MW sample. This demonstrated that the activity or activities in Shilajit that is responsible for down regulating MMP-1 has a MW of less than 3000 Daltons. None of the samples affected the protein expression of tissue inhibitor-1 of the MMPs (TIMP-1) or TIMP-2. Additional experiments are ongoing to further separate the active components of Shilajit.

P58 Mechanical Property and Biocompatibility of PLLA Coated DCPD Composite Scaffolds. N. TANATAWEETHUM^{1*}, W.C. LIU², T.G. CHU² (¹Purdue School of Engineering and Technology; ²Indiana University School of Dentistry)

Introductions: Dicalcium phosphate dehydrate (DCPD) cements have been used for bone repair and replacement in clinics due to its excellent biocompatibility and unique advantage over the other calcium phosphate cement system (hydroxyapatite cement), which is the ability to resorb under physiological conditions. However, DCPD cements have some drawbacks related to their low mechanical properties and brittleness. To address these limitations, the addition of sodium citrate as a regulator and polylactic acid (PLLA) as reinforcing agent has been proposed in this study. **Objectives:** 1) To develop composite PLLA/ DCPD scaffolds with enhanced toughness by PLLA coating. 2) To improve mechanical properties of DCPD cements by increasing the powder to liquid ratios and adding sodium citrate as a setting retardant. 3) To examine cell adhesion and proliferation on the scaffolds. 4) To investigate the degradation behaviors of DCPD scaffolds with and without PLLA coating. **Materials and Methods:** DCPD cements were synthesized with a 1:1 ratio of monocalcium phosphate monohydrate and β -tricalcium phosphate. These powders were mixed with water or 100 mM sodium citrate. The specimens were prepared with powder to liquid ratio (P/L) of 1.00, 1.25 and 1.50. The scaffolds were fabricated by the templatecasting method. To fabricate the PLLA/DCPD composite scaffolds, DCPD scaffolds were coated with 5 % PLLA solution. The chemical and mechanical properties of DCPD scaffolds with and without PLLA coating after the in-vitro degradation (day 1, week 1, 4, and 6) were investigated by measuring their porosity, diametral tensile strength, energy to fracture, pH values, and weight loss. In addition, cell adhesion and proliferation on these scaffolds were examined by scanning electron microscopy. **Results:** the addition of sodium citrate and the infiltration of PLLA significantly increased the mechanical properties of DCPD scaffolds ($p < 0.05$). The range of diametral tensile strength was 0.50-2.70 MPa and the range of energy to fracture was 0.80 to 9.90 N-mm. The most effective improvement of tensile strength and energy to fracture was achieved with P/L of 1.50. Moreover, incorporating PLLA to DCPD scaffolds slowed down the weight loss in the vitro degradation. **Conclusion:** a combination of template-casting and polymer impregnation methods can be applied to fabricate a cement/polymer biodegradable scaffold for bone tissue regeneration with significantly slow down degradation and excellent biocompatibility.

TOBACCO RESEARCH

- P59 Gender Differences: Smokers With and Without Substance Abuse History.** S. BENNETT^{1*}, A. CHRISTEN^{1,2}, L.M. ROMITO¹ (¹Indiana University School of Dentistry, ²Fairbanks Addiction Hospital, Indianapolis)

Previous research suggests that individuals with a chemical dependence history experience a higher intensity of nicotine addiction, and during smoking cessation they may be more likely to demonstrate an increase in negative affect and unfavorable scores on psychometric assessments compared to smokers without a substance abuse history. It is unknown how men and women may be different in their susceptibilities to such undesirable outcomes. From 1992-2004, The Indiana University Nicotine Dependence Program (IUNDP) treated over 1200 patients using a Mayo Clinic-based protocol which assesses the behavioral, social, and physiological aspects of nicotine dependence. Subsequently, the IUNDP was instituted at Fairbanks Hospital's addictions treatment center to address tobacco use among the patients and staff. Charts of individuals who completed nicotine dependence treatment (1992-2011) were selected from IU School of Dentistry and Fairbanks Hospital for retrospective analysis. Inclusion criteria for chart selection consisted of the availability of complete pre-and post quit measures for a minimum of four total appointments, and two post-quit appointments. Reviewed were 107 charts from patients without a history of chemical dependence (ND) and 123 from those with a chemical dependence history (CD); these included 120 men and 110 women. Student researchers, trained to a standardized protocol, captured 16 tobacco use and demographic variables, and 12 post-quit treatment measures. Comparisons between CD and ND groups were made using Pearson chi-square tests for binary data, Wilcoxon rank sum tests for all other data, and Wilcoxon signed rank tests for changes between time periods. Compared to the ND group, smokers in the CD group were more likely to be male. CD males exhibited sharply increased average withdrawal at the end of treatment, particularly in nicotine craving and increased appetite, and had significantly increased negative mood throughout the course of treatment ($p < 0.05$). Males were more likely to experience adverse events with NRT. Females had increased scores relating to psychological dependence on addiction-related sensorimotor manipulation. Despite similarities among smokers within CD and ND groups, males and females appear to face distinct challenges. Results suggest that CD males are significantly more negative in mood, and may be more likely to have increased withdrawal symptoms at the end of treatment. Females may have increased propensity for psychological dependence. Both CD males and females experienced more increased appetite than their ND counterparts. (Indiana University-Purdue University Indianapolis IRB # 1109006701)

- P60 Analysis of 871 Antique Postcards (1901-1934) Portraying Children Smoking Tobacco.** A. CHRISTEN^{1,2*}, J. CHRISTEN² (¹Indiana University School of Dentistry, ²Fairbanks Addiction Hospital, Indianapolis)

Americans first discovered picture postcards during the Columbian Exposition in Chicago in 1893. By 1905, postcard use and collection became a popular activity, both in North America and in Europe. Before World War I, millions of German and English postcards covering a wide variety of topics, were shipped annually to the U.S. Although societal injunctions against children using tobacco were strong during the early 20th century, one relatively puzzling and common theme portrayed in antique novelty postcards, regardless of the country, was the depiction of pipe, cigarette or cigar smoking by children in a wide variety of winsome, "cutesy" poses. The authors have accumulated 871 different, world-wide commercial, child-focused, tobacco-related novelty postcards issued from 1901-1934. The purpose of this study was to provide an initial and preliminary socio-cultural analysis of these antique postcards depicting childhood tobacco use of yesteryear which may lead to a further understanding of the plentiful, youthful smoking behaviors of today. In fact, almost all of today's current adult smokers first experimented with tobacco prior to age 18, often by age 9. Sixty percent of this collection are actual photographs and 40% are drawings. These cards, printed in 25 countries are listed here by production percentage: Germany

(23.7%); United States (17.1%); France (15.9%); England (15.7%); Holland and Belgium (4.8%); Sweden (4.2%); Italy (3.5%); Austria (2.9%); Switzerland (1.3%); Algeria, Canada, Ceylon, Czechoslovakia, Denmark, Finland, Philippines, Poland, Portugal, Russia, South Africa, Spain, Tunisia, Turkey and Yugoslavia each produced less than 1 percent. The heaviest production years were 1905-1912 when 50% of these cards were printed. Of this sample, 76% of the cards showed boys smoking and 24% were girls. The children were using the following forms of tobacco: pipe (43.7%); cigarettes (40.6%); and cigars (15.6%). Only 6.7% of the children were portrayed as being sick or miserable as a result of their smoking activity. Many of this sample showed infants, toddlers or preschoolers smoking. Often, boys or girls were expertly mimicking the smoking behavior of adults.

P61 Puffing Topography and Bonding Behaviors: Recovering Addicts Versus General Smokers.
R.A. HOFFMAN*, P.O. KUNKEL, L.M. ROMITO, A.G. CHRISTEN (Indiana University School of Dentistry and Fairbanks Addiction Hospital, Indianapolis, Indiana)

Smokers can inherently manipulate nicotine doses on a puff-by-puff basis. The character of smoking behavior may be determined by using complex forms of smoking topography in laboratory settings or by unobtrusively observing the time spent smoking a single cigarette, the number of puffs taken, interpuff intervals and smokers' behaviors. The purpose of this study was to observe and compare smoking topography and interpersonal bonding behaviors of a group of recovering drug addicts to that of a group of general smokers in a natural setting. Following a variable chemical substance detox/treatment period, Fairbanks addiction treatment patients spend 3-12 weeks in follow-up treatment in two groups: Partial Hospitalized Patients (PHP) and Intensive Outpatients (IOP). PHP and IOP form tight interpersonal bonds and friendships with each other. Patients are periodically released and they meet and smoke together at an approved outdoor smoking area. From a distance, PHP and IOP (20 men and 20 women) cigarette puffing behaviors were unobtrusively observed and recorded. Two calibrated investigators, using a stop watch monitored the exact time of lighting and the extinguishing of each cigarette. For each subject, the number of puffs taken was recorded and the interpuff interval was calculated. The same protocol was followed for a population of general smokers observed on the campus of Indiana University Purdue University in Indianapolis (IUPUI). The mean interpuff intervals were IUPUI men: 25.2 seconds (SD 11.93); IUPUI women: 30.9 seconds (SD 16.0); Fairbanks men: 16.2 seconds (SD 6.21); and Fairbanks women: 21.1 seconds (SD 6.51). There was a statistically significant difference in interpuff intervals between the general smokers and the recovering addicts ($p < 0.001$) and this effect was not dependent upon gender. Behavioral observations between general smokers versus recovering addicts will be presented. Smokers who were recovering from chemical drug addiction smoked more intensely than the general smoking population and their smoking behaviors were often quite different. (Indiana University-Purdue University Indianapolis IRB # #1110007208.)

P62 Mechanisms of Attachment of Tobacco-Treated *Streptococcus mutans* to Human Endothelial Cells. A.R. MILLER*, L.J. WINDSOR, F. SONG, R.L. GREGORY (Indiana University School of Dentistry)

Smoking has been proven to cause increased dental caries, which is an infectious disease caused by *Streptococcus mutans* (*S. mutans*), a gram-positive bacteria commonly found in the oral cavity. *S. mutans* is also known for its contribution to atherosclerosis, specifically the accumulation of plaque in the coronary arteries. This is facilitated by the interaction and binding of *S. mutans* to local endothelial cells (HUVEC). This study was conducted to explore the direct effects that tobacco has on the ability of *S. mutans* to affect endothelial cells that might lead to atherosclerosis. *S. mutans* were treated with different concentrations of nicotine and cigarette smoke condensate (CSC) to test if they affect the binding capabilities of *S. mutans* to endothelial cells. Blocking reagents, enolase antibody and purified DnaK, were also used to treat the HUVEC to observe the effects these reagents have on the ability of *S. mutans* to bind to the cells. Binding was measured by performing a binding assay that incorporated these reagents

and reading the absorbance using a spectrophotometer at 450 nm. To do this, sonicated HUVEC were added to a 96-well microtiter plate with 1% bovine serum albumin (BSA), followed by treated *S. mutans*, extra-avidin labeled horseradish peroxidase, and O-phenylenediamine (OPD). The experiment is still in progress; therefore, no results have been obtained thus far. However, it is expected that the nicotine/CSC treatment of *S. mutans* will increase binding to the endothelial cells thereby providing a possible mechanism of *S. mutans* contributing to atherosclerosis. The knowledge obtained from this experiment will be significant in developing treatment modalities to decrease the effects of smoking on cardiovascular disease.

P63 Effects of Milk and Tobacco on *Streptococcus mutans* Biofilm Formation and Metabolic Activity. A. O'NEILL*, R. HUANG, R.L. GREGORY (Indiana University School of Dentistry/James Whitcomb Riley Hospital for Children)

This study investigated the association of nicotine on *Streptococcus mutans* (*S. mutans*) with and without the addition of cow's milk. The study was designed to determine if milk is effective in neutralizing the detrimental effects of tobacco's cariogenic effect. This study investigated the effects of cow's milk, nicotine and the association of nicotine and cow's milk on *S. mutans* biofilm formation and on its metabolic activity. A 24 hour culture of *S. mutans* was treated with various concentrations of nicotine, milk, and nicotine with 1:4 milk. The culture was grown in sterile 96-well flat bottom microtiter plates. The minimum biofilm inhibitory concentration was determined for all three test treatments. To test for biofilm formation, the *S. mutans* was cultured with and without the test treatments, washed, fixed, and stained with crystal violet. The absorbance was read to evaluate biofilm growth. Biofilm metabolic activity was measured based on biofilm having the ability to reduce XTT to a water-soluble orange compound. This allows calculating the ratio of specific biofilm metabolic activity. For the biofilm formation, nicotine was found to increase with increasing concentration until the minimum bactericidal concentration was reached. The addition of milk was found to decrease biofilm formation. The combination of 1:4 milk and nicotine demonstrated a decrease in biofilm formation that was less than the control. For the metabolic activity of the nicotine, concentrations were found to have an increasing metabolic activity with increasing concentrations. The metabolic activity when milk was added had a decrease in metabolic activity for all concentrations. The combination of 1:4 milk and nicotine indicated a decrease in metabolic activity, but higher concentrations of nicotine overcame the inhibitory effect of the milk. The addition of milk into the diet of someone who is electing to use nicotine products may decrease the deleterious effect of the increase in biofilm and metabolic activity of *S. mutans*. Also those that are exposed to second hand smoke that do not have a choice will be able to supplement their diet with milk to counteract the effect of the nicotine.

P64 Assessment of Tobacco Dependence Education in Indiana Dental Assisting Curricula. E. SVETANOFF*, P. FORD, L.M. ROMITO (Butler University, Indiana University School of Dentistry).

Tobacco use remains the leading cause of preventable morbidity and mortality and has numerous adverse oral effects. Tobacco interventions delivered in a team approach within dental settings can be effective. Therefore, tobacco dependence education (TDE) should be an integral part of all oral health professionals' education. Research exists on TDE in dental and dental hygiene curricula; however, little attention has been given to dental assisting (DA) programs. This study was conducted to assess the level of TDE in the curricula of accredited Indiana DA programs. A 51-item survey was sent to the directors of all 12 Indiana programs. Nine programs returned completed surveys for a 75% response rate. Curricular content, minutes spent on each topic, existing level of clinical competence measured, expected level of clinical competence, and resources used were assessed. The topic "oral tobacco-related disease" was covered by all 9 programs; least covered topics were: "5As/5Rs" (3 programs), "developing a comprehensive intervention for dental practice" (3 programs), and "strategies for community-based

tobacco control” (0 programs). Responses for items regarding clinical competency assessment indicated 4 programs formally assessed whether a student asked patients about tobacco use; however, no program reported having a formal competency utilizing all of the U.S. Public Health Service’s Clinical Practice Guideline 5 As/ 5 Rs, and 6 did not assess this at all. Six programs reported that they did not assess stages of change either formally or informally; the remaining programs only did so informally. Brief Motivational Interviewing was formally assessed in 3 programs. Five programs incorporated TDE into several courses; for 3 programs all TDE was provided via 1 course. Two programs indicated that some or all TDE was in case study format and 1 program indicated TDE was only provided in clinic seminar/clinic. Four programs reported expecting their graduates to be competent in a moderate level of intervention that included all 5 As. Compared to results from a similar study of U.S. dental hygiene program curricula, only the content area “oral diseases related to tobacco use” was covered more often by the Indiana DA programs. Indiana dental assisting graduates have a less intensive education in tobacco dependence and cessation. Compared to dental hygiene programs, Indiana dental assisting programs are less likely to formally assess clinical competence in TDE. (Indiana University-Purdue University Indianapolis IRB # 1201007832)

Clinical Case Reports

DENTAL HYGIENE

CC1 Risk Factors in Providing Non-Surgical Periodontal Therapy for a Patient. L. AULT*, S. WELAGE, L.L. COAN (Indiana University School of Dentistry)

The objective of this clinical case is to: evaluate the risk factors contributing to the patient’s periodontal and dental disease; deliver individualized care based on risk factors; provide non-surgical periodontal therapy; and re-evaluate the outcomes of the provided treatments. Assessment: The patient presented with generalized, moderate, plaque-induced, marginal and papillary gingivitis evidenced by dark pink, bulbous, rolled, spongy, fibrotic gingival tissue and a bleeding score of 52%. Generalized chronic periodontitis was present and FMXR revealed 2-5mm bone levels from the crest of the CEJ. Generalized, moderate, supra/sub-gingival and interproximal calculus and a 99% plaque score were recorded. Dental history revealed multiple restorations and newly- diagnosed caries. Caries risk was high. Contributing risk factors included: poor oral hygiene; frequent drinking of Mountain Dew; intake of fermentable carbohydrates, and a 20 pack-year history of tobacco use resulting in her current oral health status. Periodontal and caries disease processes were discussed with the patient who reported comprehension and gave informed consent for the proposed Dental Hygiene treatment plan. Treatment: OHI, dietary analysis and personalized recommendations, scaling and root planing and a periodontal tissue re-evaluation were completed. Although tobacco cessation was recommended the patient reported having no interest in discussing quitting and didn’t want to consider counseling. Evaluation: Periodontal evaluation revealed improvement in gingival status that was clinically apparent by a reduction of gingivitis from generalized moderate to generalized mild, plaque-induced: marginal gingivitis. The generalized, chronic periodontitis showed clinical improvement in 32% of the probing depths by 1-2mm. The bleeding score reduced 28% from the initial exam. Progress was also made in the plaque score (decreased 33%). Besides reduction in PS, bleeding and probing depths, the patient showed improved home care, and reduced intake of fermentable carbohydrates. However, the patient is still considered a high caries risk, primarily: due to continued consumption of Mountain Dew. Further, she has no interest in quitting tobacco at this point. Conclusion: Developing a care plan based on risk factors assures the practitioner will address the most important contributions to the disease processes and can result in improvement in overall oral health.

CC2 The Impact of Dental Hygiene Care on Patient's Self-Healing Philosophy. M. BONILLA*, S. BURKS, S. PHILLIPS (Indiana School of Dentistry)

Objective: The objective of this clinical case report is to describe how a patient's beliefs of self-healing were addressed during the delivery of comprehensive, non-surgical periodontal therapy provided by a dental hygiene student. **Assessment:** A 79 year-old Caucasian male patient presented with a chief complaint of "a cleaning and oral exam." The patient reported no dental care for over 20 years. He believed his health was maintained through positive thinking and self-healing. Review of medical history revealed a previous history of cancer, high cholesterol and heart attacks. The patient's caries risk was high. He reported brushing four-to-five times a day and flossed four times a week. Clinical examination revealed generalized, severe periodontal disease with probing depths ranging from 3-10 mm and clinical attachment levels (CAL) ranging from 4-12 mm. Patient also presented with generalized, severe, diffuse, plaque-induced gingivitis. Radiographs revealed generalized mild and localized moderate bone loss. **DH Care Plan:** Four quadrants of scaling and root planing (SRP), with extensive oral hygiene instructions that included education on the progression of periodontal disease generally and in his mouth as well as the role of plaque biofilm in this process. **Evaluation:** Periodontal re-evaluation revealed CAL measurements which improved from 7-12 mm to 7-8 mm. The plaque score decreased over the course of treatment. The patient was referred to the Comprehensive Care Clinic for tooth extractions. The SRP resulted in improvement of gingival health from severe to mild gingivitis levels, but only minimal changes in probing depths occurred. Behavioral changes and conversations with the patient indicated that he no longer relies solely on the philosophy of self-healing and is now demonstrating proactive health behaviors including compliance with recommended regular home care procedures which have resulted in improved gingival health. Conclusion: Post-therapy evaluation shows improvement of the patient's periodontal health. He now realizes that dental care is necessary to improve his oral health. Through oral health education and the healing achieved by non- surgical periodontal therapy the patient was able to see that self-healing alone was not the primary factor involved in his oral health status.

CC3 Overcoming Cultural Beliefs of Oral Health through Hygiene Care. A. BROWN*, C. NORTON, A. RIECK (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to evaluate the success of non-surgical periodontal therapy and oral hygiene instruction by a dental hygiene student on a patient whose cultural upbringing did not value routine oral care. **Assessment:** A 39 year-old male, Chinese patient reported to the DH Clinic with a chief complaint of "I want to have my third molars extracted, and I have a problem with grinding". The patient reported having only one previous dental care experience in his life, which was over seven years ago. He attributed this neglect to limited value and access to dental care. His medical history was negative. The patient reported brushing twice daily and rarely flossed. Clinical examination revealed generalized, heavy, supragingival and subgingival calculus, strong evidence of generalized tetracycline staining, and probing depths ranging from 1-8 mm. Patient presented with generalized, mild, plaque-induced diffuse gingivitis and localized, moderate, plaque-induced gingivitis. Radiographs revealed generalized, heavy calculus deposits, and localized, moderate bone loss. **Dental Hygiene Care Plan:** Four quadrants of scaling and root planing (SRP), with extensive oral hygiene instructions and periodontal re-evaluation were planned. Concurrently, the patient was referred to and treated by a pre-doctoral dental student for extractions, restorations and occlusal mouthguard due to extensive tooth wear. **DH Treatment:** Included four quadrants of SC/RP using hand instruments and ultrasonic scaler with local anesthesia. **Evaluation:** Eight-week post-therapy periodontal re-evaluation revealed periodontal healing with a 44% reduction in bleeding points, generalized healthy gingival appearance, and 1-2 mm. generalized improvement in probing depths. New deposits of slight supragingival calculus were noted in localized areas. Consistent improvement was visible at each visit during the four months of active treatment. Conclusion: Non-surgical periodontal treatment along with compliance in developing effective home care habits resulted in visibly-improved periodontal health.

These outcomes motivated the patient to continue with treatment and gave the patient a better understanding of the importance of regular care.

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CC5 Brief Tobacco Intervention: Implementing the Dental Hygiene Process of Care. L. CLARK*, L. LANEY, M. MEADOWS (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to educate dental healthcare providers about the importance and implementation of brief tobacco interventions with patients who use tobacco. Background: A 35 year-old male presented to the DH clinic for a prophylaxis and exam. Patient’s primary concern was “fear of losing my teeth.” Patient reported no dental care for three years and was aware that smoking can cause tooth loss. Medical history was positive for past illicit drug use, the pulse rate was of 104 bpm and the BP was 138/88 mmHg RAS, placing him in the pre-hypertensive range. No medications were reported. Patient reported smoking 1 ½ packs of cigarettes per day for 20 years and occasionally uses chewing tobacco. Assessment: Intra-oral examination revealed generalized, moderate, marginal gingivitis as evidenced by red margins with spongy, rolled edges. Attached gingiva appeared generally pale pink, with areas of paler, almost white striations. Generalized 4-5 mm probing depths were recorded; however, radiographic bone levels appeared healthy (1-2 mm from CEJ to bone). Slight loss of crestal lamina dura was noted bilaterally in the maxillary posterior and radiographic calculus was evident. A 6 mm round patch of leukoplakia was noted on the patient’s lower left vestibular tissues, consistent with spit tobacco use. There was generalized plaque (39%), but only five bleeding points. Generalized heavy nicotine stain was noted throughout the dentition. DH Treatment Plan: Oral hygiene instruction (OHI), tobacco intervention, scaling and prophylaxis, topical fluoride and a dental exam were planned. OHI focused on sulcular brushing and c-shaped flossing. A brief tobacco intervention utilizing the principles of Motivational Interviewing was provided. Results: Patient tolerated treatment well, was attentive and

demonstrated oral hygiene techniques successfully after instruction. Patient was interested in tobacco cessation, but was not ready to set a quit date. He was provided tobacco cessation materials and consented to follow-up conversations about cessation at the next four month recall. Dental exam revealed no restorative treatment needs and the oral cancer exam was negative. Conclusions: Research reveals higher tobacco quit rates when healthcare providers repeatedly advise patients about tobacco cessation. In this particular case, the patient expressed concern about his tobacco use and is considering quitting in the future. Although a single, brief intervention may not result in tobacco cessation; discussing its benefits, providing tangible educational materials and following up at subsequent recall appointments greatly improves the chance at a successful quit attempt.

CC6 Can This Unmotivated Patient be Motivated to Improve Oral Hygiene? M. CLARK*, J. RICE, L. MAXWELL (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to evaluate oral hygiene compliance and motivation on a disinterested and unmotivated patient. Assessment: : A 53 year old African-American male patient presented to DH clinic stating he had not received dental care in ten years. His chief complaint was “I need to get my teeth cleaned.” His medical history included: hypertension, hyperlipidemia, obstructive sleep apnea, and environmental allergies. He presented with moderate, plaque-induced, marginal and papillary gingivitis as evidenced by red, rolled, blunted and spongy gingiva and generalized heavy calculus. He also presented with macroglossia and gagged easily. The patient admitted to brushing, flossing and using a mouth rinse only once a week. When asked why he did not perform routine oral hygiene more frequently, he stated that he simply didn’t have time. DH Care Plan: Radiographs, adult prophylaxis, oral hygiene instructions at every visit, and periodontal tissue re-evaluation. Treatment: The patient’s first plaque score (PS) was 87%. Therefore, after oral hygiene instruction, we set a goal for the patient to increase brushing to once daily, use a Reach flosser every other day, and use Listerine® once daily. The second PS, at his next appointment, was 83%. The care plan goals were not met, as the patient admitted to only brushing twice a week after his initial appointment. We again discussed the importance of daily brushing for optimal oral hygiene. I used co-diagnosis techniques to improve his compliance toward incorporating brushing into his daily routine. He decided that he would try to brush once a day, after he came home from work. The third PS was 77% and our goal of brushing once a day was still not met. Evaluation: Periodontal tissue re-evaluation showed healthier gingiva. The PS at this visit was 66%; however reduction in PS could have been attributed to debridement and not oral hygiene instructions. His oral hygiene had improved to brushing three times per week. The patient was once again educated and instructed on proper technique and we reset a goal to brush once a day by the next recall appointment. The patient was put on a three month recall. Conclusion: In spite of repeated efforts, patient was not motivated to perform daily oral hygiene care and did not meet the established treatment goals.

CC7 Treatment Planning and Care Management of a Special Needs Patient. K. FISH*, A. KELTZ, T. BEATY (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to demonstrate adaptations for dental hygiene care delivery for a special needs patient with intellectual and developmental disabilities. Assessment: Forty-nine year-old, male patient presented with a history of Type II diabetes, hyperlipidemia, seizures, and undiagnosed intellectual and developmental disabilities. Patient presented with child-like conversation, lack of coordination, and was dependent on his parent for decision making. Patient presented with generalized, heavy plaque and calculus. Clinical examination revealed severe periodontitis and severe plaque-induced gingivitis. Original Treatment Plan: Periodontal referral due to severity of periodontal conditions was indicated and DH care was to include FMX radiographs, comprehensive dental exam, and oral hygiene instruction. Treatment: The patient’s parent, as legal guardian, refused the recommendation for referral so full mouth debridement (4355), adult prophyl (1110), FMX, comprehensive dental exam, and oral hygiene instruction were performed as an alternate DH Care Plan for which consent was

obtained. The parent also consented to a post-debridement evaluation visit. Evaluation: After treatment the patient still had residual and newly-formed bands of calculus. Due to lack of patient home care compliance, definitive periodontal treatment was not practical. Patient and parent were given additional oral hygiene instruction and were advised to use a floss holder and an electric tooth brush. Exam indicated no restorative needs, but periodontal referral was again recommended, but parent declined. Conclusions: Dental health providers need to be creative and logical in developing treatment plans that serve the range of patient's mental, financial, and physical needs while encouraging and promoting home care for special needs patients and care takers.

CC8 Management of a Special Needs Patient with Hopeless Periodontal Prognosis. D. Fleming*, K. Rivers, N.A. Young (Indiana University School of Dentistry)

Objective: The purpose of this clinical case report was to provide an effective treatment plan for a patient with “hopeless” maxillary molars due to severe periodontal conditions. Assessment: A 75 year-old, African American male presented to the Dental Hygiene clinic with an ASA III status including a history of Alzheimer's disease, controlled Type I diabetes, multiple strokes, and a heart attack. Antibiotic premedication was recommended by his physician. Patient history and consent were completed in consultation with his spouse, due to his impaired memory. Oral hygiene does not take priority in routine daily care. This factor, in addition to systemic diseases and extended recall periods, has led to severe bone loss. Clinical examination revealed generalized, mild, plaque-induced gingivitis with localized areas of moderate gingivitis, and moderate to severe periodontitis. Significant clinical attachment levels and furcation involvement were noted. DH Treatment Plan: An in-depth periodontal maintenance and exam were planned. Normally, this patient's conditions would not be consistent with periodontal maintenance treatment, but this treatment was deemed most appropriate due to special circumstances. The benefits of SRP or a periodontal referral did not seem beneficial with “hopeless” teeth. Treatment: During Fall 2012, the patient underwent a periodontal maintenance appointment and periodic oral evaluation, along with oral hygiene instruction, and fluoride varnish. Evaluation: The patient's recall was delayed in Spring 2013, due to rehab. A discussion took place with the patient and his wife concerning the need for a 3 month recall as opposed to his usual 6 month recall, due to the unstable periodontal conditions and calculus accumulation. Agreement resulted in the continuation of involved periodontal maintenance treatment at a 4 month recall, in hopes of maintaining the molars as long as possible. Conclusion: Although our ideal goals are to provide comprehensive and optimal treatment to all patients, clinicians must adopt more realistic goals for those patients for whom treatment goals are not practical or attainable.

CC9 What You Should Know About Treating Cancer Patients Undergoing Chemotherapy. A. LANE*, J. MCCLURE, N.A. YOUNG (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is describe dental hygiene treatment of a patient undergoing chemotherapy and to educate dental professionals regarding evidence-based approaches to management of dental patients undergoing chemotherapy. The patient has been undergoing chemotherapy for nineteen months and will continue chemotherapy treatments for the rest of her life. This patient had a positive attitude and a clear understanding of the importance of routine dental care before, during and after chemotherapy. Special treatment considerations included: obtaining a medical consult and need for pre-medication, patient interview questions, screening of oral conditions that present as side effects from chemotherapy, and development of a customized oral hygiene routine. Assessment: A 76 year-old female presented with a chief complaint of “prophy and exam”. The patient's medical history was positive with a diagnosis of lung cancer and was undergoing chemotherapy treatments including immunosuppressive therapy at the time of dental care. A medical consultation was processed and returned by her oncologist. Research indicates that 40% of patients receiving chemotherapy may have oral complications. Therefore, it is imperative that clinicians perform a comprehensive intraoral examination and provide thorough oral hygiene instructions. This patient complained of xerostomia but did not present with any other common

complications related to chemotherapy. She was considered a high caries risk patient due to a plaque score of over 50%, recent restorations and signs of xerostomia. Care Plan: The dentist approved the plan for a dental prophylaxis and periodic oral examination for this patient with an emphasis on oral hygiene instruction. Informed consent was obtained by the patient to continue treatment as planned. Treatment and Evaluation: Preventive maintenance (prophylaxis) and a periodic exam were completed and the patient tolerated all treatments well. She was instructed on proper oral hygiene technique and educated about the importance of routine dental care at home and in the office. Conclusion: It is important that both dental professionals and cancer patients understand the importance and benefits of good oral hygiene. Dental professionals play a key role in helping clients with cancer understand that good oral hygiene care prevents or reduces oral complications, which in turn improves client's quality of life and the likelihood that they will be able to tolerate optimal doses of cancer treatment.

CC10 Non-Surgical Periodontal Therapy on a Patient with HIV who Smokes. L. MAI*, V. MCQUEEN, T. WEST (Indiana University School of Dentistry)

Objective: The purpose of this case presentation is to evaluate clinical outcomes of non-surgical periodontal therapy in a patient with underlying medical and behavioral complications. Background Information: A 43 year-old, HIV-positive, African-American male patient presented to the Dental Hygiene Clinic for treatment in 2012. Sixteen months earlier, the Graduate Periodontics Department had evaluated the patient's periodontal status and planned osseous surgery for the lower right quadrant and indicating vertical defects on teeth 27, 29, 30, and 31. The patient had not followed through with this treatment recommendation and now presented with several teeth with hopeless prognosis, including #'s 29-31. Due to acute pain, he was referred immediately for extraction of abscessed tooth #31 prior to beginning dental hygiene non-surgical periodontal treatment. Four months later, the patient returned to begin dental hygiene treatment. Assessment: Patient presented with moderate, diffuse, plaque-induced gingivitis, with red, blunted, soft gingiva and eight bleeding sites. Generalized severe chronic periodontitis was present, as evidenced by 4-12 mm. clinical attachment levels, and radiographic bone levels 4-9 millimeters apical to CEJ. The initial plaque score was 43%. The patient had been a 23-pack-year user of menthol cigarettes and his alcohol dependence AUDIT score was 17. Dental Hygiene Care Plan: Four quadrants of scaling and root planing followed by a periodontal re-evaluation, fluoride varnish application, oral hygiene instruction to include use of oral irrigator, tobacco cessation and behavioral counseling, and referral to Graduate Periodontics for comprehensive evaluation. All proposed treatment was provided. Evaluation: Post-treatment re-evaluation revealed improvement in gingival health evidenced by a 25% reduction in bleeding. A 65% reduction in plaque score and significant improvement in the frequency of brushing and flossing contributed to the improvement of gingival tissues, which appeared pink, knife-edged and firm. Periodontal probing revealed 1-3 mm. decreased probing depths in all teeth except #'s 2, 13, 27, and 29. The patient was referred to Comprehensive Care Clinic for evaluation and restorative treatment for a carious lesion on tooth number 29. Although the patient was referred to the Graduate Periodontics Department for more definitive periodontal therapy, he declined. Two weeks following tobacco cessation counseling, the patient reported quitting. Conclusion: Providing non-surgical periodontal therapy, even under adverse behavioral and systemic conditions, can result in improvement, especially when performed in conjunction with behavioral modification and patient compliance.

CC11 Treating a Patient with Unilateral Parotidectomy and Facial Nerve Resection. J. MULLEN*, H. ODEN, P. RETTIG (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to evaluate the outcomes of nonsurgical periodontal therapy in the upper left quadrant of a patient with ipsilateral facial paralysis. Assessment: A 75 year old male presented to the IUSD Dental Hygiene Clinic with a chief complaint of needing a "cleaning" and exam. His medical history revealed a diagnosis of squamous cell carcinoma anterior to his

left ear in 2004, with subsequent removal of his left parotid gland, facial nerve, and proximate lymph nodes. The patient also received head and neck radiation therapy. The patient reported total loss of sensation and muscle control on the left side of his face, and has had no dental care for eight years. Clinical examination revealed localized mild-to-moderate periodontitis with six out of the seven total involved teeth located on the patient's left side, having clinical attachments levels of 2-7mm. Localized mild gingivitis was also noted along the left molars. Multiple sites presented with active decay, and hard deposits were more prominent on the patient's left side of the mouth. DH Care Plan: Patient received scaling and root planning in the upper left quadrant with tissue re-evaluation four weeks later. Oral hygiene was assessed and reviewed at each appointment, with efforts focused on effective care of the patient's left side. Evaluation: The patient's soft tissues exhibited generalized improvement at the tissue re-evaluation, with healthy contour and consistency noted in previously inflamed areas on the left side. Plaque reduction was noted as well, and the patient reported trying to incorporate the suggested brushing and flossing techniques into his routine; however, he expressed continued difficulty with the left side due to lack of tactile sensation and inability to retract the cheek. Only mild improvements in clinical attachment levels were observed on the buccal aspect, and the lingual clinical attachment levels remained the same or worsened by 1-2mm. Re-accumulation of calculus was detected on the left molars and required debridement. Conclusions: The nonsurgical periodontal therapy proved helpful, and the patient was placed on a three-month recall to be seen again in the Dental Hygiene Clinic for further evaluation. At the recall appointment, referral to the graduate periodontics department may be indicated if the patient appears to have active periodontal disease. The patient was referred to comprehensive care to address restorative needs.

CC12 Result of Poor Oral Hygiene in a Young Adult. C. Murdock*, N. Cleverly, P. Rettig (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to establish the strong relationship between effective home care, maintaining necessary recall visits, and their effects on oral health. Assessment: A 24 year old Caucasian, male patient presented to the Dental Hygiene Clinic with the chief complaint of "I have not had a dental cleaning since I was a small child and I'm in need of restorative work as well." The medical history was negative. Clinical examination revealed generalized moderate to severe gingivitis, generalized mild to moderate periodontitis, generalized demineralization and decay, poor oral hygiene, and poor nutritional habits. DH Treatment Plan: Four quadrants of scaling and root planing with local anesthesia, intensive oral hygiene instruction, and a periodontal re-evaluation following treatment. Treatment: Completed dental hygiene treatment plan as recommended and additional restorative treatment was performed by a dental student. Prior to treatment the patient did not value well maintained oral home care and routine professional cleanings. After treatment was complete, the patient acknowledged the importance of professional routine cleanings for overall health. Evaluation: At the periodontal re-evaluation, the patient presented with generalized improvement of gingival and periodontal conditions. Gingival inflammation and bleeding decreased significantly. There was also a generalized improvement of 1-2 mm in probing depths. Conclusions: Although there were vast improvements overall, the patients poor oral hygiene habits may have limited the amount of potential healing and his overall future oral health.

CC13 Response to Non-Surgical Periodontal Therapy Following Absence of Periodontal Maintenance. S. PARDIECK*, M. CORRIE, P. RETTIG (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to show the importance of regular dental care in a patient with periodontal disease. Background: A 60 year-old Caucasian male with a seven year history of periodontal disease presented to the DH Clinic for periodontal maintenance. He had no periodontal maintenance care in the past four and a half years since his initial periodontal treatment. Review of

medical history revealed a positive medical history for hyperlipidemia and hypertension, which was controlled with medication. He had a positive history of tobacco use over the past seven years, including both cigarettes and smokeless tobacco. Clinical Examination: Hyperkeratosis was visible on the buccal mucosa in the area where the chewing tobacco is held. Additionally, a small, round, raised lesion on the alveolar mucosa on tooth #23 was detected and brought to the dentist's attention. Patient's gingival tissue appeared spongy and inflamed with generalized, red, rolled margins and spontaneous bleeding. Generalized, heavy plaque accumulation was present accompanied by generalized, heavy, hard deposits. Dental Hygiene Care Plan: The patient consented to scaling and root planing with anesthesia in all four quadrants, OHI, and re-appointment for periodontal re-evaluation. Treatment: Four quadrants of scaling and root planing were completed using local anesthesia and Oraqix®. After obtaining a plaque score, extensive oral hygiene instructions were provided at each appointment. Evaluation: The periodontal re-evaluation revealed a reduction in the severity of gingivitis as evidenced by coral pink gingiva, light pink rolled margins, spongy consistency and reduced bleeding upon probing. The periodontium had areas of localized improvements of probing depth reductions of 1-2 mm. Some areas of regression, as evidenced by an increase in probing depths, were also seen. The patient was referred to the Graduate Periodontics Clinic for a complete evaluation regarding his continued active periodontal status. Patient was also placed on a 3-month periodontal maintenance recall. Conclusion: Disregarding periodontal maintenance recall appointments over an extended period of time as well as the continuous use of tobacco, possibly led to unsatisfactory outcomes of initial non-surgical periodontal therapy resulting in a referral to the periodontal department for further evaluation, with the possibility of periodontal surgery.

CC14 Medical History Influences on Dental Hygiene Care. B. PRICE*, M. MULL, P. RETTIG
(Indiana University School of Dentistry)

Objective: The objective for this clinical case report is to evaluate the clinical decision-making related to provision of periodontal dental hygiene care for a geriatric, periodontally-involved patient with a complicated medical history. Assessment: The patient was a 72-year-old male with an extensive and complex medical history including history of asthma, coronary artery bypass graft, hypertension, pulmonary embolism, hyperlipidemia and anticoagulant therapy. The patient was last seen for dental care in 2010, when it was noted that his periodontal disease was progressing. The clinical examination revealed generalized, moderate, plaque-induced marginal gingivitis with dark pink, inflamed and spongy tissues and generalized bleeding upon probing. Generalized chronic periodontitis with 4-6 mm clinical attachment levels and furcation involvement was present in posterior teeth. Dental Hygiene Treatment Plan: Four quadrants of scaling and root planing (SRP), modification of current oral hygiene routine, and a periodontal tissue re-evaluation were completed. The presence of undiagnosed hand tremors was recognized and appropriate modifications for home care were made. Patient's previous hospitalization due to a coronary bypass surgery affected his ability to maintain effective home care. Evaluation: Gingivitis improved from moderate to mild gingivitis and an overall, generalized decrease in bleeding on probing resulted. Probing depths improved generally by one mm, but localized increases in probing depths occurred and were evaluated. Periodontal referral was considered but not deemed necessary by the supervising dentist. Conclusion: In order to provide optimal treatment of an elderly patient with a complicated medical history, dental health care providers must carefully consider appropriate modifications indicated by the patient's health history as well as current health status.

CC15 The Effects of Smoking on Healing After Non-Surgical Periodontal Therapy. L. PRICE*, J. DUONG, N.A. YOUNG (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to evaluate the process of healing after non-surgical periodontal therapy in a patient who smokes. Assessment: A 34 year-old, Asian, male patient presented with a chief complaint of prophy and exam. The patient reported previous non-surgical periodontal therapy within the last year at a private practice. Medical history revealed no significant

findings other than smoking a pack of cigarettes per day for the equivalent of 16 pack-years and social consumption of alcohol (3-5 drinks per week). He admitted that he had poor dietary habits with frequent snacking and sipping of sweetened beverages between meals. Discussion revealed poor oral homecare, e.g. brushing only once a day and infrequent use of interdental aids and mouth rinses. Clinical examination revealed generalized, moderate plaque-induced marginal and papillary gingivitis. Periodontal findings were generalized chronic periodontitis and generalized mild, radiographic, horizontal bone loss. DH Care Plan: Four quadrants of scaling and root planing (SRP) followed by periodontal tissue re-evaluation, extensive oral hygiene instructions (OHI), tobacco cessation counseling, and dietary analysis. Treatment: Tobacco cessation counseling was performed discussion of the complications that can arise in the healing process due to his continued smoking. The patient set a quit date for February 9th 2013, Chinese New Year. Evaluation: Reduction of intake of fermentable carbohydrates after dietary analysis and OHI succeeded in drastically reducing plaque score from an initial 75% to 17%. In most areas probing depths remained stable or showed a 1-2 mm improvement; however, some areas continued to show increased probing depths. Periodontal re-evaluation revealed an improvement in gingival condition to generalized mild gingivitis with only localized areas of moderate gingivitis remaining in the molar region. Although this patient showed an improvement in gingival condition he still exhibited gingivitis, some areas of bleeding, and increased probing depths possibly due to poor healing aggravated by his continued smoking. Evidence regarding the impact of smoking on periodontal healing will be discussed as well as other factors that may have led to incomplete healing in this case. Conclusion: Dental care providers need to be aware that the smoking habits of their patients have a great potential to negatively affect the results of non-surgical periodontal therapy and to address these issues with the patient when developing a treatment plan and predicting potential outcomes.

CC16 Managing a Patient with a History of Thyroid Cancer. S RANEGAR*, R PIERINI, P RETTIG, (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to show the management of a patient with a history of head and neck radiation due to thyroid cancer, Type II diabetes and lichen planus. Assessment: A 55 year-old female patient presented with a chief complaint of “I need my teeth cleaned and examined.” The patient reported dental hygiene treatment six months prior to her appointment. Medical history revealed Type II diabetes and a history of thyroid cancer resulting in lymph node removal and thyroidectomy. Clinical examination revealed generalized, radiographic, mild, bone loss and generalized chronic periodontitis. Probing depths ranged from 4-5 mm in the maxillary arch and lower left quadrant. Generalized gingival recession was present in all quadrants. Generalized, moderate, plaque-induced gingivitis was present with red, rolled, spongy gingival tissue and a bleeding score of thirty-two (32). The patient complained of burning and irritation of soft tissue which was associated with oral hygiene products used at home. DH care plan included: prophylaxis, fluoride varnish application, and periodic exam. Use of Biotene® toothpaste and mouth rinse were recommended at the initial appointment and patient was instructed to stop using Listerine® mouth rinse and Sensodyne® toothpaste. All planned treatment was provided. Evaluation: One week after the initial appointment the patient reported an improvement in soft tissue condition after discontinuing Listerine® and Sensodyne® products. Reevaluation at recall will include periodontal charting to observe any improvements in probing depths and bleeding, observation of the status of gingival tissue, detection for calculus and a new plaque score. Assessment of the patient’s improvements and compliance regarding the prescribed oral hygiene products will occur at that time. The need for referral will also be evaluated. Conclusion: In this case report, a patient with a history of head and neck radiation was treated by a dental hygiene student. The patient’s complaint about oral hygiene products was addressed and significant improvement was observed after switching products.

CC17 BP 200/100 mm - Hg- Would You Treat This Patient? G. RANGEL*, A. FUHRMAN, L. MAXWELL (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to educate dental care providers on the systemic effects of local anesthetics when administered in hypertensive patients. **Assessment:** A 47 year-old male presented with uncontrolled hypertension, type II diabetes mellitus, and renal failure. The patient was in need of a kidney transplant. Before being placed on the kidney transplant list, the patient had to complete dental treatment. The patient presented with generalized, moderate, plaque-induced gingivitis and moderate chronic periodontitis. Teeth numbers 22-26 exhibited class I mobility. All mandibular teeth had generalized heavy subgingival calculus. The patient also had active decay. **DH Care Plan:** Patient's difficulty level was a DH Class IV who needed 4 quadrants of scaling and root planing with local anesthetic. **Treatment:** Therapy was initiated on teeth numbers 21-29 due to severity of treatment needs. Topical anesthetic (Oraqix®) was applied to the gingiva but was inadequate for pain control. The attending dentist determined that local anesthesia was not appropriate for this patient due to hypertension. **Evaluation:** Although the patient agreed to reappoint, multiple attempts at rescheduling proved unsuccessful and the patient never returned to continue treatment. The patient's status with regard to needed kidney transplant is unknown but presumed to be incomplete. Due to the patient's systemic condition, alternate methods of pain control could have been used and evidence-based approaches to providing local anesthesia for hypertensive patients will be discussed. **Conclusion:** The results of this case study show the potentially negative effects of limited options for pain control. The decision to incorporate local anesthesia into a hypertensive patient's treatment plan should be determined on a case by case basis and not refused solely on the basis of elevated blood pressure. Reevaluating widely-held misconceptions concerning contraindications to local anesthesia can lead to improved treatment success and patient comfort.

CC18 Non-Surgical Therapy on an Advanced Periodontitis Patient. B. RICE*, A. SWACKHAMER. R.H. RACKLEY. (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to evaluate the outcomes of non-surgical periodontal therapy on the mandible by a dental hygiene student on an advanced periodontitis patient. **Background:** A 33 year-old male patient presented with a chief complaint of "My gums are very sensitive and they bleed during the night and sometimes when I brush." The patient reported never having any dental care. His medical history was negative. The patient stated that he brushes twice a day and never flosses. **Assessment:** Clinical examination revealed advanced periodontitis disease with probing depths ranging from 2-7 mm. and clinical attachment levels ranging from 2-9 mm. Patient also presented with severe, generalized, plaque-induced gingivitis evidenced by dark red, inflamed, loose gingiva, and heavy bleeding on probing. Radiographs revealed generalized, mild to moderate bone loss with localized, severe bone loss. **DH Treatment Plan:** Prescription of 0.2% Chlorhexidine®, extensive oral hygiene instructions (OHI), full mouth debridement, 4 quadrants of scaling and root planing (SRP), and tissue re-evaluation were completed. At this time only the mandible is complete due to scheduling difficulties. **Evaluation:** Periodontal re-evaluation of the mandible revealed generalized 1-3 mm. improvement in probing depths, but this slight improvement in pocket depths was not clinically significant in terms of his overall periodontal health. Degree of gingivitis, however, was significantly better with measured decreases in bleeding and inflammation and improved color, contour, and consistency. Regular compliance with home care instructions was an important factor in achieving improved gingival health. **Conclusions:** Despite the improvement in overall gingival health and slight improvement in probing depths, the severity of the patient's periodontal disease requires treatment by a periodontal specialist in order to adequately address the patient's treatment needs beyond initial therapy. Once initial treatment of the entire mouth is completed, the patient will be referred for additional evaluation and treatment in the Graduate Periodontics Department.

CC19 Compliance and Systemic Connection of Periodontal Disease after Heart Attack. K. COX, I. SCOTT*, N.A. YOUNG (Indiana University School of Dentistry)

Objective: Our goal is to understand if patients will gain compliance after understanding the link between their periodontal status and systemic conditions. **Assessment:** A 56-yr-old Caucasian male presented for a “deep cleaning and exam”. Treatment history revealed multiple delays of dental treatment due to uncontrolled hypertension. Patient was noncompliant to recommendations for medical evaluation. Medical history revealed recent heart attack in Jan. 2012, a pacemaker placed post-myocardial infarction, and a history of smoking for 38 years. He stated that he made a conscious effort to stop smoking and began exercising after having the heart attack. Patient reported brushing once per day and seldom flossing. Clinical examination revealed generalized, severe, plaque-induced gingivitis and generalized BOP and generalized, moderate, chronic periodontitis. Radiographs showed generalized, moderate horizontal bone loss. Initial plaque score was 76%. DH care plan: Four quadrants of scaling and root planing followed by tissue re-evaluation in 6 to 8 weeks. Extensive oral hygiene instruction, including systemic health linkage to disease process and, support for continued tobacco cessation was also planned. **Treatment:** SRP of all quadrants was completed with use of local anesthesia and Oraqix®. **Evaluation:** Tissue re-evaluation revealed generalized, mild, plaque-induced gingivitis. Probing depths improved by 1-3 mm. and also bleeding sites decreased. Plaque score improved significantly from 75% at the initial visit to 28% at re-evaluation appointment. Patient was compliant with oral hygiene goals. Patient reported continued cessation of tobacco use, routine exercise daily and an increased knowledge of periodontal disease process. The patient stated the linkage between his periodontal status and systemic conditions accurately. **Follow-up:** Patient was placed on a 3-month periodontal maintenance recall with evaluation of need for referral to a periodontal specialist at that time. **Conclusion:** This case exemplifies that patients who are knowledgeable of the link between periodontal disease and systemic conditions show increased compliance with dental treatment.

CC20 Treating Chronic Periodontitis in a Patient Awaiting a Kidney Transplant. C. SAMS, J. SUMMERLIN*, J. BLANCHARD (Indiana University School of Dentistry)

The objective of this clinical case presentation is to report on a patient who presented with chronic periodontitis and is awaiting a kidney transplant. This case will also evaluate the outcome of nonsurgical periodontal therapy in this patient. **Background Information:** A 51 year- old, African American, male patient presented with chief complaint: “I need to get my teeth cleaned before I can be on the kidney transplant waiting list.” The patient reported no dental care for more than 20 years, and only came to Indiana University School of Dentistry to get his kidney transplant forms signed confirming that there was no active dental disease. Patient has an extensive and complicated medical history, including uncontrolled Type II diabetes, hypertension and kidney dialysis every Monday, Wednesday, and Friday. The patient stated that he brushed once a day and seldom used floss. **Assessment:** Clinical examination revealed chronic periodontitis with probing depths ranging from 2-5mm with clinical attachment levels ranging from 3-8mm. There was generalized recession and mobility throughout the dentition. Patient also presented with generalized, moderate, marginal, plaque-induced gingival inflammation as evidenced by dark pink, rolled, and swollen tissue with heavy supra- and sub- gingival calculus. The intraoral radiographs revealed generalized, severe, horizontal bone loss as the alveolar crest was located 7+ mm from the CEJ on intraoral radiographs. **Dental Hygiene Care Plan:** Four quadrants of scaling and root planing (SRP) using local anesthesia, and extensive oral hygiene instructions followed by a periodontal tissue re-evaluation, 4-6 weeks after completion of initial periodontal therapy. Dental hygiene therapy was performed on Tuesdays and Thursdays to coordinate with dialysis appointments. **Evaluation:** Periodontal re-evaluation revealed a generalized improvement of probing depths by 1 mm and a reduction in gingival inflammation throughout. The patient’s improved home care and oral hygiene habits resulted in less gingival bleeding and a lower plaque score. The patient was referred to Comprehensive Care Clinics for extraction of a root tip and restorative dentistry to eliminate all remaining active dental

disease. Conclusion: In order for the patient to be a candidate for a kidney transplant, all acute dental disease must be eliminated, which included completion of initial periodontal therapy, regular periodontal maintenance following therapy, extraction of root tip and restorative dentistry.

DENTAL MATERIALS

CC21 Nanotube-Modified Adhesives-Effects on Dentin Bonding, Degree of Conversion and Microhardness. G. BATARSEH*, J. PALASUK, J.A. PLATT, L.J. WINDSOR, M.C. BOTTINO. (Indiana University School of Dentistry)

Objective: To evaluate the effect of experimental nanotube-modified adhesive bond strength to dentin. The effect of nanotube incorporation on adhesive degree of conversion (DC) and Knoop microhardness (KHN) was also investigated. Aluminosilicate clay nanotubes (Halleysite/HNT, Applied Minerals) were incorporated into the adhesive solution as a filler (Adper Scotch Bond, 3M/ESPE) and mechanically mixed at distinct concentrations: G1-5%, G2-10%, G3-15%, G4-20%, G5-30wt.%, and G6-Control. For shear bond strength/SBS testing, 72 human third molars (n=12) were embedded in acrylic, followed by occlusal surface grinding, to expose dentin, and smear layer standardization. Specimens were placed in a bonding jig and the experimental adhesives or the control were applied to the treated dentin following the manufacturer recommendations. A Teflon mold was used to build resin composite (Z100, 3M/ESPE) buttons ($\Phi=2.38\text{mm}$). SBS (in MPa) was determined after 24h using a testing machine (1mm/min). Bond failure modes were determined. Scanning electron microscopy (SEM) was also used. DC was assessed from two absorbance bands at $1637\text{cm}^{-1}(\text{C}=\text{C})$ and $1715\text{cm}^{-1}(\text{C}=\text{O})$ of unpolymerized and polymerized specimens (24h after curing). Scans were run twice/specimen (n=12). KHN was performed on adhesive (n=5, 8 readings/specimen) discs ($1.0\text{mm}\times 10\text{mm}$) using a diamond indenter (50gf and 15s). One-way ANOVA and Bonferroni's test were used for data analysis at 5%.

SBS, failure mode, DC, and KHN results are given below.

Groups (%)	SBS (MPa)	Failure Mode (%)			Knoop Microhardness (KHN)	DC
		AD	MX	CH		
					12.8 ± 0.9^a	82.5 ± 2.1^a
G1-5%	$24.0\pm 6.9a$	16.7	83.3	0	12.9 ± 1.1^a	84.9 ± 2.8^a
G2-10%	$23.6\pm 5.4a$	41.7	58.3	0	12.8 ± 1.3^a	82.4 ± 3.4^a
G3-15%	$27.1\pm 7.8a$	33.3	66.7	0	13.8 ± 0.9^b	83.4 ± 3.8^a
G4-20%	$29.8\pm 6.1a$	25.0	66.7	8.3	14.2 ± 1.5^b	74.6 ± 3.1^b
G5-30%	30.5 ± 6.5^b	83.3	16.7	0	12.2 ± 2.3^a	85.1 ± 2.0^a

Same letters within the column indicate non-significant differences ($p>0.05$).

The results suggest that Halleysite nanotubes incorporation into a commercial dentin adhesive led to improved bond strength without compromising the physico-chemical and mechanical properties. (Indiana University-Purdue University Indianapolis IRB protocol #NS1004-03).

ENDODONTICS

CC22 Endodontic Management: Infected Immature Tooth With Spontaneous Root Closure and Dens Invaginatus. R.W. BAKER*, J. SOUTHARD, Y. EHRLICH, A. GHONEIMA, M.M. VAIL, K.J. SPOLNIK (Indiana University School of Dentistry)

Objective: To report the use of cone beam computed tomography (CBCT) in the treatment of an infected immature lateral incisor #10 with dens invaginatus, spontaneous closure of the an open apex and apical periodontitis. **Methods:** A 22 year old male was referred to the graduate endodontic clinic at IUSD for evaluation. A periapical radiolucency (PARL) had been detected on tooth #10 in radiographs taken as part of a hygiene recall exam. Clinical exam revealed the patient was asymptomatic and #10 exhibited a lingual pit invagination suggestive of dens invaginatus. **Radiographic findings:** Periapical intraoral radiograph revealed a large (10mm x 8mm) PARL centered on root tip #10. The pulp canal was large (2.5mm mesiodistal width at point of largest dimension) and there was an invagination of enamel and dentin in the cingulum area extending into the pulp canal indicative of dens invaginatus. An apical barrier (approximately 2.75 x 3.25mm) of calcified dental tissue could be appreciated. CBCT scan revealed that the apical calcified barrier was somewhat porous, and that almost all the cancellous bone in the area of the PARL had been resorbed, leaving only the labial and palatal cortical plates intact. **Diagnosis:** Pulp necrosis with asymptomatic apical periodontitis. **Treatment:** First appointment: Anesthesia obtained (lidocaine 2% w/ epinephrine 1:100k), apical patency was attempted with hand files but could not be achieved through the apical mineralized barrier. The root canal walls of the immature tooth were disinfected primarily via irrigation rather than by mechanical debridement. A layer of Mineral Trioxide Aggregate (MTA) 5mm in depth was placed apically, and the tooth was temporized. Second appointment: the interim restoration was removed. A final irrigation was performed with 6% NaOCl. The canal was dried, and acid etch (phosphoric acid 17%) was placed in the canal for 20 seconds, followed by a thin layer of bonding agent which was then light cured. The canal was then filled a fiber post and core build-up material. **Results:** Six month post-operative radiographs reveal deposition of cancellous bone around the margins of the radiolucency indicative of significant, though not yet complete resolution of the apical periodontal lesion, thereby suggesting the efficacy of this treatment protocol for this clinical scenario.

CC23 Endodontic Treatment of Necrotic Tooth With Cemental Tear. A.C. EDDS*, D. JENKS, Y. EHRLICH, M. VAIL, K.J. SPOLNIK (Indiana University School of Dentistry)

Objective: To report the nonsurgical and surgical endodontic treatment of a necrotic tooth with cemental tears. **Methods** A 72 y/o male patient was referred to Indiana University Graduate Endodontic Clinic from the undergraduate clinic for evaluation of #25. A PARL (periapical radiolucency) was found on #25 with which the patient had reported some sensitivity. The patient presented with a sinus tract associated with #25 and testing of tooth #25 revealed no percussion sensitivity, slight palpation sensitivity, and no response to thermal testing or EPT. Tooth #25 was unrestored, but all lower incisors displayed attrition. Radiographically, #25 revealed a PARL and evidence of a calcified chamber and reduced canal width. Tooth #25 had Class 2 mobility, 6mm probing depth on MF, and 2mm facial gingival recession with cervical abrasion. The diagnosis of #25 was necrosis w/ chronic apical abscess. The patient could not recall a history of trauma. Tooth #25 was treated with RCT, and later underwent an apicoectomy due to continued swelling. Upon surgical access, a cemental tear was revealed on the facial root surface and removed. The patient's swelling healed, but at three months post-op, he presented with 2 sinus tracts. A root fracture or additional cemental tear was suspected and the patient agreed to extraction-replant of #25. Upon extraction, another cemental tear was found on the lingual surface of the root (inaccessible during previous root surgery) was removed, and the tooth replanted and splinted. **Results** After five months, the short-term results of our case reveal both clinical and radiographic evidence suggesting a favorable response. Evaluation reveals increased bone density in the area of the periapical lesion and reattachment

(reduced probing depth) without signs of infection. This case report illustrates the need to completely debride the loose cementum to improve prognosis.

CC24 Treatment of Persistent Extraradicular Actinomycosis Infection in Root-filled tooth using Apical Microsurgery. A. GRIGLIONE*; C. KUTANOVSKI; Y. EHRLICH, M.M. VAIL; K.J. SPOLNIK (Indiana University School of Dentistry)

Objective: To present the surgical endodontic treatment of persistent/refractory extraradicular infection of actinomycosis. Methods: A 34 year old male with unremarkable medical history presented to the graduate endodontic clinic referred for evaluation of an asymptomatic radiographic lesion apical to teeth #7 and 8 . He recalled a history of trauma to the face when he fell at 8 years old. Clinical exam: #7 Intact Crown, Cold: no response. Percussion: no response. #8 Crown build up with resin restoration, Cold: no response. Percussion: no response. Pain on palpation at the apices at 7 and 8. Probing depths within normal limits and class 1 mobility was noted on both teeth. Radiographic findings A 2 x 1.5 cm solitary periapical radiolucent lesion with well-defined borders encompassing the apices of teeth #7 and 8. Tooth #7 with wide canal and slightly open apex. #8 had a large coronal pin resin restoration buildup. Clinical Diagnosis: Necrosis with symptomatic apical periodontitis #7 and 8. Treatment: Non-surgical treatment was completed without resolution prior to surgical therapy. Microscopic surgical techniques consisted of root preparation with a surgical operating microscope, surgical ultrasonic tip and Brasseler's Endodontic Root Repair Material putty. Emdogain, demineralized freeze dried bone allograft and calcium sulfate were used to graft the residual bony crypt. Post-operative instructions included cold pack, antibiotics, analgesics, chlorhexidine mouthwash and warm salt water rinses. Histologic Diagnosis: Periapical granuloma with colonies consistent of actinomyces species. Results: Four months following surgical treatment, radiographic evaluation showed uneventful hard and soft tissue healing and an intact periodontal ligament with undetectable pathosis. Conclusion: Successful treatment of persistent or refractory periradicular pathosis with an etiology of actinomycosis can be achieved through surgical endodontic therapy.

PERIODONTICS

CC25 Dental Implant Placed in Infected Extraction Socket Immediately Following Extraction. D. BENNETT*, B. MCLELLAN, S. PRAKASAM, V. JOHN (Indiana University School of Dentistry)

Dental implants are considered one of the important treatment alternatives for tooth replacement. Typically dental implant placement is sequenced as follows: extraction of the tooth with socket preservation; 3-6 months healing followed by re-entry and implant placement. This is often described as "delayed implant placement". Recently, "immediate implant placement", where dental implants are placed in extraction sockets, have been demonstrated to have equivalent osseointegration as compared to delayed implant placement. One relative contraindication advocated by many clinicians is placement of implants in an infected socket. Few reports have been published of late that demonstrate functional osseointegration and successful tooth replacement even in dental implants placed in previously infected socket. The objective of this clinical case presentation is to demonstrate the steps and techniques involved in placing dental implants in infected extraction sockets. An additional objective is to educate clinicians that such immediate placement procedures in infected sockets are possible and can be successfully accomplished. This case report is of a 58 years old female patient who presented to the Indiana University School of Dentistry to evaluate a cracked tooth. She stated that a previous Dentist told her that tooth #4 was cracked. Clinical evaluation revealed a crown/root fracture associated with #4 along with a periapical infection which drained to the buccal aspect of #4. The tooth was diagnosed as being non-restorable. The patient elected to have the tooth extracted and replaced with a dental implant. Surgical treatment involved the following: extraction of #4; envelope flap reflection; debridement and curettage of the extraction

socket along with the buccal fenestration; osteotomy (drill) sequence to prepare for the dental implant; placement of dental implant (4.1 mm x 11.5 mm); placement of healing abutment; grafting of the non-filled portion of the extraction socket with freeze-dried bone allograft; suturing of the flap with 4-0 cytoplast. The site was allowed to heal for five months. Following the five months of healing, the patient's crown was fabricated and cemented in place. The patient has had the crown in place for over 5 months. No further infection has been noted in the surgical site. Health, comfort and function have persisted following the immediate placement of the dental implant into this site which was infected at the time of the tooth's extraction and dental implant placement.

CC26 Trephined Core Osteotome Sinus Lift and Immediate Implant Placement after Maxillary Molar Extraction: A Novel Technique. M. HASSAN*, V. JOHN, S.B. BLANCHARD (Indiana University School of Dentistry)

Background: Maxillary molar extraction and immediate implant placement, with simultaneous osteotome sinus elevation, is a predictable method of implant supported restorative treatment. There are reports of using trephined osseous core for sinus elevation in edentulous areas but not at an immediately extracted site. However, there are no reports of using a trephined core osteotome sinus elevation in a maxillary molar extracted site along with immediate implant placement without attempting primary closure. Aim: To describe a method of sinus floor elevation using a trephined core osteotome technique following maxillary molar extraction and immediate implant placement without primary flap closure. Materials and Methods: A healthy 52-year-old Caucasian female presented with nonrestorable tooth #14 requesting replacement with a dental implant. A preoperative focal cone beam computed tomography scan and models were used to fabricate a surgical guide. Following minimally traumatic tooth extraction, a 3.5 mm diameter trephine drill was used to initiate the osteotomy to a depth short of 1 mm from the sinus floor using the surgical guide for alignment. Sinus floor was elevated using osteotome and freeze dried bone allograft (FDBA) by hydraulic pressure. A 4.8 x 10 mm bone level implant was placed with good primary stability. FDBA was used between implant and the socket, covered with amnion chorion membrane and sutured without primary closure. Results: Implant position appeared good with 4-5 mm of sinus floor elevation. Postoperative healing was uneventful with almost complete soft tissue closure at 2 weeks. Radiograph at 2.5 months showed no evidence of peri-implant bone loss. The implant was successfully restored 4 months postoperatively. Conclusion: Trephined core osteotome sinus elevation at a maxillary molar extracted site with immediate implant placement can be a viable treatment option. Meticulous planning and adequate inter-radicular bone are critical in achieving a successful outcome.

CC27 Nonsurgical Periodontal Therapy in an Uncontrolled Diabetic Patient. B. LANE*, S.B. BLANCHARD, V. JOHN (Indiana University School of Dentistry)

It is estimated that over 12-14 million people in the United States have diabetes mellitus, with only half of them diagnosed. It is well understood that people with diabetes are more at risk for periodontal disease. In fact, the American Diabetes Association has recognized that periodontal disease is common in diabetic patients and has added periodontitis as the sixth complication associated with diabetes (in addition to retinopathy, nephropathy, neuropathy, macrovascular disease, and altered wound healing). Research has shown that poorly controlled diabetics have an increased severity and extent of periodontitis compared to well and moderately controlled diabetics. Infection alters the action of insulin and can impair metabolic control for diabetics, thus increasing the risk for diabetic complications previously mentioned. With this in mind, it is important for the dental clinician to monitor the diabetic patient with regards to their metabolic control and periodontal infection. Case Report: A 35-year-old Hispanic female presented to the Indiana University School of Dentistry Graduate Periodontics clinic in August 2011 with a chief complaint of "a periodontist needs to look at my teeth and gums." A medical history was elicited by questionnaire and interview. Patient reported a medical history of type 2 diabetes, rheumatoid arthritis, and asthma. The patient was taking the following medications: Novolog, Lantus, methotrexate,

hydroxychloroquine sulfate, naproxen, folic acid, calcium +vitamin D, and Advair. The patient's HbA1c history ranged from 10.5%-11.2%. In general, the marginal and papillary gingiva appeared erythematous, especially in areas with heavy plaque and calculus accumulation. Erythematous, elevated, nodular lesions were found associated with the facial gingival margin between #8 and #9, the palatal gingival margins of #3, #6, #7, #8, #9, #10, #11, and on the lingual and facial gingival margins of #22, #23, #24, #25, #26, and #27. Patient education, oral hygiene instruction, and scaling and root planing of all four quadrants with adjunctive systemic antibiotics (amoxicillin 500 mg, metronidazole 250mg x 10 days) were completed. A re-evaluation of oral hygiene, tissue response and reassessment of treatment plan was done 4-6 weeks post non-surgical therapy. Following initial therapy, the gingival color, contour and consistency showed improvement. The erythematous nodular lesions associated with the gingival margins resolved. The patient's HbA1c also improved post non-surgical periodontal therapy from a history of 10.5-11% to 10%. The patient has been placed on 3-month periodontal maintenance recall visits.

CC28 Case Report on the use of Platelet Rich Fibrin for Ridge Preservation in an Extraction Socket of an HIV+ve Individual. Y. HAMADA*, M. GOSSWEILER, D. SHIN, S. PRAKASAM (Indiana University School of Dentistry)

Bio-Oss®, a deproteinized bovine bone Xenograft is used in ridge preservation. The major advantage of Bio-Oss® is its slow turnover rate, which helps in maintaining the integrity of the socket wall. A major disadvantage is that it lacks bioactive molecules that aid in healing especially in patients with compromised healing due to systemic conditions. Admixing of bioactive molecules have been explored but these have short half-life. A potential sustained source of multitude of growth factors is autologous blood platelets. Platelet alpha-granules form an intra-cellular pool of wound healing molecules (PDGF, TGFb, VEGF, EGF and IGF1). Platelet rich fibrin (PRF) is an inexpensive autologous gel enriched for platelets from blood draw that is easily processed in a clinical setting. Bio-Oss®, in combination with a PRF membrane and admixed fragmented PRF may help with initial wound healing resulting in an improved preservation of the alveolar ridge post extraction particularly in immuno-compromised individuals. Wound healing of HIV+ve individuals with good CD4 counts is usually not compromised. Nevertheless, retrospective analysis reports indicate that invasive dental procedures may result in higher adverse events in HIV+ve individuals. BioOss in combination with PRF may be of some value in these individuals. The purpose of this case report is to demonstrate the use of PRF in an extraction socket of a HIV+ve individual. Here we report on the case of a 49-year old male with a 15 year history of HIV+ve status (CD4 count- 1080 and undetectable viral load) and he had an undetectable viral load. He is on combinational retroviral therapy. He was referred for replacement of non-restorable #19 with dental implants. Informed consent was obtained from patient after explaining costs benefits and risks. Patient agreed to treatment plan of extraction of #19, socket preservation with Bio-Oss® and PRF and subsequent delayed implant placement. On day of surgery, 20ml of blood was drawn and was processed to make PRF membranes. One PRF membrane was shredded and mixed with Bio-Oss® hydrated in platelet poor plasma. #19 was sectioned and extracted with minimum trauma. Socket was thoroughly debrided. The PRF mixed with Bio-Oss® was placed in the socket. PRF membrane was placed above the graft and tucked into the buccal and lingual flap. Strapping sutures were placed with 5-0 vicryl. The patient was followed for 1 month. Through this case, we aim to educate clinicians that PRF is a cost effective option for socket preservation especially in immuno-compromised patients.

PROSTHODONTICS

CC29 Zygomatic Implants - Treatment Alternative for Severely Resorbed Maxilla. D. PATEL*, F. BARBOSA, J.A. LEVON (Indiana University School of Dentistry)

In many edentulous maxilla, posterior alveolar atrophy requires bone grafting or sinus lift procedures. This clinical report describes an alternative treatment option for severely resorbed maxilla. The zygomatic implants allows for surgical placement of implant to restore maxilla without any major bone grafting or sinus lift procedures. Patient acceptance is increased by eliminating bone grafting procedure in combination with immediate function. Surgical guide was fabricated using Nobel implant planning software. Maxillary 4 anterior, with 2 bilateral zygomatic implants and mandibular 7 implants were designed in the software. Planned data were sent to manufacturer to fabricate custom surgical template. Guided implant surgery has several advantages like accurate fit, safe and predictable surgery, shorter operation time and healing time with flapless surgery, smaller incision with less bleeding and pain, minimized bone grafting procedure and immediate bone grafting can be done. The existing dentures were converted chair-side to immediate fixed provisional acrylic resin prosthesis 2 hours following implant placement. Titanium temporary cylinders (Nobel Biocare) were placed on implants and picked up with autopolymerizing acrylic resin. Occlusion verified, removed prosthesis, finished, polished and deliver prosthesis same day. Definitive prosthesis with metal framework in the maxilla and sectional fixed bridge prosthesis in the mandible will be delivered after healing. (Indiana University-Purdue University Indianapolis IRB #1105005588)

CC30 Implant Use in Maxillofacial Prosthodontics. P. ROMRIELL*, J.A. LEVON (Indiana University School of Dentistry)

Case report of implant retained nasal prosthesis. A technique is outlined for utilizing tissue conditioning to optimize the emergence profile of implant abutments. Difficulty arises in extraoral implants when placing implants perpendicular to the tissue is not possible. The result of implants not being perpendicular to the overlying tissue is that the inferior border of the implant has more tissue covering it and creates a problem when the implants are being utilized. After the magnetic keepers were positioned, the tissue grew up around the keepers preventing proper engagement of the magnets. The tissue overlaying the implant abutment was thinned with some success. Flowable composite was added to healing abutments and placed on the implant after the tissue was thinned in order to control the tissue contour. A night time framework with magnets was fabricated to keep the soft tissues from rebounding at night. The result of utilizing tissue conditioning and night time framework allowed for better tissue contour, and healthier tissue surrounding the implant keepers. Having a more uniform thickness of tissue and wider area surrounding the magnetic keeper allowed the prosthesis magnets to be in direct contact. The magnetic keepers being in direct contact with the prosthesis magnets resulted in stronger attachment of the prosthesis with the keepers as the magnet-magnet interface was in full contact.

CC31 Anterior Resin-Bonded Fiber-Reinforced Interim Fixed Partial Denture. H. YEH*, J.A. LEVON (Indiana University School of Dentistry)

In recent years resin-bonded fiber-reinforced fixed partial dentures have become a treatment alternative for replacement of missing teeth. A combination of good esthetics and fracture toughness validates their use in a diverse range of clinical applications. In this case report an indirect anterior resin-bonded fiber-reinforced interim partial denture is described. A 51 year old male was referred from the periodontist with a large bony defect in area #24 – 26. He was to undergo bone grafting to the area and the periodontist had requested that no pressure be applied to that area by a provisional restoration for 5 months. A long span resin-bonded fiber-reinforced interim fixed partial denture was fabricated and used for this case. The overall clinical outcome was both esthetic and functional. In this case, a long span anterior resin-bonded

fiber-reinforced fpd was luted during bone healing phase. During this 5 month healing phase, the fpd maintained both esthetics and function for the patient. The only adjustment needed was to shorten the fiber attachment from second molar to first molar. The overall outcome of this long span resin-bonded fiber-reinforced fpd was successful in this case.

CC32 Gingival Defect: An Approach Towards a More Esthetic Outcome. N. AL-ANGARI*, J.A. LEVON (Indiana University School of Dentistry)

In a patient with a high smile line, gingival defect may compromise the esthetic outcome. Implant supported restorations in the esthetic zone associated with such a defect could be managed by site development through bone and soft tissue regenerative procedures. Despite the recent developments in periodontal and peri-implant surgical regenerative procedures, completely and predictably reestablishing the hard and soft tissue contours is very challenging in some cases with ridge deficiencies. An alternative treatment modality is the use of prosthetic gingival restoration which helps reestablish natural gingival profile, crown to root or implant ratio, and both simplifies and reduces the cost of the treatment. Prosthetic gingival restorations can overcome the limitations of the regenerative procedures to the soft and hard tissues. The treatment outcome can be very predictable when prosthetic gingival restoration is considered in the initial treatment plan rather than using it as a bailout for a failed treatment. When prosthetic gingival restoration is considered in the initial treatment plan rather than using it as a bailout for a failed treatment. The treatment outcome of gingival defect in a patient with a high smile line, can be very predictable.

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P65 Healthy Smiles for Employability – An Oral Health Program. J. BHAHEETHARAN^{1,2}, C. FOULKES², S.R. HENDRICKS², T.J. MORGAN^{2,3}, B.T. ROCHFORD²; E.C. SCHMIT²; T.J. CARLSON², K.M. YODER² (¹Fairbanks School of Public Health, Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry, ³School of Liberal Arts, Indiana University-Purdue University Indianapolis)

The Near Eastside (NES) Indianapolis community (2010 est. population 30,750¹) is subject to several negative social determinants of oral health, including low income, which can impede access to oral health care and put residents at a higher risk for oral health problems. As part of Indiana University School of Dentistry's (IUSD) commitment to serving Indianapolis residents, IUSD manages the IUSD Student Outreach Clinic, a student-run, free dental clinic. The clinic provides free dental education, cleanings, screenings, fillings and extractions to NES Indianapolis and neighboring residents at the HealthNet People's Health & Dental Center⁸. The Healthy Smiles for Employability program serves as an extension IUSD's community service and quality education efforts to improve oral health and health-related quality of life for NES residents and enhance community involvement of IUSD dental students.



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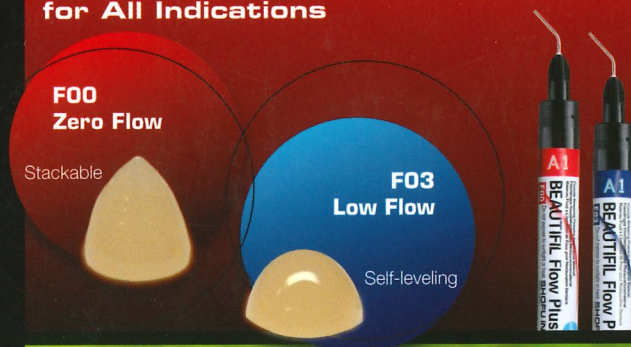
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