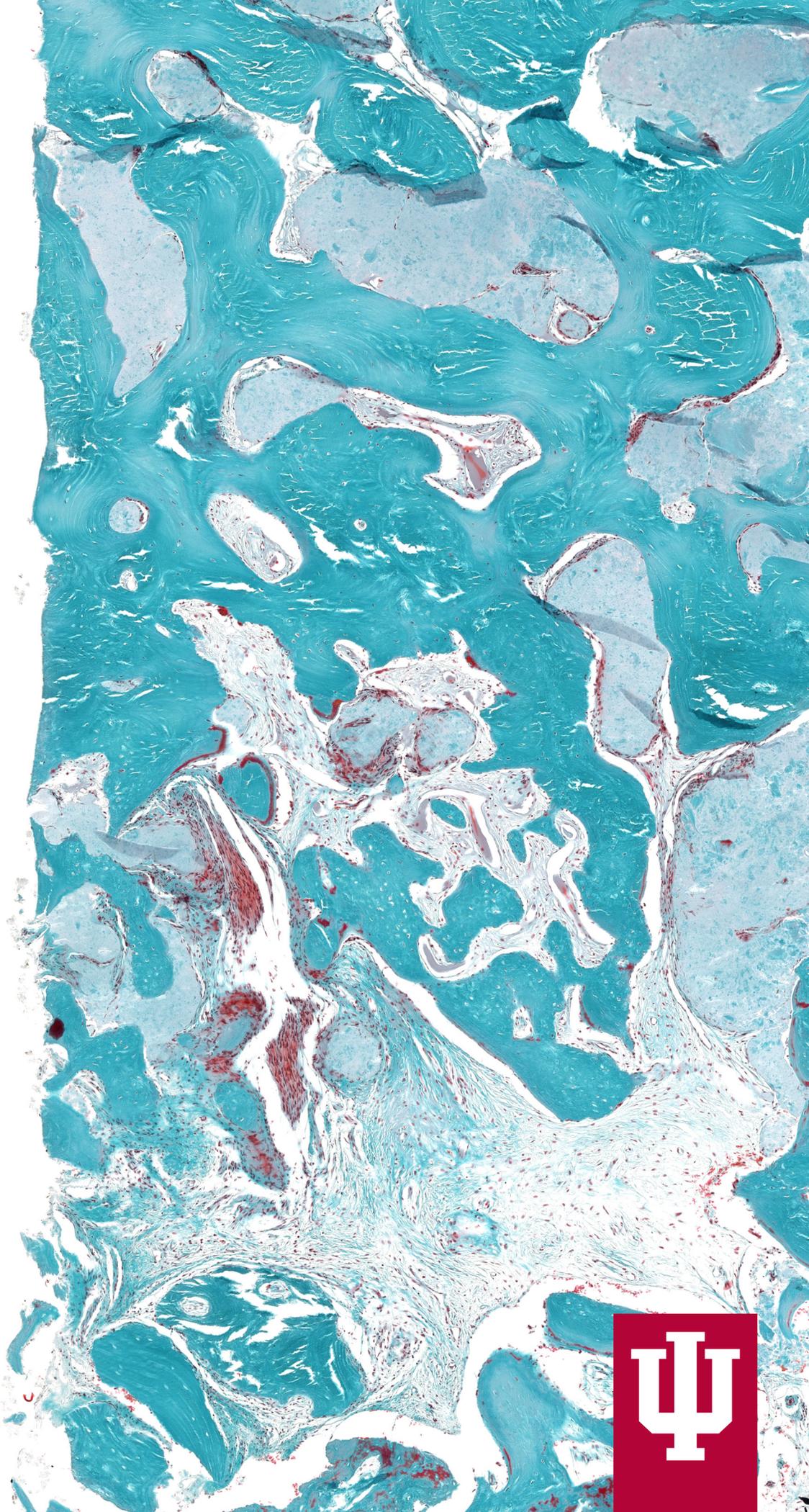


RESEARCH DAY

INDIANA UNIVERSITY SCHOOL OF DENTISTRY 24TH ANNUAL **APRIL 11, 2016** IUPUI CAMPUS CENTER





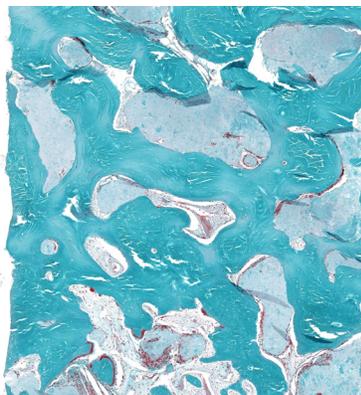
FIRST ROW: (L to R) Richard L. Gregory, PhD and Angela Bruzzaniti, PhD
Student Research Group Co-Directors, IU School of Dentistry

SECOND ROW: Molly Oster, Mark Vaughn, Stuart Ryan, Joshua Evans, Hengameh Motevasel Olhagh

THIRD ROW: Sumana Posritong, Hadeel Ayoub, Sarah Al-Angari, Afnan Al-Zain, Parand Sorkhdini,
Farbod Jalili Fazel, and Ahmad Abazari

FOURTH ROW: Yue Wang, Laura Albrecht, Allison Williams Stamer, Usama Kamal, Sarah Buedel, Loan
Anh Do, Simin Charkzarrin, and Dawn Wagenknecht

Not all student group members are pictured.



ON THE COVER: Histological section of alveolar bone embedded in poly methylmethacrylate (same as plexiglass), sectioned at 5 micrometers and stained with Goldner's trichrome.

The Mineralized Tissue and Histology Research Laboratory (MTHRL) at IUSD provides histology services. It is the only lab in the university able to cut tissue samples with hard biomaterials as metallic or ceramic screws and dental implants. Besides performing routine soft tissue sections and special stains as any pathology lab, the MTHRL also sections hard tissues using specialized techniques as embedding tissue samples in plastic resins as PMMA or GMA and thin sectioning with a tungsten carbide knife or thick sectioning using a diamond saw and followed by a microgrinding system, allowing the interface between biomaterial and tissues to be visualized under the microscope.

COVER IMAGE PROVIDED BY: Dr. Carol Bain, DVM, HTL (ASCP)
Research Associate, Department of Orthodontics and Oral Facial Genetics
Indiana University School of Dentistry

**Indiana University School of Dentistry
Research Day Proceedings
Volume 24, 2016**

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A special welcome to our guest presenters:

**The Ohio State University
College of Dentistry**

Cover design by Mark Dirlam. Student research group photo by Tim Centers.
Research Day proceedings monograph prepared by Keli Schmidt.

Research Day Organizing Committee

Ygal Ehrlich, Chair

Masatoshi Ando
Blake Ballenger
Marco Bottino
Angela Bruzzaniti
Timothy Centers
Judith Chin
Tien-Min Gabriel Chu
Mark Dirlam
Dominique Galli
Ahmed Ghoneima
Richard Gregory
Sue Kelly
Frank Lippert
Lisa Maxwell
Sheryl McGinnis
Stuart Ryan
Keli Schmidt
Jeannie Vickery
Ned Warner
John Williams
Terry Wilson
Domenick Zero

Officers

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American Association for Dental Research

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Vice President: Ned Warner

Secretary/Treasurer: Frank Lippert

Councilor: Tien-Min Gabriel Chu

Chair Research Award Judging Committee: Ahmed Ghoneima

Chair Staff Award Judging Committee: Angela Bruzzaniti

Officers

IUSD Student Research Group

President: Stuart Ryan

Vice President: Blake Ballenger

Secretary/Treasurer: Michael Daetwyler

Newsletter Editor: Mark Vaughn

Faculty Adviser: Angela Bruzzaniti

Future Research Day Event: April 10, 2017



April 11, 2016

Dear Participants and Guests,

It is with great pleasure that we welcome you to the 24th Annual Research Day of the Indiana University School of Dentistry. This annual event was established in 1993 to provide a forum for IUSD researchers, faculty, staff and students, including undergraduate, predoctoral and graduate students to present their research work and clinical case studies to the IUPUI community. Additionally, it fosters many opportunities for research collaborations aiming for the advancement of oral, dental and craniofacial research with the ultimate goal of prevention and treatment of oral diseases. We also welcome student representatives from The Ohio State University College of Dentistry who will share their research findings with us and participate in the interschool research competition.

This year we are honored to have Dr. Simon Atkinson, PhD, IUPUI Interim Vice Chancellor for Research and Chancellor's Professor of Biology at IUPUI School of Science provide opening remarks. We are also privileged to have as our keynote speaker Dr. Jack L. Ferracane, PhD, Professor and Chair of the Department of Restorative Dentistry at Oregon Health & Science University in Portland, Oregon. The title of his presentation is "Caries Formation around Dental Composite Restorations - Assessing In vitro Models for a Multifaceted Problem."

We would like to offer a special word of thanks to our event and award sponsors, Shofu, Delta Dental, Johnson & Johnson, Procter & Gamble, Indiana Dental Association, and the American Student Dental Association. We also wish to extend our gratitude to all the exhibitors for their participation year after year. The success of IUSD Research Day depends on the continued support of our sponsors and exhibitors. We encourage everyone to visit our exhibitors and become acquainted with the dental products and services they have to offer.

We thank all of the members of the Research Day Committee for their hard work and dedication. We also thank all of the award judges for their dedication to evaluate all research projects. 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 Research Day 2016 and sincerely hope that you will enjoy the scientific program.

Sincerely,

A handwritten signature in black ink that reads "Y. Ehrlich".

Ygal Ehrlich, DMD
President
Indiana Section of the AADR

A handwritten signature in black ink that reads "Stuart Ryan".

Stuart Ryan
President
Student Research Group, IUSD



IUPUI

SCHOOL OF DENTISTRY

OFFICE OF THE DEAN

Indiana University-Purdue University
Indianapolis

April 11, 2016

Dear Colleagues:

Welcome to the 24th Annual Indiana University School of Dentistry Research Day!

Today's presenters join a long and prestigious lineage of IUSD researchers. Beginning with Dr. Howard Raper's bitewing X-ray in 1906, followed by the discovery of the first successful stannous fluoride formula that became Crest[®] toothpaste to the leading-edge studies operating today, research is a foundational pillar of our vision to be one of the best dental schools of the 21st century.

I thank the Research Day Committee and the Indiana Section of the American Association of Dental Research for their excellent planning and execution of this annual event. Thank you also to our sponsors who help underwrite this important day.

We are most pleased to welcome Simon Atkinson, PhD, IUPUI Interim Vice Chancellor for Research and Chancellor's Professor of Biology at the IUPUI School of Science, to deliver opening remarks, and Dr. Jack L. Ferracane, Professor and Chair of the Department of Restorative Dentistry at Oregon Health & Science University, who is this year's keynote speaker.

This 2016 IUSD Research Day monograph serves to record the science and expand the educational experience of this day, illustrating the promising work of our colleagues. After the events have concluded and the posters are rolled, the research continues. This book ensures that we remain mindful of the extraordinary variety of research taking place at this dental school and the Oral Health Research Institute.

After all, a foundational attribute of dental education is sheer intellectual curiosity – a trait as important for the clinician as for the scientist. We become better dentists and provide better patient care when we develop the skills to acquire and assimilate new knowledge and to adapt to the changes in practice and in the profession that the future requires.

Participating in Research Day is a highlight of the school year for me. I invite you to join me in congratulating our colleagues for their hard work by actively listening to their poster presentations. You will hear creativity, innovation and inquiry. I wish everyone an enlightening day of discovery!

Best wishes to all Research Day participants,

John N. Williams, DMD, MBA
Professor and Dean

Program
IUPUI Campus Center 3rd and 4th Floor

Thursday, April 7

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

Monday, April 11

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)

12:30 p.m. Welcome Remarks
(CE 450A-B) **Dr. John N. Williams**
Dean, IU School of Dentistry

12:35 p.m. Opening Remarks **Dr. Simon Atkinson**
IUPUI Interim Vice Chancellor for
Research, IUPUI School of Science

12:45 p.m. Introduction of Keynote Speaker **Dr. Gabriel Chu**
Associate Dean for Research,
IU School of Dentistry

12:50 p.m. Keynote Address **Dr. Jack L. Ferracane**
Professor and Chair,
University of Oregon Health & Science

1:50 p.m. Announcement of Faculty Awards **Dr. John N. Williams**
Dean, IU School of Dentistry

2:00 p.m. Announcement of Poster Awards **Dr. Ygal Ehrlich**
President, Indiana Section AADR

2:15 p.m. - 4:30 p.m. Commercial Exhibitions (CE 450C)

Interschool Poster Presentations (CE 406)

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

2:30 p.m. - 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. Announcement of Exhibitor Passport Winners
Removal of Posters

Introducing the Keynote Speaker



Dr. Jack Ferracane is Professor and Chair of Restorative Dentistry, and Division Director of Biomaterials and Biomechanics at Oregon Health & Science University, Portland, Oregon. Dr. Ferracane received a B.S. in Biology from the University of Illinois, and an M.S. and Ph.D. in Biological Materials from Northwestern University. He is a founding fellow and past-President of the Academy of Dental Materials. He is a past-President of the Dental Materials Group of the International Association for Dental Research. He is the President-elect of the American Association for Dental Research. He is the recipient of the Wilmer Souder Award from the Dental Materials Group of the IADR, and the Founders Award from the Academy of Dental Materials. He is an honorary member of the American College of Dentists and the Oregon Dental Association.

Dr. Ferracane serves on the editorial board of ten journals and is Associate Editor of the Journal of Dental Research and Odontology. He has authored a textbook entitled "Materials in Dentistry. Principles and Applications." He is a co-editor of a textbook entitled "Summitt's Fundamentals of Operative Dentistry. A Contemporary Approach," now in its fourth edition. He has published and lectured extensively on dental materials, including dental composites, adhesives, amalgam, and practice-based dental research. His current research interests are in developing new monomers for enhanced dental composites and the use of bioactive glasses in resin-based dental materials. He also is actively involved in the establishment and operation of networks designed to conduct dental clinical research in the private practice setting. His research is funded by the NIH/NIDCR as well as private industry. He has provided continuing education at annual meetings of the ADA, British Dental Association, California Dental Association, Chicago Midwinter, Midwest Dental Conference, Oregon Dental Conference, Pacific NW Dental Conference, Southwest Dental Conference, Yankee Dental Congress, and to other professional dental organizations.

Presentation

Caries Formation Around Dental Composite Restorations - Assessing In vitro Models for a Multifaceted Problem

Recognizing Excellence

2016 List of Awards

Dental Hygiene

Elizabeth A. Hughes Dental Hygiene Case Report Award

Undergraduate Students

Johnson & Johnson Undergraduate Student Award

Predoctoral Dental Students

AADR Student Research Day Award

King Saud University Travel Award*

American Dental Association/Dentsply International Student Clinician Award

INAADR Interschool Dental Student Research Award

ASDA-sponsored IUSD Student Research Group Award

Procter & Gamble Award for Excellence in Preventive Oral Health Care

Cyril S. Carr Research Scholarship

Graduate Dental Students

Shofu Ph.D. Student Oral Presentation Award

Delta Dental Award for Innovation in Oral Care Research

Indiana Dental Association Best Clinical Case Report Award

King Saud University Travel Award*

Maynard K. Hine Award for Excellence in Dental Research

Staff

INAADR Research Staff Award

Faculty

IU School of Dentistry Alumni Association Distinguished Faculty Award for Teaching

* Award is applicable to mentors of awardees.

Poster Presentations

All posters will be available for viewing from 2:30 p.m. to 4:30 p.m.

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

CARIOLOGY

- P1 Near-infrared Digital Imaging Transillumination for Approximal Non-cavitated Caries Detection.** N. ABOGAZALAH¹, A.T. HARA¹, A. GOSSWEILER¹, G.J. ECKERT², J.A. PLATT¹, N.B. COOK¹, K.E. DIEFENDERFER¹, M. ANDO¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Objective: The objectives of this *in vitro* study were: 1) to evaluate the ability of Near-infrared Digital Imaging Transillumination (NIDIT) to detect non-cavitated approximal caries lesions; and 2) to compare the performance among NIDIT, International Caries Detection and Assessment System (ICDAS), Digital Radiography (DR), and Digital Imaging Fiber-Optic Trans-Illumination (DIFOTI). Methods: Twenty-eight human extracted premolars were selected. The approximal surface status ranged from sound to surfaces with non-cavitated caries lesions into the outer one-third of the dentin. Lesion depth was determined by micro-computed tomography (μ -CT) and used as a gold standard. Teeth were mounted in custom-made device to simulate approximal contact. ICDAS, DR, DIFOTI and NIDIT examinations were performed and repeated by three trained and calibrated examiners. Sensitivity, specificity, area under ROC curve (Az), inter- and intra-class correlation coefficients (ICCs) of each method, and correlation among the methods were determined. Results: ICCs for intra-/inter-examiner agreement was almost perfect for DIFOTI (0.85/0.83), substantial for ICDAS (0.79/0.72) and NIDIT (0.69/0.64), and moderate for DR (0.52/0.48). Sensitivity/specificity for DIFOTI, ICDAS, DR and NIDIT were 0.91/0.69, 0.89/0.83, 0.50/0.64, and 0.68/0.93, respectively. As for the comparison between the methods, Az of DR (0.61) was significantly lower than that of DIFOTI (0.91, $p=0.002$) and ICDAS (0.90, $p=0.005$); but was not significantly different from NIDIT (0.81, $p=0.052$). DIFOTI, ICDAS, and NIDIT were not significantly different from each other ($p>0.13$). Spearman correlation coefficient of DIFOTI (0.79, $p<0.001$), ICDAS (0.74, $p<0.001$), and NIDIT (0.65, $p<0.001$) demonstrated a moderate association with μ -CT, and that of DR was no association (0.19, $p=0.289$). Conclusion: Within the limitations of this *in vitro* study, NIDIT system demonstrated a potential for early approximal caries detection. ICDAS, DIFOTI and NIDIT performance was superior in terms of validity and reliability to DR.

- P2 Effect of Milk with Strontium and Fluoride on Enamel Surface Microhardness.** A.T. AHMED* and F. LIPPERT (Indiana University School of Dentistry)

Objective: The purpose of this study was to determine the effect of different concentrations of Strontium with and without fluoride added to milk on enamel surface microhardness. Methods: Artificial caries lesions were created in 54 polished human enamel specimens. Initial hardness of the demineralized specimens was determined using a Vickers microhardness (VMH) indenter (200g / 15 seconds). Only specimens with a lesion surface hardness ranging between 25 and 85 were accepted. The specimens were randomly balanced into three treatment groups ($n= 18$) based on baseline VMH readings after

lesion creation. Nine Treatment subgroups were generated based on a 3 x 3 factorial design (0/1/10 ppm fluoride and 0/5/30 ppm strontium). Thereafter, the cyclic treatment regimen involved a 4 hrs/day acid challenge in the lesion forming solution and four, ten-minute treatment periods with the specimens stored in the remineralization medium in between. The regimen was repeated for 7 cycling days. Posttreatment VMH was measured and differences to baseline values calculated. Data were analyzed using two-way ANOVA. Results: Milk with different concentrations of fluoride and Strontium varied in their remineralizing capacity and least square means of lesion remineralization was greatest in the group with the highest fluoride concentration with or without strontium (10 ppm Fluoride and 0/5/30 ppm strontium). The remineralizing effect of the different levels of Fluoride was not dependent on the level of Strontium. There was not a statistically significant interaction between Fluoride and Strontium ($P = 0.738$). Conclusion: A clear trend of remineralizing artificial caries lesions with fluoridated milk was evident under the selected in vitro pH cycling model. However, addition of Strontium to fluoridated milk in concentration as high as 30 ppm did not improve the remineralization potential of artificial caries lesions.

P3 Fluoride in Saliva and Plaque after Varnish Application. L. AL DEHAILAN^{*1}, F. LIPPERT¹, C. GONZÁLEZ-CABEZAS², G.J. ECKERT³, E. A. MARTINEZ-MIER¹ (¹Indiana University School of Dentistry, ²University of Michigan School of Dentistry, ³Indiana University School of Medicine)

Most of the commercially available fluoride varnishes (FV) have not been evaluated for their cariostatic properties or surrogate measures thereof. Consequently, the aim of this in vivo study was to investigate intra-oral fluoride retention and clearance from three FV. Eighteen subjects (7-11 years) participated in a laboratory analyst-blind, randomized, crossover study comparing the ability of 5% sodium fluoride varnishes (CavityShield-CS, Enamel Pro-EP, Vanish-V) to enhance fluoride concentrations in plaque fluid, centrifuged and whole saliva over a period of 48h after a single FV application. Similar fluoride concentration x time patterns were noted for all investigated FV and studied variables, with the highest fluoride concentrations observed for the first biological sample collected after FV application (30min). Mean \pm SE (area under fluoride clearance curve) values were (μ g F/g or ml x min): plaque fluid – CS (1237 \pm 440), EP (525 \pm 82), V (1916 \pm 468); centrifuged saliva – CS (51 \pm 7), EP (23 \pm 3), V (51 \pm 8); whole saliva – CS (83 \pm 14), EP (76 \pm 11), V (66 \pm 7). V delivered more fluoride to plaque fluid than CS ($p=0.0116$) and EP ($p=0.0065$), which did not differ ($p=0.27$). For centrifuged saliva, both CS and V were not significantly different ($p=0.86$), but resulted in higher fluoride retention than EP ($p=0.0006$ and $p=0.0008$, respectively). No significant differences among FV were observed for whole saliva ($p=0.79$). The present study has shown that FVs vary greatly in their ability to deliver fluoride intra-orally which may be attributed to formulation differences. To what extent the present findings relate to clinical efficacy remains, however, to be determined.

P4 Remineralization of Artificial Enamel Caries by Theobromine, Theophylline and Caffeine. H. AYOUB* and F. LIPPERT (Indiana University School of Dentistry)

Fluoride has been considered the most effective preventive measure against dental caries. However, several issues are tied to the dependence on fluoride exclusively such as dental fluorosis. Therefore, some efforts have been conducted to find alternative naturally occurring compounds that have similar, or better, anticaries effect. Caffeine, theophylline, and theobromine are all naturally occurring alkaloids, which are found in coffee, tea, and cocoa. Objective: To investigate the anticaries potential of theobromine, theophylline and caffeine alone and in combination with sodium fluoride (NaF) to remineralize early carious enamel lesions under dynamic condition simulating dental caries. Methods: Sound bovine enamel specimens were demineralized to create caries lesions. These lesions were characterized using surface microhardness (Vickers, VHN) and assigned to the nine treatment groups. Lesions were then pH cycled for 7 days. Surface microhardness was assessed after the pH cycling.

Then, all lesions were sectioned and the sections analyzed for changes in mineral content using transverse microradiography (TMR). Changes in surface microhardness (Δ VHN), integrated mineral loss (Δ Δ Z) and lesion depth (Δ L) were calculated. Results: The present model did not show fluoride dose-response. No alkaloid was able to enhance lesion remineralization, either alone or in presence of fluoride. Also, there were no differences between any groups for any of the tested variables. Conclusion: The present in vitro study failed to demonstrate a fluoride dose-response. Theobromine, caffeine, and theophylline did not enhance lesion remineralization either on their own or in presence of fluoride.

P5 *Fusobacterium nucleatum* Biofilm Formation in the Presence of Electronic Cigarette Juice. B. HERRON*¹ and R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Fusobacterium nucleatum is a bacterium commonly found in the oral cavity of humans and plays a primary role in the formation of periodontal disease. A recent advancement in technology has promoted the trend of electronic cigarettes as tools for a “healthier” smoking habit by removing tobacco. E-Cigarettes vaporize re-fillable liquids that contain various flavors and concentrations of nicotine. In the presence of both 18 and 0 mg/mL Halo brand E-Cigarette juice products, it was hypothesized that *F. nucleatum* will form significantly higher amounts of biofilm in the nicotine-containing juice than the 0 nicotine juice. In this experiment, *F. nucleatum* was exposed to various concentrations of Halo brand E-Cigarette juice containing dilutions of the 18 mg/mL Halo product and the 0 mg/mL control to determine their ability to alter biofilm formation. An overnight culture of the bacterium was incubated with six different concentrations of two types of Halo brand E-Cigarette juice (0.28, 0.56, 1.13, 2.25, 4.5 and 9.0 mg/mL) in 96-well flat-bottom microtiter plates for 48 h. The cells were fixed with 0.5% formaldehyde for 30 minutes, washed with DI water and then stained with Crystal Violet stain for another 30 minutes. The wells were washed and then fixed with isopropanol for 1 hr. A greater color change directly correlated with greater biofilm formation. The amount of color change (optical density) was quantified using a SpectraMax190 spectrophotometer. It was determined that both types of Halo brand E-Cigarette juice caused similar effects on *F. nucleatum* biofilm formation. In most experiments, there was a correlation of significantly increased binding seen in both concentrations of Halo E-Cigarette juice at 0.28 and 0.56 mg/mL. The observations from this experiment may suggest an increased risk of periodontal disease for E-Cigarette smokers.

P6 Nicotine/Tobacco Exposure on *Streptococcus mutans* Biofilm and Polyphenol Effects. E.S. TAYLOR*, G.F. GOMEZ, J.E. JONES, J.F. YEPES, B.J. SANDERS, A. TOMLIN, R.L. GREGORY (Indiana University, Riley Hospital for Children)

Objective: The purpose of this study was to compare the effects of primary, secondary and tertiary nicotine/tobacco exposure on *Streptococcus mutans* biofilm formation and the inhibitory effect of the major antimicrobial polyphenol, epigallocatechin-3 gallate (EGCG), found in green and black teas. This study addressed the results of biofilm assays with varying concentrations of EGCG and nicotine/tobacco levels consistent with tea content and primary, secondary and tertiary levels of nicotine/tobacco exposure. Methods: A 24 hour culture of *S. mutans* UA159 in microtiter plates was treated with varying levels of nicotine or cigarette smoke condensate (CSC) concentrations (0-32 mg/ml) in Tryptic Soy broth supplemented with 1% sucrose simulating primary, secondary and tertiary exposure with and without EGCG at 0.25 mg/ml. A spectrophotometer was used to determine total growth absorbance and biofilm formation using a crystal violet dye biofilm staining assay. Hypothesis: The presence of EGCG inhibits primary, secondary and tertiary nicotine-induced *S. mutans* biofilm formation in the absence of nicotine and at low concentrations of nicotine and CSC (0.25-4 mg/ml). Results: For primary, secondary and tertiary nicotine and CSC exposure levels, significantly overall greater biofilm growth was observed

without EGCG than with EGCG. However, biofilm growth was not statistically different among the differing individual concentrations of CSC. For total absorbance, significantly greater growth absorbances were observed in the absence of EGCG compared to when EGCG was present. This was true for primary, secondary and tertiary levels of exposure for both CSC and nicotine. Conclusion: The results of this study help illustrate that nicotine-induced *S. mutans* biofilm formation is reduced by the presence of EGCG. This provides further evidence of the harmful effects of nicotine, as well as provides insight for potential beneficial properties of polyphenols.

CIVIC ENGAGEMENT

P7 Oral Health Program Evaluation of Healthy Smiles for Employability. S. BUEDEL*, M. KINGORI, J. BHAHEETHARAN, W. BURCHAM, N. AHMED, K. BONTRAGER, J.P. THOMPSON, J. WU, K.M. YODER, T.J. CARLSON (Indiana University School of Dentistry)

Through Indiana University Student Outreach Clinic, the Healthy Smiles for Employability (HSE) program purposes to improve oral health and employment opportunities by providing free dentures for local low-income and uninsured residents who perceive the appearance of their teeth as a barrier to employment. HSE participants are connected with a local community center to complete a one-week job assistance workshop to enhance skills such as resume writing, interviewing, and financial management. Participants are then paired with a 3rd or 4th year dental student at Indiana University School of Dentistry for their denture treatment. The objective of this study was to evaluate program impact and implementation. In order to evaluate program impact on participants' oral health and employment, two assessments were identified: Oral Health Impact Profile survey (OHIP-14) and employment income status. Each assessment is utilized prior to involvement in the program as well as at least one month after receiving dentures. OHIP-14 examines the frequency of negative oral health impacts on individual well-being (e.g. pain, psychological discomfort, social disability). Employment income status, based on Federal Poverty Level Guidelines, is categorized as unemployed, underemployed (<200% FPL), and employed (>200% FPL). To evaluate and improve program implementation, HSE participants complete qualitative surveys related to personal experiences and program satisfaction. Examining OHIP-14 survey responses, post-program scores showed improvement, signifying a reduced frequency of negative experiences related to oral health after receiving dentures in completion of HSE. Additionally, participants' post-program employment income status remained unchanged or showed improvement (e.g. unemployed to underemployed). However, findings are limited due to a small sample size (n<30), patient non-compliance, and a general focus on immediate assessment without long-term follow-up. (Supported by IUPUI Solution Center Community Venture Fund, JP Morgan Chase Foundation, and Lily Endowment)

DENTAL INFORMATICS

P8 Creating a Protocol to Evaluate Use of Dental Diagnostic Terminologies. K.M. FRAZIER*, H. TAYLOR, Z. SIDDIQUI, T. THYVALIKAKATH (Indiana University School of Dentistry)

Objectives: Unlike medicine, dentistry has yet determined universally accepted diagnostic terminology for oral diseases and conditions. Currently, two comprehensive diagnostic terminologies exist for dental care providers – SNODENT and DDS codes. Limited studies evaluating both terminology sets exist. We created protocol to evaluate the ease of understanding and clinical usability of the two dental diagnostic terminologies at the Indiana University School of Dentistry (IUSD). Methods: We selected six cases from National Dental Board Examination Part II released questions (with permission), containing pertinent medical and dental histories, clinical images, and radiographs. Cases represented cases typically seen in orthodontics, pediatrics, and comprehensive care clinics at IUSD. Corresponding patient charts were

created in the Electronic Dental Records (EDR) (axiUm, Exan Corporation) IUSD uses. Six faculty participants reviewed two cases relevant to their specialty. They entered findings and diagnoses into EDR using both terminologies. Participants thought aloud while working through cases and their voice and interactions with EDR were recorded using screen capture software (Camtasia). After all completed sessions, researchers reviewed the recordings to identify challenges experienced by participants using the two terminologies within EDR. Results: All study participants experienced difficulty linking diagnoses to corresponding findings using both terminologies in EDR. They encountered trouble finding desired diagnosis for two reasons: 1) limited terminology organization to support clinicians' thought processes; 2) Inability to search diagnoses using synonyms or terms clinicians use to describe oral conditions. Upon reviewing all sessions, we concluded utilizing one patient case with multiple findings is sufficient to identify most of the problems encountered due to user interface design and diagnosis presentation within the EDR. Conclusions: Preliminary results indicate EDR interface design influence and presentation of diagnostic terminologies on the clinicians' effective use of diagnoses. The final study design will utilize one case to evaluate both terminologies within the academic setting of IUSD.

P9 Assessing Usefulness of Risk-Based Clinical Decision Support System in Dentistry. Z. SIDDIQUI* and T. THYVALIKAKATH (Indiana University School of Dentistry)

Background: Clinical decision support systems (CDSS) are "information technology-based systems designed to improve clinical decision-making". However, limited studies exist that determine the effectiveness and clinicians' attitude towards CDSS in dentistry. This is particularly true for risk-based CDSS. Periodontal Risk Calculator (PRC) is a risk-based CDSS that helps to assess a patient's risk and disease status for periodontal disease. It also helps the clinicians in formulating treatment planning and oral hygiene instruction. Objective: In this study we examined the dental clinicians' utilization of the PRC by assessing their clinical documentation before and after implementing a PRC. We also assessed the extent to which clinicians agreed with the PRC generated report. Method: A 3 months of pre-post intervention study was performed at a private dental practice using PRC. A total of 142 patient records were analyzed using Fisher's exact test to determine statistical significance between pre- and post-implementation data. Clinicians' responses towards PRC report were recorded on a close ended questionnaire and were analyzed using descriptive statistical method. Results: PRC does not lead to any significant changes in the clinical documentation of risk factors. However documentation of periodontal diagnosis and oral hygiene instruction showed statistically significant increased with p-value of 0.012 and 0.004 respectively. The clinicians found PRC report to be beneficial on gingival health and oral hygiene instruction in more than 85% of report. However, Limited usefulness was reported with the PRC report on periodontal risk assessment (21%) and treatment options (10%). Conclusion: Study demonstrated the usefulness of risk-based CDSS in dentistry. We found that implementation of PRC increases the clinicians' recording of periodontal diagnosis and oral hygiene instructions which is beneficial for tracking periodontal disease progression and oral health improvement. (This study was supported by NIH/NIDCR grant # 1K08DE08957-01A2)

DENTAL MATERIALS

P10 Coaxial Electrospun Polymer Nanofibers: Potential Applications in Dentistry. Y. AFSHAR* and M.C. BOTTINO (Indiana University School of Dentistry)

With increased emphasis on the wide and multidisciplinary applications of electrospun polymer nanofibers, there is a keen interest in engineering these fibers with various properties ranging from cell encapsulation to multifunctional drug delivery systems. An innovative extension of electrospinning, i.e., coaxial electrospinning, could be used to fabricate core-shell nanofibers composed of distinct polymers

with unique properties that may serve as carriers of biomolecules for use in drug delivery, tissue engineering, cell biology, and regenerative dentistry. The purpose of this study was to fabricate coaxial nanofibers using two polymers, namely poly(vinyl alcohol) (10 wt.% PVA solution) as the core solution and polydioxanone (10 wt.% PDS solution) as the shell solution. PVA and PDS were coaxially electrospun while processing parameters such as applied electric field strength, fluid flow rate, and the distance from nozzle to collector were systematically adjusted. The experiment was carried out in a fully encased laboratory-based electrospinning setup to reduce potential effects of the surrounding environment. The fabrication of coaxial fibers were achieved using 17kV, 9 cm distance to collector, and the flow rates of 120ul/hr and 0.8ml/hr for core and shell solutions, respectively. The successful fabrication of coaxial fibers (with a core diameter of ~ 33 nm and a shell diameter of ~ 65 nm) was confirmed using both light and transmission electron (TEM) microscopies. These coaxial PVA-PDS nanofibers could be further studied for potential applications in regenerative dentistry as drug delivery systems and tissue scaffolds.

P11 Internal Adaptation Quantitative Comparison Between Bulk-fill and Multi-increment-fill Resin Composites. F.S. ALQUDAIHI*, A.T. HARA, N.B. COOK, M.C. BOTTINO, T.G. CHU, J.A. PLATT (Indiana University School of Dentistry)

Recently, many resin-based composite (RBC) materials have been introduced to the market allowing for use of the bulk-fill technique with many advantages over the standard incremental placement technique. Objectives: To quantitatively evaluate the internal adaptation among different light-activated bulk-fill RBC materials and a traditional RBC material placed incrementally by measuring the gap area between the restorative material and the tooth structure and to evaluate an aging effect on the internal adaptation. Methods: 70 teeth with a Class I cavity preparation were randomly distributed into five groups; four groups were restored with different bulk-fill RBC; Tetric EvoCeram Bulk Fill (TEC), SonicFill (SF), QuiXX Posterior Restorative (QX), and x-tra fil (XF); the fifth group was restored with multi-increment-fill Filtek Supreme Ultra Universal Restorative (FSU). One-half of the samples of each group were thermocycled. Each tooth was sectioned, digital images recorded, and the dimension of any existing tooth-restoration gap was measured. Data were analyzed using ANOVA ($\alpha=0.05$). Results: FSU had the smallest gap measurement values compared with the bulk-fill materials tested except QX and TEC ($p \leq 0.008$). FSU had the smallest sum of all gap category values compared with the bulk-fill materials tested, except QX ($p \leq 0.021$). The highest gap incidence and size values were found at the composite/adhesive interface. All aged groups had greater gap values than non-aged groups. Significance: The incrementally placed material FSU had the highest internal adaptation to the cavity surface while the other four materials using the bulk-fill technique showed various behaviors and results. The thermocycling aging technique influenced the existing gap quantities. These findings suggest that the increment-fill technique has advantages in terms of internal adaptation over the bulk-fill technique.

P12 In Vitro Evaluation of Polymerization Threshold Energy for Bulk Fill Composites. R. ALRASHEED*, J. WALLACE, B. MATIS, T.G. CHU, N.B. COOK, J.A. PLATT (Indiana University School of Dentistry)

Recently, the concept of “bulk-fill” resin based composites (RBCs) has been re-emphasized, with claimed improvements in depth of cure (DOC) with similar mechanical properties and comparable adaptation to walls and margins relative to conventional composite. More research is needed to carefully examine the properties of these new materials. The objective of this study was to measure the light energy, microhardness (VHN) and elastic modulus across the depth of one conventional and three bulk-fill RBCs. Three commercially available bulk-fill RBCs (Tetric EvoCeram Bulk Fill [TE], SonicFill [SF], X-tra fill[XF]) and one conventional RBC (Premise [PR]) were evaluated (n=10). DOC (using Vickers’s

microhardness), elastic modulus (using atomic force microscopy), and the mean irradiance and total light energy transmitted through different thicknesses of RBC were measured by a spectrometer. The effects of group, location, and curing depth on VHN were analyzed using mixed-model ANOVA. Elastic modulus and light energy comparisons were made using two-way ANOVA, with a significance level of 5%. There was a significant difference in the depths for the mean irradiance and total energy between different depths in all materials. All materials achieved the manufacturers' claimed DOC. XF had the highest DOC with 7 mm and a light energy of $0.56 \pm 0.02 \text{ J/cm}^2$ at 7 mm. PR had the lowest DOC with 3 mm and a light energy of $0.84 \pm 0.12 \text{ J/cm}^2$ at 3 mm. The elastic modulus showed significant variation in depth profiles that were different than the DOC. The manufacturers' claims for bulk-fill DOC were achieved using a microhardness method. However, this method failed to detect quality of the polymerization. Assessment of the elastic modulus using AFM is a promising method for greater understanding of the polymerization. (Supported by Delta Dental)

P13 Beam Profile Influence on Polymerization Characteristics of Resin-Matrix Composites.

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The objective of this study was to quantify the homogeneity of the beam of light radiated from each of two different light-curing units (LCUs) using beam profiling, and then evaluate the relationship between these beam profiles and polymerization patterns of a resin-matrix composite (RMC). Beam profile and irradiance measurements of one light-emitting diode (LED) and one quartz-tungsten-halogen (QTH) curing unit were collected using a beam-profiler-system and a MARC-RC resin calibrator, respectively. The camera-based beam-profiler-system (BGP-USB-SP620 with 50-mm-lens, Ophir-Spiricon) combined radiant-power-values from an irradiance-probe (cosine-corrector/spectrometer-assembly) to measure beam-homogeneity (the distribution of irradiance-values across the light-beam) for each curing-unit. A mapping approach was used to investigate the polymerization pattern of nano-hybrid RMC samples (5x5x2mm) at various depths utilizing both micro-Raman-spectroscopy (degree-of-conversion, DC) and ethanol softening (cross-link-density, CLD), which was determined using automated-microhardness testing after exposure to ethanol. Two-sample t-tests with unequal-variances were used to compare the LCUs for differences in irradiance (mW/cm^2) and radiant-exposure (J/cm^2). Comparisons among polymerization by depths with-respect-to LCU were made using paired t-tests and two-sample t-tests as appropriate for the specific depths. The effects at each depth of location on the sample and LCU were tested using mixed-model ANOVA. The LED demonstrated inhomogeneity and significantly higher irradiance values compared to the QTH. Both LCUs demonstrated variations in DC (62-74%) and percent Knoop hardness number (KHN) reduction (33-49%) at different depths and locations. A gradual decrease in KHN occurred from top to bottom in the RMC cured with QTH unlike the LED. A gradual decrease in CLD was exhibited in both LCUs. This study showed that the beam-profile-inhomogeneity of QTH and LED curing-units resulted in localized differences in DC, KHN and CLD of RMC samples at specific depths and locations. However, adequate polymerization of the RMC was achieved at all points when using the LED LCU.

P14 Wear, Strength, Modulus and Hardness of CAD/CAM Restorative Materials. R. BANSAL^{*1}, J.O. BURGESS², N.C. LAWSON² (¹Indiana University School of Dentistry, ²University of Alabama at Birmingham School of Dentistry)

Objective: To measure the mechanical properties of several CAD/CAM materials, including lithium disilicate (e.max CAD), lithium silicate/zirconia (Celtra Duo), 3 resin composites (Cerasmart, Lava Ultimate, Paradigm MZ100), and a polymer infiltrated ceramic (Enamic). Methods: CAD/CAM blocks were

sectioned into 2.5mmx2.5mmx16mm bars for flexural strength and elastic modulus testing and 4mm thick blocks for hardness and wear testing. E.max CAD and half the Celtra Duo specimens were treated in a furnace. Flexural strength specimens (n=10) were tested in a three-point bending fixture in a universal testing machine. Vickers microhardness (n=2, 5 readings per specimen) was measured with a 1kg load and 15 second dwell time. The CAD/CAM materials as well as labial surfaces of human incisors were mounted in the UAB wear device. Cusps of human premolars were mounted as antagonists. The specimens were tested for 400,000 cycles at 20N force, 2mm sliding distance, 1Hz frequency, and 33% glycerin lubrication. Volumetric wear and opposing enamel wear were measured with non-contact profilometry. Data were analyzed with 1-way ANOVA and Tukey post-hoc analysis ($\alpha=0.05$). Specimens were observed with SEM. Results: E.maxCAD and Celtra Duo are in general stronger, stiffer, and harder than the other materials tested. E.max CAD, Celtra Duo, Enamic, and enamel demonstrated signs of abrasive wear, whereas Cerasmart, Lava Ultimate, Paradigm MZ100 demonstrated signs of fatigue. Significance: Resin composite and resin infiltrated ceramic materials have demonstrated adequate wear resistance for load bearing restorations, however, they will require at least similar material thickness as lithium disilicate restorations due to their strength.

P15 Translucency Parameters of Full-Contour- Zirconia Ceramics. E. CLOSURDO*, H. AL-JOHANI, N. SUPORNPUN, T.G. CHU (Indiana University School of Dentistry)

Objective: To investigate the translucency parameters (TP) of several recently marketed full contour zirconia and compare that to traditional zirconia and lithium disilicate glass ceramic at different thicknesses. Materials and Methods: Translucency of 4 different full-contour zirconia all-ceramic systems (CAP FZ, Zirlux, Bruxzir, and KDZ Bruxer) was compared to a Lithium disilicate glass ceramic (E-max CAD) and a traditional zirconia (CAP QZ). 150 square-shaped ceramic specimens (12 x 12 mm) were prepared from CAD-CAM material blocks with varying thicknesses (1, 1.25, 1.50, 1.75, and 2 mm). All specimens were sintered following the manufacturers' instructions without glazing afterward. Subsequent to polishing the specimens, translucency measurement were performed by a spectrophotometer device (CM-2600D). Percent light transmission through the thickness of the samples was also measured. Data of the measurements was statistically compared using 2-way ANOVA. Results: The translucency parameter of all full contour zirconia is significantly lower than that of E-max CAD. Some full contour zirconia demonstrated similar translucency parameters than those of traditional zirconia. The translucency parameter of E-max CAD ranged from 7.36 to 12.56, those of QZ ranged from 0.18 to 0.99, and those of full contour zirconia from 0.20 to 6.04. The general ranking of TP was E-max CAD > FZ = Zirlux = KDZ Bruxer > Bruxzir and QZ. There was a logarithmic relationship between TP and specimen thickness. A linear relationship between the percent light transmission and TP was found. Conclusion: All of full contour zirconia had lower translucency parameters than lithium disilicate glass ceramic. The higher thickness of any type of ceramic disk, the lower the translucency parameter becomes. Further study on the effects of TP on the degree of conversion of the resin cement underneath the ceramic will be conducted.

P16 Clindamycin-containing Scaffolds for Root Canal Disinfection. A.E. KARCZEWSKI*, S.A. FEITOSA, N.C. LAWSON, R.L. GREGORY, M.C. BOTTINO (Indiana University Bloomington, Indiana University School of Dentistry, University of Alabama at Birmingham School of Dentistry)

The goal of this study was to synthesize/characterize the morphology, tensile strength, dentin stainability, and both the antimicrobial efficacy and cytocompatibility of novel clindamycin-containing scaffolds for root canal disinfection. Two clindamycin-containing polydioxanone (PDS)-based scaffolds, i.e., clindamycin (CLYN) (35wt.%) and a tri-mix scaffold (TAM/tri-mix) (35wt.% of each antibiotic: metronidazole, ciprofloxacin, and clindamycin), were electrospun. The control group was pure PDS scaffold. Fiber

morphology was analyzed with scanning electron microscopy (SEM). Tensile testing was conducted under dry and wet conditions. Antimicrobial efficacy was evaluated using agar diffusion of disc-shaped scaffolds and aliquots, against *Actinomyces naeslundii* (*An*), *Enterococcus faecalis* (*Ef*), *Aggregatibacter actinomycetemcomitans* (*Aa*), and *Fusobacterium nucleatum* (*Fn*). A colony-forming unit (CFU) per milliliter measurement was also performed against *An* and *Ef*. SEM images of biofilm-infected scaffolds were taken to qualitatively analyze biofilm inhibition. Cytotoxicity assays were evaluated in human dental pulp stem cells (hDPSC). Human dentin (IRB#1407656657) staining was visually assessed and compared to the staining properties of clinical TAP paste. Data were statistically analyzed ($p < 0.05$). The fibers' diameters were mostly in the nanoscale; PDS was significantly larger than TAM and CLYN ($p < 0.05$). The tensile strength of TAM scaffolds was significantly lower than PDS and CLYN. Disk-shaped samples from antibiotic-containing scaffolds inhibited growth of *An* (CLYN>TAM), *Ef* (TAM>CLYN), *Aa* (TAM>CLYN), and *Fn* (TAM=CLYN). Aliquots collected at interval times inhibited growth of *An* (TAM>CLYN), *Ef* (TAM>CLYN), *Aa* (TAM>CLYN), and *Fn* (TAM>CLYN) over 21 days. TAM had small, isolated non-biofilm growths, but not enough to be counted, while CLYN and PDS did not differ statistically in viable cell count. Overall, hDPSC viability was similar amongst the groups. TAP paste noticeably stained dentin yellow, whereas all other groups produced no color change. Our data suggests that clindamycin-containing scaffolds (TAM and CLYN) would be beneficial for root canal disinfection, and would not produce tooth discoloration.

P17 Degree of Conversion of Resin Cements Cured Through Various Ceramics. M. OSTER*, N. SUPORNPUN, T.G. CHU (Indiana University School of Dentistry).

Objective: We have characterized the translucency parameters of several full contour zirconia materials in the past. The objective of this experiment is to further investigate the relation between translucency parameters, percent transmittance, and degree of conversion of resin cement beneath these full contour zirconia ceramics. Methods: Samples from four different full-contour zirconia (CAP FZ, Zirlux, Bruxzir, and KDZ Bruxer), a lithium disilicate glass ceramic (E-max CAD) and a traditional zirconia (CAP QZ) were prepared. 150 square-shaped specimens (12 x 12 mm) were prepared from CAD-CAM material blocks. All specimens were sintered following the manufacturers' instruction to achieve final thicknesses of 1, 1.25, 1.50, 1.75, and 2 mm. Five specimens in each thickness for each of the six types of ceramic were produced. Resin cement with and without catalyst (Variolink II, Ivoclar Vivadent) was placed between two mylar strips, with a glass slab beneath and on the top. An opaque-plastic frame was placed around the specimen in order to prevent light transmission and resin was cured through the different thicknesses of ceramic disks for 40 seconds using a halogen light curing unit (DEMI LED, Kerr, CA, USA). The position of curing tip was verified using a MARC® Resin Calibrator. 24 hours after light curing, the cured resin cement samples were scanned with FTIR and the degree of conversion in each group was calculated. Conclusions: When no catalyst is added, the ranking of degree of conversion is E-max CAD>KDZ, CAP FZ, Zirlux, Bruxzir> CAP QZ. There is a linear correlation between percent light transmission, translucency parameter and degree of conversion.

P18 Clinical Evaluation of a Universal Adhesive in Non-Carious Cervical Lesions. M.A. ROUSE*, J.A. PLATT, N.B. COOK, O.R. CAPIN, B.N. ADAMS, M.L. KIRKUP, K.E. DIEFENDERFER (Indiana University School of Dentistry)

The objective of the current study was to compare the effects of two surface treatment protocols (self-etch vs. selective-etch) on the clinical performance of a universal adhesive and resin composite in Class V non-carious cervical lesions (NCCLs). Thirty-three volunteer subjects (17 male; 16 female; age range = 20 to 75 years) having at least two NCCLs were selected from patients of record at Indiana University School of Dentistry. Each subject received one resin composite restoration (Tetric EvoCeram, Ivoclar

Vivadent) utilizing a self-etch (SfE) universal adhesive (Adhese Universal, Ivoclar Vivadent) with no separate enamel etching and another restoration utilizing the adhesive and selective enamel etching (SeE) with 37% phosphoric acid (H₃PO₄). The adhesive and composite were placed following manufacturer's instructions. The two techniques were compared for differences in sensitivity, retention, marginal discoloration, marginal adaptation, and clinical acceptability at baseline and 6 months using Cochran-Mantel-Haenszel tests for stratified, ordered categorical outcomes. Seventy-six restorations (38 SfE, 38 SeE) in 31 volunteers were evaluated at 6 months. No significant differences were found between SfE and SeE groups for any variable at either baseline or 6 months. Retention was 100% at 6 months for both groups. One SfE and two SeE restorations showed slight marginal discoloration at 6 months. Marginal adaptation was significantly worse at 6 months than at baseline for SeE ($p=0.0094$), but there was no difference for SfE from baseline to 6 months for both SeE ($p=0.0024$) and SfE ($p=0.0010$). This report on 6-month data for a two-year study indicates significantly reduced sensitivity for both SeE and SfE groups, and deterioration of SeE marginal adaptation. No decreases in retention, marginal discoloration, or clinical acceptability were observed in either group. All restorations placed were retained and clinically acceptable at 6-months. (Supported by Ivoclar Vivadent Grant No. 064329-00002B)

EDUCATIONAL RESEARCH

P19 Constructively Shaping Minds in a Pre-Clinical Laboratory through iPad Technology. J. HESELBARTH*, M.L. KIRKUP (Indiana University School of Dentistry)

Early in dental education, students must learn self-assessment skills to enhance accuracy towards the desired expectation. Dental educators frequently use verbal feedback to teach students how to properly evaluate their performances. If students do not comprehend the given feedback, the development of self-assessment skills may be delayed and contribute to a lack of self-confidence and poor academic performance. Within a fixed prosthodontics preclinical course, a pilot program was implemented using images taken with iPads allowing instructors to annotate acceptable and deficient areas of students' tooth preparations. The purpose of the study was to evaluate student's perceived confidence in self-assessment prior to and after receiving iPad feedback and to determine if participating in iPad feedback would increase students' grades compared to verbal feedback. After results were gathered and a comparison analysis completed, the findings demonstrated that while perceived confidence increased in self-assessment of preparations, the scores of students that received iPad feedback were not statistically significant to those who received verbal feedback.

ENDODONTICS

P20 Antimicrobial Effects of TAP-mimic Scaffolds on Dual-Species Infected Dentin Biofilm. J. EVANS*¹, M.T.P. ALBUQUERQUE¹, M. KAMOCKA², M. VALERA³, R.L. GREGORY¹, M.C. BOTTINO¹ (¹Indiana University School of Dentistry, ²IU School of Medicine, ³UNESP, São José dos Campos)

Objectives: The current standard for pulpal regeneration is to first eliminate/inhibit bacterial growth within the root canal. Recent research has shown necrotic immature permanent teeth are prevalently infected with *Actinomyces naeslundii*. Meanwhile, *Enterococcus faecalis* was found to be the main cause in refractory infections after antibiotic administration. Novel antibiotic-containing electrospun nanofibrous scaffolds have demonstrated impressive results when compared to the gold standard, triple antibiotic paste, (TAP=ciprofloxacin-CIP, metronidazole-MET, and minocycline-MINO) from a cytocompatibility standpoint. The purpose of this study was to evaluate the antimicrobial effects of novel TAP-mimic

antibiotic-containing scaffolds against a dual-species infected dentin biofilm using confocal laser scanning microscopy (CLSM). Methods: Antibiotic-containing (MET, CIP, and MINO) polymer (Polydioxanone-PDS) solution (30 mg of each antibiotic/mL of polymer solution) was spun under optimized conditions into fibers to obtain the TAP-mimic scaffolds. Human teeth (IRB#1407656657) were vertically sectioned along the mid-sagittal plane to obtain 16 dentin blocks (4x4x1 mm³, n=4). The specimens were sterilized, distributed into 24-well plates containing BHI broth, and inoculated with *A. naeslundii* and *E. faecalis* for 7 days to allow biofilm formation. Infected dentin specimens were exposed for 7 days to the following groups: TAP-mimic and PDS scaffolds, TAP solution (50 mg/mL), and an untreated control (infected dentin/saline solution). CLSM was performed (Live/Dead® Assay) to assess antimicrobial effectiveness. Data were analyzed at 5% significance level. Results: TAP-mimic scaffold had the highest percentage of dead bacteria followed by the TAP solution. Both groups led to significant ($p < .05$) reduction in percentage of viable cells when compared to the controls (untreated and PDS scaffold). No statistical ($p > .05$) difference was found between the antibiotic-containing groups. Conclusions: Collectively, the novel TAP-mimic scaffold holds significant clinical potential for root canal disinfection, as it demonstrated nearly complete eradication of the dual-species biofilm. (Supported by International Development Funds (IDF) Grant from Indiana University Purdue University (IUPUI/OVCR))

P21 Antibacterial Effects of TAP Against Three-Week Old *Enterococcus faecalis*. B. FISCHER*, R.L. GREGORY, S.M. ALYAS, G.H. YASSEN (Indiana University School of Dentistry)

Objective: This study investigated the direct antibacterial effects of various concentrations of triple antibiotic paste (TAP; equal portions of metronidazole, ciprofloxacin and minocycline) loaded into a methylcellulose system against three-week old *Enterococcus faecalis* biofilms. Methods: Standardized radicular dentin samples (2x2x1 mm) were prepared (IRB, 1408897632) and gas sterilized with ethylene oxide. Colonies of *E. faecalis* (ATCC strain 29212) were grown on sterilized dentin blocks (n=60) and incubated anaerobically for 3 weeks. Dentin samples were then treated for 3 weeks with a clinically used concentration of TAP (1000 mg/mL), low concentrations of methylcellulose-based TAP (100, 10 and 1 mg/mL), placebo paste, or 1.5% NaOCl (n=9). Antibiotic pastes were then removed using sterile water and biofilm disruption assays were performed. Detached biofilm cells were diluted in sterile saline and spiral plated on blood agar plates. The plates were incubated for 24 h in 5% CO₂ at 37°C prior to evaluation using an automated colony counter. Furthermore, one randomly selected sample from each group was processed for visualization under confocal laser scanning microscopy after live/dead staining. Fisher's Exact and Wilcoxon rank sum tests were used for statistical analyses ($\alpha = 0.05$). Results: All TAP concentrations as well as 1.5% NaOCl demonstrated significant and complete eradication of biofilm in comparison to placebo paste ($p < 0.00001$). The three-dimensional images obtained from confocal laser scanning microscopy confirmed the presence of live *E. faecalis* biofilm on dentin sample treated with placebo paste. However, no biofilm was observed on dentin samples treated with all tested TAP concentrations. Conclusion: These results demonstrated that 1 mg/mL methylcellulose-based TAP was able to eradicate established *E. faecalis* biofilm and can successfully be used as intracanal medicament for endodontic regeneration. (Supported by: the IUSD Graduate Student Research Fund)

P22 Wettability of Endodontic Sealer on Dentin Pretreated with Intracanal Medicaments. J.D. WETZEL*, G.H. YASSEN, J.A. PLATT (Indiana University School of Dentistry)

Objective: This study explored the effects of dentin pretreated with various intracanal medicaments on wetting behavior of a sealer and surface roughness of dentin. Methods: Standardized dentin samples (IRB # 1508738612) were prepared and randomized into four experimental groups according to the type of intracanal medicaments (n=12 per group). The samples were treated with calcium hydroxide, 500 mg/mL of double antibiotic paste (DAP), 10 mg/mL of DAP, or sterile water (control) for two weeks

followed by two minutes irrigation with 6% NaOCl and 17% EDTA. Then a goniometer was used to determine the contact angle between pretreated dentin surfaces and bioceramic root canal sealer (n=6 per group). Furthermore, a contact profilometer was used to evaluate the surface roughness of pretreated dentin surfaces (n=6 per group). One way ANOVA followed by Tukey pair wise comparison was used for statistical analyses. Results: Dentin pretreated with only irrigation solutions demonstrated significantly higher contact angle than dentin pretreated with 500 or 10 mg/mL of DAP. Dentin pretreated with calcium hydroxide had significantly higher contact angle than dentin treated with 500 mg/mL of DAP. Dentin treated with 500 mg/mL of DAP exhibited significantly higher roughness values (R_a and R_q) in comparison to all other experimental groups. Conclusion: Dentin pretreated with 500 mg/mL of DAP offered significantly lower contact angle (better wettability) in comparison to dentin pretreated with calcium hydroxide. This can be explained by ability of high concentration of DAP to condition dentin and increase surface roughness.

P23 Stem Cell Attachment Ability to DynaMatrix[®] and C-Point[®]. A. WILLIAMS*, B. LI, L.J. WINDOSR, F. SONG (Indiana University School of Dentistry)

Objective: The focus of this study is to determine the ability of pulp stem cells to attach to two dental scaffolds, DynaMatrix[®] and C-Point[®]. Attachment to the scaffold is crucial for tissue regeneration, including pulp tissue regeneration. DynaMatrix[®] and C-Point[®] are commonly used dental materials and have the potential to be used as the scaffold to induce pulp tissue regeneration. Method: The types of pulp stem cells used in this study were dental pulp stem cells (DPSCs) and neonatal pulp stem cells (NPSCs). After DynaMatrix[®] and C-Point[®] scaffolds were rehydrated with serum(-) media for 10 minutes in 6-well plates, approximately 100,000 cells in 100 μ L of serum(+) media were seeded onto the scaffolds. The cells were incubated with 2 mL of serum(-) media for 1, 3 and 5 days before cell morphology was observed under a microscope, and the conditioned media was collected for protein secretion analysis. The scaffolds were fixed for Scanning Electronic Microscope examination at Central Michigan University. Each experiment was repeated at least three times. ANOVA t-test will be performed to examine the statistical significance ($P < 0.05$). Results: Cell morphology showed that the cells cultured with DynaMatrix[®] maintained their regular spindle shape. C-Point[®] changed the cell culture media to a more acidic condition, which was toxic to the pulp stem cells when no HEPES buffer was added into the cell culture media. SEM showed that pulp stem cells had better attachment to DynaMatrix[®] than to C-Point[®]. Conclusion: DynaMatrix[®] might be a better scaffold for pulp stem cells compared to C-Point[®] in regard to stem cell attachment.

MICROBIOLOGY/IMMUNOLOGY/ORAL BIOLOGY

P24 The Cytotoxic Effects of Hemostatic Agents on Human Gingival Fibroblasts. A.S. ALBAKRI*¹, N.Y. LABBAN², L.J. WINDSOR¹ (¹Indiana University School of Dentistry, ²King Saud University School of Dentistry)

Objective: Gingival hemorrhage control methods are critical before impression making or cementation of restorations. These methods can be classified as mechanical, chemical, surgical or as combinations which may cause temporary or permanent injury to the gingival tissue cells. Hence, the purpose of this in vitro study was to evaluate the cytotoxic effects of different chemical hemostatic agents to human gingival fibroblasts (HGF) using lactate dehydrogenase (LDH) assays. Materials and Methods: Human gingival fibroblasts were cultured and subjected to 300 μ L of Hemodent (Premier), Astringedent (Ultradent) or Hemox-A (Keystone) for 5 minutes. The cells were washed with phosphate-buffered saline three times followed by adding 2 ml of serum-free medium to each well. After that, LDH assays were performed at time points of 1, 12, 24, 48 and 72 hours to determine the cytotoxic effects of the hemostatic agents to the

HGFs. One-way ANOVA followed by Tukey's HSD (honest significant difference) test were used for statistical analyses ($\alpha = 0.05$). Results: Within the limitations of this study, the three hemostatic agents showed no significant toxicity to the HGFs (P value >0.05). Conclusion: On the basis of LDH assays, the three hemostatic agents had no significant cytotoxic effects to the HGFs if applied for only 5 minutes.

P25 Acid Tolerance of *Streptococcus mutans* Treated with Nicotine. A.H. ALHUSSEIN^{*1}, G.G. GOMEZ¹, N.Y. LABBAN², R.L. GREGORY¹ (¹Indiana University School of Dentistry, ²King Saud University School of Dentistry)

Background: *Streptococcus mutans* is one of the main etiological agents of tooth decay, which is prevalent in 70-100% of human carious lesions. Smoking and tobacco use are considered a major public health problem. The association of smoking, caries and *S. mutans* has been minimally investigated. Aim: The purpose of this study was to evaluate the acid tolerance of *S. mutans* treated with different nicotine concentrations (0-32 mg/ml). Materials and methods: *S. mutans* UA159 strain was used in two experiments; *S. mutans* in the first experiment was cultured overnight in Brain-Heart Infusion with 1% sucrose (BHIS) media with different pH levels (5.2 and 7.0) containing different concentrations of nicotine (0-32 mg/ml). In the second experiment, *S. mutans* was initiated in BHIS media with pH7.0 for 24 h. The cultured media was replaced with fresh BHIS media adjusted to pH3.0, 5.2, or 7.0 in different concentrations of nicotine for another 24 h. The total absorbance and biofilm formation were measured using a spectrophotometer. Results: The total absorbance of the first experiment demonstrated a significant reduction in growth with nicotine concentrations between 0-8 mg/ml in an initial pH5.2 environment, while at pH7.0 *S. mutans* exhibited increased growth in a nicotine-dependent manner up to 8 mg/ml. The second experiment indicated that *S. mutans* biofilm initiated at pH7.0 has the ability to tolerate pH3.0 and was increased at pH5.2. The total absorbance of *S. mutans* initiated at pH7.0 was increased in a pH3.0 environment in a nicotine-dependent manner up to 4 mg/ml, while there was no increase in biofilm at pH5.2. Conclusion: *S. mutans* has the ability to form biofilm in a pH5.2 environment with increasing nicotine concentrations up to 2 mg/ml. Established *S. mutans* biofilm has the ability to tolerate a pH3.0 environment with nicotine concentrations up to 32 mg/ml.

P26 Nicotine-Treated *Fusobacterium nucleatum* Binding to Collagen, Fibrinogen and Fibronectin. Y.S. BESHAY^{*1} and R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Fusobacterium nucleatum, a gram-negative anaerobic bacterium found in dental plaque, causes periodontal diseases. Smoking is one of the risk factors that can increase periodontal problems and atherosclerosis. Atherosclerosis is initiated by oral bacteria (i.e., *F. nucleatum*) binding to surface proteins of endothelial cells, such as collagen, fibrinogen, and fibronectin. The main objective for this study was to test the binding of *F. nucleatum* to collagen, fibrinogen, and fibronectin under the effect of different concentrations of nicotine. *F. nucleatum* was grown overnight in brain-heart infusion (BHI) supplemented with yeast extract and 5% vitamin-K/hemin. Biofilm was grown for 48 hours in 0, 0.25, 0.5, 1, and 2 mg/mL of nicotine. Then, the biofilm cells were labeled with biotin 3-sulfo-N-hydroxy-succinimide ester sodium salt and fixed with 10% formaldehyde. A binding assay was conducted by coating a high-binding 96-well microtiter plate with 1 μ g/mL of collagen, fibrinogen, or fibronectin. The plate was incubated overnight and blocked with 1% Bovine Serum Albumin (BSA), followed by the biotinylated and nicotine-treated *F. nucleatum* cells. ExtrAvidin-Peroxidase and OPD Peroxidase Substrate was used to visualize the binding. Optical density (OD) was measured with a spectrophotometer at 490 nm. Collagen, fibrinogen, and fibronectin binding assays demonstrated significantly higher absorbance with 2 mg/mL

nicotine-treated *F. nucleatum* cells compared to untreated cells. The results indicated that an increase in nicotine concentration leads to an increase in *F. nucleatum* binding to collagen, fibrinogen, and fibronectin. This means that smokers may have an increased risk for atherosclerosis. (Supported by Life-Health and Sciences Internship (LHSI))

P27 Serine Proteinase Mediated Collagen Degradation Pathway. K. BONTRAGER*, L.J. WINDSOR (Indiana University School of Dentistry)

Background: Collagen breakdown is a key component to understanding several degenerative disorders including that of the temporomandibular joint (TMJ). Studies related to TMJ degeneration have identified that the primary method of collagen degradation is due to a serine proteinase. Serine proteinase inhibitors were more effective at inhibiting the cell-mediated collagen degradation than matrix metalloproteinases (MMP) inhibitors. This serine proteinase was previously identified via gelatin zymography. Objective: The aim of this study was to search for the expression of this serine proteinase involved in the collagen degradation process mediated by TMJ synovial fibroblasts in other human cells. Methods: Conditioned media collected previously from TMJ fibroblasts served as a positive standard for this serine proteinase by a sample of it being resolved in a 10% SDS-PAGE gel containing 1 mg/ml of gelatin (zymography). After washing, the gels were stained with Coomassie blue to allow the serine proteinase capable of digesting the gelatin to be visualized as a lytic (unstained) band on the blue background of the gel. A serine proteinase inhibitor and a MMP inhibitor were utilized in the zymography incubation solution to verify that it is a serine proteinase. Unpublished data had suggested that macrophages express a non-MMP proteinase capable of cleaving collagen. Therefore, conditioned media from unstimulated and stimulated U937 cells was tested by zymography with and without inhibitors in search of the serine proteinase. Results: The stored conditioned media from the TMJ cells no longer contained the serine proteinase as determined by zymography. The unstimulated U937 did not express the serine proteinase. Stimulated U937 cells are being re-tested. Conclusion: The search to find the serine proteinase capable of cleaving collagen has not been successful yet.

P28 Antimicrobial Activity of Indigowoad and Plains Wild Indigo Roots. J. CHANG*¹, A.C. CHANG² (¹Indiana University School of Dentistry, ²National Ilan University, Ilan, Taiwan)

Indigowoad Roots (IR) (*Isatis indigotica* Fort) and Plains Wild Indigo Roots (PWIR) (*Baptisia bracteata*) have been shown to be high in phenolic compounds and plants high in phenolic compounds often have beneficial health effects including antimicrobial activity. Indigowoad is a well-known medicinal plant as well as an edible plant root similar to daikon, sweet potatoes, yam, ginseng and carrots. Plains wild indigo roots, leaves and seeds have traditionally been used by Native Americans for medicinal purposes and its extracts are consumed to enhance health. The in vitro antimicrobial activity of IR and PWIR was determined on five microbes (*Escherichia coli*, *Pseudomonas aeruginosa*, *Legionella pneumophila* sub sp., *Pneumophila*, *Staphylococcus aureus* and *Streptococcus mutans*), as well as general oral cavity bacteria. The IR2 inhibited cell growth of *S. aureus*, *E. coli*, *S. mutans* and *P. aeruginosa*. The PWIR inhibited cell growth of *S. aureus* and *P. aeruginosa*, which are normal skin flora, *E. coli* is a normal intestinal parasite and *S. mutans* causes tooth decay. The best treatment for oral cavity bacteria was IR2 which reduced bacterial counts by 2.63 ± 0.26 log relative to water treatment. The PWIR reduced them by 0.66 ± 0.21 log.

P29 Effects of a Dynamin Inhibitor on Osteocytes in Ovariectomized Mice. S. CHARKHZARRIN*, P. ELENISTE, A. BRUZZANITI (Indiana University School of Dentistry)

Osteocytes perform a significant role in the maintenance and integrity of bone. Osteocytes reside in mineralized matrix within specialized structures called lacunae. They are involved in cell-to-cell networking with each other as well as with osteoblasts and osteoclasts via long extensions called dendrites. Changes in the viability of osteocytes and disruption of the dendrite network can lead to changes in bone remodeling which leads to changes in bone quality and quantity. Inhibition of the dynamin GTPase affects the bone resorbing activity of osteoclasts and promotes the bone-forming activity of osteoblasts. In this study, we examined the role of dynamin on osteocytes in vivo. Female mice were subject to ovariectomy (OVX) to deplete estrogen and promote bone loss and then treated with/without the dynamin inhibitor, dynasore (DS) for 4 weeks (10 mg/kg, 3 days/week). Three groups were examined; sham controls, OVX and OVX+DS. After sacrifice, midshaft coronal sections of tibia were stained with H&E. Total lacunae density per cortical area, and the number of lacunae containing osteocytes (full lacunae) versus empty lacunae (likely due to osteocyte death) were counted using Bioquant software. The lacunae density per cortical area was increased in OVX but not OVX+DS bones. OVX also had the lowest percentage of full lacunae and, correspondingly, the highest percentage of empty lacunae, while OVX+DS bones were intermediate between OVX and sham (OVX>OVX+DS>sham) ($p<0.05$). Although more studies are needed, the increase in lacunae density with OVX may be caused by a decrease in osteocyte survival (decreased % full lacunae) and loss of matrix-mineral making lacunae more visible by histology. Dynasore may partially protect cortical bone from the negative effects of OVX by potentially increasing osteocyte survival (increased % full lacunae) and reducing the loss of matrix-mineral. These findings have implications for dynamin-targeted strategies to improve bone mass and integrity.

P30 Effects of Presenilin-1 on Osteoporosis with Respect to Osteoblasts. H. DELP*, S. KAWAK, S. CHARKHZARRIN, S. POSRITONG, P. ELENISTE, A. BRUZZANITI (Indiana University School of Dentistry)

Osteoporosis patients have low bone mass making the bones more susceptible to breakage. Previous studies have reported that there is a link between Alzheimer's disease (AD) patients and low bone mass. The protein Presenilin-1 (PS1) has an important role in AD and the PS1-L166P mutation is common in patients with AD. We previously found that PS1-L166P knock-in mice show a decrease in bone mass phenotype. The purpose of this project is to determine the role of PS1-L166P in osteoblast activity, the cells that build bone. Methods: Bone marrow stromal cells were differentiated into osteoblasts in media containing ascorbic acid and β -glycerophosphate. After 7 days, osteoblasts were assayed for Alkaline Phosphatase (ALP) activity, a marker of osteoblast activity. Osteoblasts secrete a calcium and phosphate-based mineral in the process of building bones. We measured calcium deposition using the Alizarin-S red mineral stain. Results: No change in ALP activity was found in osteoblasts from female PS1-L166P mice compared to wild type controls. The mineral assay, however, revealed a significant increase in calcium deposits in osteoblasts. This result would suggest that the osteoblasts are producing more calcium which may lead to an increase in mineralized bone. This result was unexpected since PS1-L166P knock-in female mice have low bone mass. Future studies in histology will be able to give a further understanding of the results and the effect of PS1-L166P mutation in osteoblasts in vivo. Conclusion: By determining the cause of low bone mass in osteoporosis patients, there is a potential to develop a solution to the problem. The link between AD patients and PS1 could provide a gateway to developing medical remedies for osteoporosis patients.

P31 Effects of Caffeine on *Fusobacterium nucleatum* Biofilm Treated with Nicotine. A. DHAMI*, M. KAUR, R.L. GREGORY (Indiana University School of Dentistry)

Fusobacterium nucleatum is a subgingival bacteria that is associated with periodontal disease. In general, smokers tend to have a higher risk of periodontal disease and increased cavities along with greater chance of atherosclerosis, which can cause blockage leading to a heart attack or stroke. The objective of this study was to determine the effects of caffeine on *F. nucleatum* biofilm formation treated with various concentrations of nicotine (0-32 mg/ml). Nicotine is found in cigarettes and this experiment examined if caffeine will inhibit the growth of biofilm with nicotine. Various concentrations of nicotine were used ranging from 0-32 mg/ml. Total absorbance was measured using a spectrophotometer and revealed that caffeine at a concentration of 8 mg/ml significantly inhibited the formation of biofilm at nicotine concentrations of 0.25-8 mg/ml. Biofilm formation was significantly higher when caffeine was not present. Biofilm is commonly found in the mouth and is responsible for biofilm production on teeth leading to dental plaque deposits which become tartar. Simply brushing will not remove tartar and if left untreated it can cause periodontal gum disease. Caffeine-containing beverages may be beneficial in preventing *F. nucleatum* biofilm formation in smokers. (Support partially provided by the IUPUI UROP program)

P32 Effect of Phototherapy on *Streptococcus mutans* Metabolism and Protein Expression. G.F. GOMEZ¹, R. HUANG^{1,2}, G.J. ECKERT³, R.L. GREGORY¹ (¹Indiana University School of Dentistry, ²West China School of Stomatology, Sichuan University, ³Indiana University School of Medicine)

The aim of this *in vitro* study was to determine the effect of violet-blue light on metabolic activity of early *Streptococcus mutans* biofilm, reincubated at 0, 2 and 6 h after 5 min of light treatment. A secondary objective was to determine glucan binding protein B (GbpB) expression in response to violet-blue light treatment. *S. mutans* UA159 biofilm grew for 12-16 h in microtiter plates in Tryptic Soy broth (TSB) or TSB with 1% sucrose (TSBS). Biofilm was irradiated for 5 min with violet-blue light at 405 nm. After irradiation, microplates were reincubated at 37°C for 0, 2 or 6 h in 5% CO₂. A colorimetric tetrazolium salt (XTT) assay with menadione was used to investigate bacterial metabolic activity. Total protein was extracted, quantified and separated by electrophoresis. Separated proteins were transferred to PVDF membranes, blocked with 5% non-fat milk, and probed for GbpB with primary rat monoclonal and anti-rat IgG secondary antibodies. A mixed model ANOVA was used to test the effect of light at 0, 2 and 6 h in TSB and TSBS. Student t test was used to determine the expression of GbpB in TSB or TSBS. Bacterial metabolic activity was significantly lower in the violet-blue light group than the non-treated (p<0.0001) group regardless of media or time. For TSB, 0h had significantly lower metabolic activity than 2 (p=0.0049) and 6 h (p=0.0144) but 2 and 6 h were not significantly different from each other (p=0.58). GbpB expression was significantly lower (p = 0.018) in the TSBS group but not in TSB. Violet-blue light inhibits *S. mutans* biofilm and affects GbpB expression in sucrose and no sucrose conditions.

P33 *Salvadora persica*'s Effects on Human Gingival Fibroblast Proliferation and Toxicity. U.Z.I. KAMAL*, J. PALASUK, L.J. WINDSOR (Indiana University School of Dentistry)

Salvadora persica (Arak), or "Miswak", is a plant that is used in many African and Middle Eastern countries as an oral hygiene chewing stick. Recent studies have investigated the *Salvadora Persica* plant's anti-plaque, anti-carious and antimicrobial properties. Although many studies have shown that it has significant anti-inflammatory effects in animal models, there is a lack of research that examines the direct effects of the *S. persica* plant on human pathways. Its effects on matrix metalloproteases (MMPs) have not been examined. The MMPs plays a major role in the pathogenesis of periodontal disease. The aim of this study was to examine the extent to which *S. persica* exerts anti-proliferative and/or cytotoxic

effects on human gingival fibroblasts (HGFs). HGFs were grown at 37°C in 5% CO₂ and in Dulbecco's Modified Eagle's Media (DMEM) supplemented with fetal bovine serum, L-glutamine, penicillin, gentamycin, and fungizone. HGFs were seeded in 6-well plates (100,000 cells/well) and after allowing the cells to attach, the HGFs were incubated with 1.0, 0.1, 0.01, 0.001 and 0.0001% *Salvadora* for 72 hrs. Cytotoxicity was determined by the release of lactate dehydrogenase (LDH). Water soluble Tetrazolium (WST) levels were used to assess HGF proliferation. Conditioned media from the 6 well plates were examined by zymography for changes in the expression of MMP-2. The only significant effect on cell proliferation and toxicity was at 1% when compared to untreated cells ($p=0.007$ and $p=0.005$, respectively). Other concentrations had no significant effects on cell proliferation and were not toxic (all p -values >0.05). *Salvadora* had no effect on MMP-2 expression at non-toxic levels. Conclusion: The maximum non-toxic concentration of *Salvadora* that had no negative effect on cell proliferation was 0.1%. This concentration will be utilized in future experiments.

P34 Effect of Epigallocatechin Gallate on Nicotine-treated *Fusobacterium nucleatum* Biofilm.
M. KAUR*, A. DHAMI, R.L. GREGORY (Indiana University School of Dentistry)

Tea polyphenols such as epigallocatechin gallate (EGCG) have exhibited antimicrobial properties. *Fusobacterium nucleatum* is an oral bacterium that is associated with periodontal diseases. Biofilm adheres to the enamel surfaces of our teeth as plaque. Biofilm formation in the oral cavity leads to many complications such as caries and periodontal diseases. Those who smoke tend to have increased risk of periodontal diseases and *F. nucleatum* biofilm formation. The objective of this research was to determine the effects of EGCG (0.25 mg/ml) and varying concentrations of nicotine (0-32 mg/ml) on *F. nucleatum* biofilm. The study was conducted by treating *F. nucleatum* biofilm with various concentrations of nicotine (0-32 mg/ml) and EGCG. Biofilm formation was measured using a crystal violet dye staining assay and a spectrophotometer. Biofilm formation of *F. nucleatum* with EGCG and nicotine exhibited a decrease in biofilm formation at low concentrations of nicotine (0-4 mg/ml). EGCG alone without nicotine significantly reduces *F. nucleatum* biofilm formation. EGCG can be added to dental treatments such as toothpaste and mouthwash for those who smoke. Periodontal diseases lead to many health problems in other parts of the body, therefore it is important to find ways to decrease biofilm formation of *F. nucleatum*. (Support partially provided by the IUPUI UROP program)

P35 The Effect of Presenilin1-L166P Mutation on Osteoclasts in Mice. S. KAWAK*, H. DELP, S. CHARKHZARRIN, S. POSRITONG, P. ELENISTE, A. BRUZZANITI (Indiana University School of Dentistry)

The bone remodeling process is controlled via osteoblasts (bone forming cells) and osteoclasts (bone degrading cells). Disturbance in the balance between osteoclasts and osteoblasts can cause disease states, such as osteoporosis (low bone mass) or osteopetrosis (high bone mass). Prior human studies have suggested that patients with Alzheimer's disease (AD) have lower bone mass when compared to healthy people of the same age. The protein Presenilin1 (PSEN1) has an important role in amyloid plaque formation in the brain and the Psen1-L166P mutation is common in patients with AD; therefore, there could be a possible link between mutated PS1 and bone loss. Studies from our laboratory demonstrated lower bone mass in mice containing the Psen1-L166P mutation. The overall goal of this study is to examine the role of Psen1-L166P mutation on osteoclast activity in vitro and in vivo. To generate osteoclasts, bone marrow cells from female WT and Psen1-L166P mice were differentiated with RANKL and MCSF, two cytokines essential for osteoclast differentiation, for 0-8 days. Osteoclasts were stained for tartrate-resistant acid phosphatase (TRAP), which is a marker of osteoclasts, and cells with 3 or more nuclei were counted. Unexpectedly, Psen1-L166P osteoclasts showed a significant decrease ($p<0.05$) in osteoclast number at differentiation day 5 compared to the WT osteoclasts. We also assayed osteoclast

activity on dentin by measuring collagen degradation products in culture media by ELISA and normalizing for TRAP+ osteoclast number. These findings reveal that Psen1-L166P mutation may decrease early osteoclast differentiation as well as bone resorption on dentin. Given the low bone mass phenotype of Psen1-L166P mice, our findings suggest that unknown systemic factors may control bone growth and remodeling in Psen1-L166P mice. We are now investigating whether male and female Psen1-L166P mice exhibit changes in osteoclast and osteoblast number in vivo using histology.

P36 ***Streptococcus mutans* Binding to Collagen, Fibrinogen, Fibronectin, and Laminin.** S.N. KRISTOFF*¹ and R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Introduction: *Streptococcus mutans*, nicotine, and certain proteins may be involved in a complicated mechanism that contributes to atherosclerosis. Buildup of arterial plaque causes atherosclerosis. Arterial plaque is mainly composed of fat, cholesterol, and calcium. When plaque builds up in the arteries, a clot or blockage can occur and may cause an occlusion. Objective: *S. mutans* grows in oral biofilm and causes dental caries. These bacteria enter the blood stream from mucosal breaks in the oral cavity. There is evidence that *S. mutans* binds to endothelial cell surface proteins lining arterial surfaces. An increased incidence of *S. mutans* in arterial plaque seems to have a direct relationship with atherosclerosis. From preliminary research, there was a strong indication that increased *S. mutans* biofilm formation is caused by nicotine. The number of binding proteins on nicotine-treated *S. mutans* cell surface increases as well. In addition, results demonstrated that *S. mutans* binds to collagen type I, fibrinogen, fibronectin, and laminin, which are proteins found on endothelial cells. Methods: To investigate protein binding, *S. mutans* UA159 was cultured in 0, 0.25, 0.50, 1.0, 2.0, and 4.0 mg/ml of nicotine and their ability to bind to human collagen type I, fibrinogen, fibronectin and laminin was assessed using an ELISA assay. Results: *S. mutans* significantly bound to collagen type I and fibrinogen when cultured in 2 and 4 mg/ml nicotine. *S. mutans* significantly bound to laminin when the bacterium was grown in 1, 2, and 4 mg/ml. The binding of *S. mutans* to fibronectin varied when cultured in different concentrations of nicotine. Conclusion: From the results, it can be concluded that *S. mutans* UA159 binds to collagen type I, fibrinogen, fibronectin, and laminin. This indicates that *S. mutans* and the proteins studied are very likely to be part of the mechanism that leads to atherosclerosis.

P37 **Effects of Nicotinic Analogs on Biofilm Formation of *Streptococcus mutans*.** R. MCKINNEY*¹ and R.L. GREGORY² (¹University of Indianapolis, ²Indiana University School of Dentistry)

Streptococcus mutans is a key contributor to the formation of dental caries, as well as other types of oral decay, with smokers at an increased risk for caries. Nicotine has been consistently found as an inhibitor for *S. mutans* biofilm formation at high concentrations, but enhanced at physiologically relevant concentrations – 0.25 to 4 mg/mL. *S. mutans* was exposed to varying concentrations of analogs of nicotine, particularly cyclic compounds with an amine group, in order to analyze how they influenced biofilm growth. Varenicline, an analog of nicotine, is utilized in smoking cessation drugs. Other analogs have been studied as ligands for neuronal nicotinic acetylcholine receptors. Several analogs of nicotine were added to a culture of UA 159 in various decreasing concentrations – 0.25, 0.5, and 1 mg/mL. The analogs analyzed were epibatidine, tubocurarine, bupropion, cotinine, varenicline tartrate, and mecamlamine. Additionally, *S. mutans* was exposed to nicotine combined with varying concentrations of these analogs. Each treatment had equal concentrations of nicotine and analogs 0.25, 0.5, and 1 mg/mL. Tubocurarine and mecamlamine both significantly increased biofilm formation as the concentration increased. Additionally, nicotine was additive to each analog with regards to increased biofilm formation

with the exception of mecamylamine, which, combined with nicotine, biofilm growth was not increased over what the analog did alone. Since nicotine has such dramatic effects on the growth of bacteria, studying compounds of a similar chemical nature can help lead to the further understanding of how nicotine affects *S. mutans* growth. By studying the previously mentioned nicotinic analogs effect on the metabolism of *S. mutans*, further conclusions can be drawn on how these compounds affect bacterial growth in a clinical environment.

P38 Serotype k *Streptococcus mutans* Binding to Collagen and Fibrinogen in Nicotine. N.L. QUINT*¹ and R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Streptococcus mutans is a gram-positive coccus-shaped, facultatively anaerobic bacterium that is commonly found in the human oral cavity and is a major contributor to tooth decay. The bacterium has the potential to make its way into the blood stream and adhere to endothelial cell proteins such as collagen and fibrinogen in the arteries through specific receptors potentially leading to atherosclerosis. Endothelial cells secrete cell-associated and cell-free collagen and fibrinogen. Specifically, serotype k *S. mutans* have been associated with atherosclerosis and nicotine has been shown to increase the biofilm formation of *S. mutans* (serotype k). Objective: The focus of this research was to measure *S. mutans* ability to bind to collagen type I and fibrinogen when the cells were grown in the presence of nicotine. Methods: *S. mutans* serotype k strains 51, 52, and 89 were cultured in 0–2 mg/mL nicotine. Formaldehyde was added to kill the cells followed by labeling the cells with biotin. Collagen type I and fibrinogen were coated (1µg/mL) onto 96-well microtiter plates. The plates were washed and 1% BSA was added to block the wells. Then the biotinylated nicotine-treated *S. mutans* were added, incubated to allow binding to the endothelial cell proteins, and washed. Finally, ExtrAvidin HRP and OPD were added to the plate and the optical density was measured at an absorbance of 490 nm. Results: The optical density was directly related to the relative number of cells bound to collagen type I and fibrinogen. The results demonstrated a significant increase in all three strains of *S. mutans* binding to the proteins when cultured in 1 and 2 mg/mL concentrations of nicotine compared to the 0 nicotine control. The increased numbers of nicotine-treated *S. mutans* binding to the endothelial cell proteins may have the ability to contribute to atherosclerosis.

P39 *Enterococcus Faecalis* Growth at Different Nicotine Concentrations. S. SINGH* and R.L. GREGORY (Indiana University School of Dentistry)

Objectives: *Enterococcus faecalis* is a facultative anaerobe that is commonly detected in endodontic infections. These gram positive cocci catabolize a variety of energy sources including carbohydrates, glycerol, lactate, malate, citrate, arginine, etc. Smoking is a major risk factor for periodontal disease and nicotine is one of the most important and active components of tobacco. The aim of this study was to investigate if nicotine facilitates *E. faecalis* growth. Materials and methods: *E. faecalis* ATCC 29212 was used in the present study. The growth and biofilm formation of *E. faecalis* at different nicotine concentrations (0, 0.25, 0.5, 1, 2, 4, 8, 16 and 32 mg/ml) was investigated using a spectrophotometer. Tryptic soy broth without sucrose was used for this experiment. Results: The total absorbance and biofilm formation of most groups was consistent with the control group, however, the total absorbance and biofilm formation of *E. faecalis* was significantly repressed by 32 mg/ml nicotine. Conclusion: Nicotine does not significantly enhance *E. faecalis* growth. Thus, there may not be a positive correlation between smoking and endodontic infections as far as different nicotine concentrations are concerned.

P40 Binding of *Porphyromonas gingivalis* to *Streptococcus gordonii* Cells Grown in Presence of Nicotine. P. SORKHDINI*, G.F. GOMEZ, R.L. GREGORY (Indiana University School of Dentistry)

Objective: Periodontal disease is a chronic multifactorial disease, caused by several genetic and environmental factors. *Streptococcus gordonii* (Sg) plays a central role in initiating dental biofilm formation and providing binding sites for later colonizers, such as *Porphyromonas gingivalis* (Pg) to attach to and generate mature biofilm. Nicotine in tobacco has been demonstrated to promote binding and growth of bacterial pathogens resulting in plaque-induced gingivitis, destructive periodontal disease and periapical infections. The aim of this study was to investigate if nicotine, may affect co-adhesion of Pg-Sg.

Methods: Pg and Sg were grown in various concentrations of nicotine (0, 0.25, 0.5, 1 and 2 mg/ml). Pg and Sg cells were washed and Pg cells were biotinylated. Cells grown in each nicotine concentration were standardized by absorbance at 600 nm and killed using formaldehyde. Wells of sterile 96 well microtiter plates were coated with Sg cells and blocked with bovine serum albumin. Biotinylated Pg was added to the wells and incubated at 37°C for 1 h. Extraavidin-peroxidase was added, followed by o-phenylenediamine as a color detection agent to measure the amount of binding of Pg to Sg. Results: Biotinylated Pg cells grown in 0.25, 0.5 and 1 mg/ml of nicotine demonstrated greater binding to Sg grown in 0, 0.25, 0.5 and 1 mg/ml nicotine coated cells compared to Pg grown in 0 mg/ml nicotine, with the statistically significantly ($p \leq 0.05$) strongest binding at 1 mg/ml of nicotine. However, 2 mg/ml nicotine causes binding between Pg and Sg to decrease. Conclusion: Based on our data, nicotine was able to significantly increase the binding of Pg to Sg.

P41 Effects of Temperature and Salinity on *Streptococcus mutans* Kinetic Growth. A.T. STODDARD*¹ and R.L. GREGORY² (¹University of Indianapolis, ²Indiana University-Purdue University Indianapolis)

Streptococcus mutans is an etiological microbe and the major cause of dental caries in the human oral cavity. *S. mutans* has the ability to adapt its growth and protein synthesis to adjust to the environment as well as to the osmotic stress of environmental factors including temperature. The objective of this experiment was to evaluate *S. mutans* UA159 by monitoring its growth at 40°C every 20 min over a 12 h period in Brain Heart Infusion (BHI) with and without 0.585 M NaCl, as well as various concentrations of nicotine ranging from 0–32 µg/mL. Max absorbance, time to max absorbance, lag time, and growth velocity units during the logarithmic phase (Vmax) were all recorded. Bacterial growth was monitored by measuring the optical density at 550 nm. At higher concentrations of nicotine (8–32 µg/mL) there was no growth in wells containing BHI or wells of NaCl + BHI. For nicotine concentrations of 4 in BHI, the lag time was substantially longer (16000s) than the rest of the concentrations in this medium (avg. 5970s). The maximum growth in the BHI wells occurred in nicotine concentrations of 1 and 2 µg/mL (0.718, 0.710 absorbance, respectively). The least amount of growth in BHI were in wells containing 0 nicotine at 0.613 absorbance. Nicotine concentrations of 0.25-0.50 µg/mL were very similar in growth, lag time, and Vmax units during the logarithmic phase of growth. In the NaCl medium at every nicotine concentration, bacterial growth was substantially inhibited. The wells containing nicotine concentrations of 0.25 µg/mL produced the most bacterial growth with an absorbance of 0.47. Growth was completely inhibited in concentrations above 2 µg/mL which had an absorbance of 0.093. These results demonstrate *S. mutans* growth is adversely affected by salty solutions with high concentrations of nicotine.

P42 Resveratrol's Effect on Biofilm Formation of *Streptococcus mutans*. A.J. SULLIVAN^{*1} and R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Resveratrol is an antioxidant found in grapes, wine, blueberries, peanuts, cocoa and many other plant sources. Resveratrol is made in these plants to fight fungal infection, ultraviolet radiation, stress, and injury. *Streptococcus mutans* is the main bacterium that causes tooth decay leading to dental caries. Previous research has shown that nicotine increases biofilm formation of *S. mutans*. The objective of this study was to identify how Resveratrol affects biofilm formation of *S. mutans* with and without the presence of nicotine. To start, *S. mutans* strain UA159 was incubated in a microtiter plate for 24 hours with dilutions of resveratrol (0, .98, 1.95, 3.9, 7.8, 15.6, 31.25, 62.5, 125, 250, and 500 ug/mL) in Tryptic Soy Broth with 1% sucrose (TSBS). Biofilm formation was measured using a crystal violet staining assay. The results demonstrated significant inhibition of *S. mutans* biofilm formation occurred at 31.25 ug/mL resveratrol. For the next experiment, *S. mutans* strain UA159 was incubated in a microtiter plate for 24 hours with dilutions of nicotine (0, 0.25, 0.5, 1, 2, 4, 8, 16, and 32 mg/mL) in TSBS, with and without 62.5 ug/mL resveratrol. Biofilm formation was significantly inhibited by 62.5 ug/mL resveratrol at all concentrations of nicotine. The results of this study demonstrate that eating foods or drinking beverages containing resveratrol may have health benefits of reducing *S. mutans* biofilm formation in the oral cavity leading to less dental caries, even with patients who smoke. Resveratrol shows inhibitory effects to *S. mutans* with and without the presence of nicotine. (Supported by Life-Health Sciences Internship Program at IUPUI)

P43 Probiotic Impact on Biofilm Growth in an Orthodontic Study Model. M. VAUGHN*, K.T. STEWART, R.L. GREGORY (Indiana University School of Dentistry)

Objective: Oral hygiene is an issue in orthodontic patients. Brackets increase biofilm surface area and bacterial colonization. Orthodontic patients have increased *Streptococcus mutans* (*Sm*), lower salivary pH, and increased food retention. Study aims were 1) evaluate if *Sm* exhibits greater growth and attachment to ceramic or metal orthodontic brackets and 2) assess if probiotics would suppress *Sm* growth on orthodontic brackets. Identifying which material is more resistant to biofilm formation may influence clinician's bracket selection and minimize the impact that brackets have on oral microbiota. Preliminary data demonstrated that the probiotic, *Bifidobacterium dentium* (*Bd*), inhibits *Sm* biofilm in microtiter plate studies. Methods: *Sm* and *Bd* were incubated in tissue-culture plates containing metal and ceramic brackets for 48h in Brain-Heart Infusion. Biofilm was removed by vortexing and sonication, and resuspended in saline. *Sm* and *Bd* cells were quantitated by spiral plating on Mitis Salivarius Sucrose Bacitracin agar (MSSB; selective for *Sm*) and blood agar (BAP; supports growth of both bacteria), respectively. To compare biofilm formation on ceramic and metal brackets, *Sm* was incubated for 48h and spiral plated on MSSB plates to enumerate the number residing in the biofilm. Plates were incubated anaerobically at 37°C for 48h. Results: When *Sm* and *Bd* were inoculated concurrently, *Sm* biofilm significantly decreased ($p \leq 0.05$) by 29% on metal and ceramic. In addition, it was shown that when ceramic and metal brackets were subjected to the same growth environment, biofilm on metal brackets significantly outgrew the biofilm on ceramic brackets by 20%. Conclusions: *Bd* demonstrated significant inhibition of *Sm* biofilm formation on both metal and ceramic brackets. Metal brackets harbor more biofilm than ceramic. This is likely due to variation in surface attachment. These results may have a profound impact on the probiotic foods industry, and the clinicians' bracket selection.

P44 Nicotine and Arginine Increase Biofilm Growth of *Streptococcus mutans* Serotype *k* Strains. D.R. WAGENKNECHT* and R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans, a common oral bacteria key to the development of dental caries, is classified by serotypes *c*, *e*, *f* and *k* based on composition of membrane polysaccharides. Serotype *c* strains are most prevalent. Serotypes *f* and *k* strains comprise < 5% of the *S. mutans* isolated from oral cavities of healthy subjects but are significantly increased in patients with cardiovascular (CV) disease. *S. mutans* detected in diseased CV tissue has increased prevalence of serotype *f* and *k* strains compared to the oral cavities of the same patients. Tobacco use is associated with increased risk for CV and oral diseases, including caries. Nicotine, a bioactive agent in tobacco, increases *in vitro* biofilm formation by *S. mutans* serotypes *c*, *e* and *f*. Arginine alters adhesive/structural properties of the extracellular polysaccharides in *S. mutans* biofilms. We asked whether separately, and in combination, nicotine and arginine affect biofilm growth of serotype *k* (NUM-Smk51, -Smk52 and -Smk89) and *f* (OMZ175) *S. mutans* strains compared to a serotype *c* (UA159) strain. Using 96-well plates, biofilms were grown in tryptic soy broth with 1% sucrose (TSBS) without and with arginine and/or nicotine for 48h at 37°C. Biofilm growth was quantified by crystal violet staining. Each treatment was tested in four wells. Separately arginine (5.0 mg/ml) and nicotine (4 mg/ml) increased biofilm in all strains compared to TSBS alone ($p < 0.01$ and < 0.005 , respectively). Biofilm mass was greater when grown in nicotine than in arginine. There was no effect on biofilm growth by adding arginine to nicotine. Increased biofilm production by *S. mutans* serotype *k* strains in the presence of nicotine suggests that smokers' increased risk for caries and CV disease may be related to increased *S. mutans* biofilm growth caused by nicotine exposure in the oral cavity. (Supported by the IUSD PhD Student Research Fund and Franciscan St. Francis Health)

ORAL DISEASE PREVENTION & DIAGNOSIS

P45 Inflammatory Proteins in Saliva in Chronic Oral Mucosal Inflammation. S. IYPE*, S.L. ZUNT, M. SRINIVASAN (Indiana University School of Dentistry)

Objective: Mucous membrane lining the soft tissues of the oral cavity is a common site of chronic inflammatory conditions such as lichen planus, desquamative gingivitis and pemphigoid. Although the clinical presentations vary significantly, burning sensation and associated pain are common symptoms. Management is non-specific, often palliative based on the severity of symptoms. Changing oral flora and consequent mucosal inflammation is one of the common pathogenic mechanisms suggested for the multiple clinical presentations. Proteomic salivary analysis represents a non-invasive method for investigating the potential roles of inflammatory cytokines in the pathogenesis of chronic oral mucosal inflammatory conditions. The objective of our study is to detect the changes in inflammatory proteins in saliva associated with symptomatic oral mucosal lesions. Methods: Archived unstimulated saliva samples were obtained from the saliva bank. Sixteen saliva samples for each of the symptomatic oral mucosal inflammation and the healthy cohorts were selected. The samples were centrifuged at 4000xg at 4 °C for 10 min and the clarified saliva was used for assessment of inflammatory mediators. Total protein content of each of the clarified saliva sample was determined by spectrophotometry. Pro and anti-inflammatory cytokines per microgram of saliva were assessed by using BD OptEIA ELISA kits using manufacturer's instructions. Results: Salivary IL-12 and IL-4 levels were significantly elevated in the samples from chronic mucosal inflammation group as compared to the healthy controls. While IL-8 concentration was equivalent in both cohorts, IL-17 was significantly up-regulated in the chronic mucosal inflammatory

group. Conclusion: There were no distinct patterns with respect to pro-inflammatory (IL-12) and anti-inflammatory (IL-4) cytokines in the saliva of symptomatic oral mucosal inflammation. Elevated IL-17 levels suggest a combined innate and adaptive immune mechanism for the pathogenesis. Association of salivary and tissue cytokine panels is needed to delineate the role of cytokines in symptomatic oral mucosal inflammatory conditions.

ORTHODONTICS/IMAGING/CRANIOFACIAL

P46 Molar-Incisor Hypomineralization in CLP with/without Primary Alveolar Grafts. E. ALLAM*, A. GHONEIMA, S. THOLPADY, G.J. ECKERT, C. KLENE, K. KULA (Indiana University School of Dentistry)

Molar incisor hypomineralization (MIH) is a congenital defect of unknown etiology that can affect both esthetics and cariogenic susceptibility. The objective of this study was to determine whether MIH is greater in patients with cleft lip and palate (CLP) who underwent primary alveolar grafting (PAG) as compared to CLP prior to secondary alveolar grafting (SAG) and to controls. A retrospective analysis of intraoral photographs of 13 (10M:3F; 8.9 ± 1.2 yrs) CLP patients who underwent a PAG, 27 (18M:9F; 10.0 ± 2.1 yrs) CLP prior to SAG, and 60 (30M:30F; 12.4 ± 1.8 yrs) controls without CLP was performed. Mantel-Haenszel chi-square tests were used to compare the three groups for differences in MIH scores and Wilcoxon Rank Sum tests were used to compare the groups for differences in average MIH scores. A 5% significance level was used for all tests. MIH scores were significantly higher for the PAG and SAG groups compared to the control group ($p < 0.001$). The PAG group had significantly higher incisor MIH ($p = 0.016$) than the SAG group. MIH average scores were significantly higher for the two graft groups compared to the controls ($p < 0.0001$). The PAG group had significantly higher average MIH score and average MIH score for incisors than the SAG group ($p = 0.03$). The results suggest that CLP patients, in general, have significantly greater MIH compared with controls and CLP with PAGs have significantly greater MIH in the incisor region than CLP waiting for SAGs. The increased severity of MIH could be related to the grafting during the time of incisor crown formation.

P47 Development of an Animal Model for Temporomandibular Joint Overloading. M. HOAGBURG*, C. BAIN, N. KANG, A. UTREJA (Indiana University School of Dentistry)

Objective: The temporomandibular joint (TMJ) is a unique fibrocartilaginous joint that differs from other joints in the body both structurally and functionally. TMJ loading within the remodeling capacity of the joint leads to adaptive remodeling; however, overloading can lead to pathologic changes. As these changes have not been studied in the TMJ cartilage, the objective of this study was to develop an animal model for TMJ overloading and analyze the cellular changes in the TMJ fibrocartilage in adult non-growing mice. Methods: Three-month-old C57BL/6 male mice were used for this study, and were divided into 2 groups: experimental and control. The experimental group was subjected to TMJ loading with a custom-fabricated orthodontic wire spring exerting 150 grams force for 2 hours/day for 5 days, whereas the control group did not receive the force. Following this, the animals were sacrificed and the TMJs were dissected, sectioned, stained and imaged to analyze the histological changes. Results: The total TMJ cartilage area was significantly increased ($p < 0.05$) in the experimental group ($234.06 \mu\text{m}^2$) compared to the control group ($155.17 \mu\text{m}^2$). Cartilage proteoglycan accumulation was not different between the groups. In response to the intrusive force on the mandibular incisors in the experimental group, ectopic enamel calcification was observed in the root apical portion. Conclusion: Short-term TMJ overloading in adult mice increases the TMJ cartilage area, and the intrusive force on the mandibular incisor leads to ectopic enamel calcification.

P48 Segmentation Methods of Bone Voxels for Cone Beam Computerized Tomography of Human Mandibular Condyle. K. MIN*, A. NDIAYE, Y. JEONG, A.Y. HONG, D. KIM (The Ohio State University)

Objective: Cone Beam Computerized Tomography (CBCT) has been widely used to obtain high resolution 3D dental image, and is highly recommended to obtain a detailed structure and density of mineralized tissues. However, a 3D image analysis method that can accurately segment mineralized tissue voxels from not mineralized tissue voxels doesn't have been completely developed. Thus, the objective of this study was to examine if different image analysis methods are comparable to successfully segment bone voxels of patients' mandibular condyle from non-bone voxels in clinical CBCT images. Method: Following IRB approval, 12 patients' CBCT images obtained from the dental clinic. Bone voxels in the CBCT images were segmented by two methods; the semi-automatic method using image J and ITK-SNAP software, which are open source codes for image segmentation. Histograms of bone mineral density (BMD) that is proportional to gray value of each bone voxel were assessed. BMD parameters were obtained for mean, standard deviation (SD), 5 percentile low and high values. Paired t-tests, Pearson's correlations, and reliability (intraclass correlation) were used to compare the BMD parameters between the two methods. Result: The means of all BMD parameters were significantly different between the two methods ($p < 0.015$). The semi-automatic method provided lower BMD values but higher SD than the ITK-SNAP method. However, the values of BMD parameters had strong positive correlations ($rR > 0.97$, $p < 0.001$) and the intraclass correlation coefficients were higher than 0.93 ($p < 0.001$). Conclusions: The ITK-SNAP based segmentation is more conservative removing more low BMD values than the semi-automatic method, which results in higher BMD values. However, the strong correlations indicate that the semi-automatic method based BMD values can be estimated by the ITK-SNAP method.

P49 Bone Mineral Density of Cervical Vertebrae in Different Age Groups. E. MOON*, K. STEPHEN, D. KIM (The Ohio State University College of Dentistry)

Osteoporosis is a systematic disease that results in a substantial bone loss of postmenopausal women. Dual energy X-ray absorptiometry (DXA) has been used as a standard clinical technique to diagnose osteoporosis by assessing bone mineral density (BMD) of a patient's spine or hip. Cone beam computed tomography (CBCT) used in a dental clinic can also scan the whole skull of patients including cervical vertebrae. Thus, the objective of this study was to examine whether CBCT of cervical vertebrates (C2 and C3) can detect age dependent changes of BMD. Following IRB approval, CBCT images taken from 108 patients (36 males and 72 females, 10 to 69 years old) were retrospectively investigated. After segmentation of bone voxels from non-bone voxels, the C2 and C3 vertebral bodies were digitally isolated by removing posterior and lateral processes at 10 voxels from either side of vertebral endplate. Mean of CT attenuation values, which is proportional to BMD, was assessed. Multivariate analysis of variance tests were performed to compare the BMD between age groups (significant, $p < 0.05$). The C2 and C3 BMDs of women age over 60 group were significantly lower than any younger female groups ($p < 0.031$), while men age over 60 group had significantly lower values compared to men age less than 30 ($p < 0.031$). The BMD between all other age groups were not significantly different ($p > 0.08$). The average of menopausal ages is approximated 51 years old. As such, the current results indicate that progressive postmenopausal bone resorption is detected by the CBCT based BMD measurement in the cervical vertebrae of women age over 60.

P50 The Effect of LRP5 Overexpression on the Temporomandibular Joint. H. MOTEVASELOLHAGH*, C. BAIN, N. KANG, K. LIM, A. ROBLING, A. UTREJA (Indiana University School of Dentistry)

Objective: The Wnt signaling pathway is a key regulator of the mechano-transduction response in bone. Overexpression of LRP5, a Wnt co-receptor, is associated with a high bone mass (HBM) phenotype in humans and mice. Recently, LRP5 was shown to be upregulated in human and mouse osteoarthritic cartilage; however, the effect of LRP5 overexpression on cartilaginous joints that routinely experience mechanical loading, such as the temporomandibular joint (TMJ) is unknown. The objective of this study was to analyze the effect of Lrp5 overexpression on the cartilage and subchondral bone of the TMJ in mice exhibiting HBM phenotype. Methods: Sixteen-week-old C57BL/6 wildtype (CTRL) and Lrp5 knock-in transgenic mice carrying either the G171V (EXP-G) or A214V (EXP-A) missense mutations in the endogenous Lrp5 sequence were divided into 3 groups (n=11/group). The left mandibular condyles from all animals were scanned for micro-CT analyses whereas the TMJs from the right side were embedded in paraffin for sectioning and histologic staining. Lrp5 localization in the cartilage was determined by immunohistochemistry. Cartilage thickness and matrix proteoglycan were measured on t-blue and safranin-O stained slides respectively. Results: Micro-CT analysis of the subchondral bone showed significantly higher percent bone volume (BV/TV), bone surface/volume ratio (BS/BV) and trabecular thickness (Tb thickness) in the EXP-G and EXP-A groups compared to the CTRL group (p<0.05). Bone volume (BV) was significantly greater in the EXP-G group compared to the CTRL group whereas bone surface density (BS/TV) was significantly greater in the EXP-A group compared to the CTRL group. Conclusions: Increased expression of the Wnt signaling pathway co-receptor Lrp5 positively regulates subchondral bone mass in the TMJ. A better understanding of the role played by Wnt mediators during TMJ development and function is crucial for the subsequent development of cell-targeted therapies for TMJ disorders.

P51 Cervical Vertebrae Angulation and Airway Dimensions: a 3D-CBCT Volumetric Analysis. S.J. RYAN*, K. KULA, G.J. ECKERT, A. GHONEIMA (Indiana University School of Dentistry)

Objective: The purpose of this retrospective study was to evaluate the relationship between airway dimensions and cervical vertebrae angulations in orthodontic patients using 3D-CBCT technology. Methods: Pre-treatment CBCT scans and cephalometric radiographs were measured for 59 patients (mean age 22±2.3yrs.) using the Dolphin3D software system (version 11.7; Dolphin Imaging & Management Solutions, Chatworth, CA) to record airway dimensions and vertebral angulations. All CBCT images were acquired using the same standard protocol for collection using the iCAT CBCT Unit (Imaging Sciences International, Hatfield, PA): 13cm field of view, 0.4mm voxel size, 8.9sec scan time. Intraclass correlations (ICC) were performed on duplicate measurements of 10 CBCT scans after a two-week interval to assess reliability. P-value and Pearson correlation coefficients were used to statistically assess the relationship between vertebral angulations and airway dimensions. Results: ICC values from the reliability assessment were >0.90. Pearson correlation coefficients were categorized based on confidence level as follows: high(>0.75 or <-0.75), moderate(0.5 to 0.74 or -0.5 to -0.74), or weak(0.3 to 0.49 or -0.3 to -0.49). No high/moderate correlations were observed. Weak correlations (p<0.05) were observed between the nasopharyngeal volume and the soft tissue thickness at CV1(-0.47) and CV2(-0.34). A weak correlation was observed between the nasal cavity volume and S-N(+0.41) as well as ANS-PNS(+0.38). A weak correlation was observed between the total airway volume and the soft tissue thickness at CV2(-

0.34). Conclusions: The soft tissue thickness of the posterior wall of the airway at the level of cervical vertebrae-2 appears to have a weak, negative correlation with several upper airway and total airway volumes. Soft tissue thickness of the posterior pharyngeal wall may be important for clinicians to analyze prior to orthodontic treatment, as it may have an association with decreased airway volume. (This project was supported by the IUPUI 3D Craniofacial Complex Imaging Center; Jarabak Professorship)

P52 Unilateral Versus Bilateral CBCT Generated Cephalograms in Patients with Cleft. M. SINGH*, K. KULA, B. MOSER, A. GHONEIMA (Indiana University School of Dentistry)

Objectives: Traditionally, 2D cephalograms are a vital part of orthodontic diagnosis and monitoring treatment progress and outcome. One of the drawbacks of 2D cephalograms is the superimposition of anatomical structures, which interferes with landmark identification leading to inaccurate analysis. Furthermore, traditional cephalograms are a 2D representation of a 3D structure and can also result in magnified or distorted measurements. Cephalogram analysis obtained from 3D Cone Beam Computed Tomography (CBCT) overcome these limitations. The aim of this study was to investigate if there are any differences in the measurements obtained in cephalograms generated from bilateral CBCT versus unilateral CBCT images. Methods: Following IRB approval, a CBCT scans of 30 age-matched patients with cleft lip and palate (CLP) (age 8-15 years) was retrieved from the archive of the Orthodontic Department at Indiana University School of Dentistry. All CBCTs were taken with the same i-CAT scanner (Imaging Sciences, Hatfield, PA) with scanning settings of 13 cm field of view, 20 seconds of scanning time, and 0.4 mm voxel size. Bilateral (Both sides of the face) and two unilateral (left and right sides of the face) were constructed from the 3D CBCTs and analyzed using Dolphin 3D software, version 11.7 (Dolphin Imaging, Chatsworth, CA) from the Digital Imaging and Communications in Medicine (DICOM) data of each individual. Results and conclusion: The ICC value was 0.9 for all measurements. Thirteen out of nineteen parameters were significantly different between bilateral versus unilateral CLP measurement. Thus there is significant difference in the measurements obtained when cephalograms are generated from a bilateral CBCT image versus from a unilateral one. The differences noted between cephalograms generated from bilateral and unilateral images may be caused by superimposition of bilateral images. (Supported by 3D Lab, Orthodontics Dept., IUSD)

P53 Facial Soft Tissue Depths of Children with Different Malocclusions. S. TITUS*, K. KULA, A. GHONEIMA (Indiana University School of Dentistry)

Soft tissues affect orthodontic treatment and are a necessary component in forensic facial reconstruction. Facial soft tissue positions are influenced by the underlying hard tissues; however, only midline soft tissue can be measured using two-dimensional cephalograms. This retrospective three-dimensional Cone Beam Computed Tomography (3D CBCT) imaging study investigates the relationship between cephalometric measures and facial soft tissue thicknesses at key midline and bilateral points of children. 3D CBCT (iCAT, Imaging Sciences) images from the records of 75 subjects (30 male, 45 female), ages 5-13 years were divided into three groups based on skeletal classification. One investigator measured soft tissue depths perpendicular to the hard tissue at 32 facial landmarks (8 midline and 12 bilateral pairs of landmarks). Twelve hard tissue parameters were measured using CBCT-derived lateral cephalograms. Group comparisons of measurements were made using one-way ANOVA, then adjusted for age and gender using ANCOVA. Pearson correlation coefficients were calculated to evaluate linear associations among measurements. Significance was accepted at $p \leq .05$. Significant differences were found in soft tissue depths between groups. For bilateral landmarks that were symmetrically significantly different, Class III had significantly greater mid-infraorbital, supra M1, and gonion measures than Class II, and significantly greater gonion than Class I. Class I had significantly greater supra M1 measures than Class II. Class III had significantly greater nasion (midline landmark) measures than Class II and Class I. Class

III also had significantly greater SNB and 1/1 than Class II and significantly smaller ANB, SN-MP, and MP-/1 than Class II, confirming skeletal diagnosis. Class III children have more soft tissue from midfacial areas to the angle of the mandible, whereas Class II children tend to have less soft tissue in the area of the molars. This study suggests that 3D measures are necessary for facial reconstruction and also for orthodontic treatment planning.

PEDIATRIC DENTISTRY

P54 Attitudes and Perceptions of Caregivers Affecting Child Patient Anxiety. A. ABAZARI*, J.E. KOWOLIK (Indiana University School of Dentistry)

Dental fear and anxiety (DFA) that has been established through direct experience or learned from a caregiver or other person's fear presents an obstacle for pediatric dental care. Identifying the initiation of DFA is important in developing interventions that aim to limit them and promote good dental health throughout life. While research in the field of DFA has been extensive, dentists are still challenged by the treatment of pediatric patients who have DFA and how to limit exposure to experiences in the dental office that may initiate these feelings. This research introduces a new method for data collection and parallels it with established protocols using an adapted Wong-Baker Faces questionnaire filled out by the parent and child in the clinic prior to dental treatment. In addition to its use in the clinic the same questionnaire will be uploaded as an "app" on the Apple ResearchKit platform enabling anyone in the world with an Apple device to access and complete the survey digitally. Caregiver and child demographics and anxiety responses from the two IUSD groups will be summarized using frequencies and percentages for categorical data and mean, standard deviation, and range for continuous variables. Agreement between the caregiver-child pairs will be evaluated using contingency tables, kappa statistics, and Cochran-Mantel-Haenszel chi-square tests. Demographic and anxiety responses collected via the iPhone ResearchKit application will be summarized and compared against the IUSD caregivers using two-sample t-tests and chisquare tests. Conclusion: By using established questionnaire protocols and adapting it to the new Apple ResearchKit platform we are diversifying our data collection ability in a manner that has never been attempted. In doing so, we believe this will assist in identifying the best interventions to limit DFA in the pediatric patient population. At the time of this submission data collection has begun but analysis not available.

P55 Infant Oral mutilation (IOM) Related to Traditional Practices in an Urban Area in Sudan. A.T. AHMED*, A.I. ELGAMRI, O.E. HAJ-SIDDIG, N.M. NURELHUDA, J.R. CHIN (University of Khartoum Faculty of Dentistry, Indiana University School of Dentistry)

Objective: To determine the prevalence and risk factors of Infant Oral Mutilation (IOM) among children attending governmental preschools in the city of Khartoum, Sudan. Methods: A proportionate stratified sample was taken from all governmental preschools (n=12) in Khartoum locality, Sudan. A calculated sample of 212 randomly selected, eligible preschool children were included in the study. Data was collected by means of self-administered questionnaires and clinical examinations. Following IRB approval and consenting, Parents/guardians completed questionnaires inquiring about demographics, teething-associated symptoms and history of IOM. To confirm parental report of IOM, two calibrated dentists performed clinical examination of 12 indexed teeth. Results: The sample mean age was 4.68 years. The prevalence of clinical IOM was 10.8% (n=23). A multivariate regression analysis was employed to explore the risk factors that determined parents' behavior to seek help from traditional healers. Children who suffered from diarrhea during teething were 7.15 times (95% CI 2.73, 18.69) more likely to have clinical IOM over their counterparts (p-value=<0.0001). Mothers who were educated below elementary school

level were 2.69 times (95% CI 1.06, 6.81) more likely to have children with clinical IOM (p-value=0.0369). Conclusion: The magnitude of the IOM problem is not small. There is a pattern in the parents' attitude towards seeking help from traditional healers. This problem needs to be addressed. Targeted health promotional campaigns, learning from this evidence, can thus be designed and implemented.

P56 Comparing Rectangular Collimation and Round Collimation Dosimetry Using a Pediatric Phantom. Z.D. BOZIC* and J.F. YEPES (Indiana University School of Dentistry)

Historically, a circular/round collimator has been used to expose dental intraoral films, but benefits have been documented in the use of a rectangular collimator. Previous studies have compared the effective doses from circular and rectangular collimators, but few have specifically looked at the effects of round and rectangular collimation in child patients wearing a thyroid collar. The purpose of this study is, through use of a pediatric, tissue-equivalent phantom with and without thyroid shielding, to provide effective dose measurement comparisons for round and rectangular collimation. A total of 24 optically stimulated luminescent dosimeters (OSLD) were placed at sites corresponding to internal tissues of interest and exposed to ten, repeat, bitewing radiographs. Results indicate a much lower effective dose overall in the pediatric phantom exposed with rectangular collimation compared to the phantom exposed with round collimation. In addition, use of the thyroid collar made a difference when comparing round and rectangular collimation. As was the case in other studies, only the universal rectangular collimator achieved significant dose reduction, in the child patient. Consistent with other studies, the results indicate that the universal rectangular collimator used, with or without a thyroid collar, was more effective at reducing exposure than a thyroid shield used with round collimation.

PERIODONTICS

P57 Retrospective Analysis of Guided Bone Regeneration Failures. E.Z. GULERTEKIN*¹, L. ALSSUM¹, A. GRAY¹, V. YILDIZ², D.N. TATAKIS¹, B. LEBLEBICIOGLU¹ (¹Ohio State University College of Dentistry, ²Ohio State University College of Medicine)

Objectives: Guided Bone Regeneration (GBR) is not as predictable when applied to large combination type defects. We previously completed a large retrospective study screening GBR procedures performed within single training center and reported that 13% of documented cases required additional grafting at implant placement. The purpose of this follow-up study was to determine possible common predisposing factors negatively affecting GBR outcomes by retrospectively examining procedural details of the failed cases at first GBR attempt. Methods: Patients who received GBR prior to dental implant placement and any possible corrective procedure at the same anatomical area were screened by using the scheduling/billing software. Selective cases with a secondary corrective surgery at the same anatomical site were chosen. The charts of the subjects who had more than one GBR procedure documented at the same location were manually screened to determine complications. Results: 15 of 143 cases (11%) had secondary corrective surgeries to create sufficient bone to place dental implants (mean age 48±4 yrs; 9 female) in 25 sites. Most sites with complication were localized in the maxillary anterior sextant (11 sites=44%). Major complications requiring secondary corrective surgery were lack of sufficient bone augmentation/graft integration from previous GBR (9 sites= 36%), occurrence of dehiscence (6 sites= 24%) at time of implant placement, and premature wound opening following initial GBR (7 cases=28%). At 5 sites (20%), implant placement was not accomplished despite the repeated procedure. Conclusions: Within the limits of this study, it appears that the prevalence of GBR failure is low and it is mostly associated with insufficient ridge width and significant dehiscence development at time of implant placement. (Support from OSU Division of Periodontology & COD predoctoral summer research program)

P58 Representing and Annotating Coronary Heart Disease from Patient's Medical History. J. PATEL^{1,2}, D.L. MOWERY³, T. THYVALIKAKATH^{1,4} (1Indiana University School of Dentistry, ²Indiana University School of Informatics & Computing, ³University of Utah, ⁴Regenstrief Institute)

Background: Patients exhibiting poor oral health and systemic diseases may require specialized dental treatments. The relationship between oral health and coronary artery disease (CAD) is not well understood. The electronic dental records can be leveraged for large-scale studies of patients with a history of CAD and oral disease/s. However, patients' medical histories containing CAD descriptions are stored within free-text. Natural Language Processing (NLP) can automatically extract this information - CAD-related concepts, medications, procedures, and their contexts (negation, temporality, and severities) from patient medical histories. In the long term, we will develop a NLP tool to enrich a predictive model of oral health and systemic diseases over time. As a first step towards developing a NLP tool, we 1) developed a semantic schema representing CAD information and 2) assessed how reliably this information can be annotated within patient medical histories. Methods: In this pilot study, we developed a schema representing 6 CAD-related concepts and guidelines for annotating this information within patient medical histories. We randomly sampled 67 patients and their medical histories (December 31, 2011-January 1, 2012). Each patient's medical history contained 9 questions on CAD. Two dentists independently annotated each history using eHOST annotation tool. For all CAD concepts, we report an example sentence, the inter-annotator agreement (IAA using F1-measure), and the distributions by annotator. We assessed whether a statistical difference occurred between annotation distributions with a paired t-test. Results: We observed an overall IAA of 81.3%. Four concepts were annotated with IAA over 70%. We observed no statistically significant differences between annotation distributions. Conclusion: We can achieve high reliability annotating CAD-related concepts. In future work, we will improve IAA by annotating a larger dataset applying iterative annotation and consensus review. We will leverage this dataset to develop and evaluate a NLP tool that will provide patients' CAD-related information to a prediction model that assesses oral disease risk.

TISSUE REGENERATION AND REPAIR

P59 Estrogen Enhances Osteoblast Differentiation in the Absence of Pyk2. S. POSRITONG*, P. ELENISTE, A. BRUZZANITI (Indiana University School of Dentistry)

Early evidence suggests that osteoporotic patients may have increased periodontitis and alveolar bone loss. The proline-rich tyrosine kinase 2 (Pyk2) is important for bone formation by osteoblasts (OBs) and bone resorption by osteoclasts. We found that female Pyk2-deficient mice (Pyk2-KO) exhibit high bone mass, and they are protected from ovariectomized (OVX) induced bone loss. Furthermore, estrogen (E2)-supplemented Pyk2-KO OVX mice reveal an increase in bone mass greater than wild-types (WT). These findings suggested that Pyk2 might regulate bone mass in part by modulating estrogen signaling in OBs. The objective of our study was to determine the role of Pyk2 and E2 in OB activity *in vitro*. Calvarial OBs were cultured in osteogenic media with or without E2 for up to 28 days. Pyk2-KO OBs revealed significantly higher *c-fos* mRNA expression and proliferation activity than WT OBs, which was not further increased by E2. Pyk2-KO OBs also exhibited significantly higher *collagen type 1* mRNA expression than WT, and E2 further increased *collagen type 1* mRNA expression in Pyk2-KO but not WT OBs. Alkaline phosphatase (ALP) activity and calcium deposition, which are markers of mature OB activity, were also significantly higher in Pyk2-KO OBs than WT OBs. Notably, E2 further increased ALP activity and calcium deposition in Pyk2-KO OBs but not WT OBs. We also investigated the role of Pyk2 in response to raloxifene, a selective estrogen receptor modulator that approved for postmenopausal osteoporosis treatment. Comparable to E2, raloxifene increased ALP activity and calcium deposition in Pyk2-KO OBs

to a greater extent than WT OBs. Data were analyzed using two-way ANOVA ($\alpha = 0.05$). Altogether, our results suggest that targeting Pyk2 in combination with estrogen or raloxifene may be a novel strategy for the prevention and treatment of bone loss associated with periodontitis, osteoporosis or other skeletal diseases.

P60 Kalirin and Nerve Growth Factor Regulate Osteocyte Dendrite Length. L.A. DO*, A. BRUZZANITI (Indiana University School of Dentistry)

Osteocytes are differentiated from mature osteoblasts that become trapped in the bone matrix. Osteocytes contain dendrites that communicate with neighboring osteocytes, and with osteoclasts or osteoblasts. Disruption in osteocytes number and the dendritic network has negative effects on bone homeostasis that may lead to osteoporosis and other degenerative bone diseases. Kalirin is a GDP/GTP-exchange factor that can affect cellular differentiation, proliferation and cytoskeleton remodeling. We found that Kalirin is expressed in osteoclasts, osteoblasts as well as osteocytes. In addition, we found that Kalirin knockout (Kal-KO) mice show significantly reduced bone mass. In the current study, we examined the role of Kalirin on osteocyte density in vivo and osteocyte morphology in vitro. We found that osteocyte density in trabecular and cortical bones of Kal-KO mice was similar to WT mice. To examine dendrite length, osteocytes were isolated from Kal-KO and WT bones by collagenase digestion and cultured in vitro. Osteocytes were imaged and dendrite length and number per osteocyte was calculated. Our data showed a $55.6 \pm 2.6\%$ decrease in dendrite length for Kal-KO osteocytes compared to WTs (p -value=0.01). Other labs have reported that Kalirin is activated downstream of TrkA, the receptor for nerve growth factor receptor (NGF), and that NGF can promote dendrite development in neurons. Therefore, we examined if NGF can promote osteocyte dendrite elongation. We treated MLO-Y4 osteocytic cells with 100 ng/ml NGF for 5 days and measured dendrite length. Our data reveal a $44.5 \pm 6.9\%$ increase in dendrite length in NGF-treated MLO-Y4 cells, compared to controls (p -value=0.00173). These results indicate that deletion of Kalirin has no effect on osteocyte density. However, Kalirin expression and treatment with NGF both promote the elongation of osteocyte dendrites. In future studies we will determine if NGF promotes dendrite elongation by stimulating Kalirin activity and if this pathway is important for bone mineral density.

P61 BioXclude™ Membrane Effects on Human Dental Pulp Stem Cells. L.L. ALBRECHT*, J. PALASUK, L.J. WINDSOR (Indiana University School of Dentistry)

Background: Regenerative endodontics is a treatment alternative for the infected immature tooth that enables continued root development and the growth of pulp or pulp like tissue, increasing the prognosis when compared to non-vital teeth. Scaffolds placed in the canal encourage the growth of new tissue that requires angiogenesis, the generation of new vessels, which is initiated by wound hypoxia, as well as growth factors. Several angiogenic factors are released during the breakdown of the extracellular matrix and basement membranes facilitated by matrix metalloproteinases (MMPs). MMPs contribute to the remodeling of dentin and pulp tissues, and have been identified within healthy and diseased dental tissues. Objective: BioXclude™ membranes are processed human amnion chorion allografts with the potential to serve as an endodontic scaffold. The aim of this study was to investigate if exposure of human dental pulp stem cells (DPSCs) to BioXclude™ membranes would result in differences in the expression of cytokines and MMPs that play roles in angiogenesis. Methods: Three separate groups were tested: DPSCs only, BioXclude™ membranes placed in culture media without DPSCs, and BioXclude™ membranes with DPSCs. The DPSCs were detached with 0.25% trypsin, pelleted, resuspended in fresh media, and seeded (100,000 cells/well) in 6-well plates with 2 ml DMEM supplemented with 10% FBS with and without membranes. Following cell attachment (24 hours), the media was removed and 2 ml of serum free media was added. After 72 hours the conditioned media from the three groups was collected

and analyzed using RayBio® Human Antibody Arrays. The membranes were then visualized by autoradiography. Results: The results from this investigation demonstrate an increase in various MMP and cytokine expression from DPSCs. Conclusion: BioXclude™ membranes have been used with success in periodontal procedures, such as guided tissue regeneration, and have the potential to play a role in scaffolds for pulp regeneration.

P62 Pulp Stem Cells Attachment and Proliferation After Endodontic Regenerative Protocols.
M.A. ALGHILAN*, L.J. WINDSOR, J. PALASUK, G.H. YASSEN (Indiana University School of Dentistry)

Objectives: The aim of this study was to investigate the effects of dentine treated with three endodontic regeneration protocols on attachment and proliferation of dental pulp stem cells (DPSCs). Methods: Human dentin specimens (IRB number: 1507306225) were prepared (4x4x2 mm), irrigated with 17% ethylenediaminetetraacetic acid (EDTA) and 1.5% sodium hypochlorite (NaOCl), and treated with the following endodontic intracanal medicaments: clinically used concentration of triple antibiotic paste (TAP), calcium hydroxide (Ca(OH)₂), or diluted TAP in a methylcellulose system (DTAP) for 1 week. Two control groups were kept untreated. All groups except one of the control groups were then subjected to irrigation with EDTA for 10 minutes. DPSCs were seeded on each dentin specimen (10,000 cells). The DPSCs attachment was evaluated with lactate dehydrogenase activity assays and proliferation was evaluated with water-soluble tetrazolium assays after 1 day and 3 days of incubation, respectively. The experiments were performed in triplicate (total n=9 per group). Friedman's test followed by Least Square Difference were used for statistical analyses (alpha=0.05). Results: Significant increases were observed in DPSCs attachment to the dentin after TAP and DTAP regeneration protocols, as well as EDTA-treated dentin in comparison to Ca(OH)₂-treated dentin. Significant reductions in DPSCs proliferation on dentin were observed after TAP and Ca(OH)₂ protocols compared to DTAP-treated dentin and the two control groups. However, DTAP protocol did not demonstrate any significant negative effects on DPSCs proliferation. Conclusions: Within the limitations of this study, the use of antibiotic pastes significantly improved the attachment of DPSCs on dentin when compared to Ca(OH)₂. Additionally, DTAP intracanal medicament did not negatively affect DPSCs proliferation on the dentin. However, the most commonly used endodontic regeneration medicaments [TAP and Ca(OH)₂] negatively affected the proliferation of DPSCs.

P63 Degradation and Cell Proliferation in Fast-Degrading Thio-Acrylate based Hydrogel for Cranial Regeneration. B. BALLENGER¹, A. EMMAKAH², C. LIN^{2,3}, T.G. CHU^{1,2,3} (¹Indiana University School of Dentistry, ²Purdue University, ³Purdue School of Engineering and Technology, Indianapolis, IN)

Objective: Restoration of craniofacial form and function is highly dependent on successful reconstruction and regeneration of the area. Researchers have combined mesenchymal stem cells (MSCs) with scaffold biomaterials to try and solve this problem. Many issues still exist, such as slow degradation of the cell carrier, low rate of diffusivity of the carrier, and adverse effects from degradation byproducts. This study was used to (1) determine the ability to tailor biodegradable thio-acrylate hydrogel for faster degradation for MSC deliver, and (2) to determine MSC survivability and differentiation after encapsulation. Methods: Poly(ethyleneglycol)-diacrylate (PEGDA) hydrogel was prepared by visible light initiated thiol-acrylate photopolymerization. CRGD peptide was used to enhance cell attachment. PEGDA groups were prepared with 5 to 15 wt% macromere formulations with thiol concentrations from 1 to 9 mM. Degradation rate of PEGDA was evaluated. Oscillation viscometry analyses were performed to measure the modulus of the gel. MC3T3-E1 cells, rabbit bone marrow derived stem cells (BMSCs) and rabbit dental pulp derived stem cells (DPSCs) (500x10³ cells/gel) were encapsulated in the hydrogel. AlmarBlue stained cells visualized with Confocal Microscopy and ALP assays were used to evaluate viability and

differentiation. RT-PCR and Von Kossa staining were also used to evaluate differentiation. Results: PEGDA 5 wt% showed lower mechanical properties, higher swelling ratio and faster degradation rate compared to the other groups. Cell viability was shown to decrease with increasing wt% of PEGDA. There was increased metabolic activity of 5 wt% at day 3 compared to 9 and 15 wt%. After 21 days culturing in osteogenic media *in vitro* the specimens demonstrated the mineralization activities in MC3T3-E1, BMSCs and DPSCs. Conclusion: This study showed that PEGDA hydrogels can be tailored to different degradation rates and are non cytotoxic to cells. This study provided fundamental concepts for future PEGDA hydrogel clinical and translational research.

P64 Effectiveness of Double Antibiotic Paste Against Established Multispecies Biofilm. R. KOLTE*, R.L. GREGORY, G. YASSEN (Indiana University School of Dentistry)

Infection control protocol, a crucial step in Regenerative Endodontic Procedures (REPs) currently uses Triple Antibiotic Paste (TAP). TAP causes tooth discoloration because of a component, minocycline. Therefore, an alternative without minocycline, i.e. Double Antibiotic Paste (DAP), is being investigated for its effectiveness in infection control. Also, the endodontic infections are of polymicrobial nature and these pathogens co-exist in the form of biofilms. The objective of this study was to investigate the effectiveness of DAP against an established multispecies biofilm of *Enterococcus faecalis*, *Prevotella intermedia* and *Fusobacterium nucleatum* and compare this data with the effectiveness of DAP against established individual species biofilms. Methods: Each bacterial species was individually grown on anaerobic blood agar and in liquid medium at 37°C in an anaerobic environment. Overnight cultures were used as inoculum for growing the multispecies and single species biofilms on 12 well plates. Biofilms were grown anaerobically for 3 days at 37°C. After 3 days, the established biofilms were treated with four treatment groups for another 3 days: 1 and 5 mg/ml (both in methylcellulose carrier), placebo (methylcellulose) and control (sterile saline). After the treatment period, biofilm was gently washed with sterile saline. The biofilm was collected with scrappers, diluted, spiral plated and anaerobically incubated for 24 hours. The colonies on the plates were enumerated using an automated colony counter. Results: The results demonstrate a significant reduction in bacterial counts at both 1 and 5mg/ml of DAP as compared to the placebo. The control did not exhibit reduction in bacterial count. Bacterial count reduction after treatment with DAP is consistent with both multispecies and single species biofilms. Conclusion: The significant in vitro reduction of bacterial counts from the established multispecies biofilms after treatment with 1 and 5 mg/ml of DAP indicates promising applicability of DAP as an intracanal medicament during regenerative endodontics.

P65 Bioactive Nanofibrous Scaffolds for Periodontal Bone Tissue Engineering. K. PHILLIPS*, D. PANKAJAKSHAN, M.C. BOTTINO (Indiana University School of Dentistry)

Guided bone regeneration is a state of the art treatment option using biodegradable scaffolds and endogenous stem cells for replacing bone loss due to periodontal disease. These scaffolds ideally act as a physical barrier between the periodontal defect and soft tissue and can be engineered with biomolecules and/or calcium phosphates to stimulate bone growth. The electrospinning technique demonstrates great potential for fabricating bioactive nanofibrous scaffolds. The goal of the present research is to develop novel electrospun nanofibrous scaffolds for application in periodontal tissue engineering. In this study, we obtained scaffolds composed of a polymer blend of polylactic acid (PLA, 40% by weight), polycaprolactone (PCL, 40% by weight), and gelatin (gel, 20% by weight). The polymer blend of PLA, PCL and gelatin was standardized as in our previous research. Fibroblast growth factor-2 (FGF-2) and beta-tricalcium phosphate (β -TCP) nanoparticles, which have been shown to induce cell proliferation and osteogenic differentiation respectively, were incorporated into the polymer blend prior to scaffolds' processing. The electrospinning parameters were optimized through a systematic approach

involving the testing of several different voltages and flow rates. Scanning electron microscopy data demonstrated defect-free and uniform fiber morphology at 1ml/hr at 20kV for PLA/PCL/gel scaffolds and at 1.5ml/hr at 20kV for PLA/PCL/gel + β -TCP scaffolds. Human bone marrow derived mesenchymal stem cell (MSC, Lonza) proliferation was evaluated on the scaffold after incorporation of FGF-2 and β -TCP at various concentrations using an MTT assay. Preliminary results revealed higher MSC proliferation rates on scaffolds with FGF-2. Evaluation of osteogenic differentiation of MSCs by ALP assay is ongoing. Future studies will involve determination of gene expression of osteogenic markers on MSCs cultured on these scaffolds. If successful, this scaffold will be a promising candidate for guided bone regeneration, and ultimately, a more predictable treatment of periodontal disease.

TOBACCO RESEARCH

P66 Effects of E-Juices on Matrix Metalloproteinases (MMPs) From Human Gingival Fibroblasts. A. VORIS*, L.J. WINDSOR (Indiana University School of Dentistry)

Background: Fibroblasts serve as the predominant cell type within the lamina propria. In individuals suffering from periodontitis, the fibroblast's ability to produce MMPs decreases, which leads to a rapid loss of the supporting tooth tissues including the periodontal ligament and alveolar bone. Individuals who have smoked cigarettes a certain number of pack years have a greater probability of developing periodontitis compared to non-smokers. Objective: The purpose of this study was to examine the effects of an electronic cigarette liquid (E-juice) on human gingival fibroblasts in regards to cell viability and MMP expression. Methods: Water-Soluble Tetrazolium-1 (WST-1) assays were conducted to determine cell proliferation by measuring the amount WST-1 formazan dye produced via the mitochondrial dehydrogenase-mediated reduction of tetrazolium salt WST-1. Results: WST-1 assays revealed that an e-juice with a nicotine concentration of 1.8 mg/mL (10 fold stock dilution) yielded a complete loss of cellular viability, while a concentration of 0.18 mg/mL (100 fold stock dilution) did not have any effect. An E-juice without nicotine at a 10 fold stock dilution resulted in no cell viability and a 100 fold stock dilution did not have any effect. Conclusion: In comparing the data between the E-juice liquids with and without nicotine, it was determined that it is the components of the E-juice liquid other than nicotine that are causing the loss of cellular viability. In addition, it was observed that the nicotine actually increases proliferation compared to the control.

Clinical Case Reports AESTHETIC DENTISTRY

CC1 A Novel Approach to Aesthetically Treat Stained Arrested Caries Lesions. S.S. AL-ANGARI*, A.T. HARA (Indiana University School of Dentistry)

Esthetic treatment of stained arrested caries lesions (ACLs) has mostly been done using invasive restorative techniques. The aim of this paper was to propose and report the efficacy of a conservative approach based on dental bleaching to esthetically treat these lesions, both experimentally (extracted teeth) and clinically. In part one, ten extracted human teeth with stained ACLs in either pit and fissure or smooth surface were selected and treated with 15 % carbamide peroxide gel, 4 h per day, for a total of six days. Part two reports a clinical case of pit and fissure stained ACLs in four posterior teeth, which were treated with 40 % hydrogen peroxide in-office bleaching. Digital photographs were taken in both parts to document the efficacy of the treatment. The lesions showed noticeable increase in color lightness indicating the efficacy and suitability of the proposed approach. By using the conservative clinical technique presented, the aesthetics of most stained ACLs could be improved, eliminating the need of invasive restorative treatments.

DENTAL HYGIENE

CC2 Oral Hygiene Care for the Dementia Patient. R. BLAZEKOVIČ*, J. RICHARDS, T. RADER (Indiana University School of Dentistry)

Objective: Oral hygiene care with dementia patients can be challenging due to lack of patient and dental provider communication, absence of proper oral health care, and patient manual dexterity limitations. The objective of this study was to identify oral hygiene needs and address possible interventions to prevent and reduce gross plaque retention between maintenance appointments for the dementia patient. Incorporating several appointment alterations and demonstrating effective home care methods to caretakers was built into the process managing treatment. Method: During maintenance hygiene appointments, the approach to treatment has to be modified in order to accommodate patient needs and comfort. The scaling process was initially attempted with the Ultrasonic scaler to begin debridement and was proceeded by hand instrumentation where visible calculus deposits remained. Oral hygiene care was verbally given and several methods were demonstrated to the patient caretaker in order to reduce extensive plaque accumulations and generalized tissue inflammation. The importance of frequency and quality of the brushing method used was emphasized and reviewed for proper daily home care. Conclusion: Three months later, the results of the periodontal maintenance recall appointment were equivalent to the initial observed findings. Gross plaque retention and severe gingival inflammation was recorded each visit and home care preservation had not significantly changed. In order to prevent further destruction of periodontal health, frequent recalls and supplementary home care methods would need to be integrated into the daily care regimen for expressive results.

CC3 Abdominal Aortic Aneurysm and Periodontitis: Association, Education and Treatment. A. BOOHER*, R. RASSBACH, J. BLANCHARD (Indiana University School of Dentistry)

There have been reports of a possible relationship between periodontal disease and the exacerbation of abdominal aortic aneurysms. Patients with periodontitis have a large number of gram-negative bacteria that can be introduced into the bloodstream. These bacteria may interact with cardiovascular tissues and worsen aneurysmal disease. The objective of this case report is to bring awareness to the possible link between periodontitis and aortic aneurysms, and to evaluate the outcome of non-surgical periodontal therapy in conjunction with patient compliance. Conclusion: Patients with aortic aneurysms and periodontitis may benefit systemically by reducing the bacterial load that can exacerbate the inflammatory process. If a relationship exists, increased attention and emphasis on prevention, education and periodontal therapy will be important to help these patients achieve optimum oral health and reduce systemic risk factors.

CC4 Achieving Patient Motivation and a Successful Treatment Outcome. K. DALLEY*, K. EISELE, J. BLANCHARD (Indiana University School of Dentistry)

The objective of this case presentation is to discuss how to achieve patient motivation and a successful outcome when treating a patient who had not received any dental treatment in seven years since immigrating from India. A 23-year-old male patient presented to the dental hygiene clinic with the chief complaint of "I need to get my teeth cleaned." The patient's medical history was noncontributory. The clinical assessment showed generalized severe plaque-induced gingivitis as evidenced by diffuse, red, bulbous and soft gingiva with generalized BOP and poor oral hygiene. The radiographs showed generalized normal bone levels. Clinically, he presented with generalized 4-6 mm probing depths, but without radiographic bone loss the probing depths were attributed to inflammation. The dental hygiene treatment plan was an adult prophylaxis and extensive oral hygiene instruction. The LEARN

Communication Model can be helpful in successful cross-cultural patient education. He was unfamiliar with preventive oral health care and was attentive to oral hygiene instructions to improve his dental health. It was important to be sensitive to his lack of awareness, to make recommendations, and encourage him with a nonjudgmental attitude. An effective patient-hygienist rapport motivated him to improve his home care and take responsibility for his dental health. The patient returned three months after completion of the debridement for a re-evaluation appointment. His first plaque score was 91% but 3 months later his plaque score had decreased to 23%. The gingiva showed less inflammation with generalized 1-3 mm probing depths. Successful communication and education was effective in motivating this patient to accept responsibility and improve his oral health. The LEARN Communication Model is one way of overcoming communication and cultural barriers to patient education.

CC5 Factors Influencing Periodontitis Development in the Healthy Young Male Patient. A. HARDY*, V. DAKU, T. RADER (Indiana University School of Dentistry)

The patient selected is a 28 year old African American male graduate school student. This patient presented to IUSD with a non-contributory medical history, generalized heavy calculus, moderate periodontitis, tooth mobility, spontaneous bleeding, and recession. Young, healthy, and highly educated, this patient is an outlier when compared to the typical patients who have extensive periodontal involvement. He attended both private and public school, his father was a chemist, and his family was in the middle class sector. Risk factors for development of periodontitis include: heredity, poor oral hygiene, tobacco use, diabetes, older age, and low socioeconomic /educational background. This patient only exhibited typical risk factors of poor oral hygiene and a brief history of tobacco use, and yet, his disease progressed. Biologic and behavioral factors, socioeconomic status, and educational background were further investigated. A patient history interview and a saliva flow rate test were performed to gather data. Results: Factors that prevented this patient from seeking treatment which led to his disease included growing up without dental health knowledge or priority, lack of dental insurance in adulthood, and general unawareness. The saliva flow rate test demonstrated normal results. No dental fear or anxiety was revealed. This patient was given extensive oral hygiene instruction at each visit and taught the importance of maintaining his recall visits. Tissue improvement could be observed after a full debridement. Conclusion: The patient's periodontal condition may have been prevented through effective community and school outreach programs if presented during his childhood and adolescent years. Dental health education must be implemented in the early stages of life because they are more receptive to new information which would lead to advanced dental health awareness. Health care professionals must be willing to take the initiative and step outside of the typical clinical setting and provide education in their communities.

CC6 The Dental Hygienist's Role in Treatment of Sjogren's Syndrome Patients. J. HENRY*, K. HASTE, S. PHILLIPS (Indiana University School of Dentistry)

Objectives: Identifying the effects of Sjogren's syndrome on the oral cavity, determining how to manage the patient's discomfort, and formatting a plan to decrease the patient's risk for developing caries. Methods: The patient presented with a medical history of Sjogren's syndrome, low IgG function, hypertension, osteoarthritis, and bipolar disorder. These conditions are being controlled well due to medications that the patient is taking. Several of these medications have the side effect of xerostomia. Due to several infections in her parotid gland caused by low IgG function, the majority of the patient's Parotid glands were removed. Clinical assessment revealed fractured teeth due to caries on #13 and 29. Radiographic decay was present under the crown of #30. The patient is at a high risk of developing caries due to decreased salivary flow, and sipping on three coke sodas per day. Results: Several recommendations were made for this patient, a few of them were chewing sugar free gum after meals or

soda consumption, drinking plenty of water throughout the day and especially before bed, rinsing with a fluoridated mouthwash that does not contain alcohol, swishing with Biotene to moisten the oral cavity, improving oral hygiene practices due to increased risk for decay, brushing with a fluoridated toothpaste twice a day, refer for a salivary flow test to see if patient is a candidate for saliva substitutes or stimulants, and recommend an in office fluoride treatment. Conclusion: In order to decrease the patient's discomfort and risk for developing caries it is important that we educate patients on the preventative strategies needed to keep their oral cavity at optimal health.

CC7 Tooth Morphology Related to Periodontal Disease. M. KAHL*, M. WEAKLEY, N. STUMP
(Indiana University School of Dentistry)

Dissimilarity of the root morphology of the mesial of the maxillary first premolar and the distal of the canine creates a unique interproximal relation in which increases retention of plaque and calculus formation resulting in chronic inflammation. Objective: To identify the contributing factors that may be involved in bone loss that was observed in a patient bilaterally in the maxillary canine and premolar locations. Methods: After initial assessment and treatment planning it was determined that these areas would be treated with localized scaling and root planning as well as the rest of the teeth. Results: At the tissue reevaluation there was little change in the tissue health and probing depths from initial therapy of teeth numbers 5, 6, 11 and 12. The initial phase of therapy was inadequate to result in improving clinical attachment levels. It was determined to refer the patient to Graduate Periodontics to be evaluated for surgical options. Conclusion: Since attachment level improvements were noted in all other areas besides these two it was likely that the significant contributing factor was the unique root morphology of the mesial of the maxillary first premolar and the distal of the canine.

CC8 Effects of Tobacco Use and Cessation on Periodontal Tissues. K. LOEHMER*, L. DENNY,
P. RETTIG (Indiana University School of Dentistry)

Objective: To discuss the effects of tobacco use on the periodontal tissues and tobacco cessation counseling with a patient who is a healthcare professional. Background: A forty-six year old Caucasian female presented as a new patient to the dental hygiene clinic after not receiving dental care for the past 17 years. The medical history was negative, with the exception of allergy to Sulfa drugs, history of gastroesophageal reflux disease, osteoarthritis and 1 pack per day tobacco use for the last 18 years. Clinical Examination: The patient presented with generalized 1-3 mm clinical attachment levels with localized 4-5 mm clinical attachment levels in the posterior teeth. Radiographically, the patient presented with generalized healthy bone levels as evidenced by 1-2 mm from the CEJ to crest of bone and localized slight bone loss in posterior teeth as evidenced by 3-4 mm from CEJ to crest of bone. The patient presented with generalized plaque-induced marginal and papillary gingivitis as evidenced by bulbous, dark pink to dark red, soft gingiva with bleeding on probing. The patient presented with generalized heavy calculus deposits and an 11% bleeding index. DH Care Plan: The patient received four quadrants of scaling and root planing, tobacco cessation education, and completed a tissue re-evaluation. Results: Upon completion of scaling and root planing, findings from the tissue re-evaluation included generalized 1-2 mm improvement in probing depths and localized 1-2 mm increases in probing depths on #2, 4, 7, 11, 13 and 18. The patient states she has decreased her tobacco use by 6 cigarettes less per day and switched from 100s to short. Conclusion: The patient did not show all signs of gingivitis due to the vasoconstrictor effects of nicotine. The changes in probing depths and delayed tissue healing are effects of tobacco. She will return for a three-month periodontal maintenance recall.

CC9 Management of a Periodontal Patient from a Diverse Background. L. MILLS*, M. DENZIO, N. ROMBOLD, P. RETTIG (Indiana University School of Dentistry)

Objective: To discuss the long-term effects of a patient performing oral hygiene with alternative methods. Background information: A 41-year old African American male patient presented to the dental hygiene clinic as a new patient with the chief complaint of prophylaxis and broken tooth. The patient's health history was negative. Clinical examination: The patient presented with generalized slight plaque-induced marginal and papillary gingivitis as evidence by light pink, swollen, soft, blunted tissue with bleeding, and also localized areas that were dark red, swollen, soft, blunted tissue with bleeding on the lingual of sextant 5. The periodontal description includes generalized mild horizontal bone loss as evidence by 3-4mm from the crest of alveolar bone to the CEJ and localized moderate horizontal bone loss as evidence by 5-6mm from the crest of alveolar bone to the CEJ on #'s 2, 9, 24; generalized moderate chronic periodontitis as evidence by 5-6mm probing depths and localized severe chronic periodontitis as evidence by 7mm+ probing depths on #s 2, 5, 14, 15, 16, and 18. The primary factor to tissue inflammation was the 77% plaque score and generalized moderate to heavy calculus. Evidence of radiographic and clinical decay presents on #s 4, 5, 13, 14, 15, 16, 18, 19, 20, 30. Oral hygiene habits consist of brushing with coconut oil and baking soda once daily. DH Care Plan: Patient received a full mouth debridement, scaling and root planing in all four quadrants, a tissue re-evaluation, and extensive oral hygiene instructions. The patient was advised that coconut oil has limited benefits and was instructed to start using fluoridated toothpaste two times a day. Results: At the re-evaluation there was limited improvement of the gingival tissue. Conclusion: This limited improvement in the gingival health is primarily related to the patient's lack of compliance to recommendations made.

CC10 An Educational Plan for Patients with Periodontitis and Aortic Aneurysm. L. PEASTER*, S. SWINDLE (Indiana University School of Dentistry)

Objective: The objective of this clinical case presentation is to propose an educational plan to familiarize dental patients who present with an aortic aneurysm with the systemic and oral conditions that commonly accompany, and are known to possibly contribute to, the formation of an aortic aneurysm. Additionally, this plan includes oral hygiene considerations for a patient with a condition of an aortic aneurysm or a repaired aneurysm. Assessment: A 66-year-old male presented as a periodontal maintenance patient with a history of smoking, hypertension, hyperlipidemia, and recent aortic aneurysm. Clinical examination revealed generalized severe periodontitis as evidenced by 7-11mm clinical attachment levels. Radiographically, the patient presented with generalized mild bone loss as evidenced by 3-4mm apical to the CEJ to the crest of the alveolar bone. Evaluation: Initially the patient agreed to reappoint for a tissue re-evaluation, but later refused to return for a follow up. Consequently, presentation of the educational plan and further evaluation of the patient's periodontal involvement and healing could not be conducted as a result of non-adherence of the patient. Conclusion: Patients presenting with a history of smoking, hyperlipidemia, hypertension, periodontal disease, and recent aortic aneurysm should be promptly educated on how these factors work together to compound the effects of degradation of the endothelial lining of blood vessels; possibly contributing to a future aortic rupture. Furthermore, the patient needs to be made aware that their periodontal disease may have been a contributing factor to their previous aortic aneurysm.

CC11 Treating an Autistic Patient in the Dental Office. M. RUSSELL*, R. THURSTON, P. RETTIG
(Indiana University School of Dentistry)

Objective: The objective of this clinical case was to provide excellent care for an individual with Autism, allowing the necessary modifications. Background Information: A 28 year old African American female patient presented to the Dental Hygiene Clinic for routine prophylactic care. The medical history was negative with the exception of she suffers from Autism, borderline diabetes, and depression. The patient's Autism is being treated with Neurontin, Geodon, Ativan, and Fanapt. The patient's depression is being treated with Trazodone and Prozac. Clinical examination: The patient presented with generalized, plaque-induced, marginal and papillary gingivitis as evidenced by pink, pigmented, slightly swollen, stippled gingiva with slightly rolled margins and knife-edge papillae. The patient presented with generalized healthy periodontium as evidenced radiographically by 1-2 mm from the cemento-enamel junction to the alveolar bone crest and localized 4-5 mm clinical attachment levels due to negative recession on teeth 2, 11, 12, 18, 19, 31. Oral hygiene habits include a supervised routine of brushing 3-4 times a day, flossing once a day, and Crest mouthwash once a day. The patient is at low risk for caries, even though patient is taking several medications that may cause xerostomia she reported no symptoms, there is no clinical evidence of decay and the patient has excellent home care. Dental Hygiene Care Plan: Prophylaxis with oral hygiene instructions were performed. Fluoride mouth rinse and a Reach flosser were recommended for ease of care, while continued supervision during at home care was encouraged. Evaluation: This patient will return for a prophylaxis in July of 2016. At that time, oral hygiene and caries risk will be evaluated. Conclusion: In this case report, the necessary adjustments needed for Autism were addressed. The appointment length was kept short, the tell/show/do method was utilized, verbal affirmation was awarded, and specific oral hygiene needs were addressed.

CC12 How Culture and Socioeconomic Status Affect Oral Health. M. SMITH*, P. PICKENS, P. RETTIG (Indiana University School of Dentistry)

Objective: The purpose of this clinical report is to evaluate how poor diet, low socioeconomic status, and minimal dental knowledge affect the patient's health and oral habits. Background: A 23-year-old, Hispanic female presents to the clinic as a new patient for a cleaning and exam. Medical history appeared negative with the exception of a contraceptive patch. Assessment: The patient presents with generalized plaque-induced gingivitis as evidenced by dark red spongy gingiva, red rolled margins, bulbous papilla, with heavy bleeding upon probing. Localized diffused red, bulbous, loose, and shiny gingiva on teeth numbers 24-26. Radiographically the patient presents with generalized healthy bone levels as evidenced by 1-2mm from the CEJ to the crest of the alveolar bone and localized mild bone loss as evidenced by 3mm on tooth numbers 23-26, and a localized 4mm measurement on 8 mesial. Probing depths ranged from 2-6mm with the majority of the depths ranging from 4-6mm as a result of inflammation. Heavy subgingival calculus was present throughout the dentition and was also visible radiographically. The patient presents with generalized plaque with a plaque score ranging from 40-60%, as well as active decay. The patient's oral hygiene had little change throughout the course of treatment. Plaque scores stayed very consistent in the 50% range and the gingival health showed little improvements as well. The patient's diet played a major factor in caries risk status; patient was frequently snacking on candy, chips and other non-healthy choices. Completed a five-day food diary on the patient and suggested healthier alternatives. Dental Hygiene Care Plan: Patient received scaling and root planing in all four quadrants, a tissue re-evaluation, and extensive oral hygiene instruction. Results: The results from this report concluded that socioeconomic status, poor diet, and minimal dental knowledge have a negative effect on a patient's oral health.

CC13 Management of a Patient with Multiple Critical Dental Needs. S. SPARKS*, A. FLOWERS, P. RETTIG (Indiana University School of Dentistry)

Objective: The objective of this clinical case report is to educate dental professionals on management of young patients with poor oral habits. Background information: A 22 year old male patient presented to the dental hygiene clinic with a chief complaint of improving the appearance of his teeth. Patient stated after the recent loss of his father, he was depressed with a lack of interest for self-care resulting in a poor diet and oral hygiene habits. Assessment: The medical history was negative. Patient presented with severe gingivitis evidenced by red, bulbous, soft, inflamed gingiva. Patient also presented with a generalized healthy periodontium as evidenced by 1-3 mm probing depths with localized moderate 4-5 mm probing depths due to inflammation in the posteriors. Radiographically the patient presented with generalized healthy bone levels as evidenced by 1-2 mm from the CEJ to the alveolar crest. Calculus was generalized heavy deposits. Patient presented with rampant decay with poor oral hygiene habits only brushing once a day without flossing or rinsing. Patient reported consuming highly acidic sodas and sugary sport drinks throughout every day. DH Care Plan: Adult prophy with extensive oral hygiene instruction and nutritional counseling were performed on this patient. Prevident was prescribed with the recommendation of using it every night. Patient was referred for restorative work. Results: Patient is to return for prophy recall April 2016 where oral hygiene and caries risk will be reevaluated. Conclusion: In this case report, the patient's concerns of anesthetics were addressed with a referral for crowns and fillings, but oral hygiene instructions were also given along with a nutritional counseling session in order to maintain his appearances once all of the treatments have been completed.

CC14 Potential Causes of Rapid Accumulation of Supragingival Dental Calculus. N. TUMAN*, K. LOPEZ, P. RETTIG (Indiana University School of Dentistry)

Objective: To discuss potential factors related to rapid supragingival calculus formation in the oral cavity and determine the most likely source. Background: A 47-year-old Hispanic male presented to the dental hygiene clinic with chief complaint of "I want implants and need teeth cleaned first." Medical history was negative with the exception of seasonal allergies. Patient reported no medications and vital signs were all normal. Assessment: Radiographs revealed generalized moderate 3-4 mm bone loss with localized severe 6 mm bone loss on #2. Radiographs show generalized heavy spicules of calculus. Clinical examination revealed generalized moderate chronic periodontitis as evidenced by 5-6 mm CAL and localized severe periodontitis as evidenced by 7-12 mm clinical attachment levels on #2, 3, 4, 14, 15, 25, 30. Gingival description was generalized plaque induced, diffuse gingivitis as evidenced by red, bulbous, edematous tissue. Plaque score was 100%. Home care consisted of brushing two times daily, never flossing, with limited mouthwash use. DH Care plan: The plan included four quadrants scaling and root planning, periodontal tissue re-evaluation, and oral hygiene instruction. Oral hygiene instruction included demonstration of end tuft, proxy brush, sulcular brushing, and c-shape flossing. Fluoride varnish recommended. Results: Tissue re-evaluation was completed 5 weeks post scaling and root planing. Clinical evaluation indicated improved periodontal status. Gingival health was improved in quadrant 1 and buccal of the mandible as evidenced by pink, firm and rolled margins with reduced probing depths. Areas of gingivitis remained where supragingival calculus reformed: buccal side of quadrant 2 and lingual aspects of the mandible. Conclusion: Patient has propensity to build calculus quickly. This is a multi-factorial condition. The upper left lacks opposing teeth to disturb biofilm remaining after poor home care. The lingual of the mandible has generalized recession, increasing the surface area of those teeth, making plaque removal more challenging.

CC15 The Effect of Smokeless Tobacco on the Periodontium. J. ALDERMAN*, C. ANDERSON, L. MAXWELL (Indiana University School of Dentistry)

A 47 year old male from Delphi, IN presented to the dental hygiene clinic for an appointment. The patient has used smokeless tobacco for the last thirty years, chewing one can per day and has never tried quitting. The patient was diagnosed with periodontal disease in private practice approximately 14 years ago. Scaling and root planning was performed at that time and he was put on a three month recall. The patient presented to the dental hygiene clinic with generalized plaque induced, diffuse gingivitis as evidenced by red tissue with spongy, rolled margins and a bleeding index of 23. This patient's periodontal assessment shows generalized severe periodontitis as evidenced by 5mm to 8mm CAL on teeth #4, 7, 11, 14, 15, 23, 27 and localized moderate periodontitis as evidenced by 3mm-4mm CAL on teeth #3, 4. The patient holds his tobacco in the vestibule apical to #22-#27; these teeth presented with facial recession of 3mm-7mm. Clinical photographs show substantial negative effects from this 30 year habit. A periodontal referral was made for teeth #24 and #25 due to recession and boney defects. An oral medicine referral was also given to the patient to evaluate the gingiva where the patient holds his tobacco. The treatment plan presented to this patient was four quadrants of scaling and root planning followed by a tissue re-evaluation. At the tissue re-evaluation there was evidence of slight improvement as noted by the periodontal chart which showed generalized pocket depth improvement by 2mm; however, there was no improvement in the patient's gingival description. Conclusion: Treatment cannot truly be successful due to patient's inability to comply with tobacco cessation.

ENDODONTICS

CC16 Intentional Replantation. S.M. ALYAS*, B. FISCHER, Y. EHRLICH, J. BRINGAS, K.J. SPOLNIK (Indiana University School of Dentistry)

Intentional replantation (IR) is an alternative endodontic treatment modality for failed endodontically treated teeth. It entails the extraction of the infected tooth; extra-orally resecting the apex and placement of a retro-fill prior to replanting it back in the socket. Case Report: A 68 year old female was referred to the graduate endodontic clinic at IUSD for evaluation on tooth #20. The records and clinical exam revealed the patient has been symptomatic for several months. Tooth had resin restorations. Periapical radiograph (PA) of #20 revealed a root canal treatment that was overextended and a large periapical radiolucency. CBCT scan revealed area of low density around the apex of tooth #20 that was consistent with the PA. CBCT also demonstrated that the root canal filling was overextended and off-centered, suggesting the presence of a 2nd canal that splits in a type IV fashion at the apical aspect of tooth #20. Diagnosis: Pulpal: Previously Treated. Apical: Symptomatic Apical Periodontitis. Treatment: Preoperative sedation was achieved and anesthesia obtained shortly after. Sulcular incision made around tooth #20 and it was extracted. The tooth was placed in Hanks Balanced Salt solution. Root end was resected by 2 mm from apex. Ultrasonic retro-preparation was performed and a second canal was found and prepped. Both canals were filled with Endosequence Root Repair Material[®]. Socket was irrigated with saline and curetted gently. Tooth was re-implanted into socket. Composite stent was placed to stabilize the tooth. Extra-oral time for procedure: 3 minutes and 50 seconds. Results: Twelve month post-op: Patient was asymptomatic and radiographs reveal deposition of bone around the apex of #20 indicative of significant resolution of the apical periodontal lesion. IR is a viable and predictable treatment option failed endodontically treated teeth.

CC17 Regenerative Endodontic Management of a Maxillary Anterior Tooth. D.J. JENKS*, J. BRINGAS, Y. EHRLICH, K.J. SPOLNIK, G.H. YASSEN, K. RIAD (Indiana University School of Dentistry)

Introduction: Regenerative endodontic procedures (REP) are used to treat immature teeth with pulpal necrosis. With REP, infection can be controlled, symptoms alleviated and healing can occur. The management of an immature maxillary incisor with pulpal necrosis using REP is presented. The AAE guidelines for REP were slightly modified; 10 mg/mL of Double Antibiotic Paste (DAP) containing metronidazole and ciprofloxacin loaded into a methylcellulose system was used as the intracanal medicament instead of the recommended Triple Antibiotic Paste (TAP) containing minocycline, which is known to discolor teeth. Case Report: A 13-year-old male presented to Graduate Endodontics with his mother for emergency evaluation of tooth #9. The patient reported a history facial trauma and pain that started prior to seeking treatment. A large fluctuant intraoral swelling was noted in the labial vestibule. Intraoral radiograph revealed an immature apex with a periapical radiolucency. No response to cold and tenderness to percussion was noted. Control teeth responded normally. Diagnosis: Pulpal Necrosis with Acute Apical Abscess. Local anesthesia and endodontic access were completed. The canal was irrigated with 1.5% NaOCl and 17% EDTA using minimal instrumentation. The canal was dried and DAP in aqueous methylcellulose (10mg/mL) was placed in canal. Incision and drainage was completed prior to dismissal. Second appointment: The abscess had resolved. The canal was accessed, irrigated with 17% EDTA and dried. Bleeding was initiated to the CEJ by gently lacerating the apical area. CollaPlug® and Biodentine® were placed on the blood clot and allowed to set. The access was closed with glass ionomer. Six month post-operative radiograph reveals a functional #9 with evidence of bony healing. Discussion: This case presents the clinical effectiveness of using DAP in methylcellulose as the intracanal medicament in REP and demonstrates that it can be a viable alternative to the conventional TAP without the potential for discoloration.

CC18 Cholesterol Granuloma is Dictated by Lesional Size but Not Age. R. KNEPPER*, P.C. EDWARDS (Indiana University School of Dentistry)

Objectives: The presence of cholesterol granulomas (CG) within periapical inflammatory lesions (PIL) has been implicated as a possible factor associated with poor response to conventional endodontic therapy. Hypotheses offered as to the etiopathogenesis of this process include vascular stasis, and breakdown of inflammatory cells, and the bodies' inability to breakdown cholesterol crystals. One recent study using age as a surrogate marker for hyperlipidemia reported a higher incidence of CG in the elderly compared adolescents, inferring an association between hyperlipidemia and CG. Our hypothesis is that the incidence of CG is instead related to the size of the lesion, modified by the degree of inflammation and tissue vascularity. Methods: CG-containing PIL biopsies (January 1, 2014 to December 31, 2014) were examined (IRB 1509947622). Lesion size, and age were compared between CG, periapical granuloma and periapical cysts. Degree of inflammation, plasma cells, histiocytes, hemosiderin deposits, and vascularity was assessed on a 4-point scale (0= none; 1= less than 50; 2= 50-199; 3= greater than 200 cells/vessels per HPF). Results: 62 CGs were identified. Larger lesional size, hemosiderin deposits and histiocytes were greater in CG-containing PILs than periapical granulomas and cysts without CGs. No differences were noted with respect to the remaining variables. Conclusions: The incidence of CG appears to be related to lesional size as opposed to the age of the host. The higher prevalence of hemosiderin deposits within CG-containing PILs suggests an association with erythrocyte breakdown.

CC19 Endodontic Management of Chronic Fibrosing Osteomyelitis (CFO). C.D. KUTANOVSKI*,
Y. EHRLICH, K.J. SPOLNIK, W.R. ADAMS (Indiana University School of Dentistry)

Chronic facial pain of non-odontogenic origin can occur in the mandible and the maxilla. Chronic Fibrosing Osteomyelitis (CFO) is a chronic pain affliction in the jaw. The successful management of a pain patient with CFO using surgical endodontics is presented. Case Report: A 50 year old male, presented to the dental VA clinic with a complaint of persistent pain of unknown origin in the right maxillary premolar area for the past year. Dental Hist.: In the past year a general dentist attempted to address pain by extraction of #4. An immediate implant was also placed and eventually removed due to persisting pain. I/O: #4 Healed extraction socket. Sensitivity to palpation in area. #5: Defective DO restoration. Heightened response to sensibility tests. Radiograph: #5 Normal apical area. Area #4: Extraction socket and widened bone marrow spaces. Diagnosis: #5 Symptomatic irreversible pulpitis with symptomatic apical periodontitis. Area of #4: Pain of Unknown Origin. Treatment: #5 Root canal treatment. Symptoms associated with #5 were alleviated. Pain in area of #4 persisted. CFO suspected. Follow-Up (One month): An X-tip® was placed in area of #4 resulting in serosanguinous drainage. Patient reported immediate relief of pain, which was transient. Patient was scheduled for exploratory surgery to r/o CFO. Surgeries in the area of #4-6 revealed intact cortical bone intact and cavitations in medullary bone. Debridement of cavitations removed soft medullary bone and waxy lipid like hemorrhage. The biopsy diagnosis was CFO. Six month follow up examination: Significant improvement in patient's symptoms. Post-operative radiographs showed evidence of healing and new bone formation. Conclusion: CFO is a medullary bone pain entity which can be helped by surgical debridement of inflamed and necrotic medullary bone in the jaw.

ORAL/MAXILLOFACIAL SURGERY

CC20 Role of Teriparatide in the Treatment of MRONJ. K. CHOPRA, P.C. EDWARDS (Indiana University School of Dentistry)

MRONJ is a painful and intractable disease of the jaw. It clinically appears as small ulceration or exposed/necrotic bone with or without an intraoral or extraoral fistula. In severe cases, it can cause jaw fracture, skin fistula or osteolysis extending beyond the region of alveolar bone. No standard treatment has been established yet. Recently, Teriparatide, a recombinant parathyroid hormone, and the only FDA approved osteoanabolic drug for the treatment of glucocorticoid induced osteoporosis, has been used for the treatment of MRONJ. Here, we report two case studies where Forteo has been used for the treatment of MRONJ and a literature review, as well as highlight the efficiency of Teriparatide alone or as an adjunct for the treatment of ONJ. A review of literature was done using PUBMED search database using key words 'Teriparatide', 'ONJ' and 'Bisphosphonates'. All publications identified in the literature search were retrieved and selected on the basis of the inclusion and exclusion criteria. We identified 57 articles, out of which 18 publications were selected in the present study. 50 patients, apart from the two described, diagnosed with stage 2 or 3 MRONJ secondary to antiresorptive/antiangiogenic drugs, were included. Trauma due to implant placement was considered the most common triggering factor for the development of MRONJ. The patients were treated with subcutaneous injections of 20 µg Teriparatide for 3 - 12 months (5 ½ months average). Two patients were withdrawn due to adverse events. There was symptomatic relief in almost all the cases and the lesions completely healed in 45 out of 50 patients. The success rate was approximately 90%. Based on the findings, it can be assumed that teriparatide's role in the treatment MRONJ is significant. Therefore, well-designed RCT's are required to further establish its role in the management of ONJ.

PERIODONTICS

CC21 Peripheral Ossifying Fibroma: A Clinical and Histological Case Report. T. DE BEDOUT*, V. JOHN, P. EDWARDS, S. BLANCHARD (Indiana University School of Dentistry)

The gingiva is often the site of localized growths that are considered to be reactive rather than neoplastic in nature. Many of these lesions are difficult to identify through only a clinical exam. They usually require histological examination to confirm the diagnosis. Peripheral ossifying fibroma (POF) which is one such lesion is considered to be a reactive lesion. It is believed to arise from the periodontal ligament and represents between 2-9% of all gingival growths. This case report describes a very large gingival lesion and its management. Case Report: A 34 year old female patient reported to the IUSD Department of Periodontology for evaluation of "a bump on her upper jaw" which had been present for about 5 years. The lesion appeared pedunculated, slightly mobile pink to bright red in color with a smooth surface. This lesion was asymptomatic and measured about 2.5cm x 2cm covering both the attached and free gingiva. The lesion extended from the mid-facial of the right maxillary canine to mesial-facial aspect of the right maxillary incisor. A differential diagnosis of peripheral giant cell granuloma, peripheral ossifying fibroma, and pyogenic granuloma was made. Following instrumentation to reduce the level of inflammation, the lesion was excised and sent for histopathologic examination. Histological diagnosis confirmed the clinical differential diagnosis of peripheral ossifying fibroma. The key element, which confirmed the diagnosis was prominent interconnecting trabeculae of viable bone and osteoid, in addition to foci of inflammatory cells, mainly lymphocytes and plasma cells. The patient was recalled after 2 weeks, and followed up to 6 months post-surgery with no recurrence of the lesion. The size of the lesion makes it unique, as POFs are usually smaller in size. It is important that clinicians become knowledgeable about gingival lesions, the variations, their differential diagnosis, and their clinical management.

CC22 GBR with Combination Bone Grafts for Early Implant Bone Loss. T. KISHIMOTO*, Y. HAMADA, S. BLANCHARD (Indiana University School of Dentistry)

Background: Various risk factors associated with early peri-implant bone loss include smoking, surgical trauma, and peri-implant infection. However, there is currently no gold standard to treat peri-implant bone defects due to less than predictable outcomes. The aim of this case report is to evaluate the effect of guided tissue regeneration (GBR) performed with two bone grafts of different resorption speed and a collagen membrane in a patient demonstrating early implant bone loss. Material and Methods: A 40-year old female patient with a history of gastric bypass surgery and depression presented for implant replacement of #10. Ridge augmentation was performed with freeze dried bone allograft (FDBA) and collagen membrane due to a horizontal ridge deficiency. Six months later, a 3.3x10 mm Straumann® Bone Level implant, was placed with primary stability of 35N/cm in a 2-stage approach. However, at 4 months following the implant placement, bone resorption was noted over 50% of implant length on the buccal aspect based on radiographic and clinical observations. After flap reflection, decontamination of the implant surface was performed with titanium curettes and tetracycline, grafted with a mixture of FDBA and deproteinized bovine bone mineral, and covered with a cross-linked collagen membrane. Second stage surgery was performed six months after GBR. Radiographic bone fill and implant stability quotient (ISQ) value were assessed at the time of GBR and 6 months later. Results: Six months after GBR, bone-like hard tissue was clinically observed around the implant, although two micro implant threads were still exposed on the buccal aspect. Furthermore, radiographic bone fill and ISQ values were improved: ~90% bone fill with ISQ improved from 28/30 to 61/60. Conclusions: Within the limits of this study, GBR with a combination of bone grafts achieved sufficient quantity of augmented bone and implant stability to correct early peri-implant bone loss.

CC23 Double Membrane Technique with Sandwich Bone Graft for Ridge Augmentation. A. MARLOW*, H. ALSAYED, S. BLANCHARD, S. TOWNS, Y. HAMADA (Indiana University School of Dentistry)

Commonly used techniques to augment ridge dimensions prior to implant placement involve bone substitutes and barrier membranes. However the use of titanium-reinforced membranes for space maintenance commonly results in membrane exposure and loss of newly formed bone due to resorption. The aim of this case report is to offer a novel approach to obtain predictable outcomes with a sandwich technique using two bone grafts of different resorption speed (Freeze Dried Bone Allograft; Deproteinized Bovine Bone Mineral), with a double membrane technique combining resorbable and non-resorbable membranes for ridge augmentation in an atrophic anterior maxilla. Methods: A 58-year old African-American male with a history of Chronic Periodontitis and Hypertension presented for implant supported fixed prosthesis in the area of #7-10. Intra-sulcular incision from #6-11 was made with two vertical releasing incisions. Following mucoperiosteal flap reflection, extraction and buccal decortication of #7-10, FDBA was grafted into the sockets with DBBM placed over the buccal FDBA only. Two Amnion-Chorion membranes and one titanium reinforced membrane were utilized over the grafts. Primary closure was obtained with periosteum releasing incisions. Eight months later, a trephine core was taken during implant placement for histomorphological analysis. Results: 7 weeks after augmentation, isolated wound opening, membrane exposure, and infection was found. The patient received Amoxicillin 500mg for a week. At 10 weeks, the titanium d-PTFE membrane was surgically removed. CBCT was obtained showing adequate amount of horizontal ridge dimension achieved for implant placement even with prior infection. 4 implants were placed 8 months after augmentation. Histologic healing showed vital bone formation around residual graft material from the osteotomy site. Within the limits of this case report, ridge augmentation with double membrane technique with sandwich bone graft achieved sufficient quality and quantity of augmented bone prior to implant placement with membrane exposure and infection during the early healing period.

PROSTHODONTICS

CC24 Prosthodontic Rehabilitation for an Existing Transmandibular Implant System. N. ALAWADHI*, N. ALQAHTANI, J. LEVON, D. MORTON (Indiana University School of Dentistry)

During the early period of dental implant evolution, the 1970's witnessed introduction of the transmandibular implant system, subsequently modified by Hans Bosker. It utilized implant-assisted prosthesis for the severely resorbed mandible. This system has been recently abandoned due to high-risk complications such as; pathological mandibular fracture, infection, post fracture, and prosthesis failure. Patients still present with this system in dental offices, but parts and tools for this system are no longer marketed. This case report presents prosthodontic rehabilitation for a seventy-two year old female with an inefficient Dolder bar® and implant-assisted complete denture on a surviving Bosker® transmandibular implant system.

CC25 Treatment of Inadequate Implant Overdenture for Patient with Ectodermal Dysplasia. H. ALSAYED*, N. ALQAHTANI, J. LEVON, D. MORTON (Indiana University School of Dentistry)

Overview: Ectodermal dysplasia (ED) is a genetic disorder that has congenital birth defects of two or more ectodermal structures. Hypohidrotic ectodermal dysplasia (HED) is the most common type of ED. In this report, a 55 year-old male presented to the graduate prosthodontic clinic with a diagnosis of HED and history of complete anodontia with a 15 year-old maxillary complete denture and a mandibular implant-assisted removable overdenture with cast Hader bar and distal cantilever ERAs attachments. Clinical findings: fibrous soft tissue of anterior maxillary ridge, hyperplastic tissue underneath the bar, and

severely resorbed posterior mandibular ridge with minimum keratinized tissue. The dentures were severely worn and inadequate. The existing Branemark system®Mark III implants were placed with good condition. Treatment: The bar was removed to facilitate the surgical removal of the hyperplastic tissue and healing abutments were placed. After healing, maxillary open tray impression technique was made for complete denture with regular and light body Vinyl Polysiloxane Impression (VPS). Mandibular open tray implants impression was made with VPS to pick up the implant's locations. Wax trial dentures were fabricated and tried in. Then, ATLANTIS™ Conus abutments were fabricated by CAD/CAM technology. Wax trial dentures were fabricated and tried in. Dentures were fabricated with heat-processed acrylic resin. The ATLANTIS™ SynCone Caps were picked up in the patient's mouth. Finally, the dentures were placed, oral hygiene instructions were given, and the patient was scheduled for follow up appointments. Conclusion: Overdentures with Conus abutments is an excellent alternative option for implants bar assisted overdenture if the patient lacks the ability maintaining the required hygiene underneath the bar. Conus abutments add stability, support and retention needed for the patient in order to eliminate any pressure on mental foramens since the patient have pain in those areas because of the severely resorbed ridges.

CC26 Virtual Surgical Planning for Implant Supported Auricular Prosthetics: Three Scanning Techniques Explored. T. BELLICCHI*, A. GHONEIMA, J. LEVON (Indiana University School of Dentistry)

Objective: To determine the most efficient, accurate method for auricular scanning for implant-supported auricular prosthetics. Implant-supported auricular prosthetics is ideally suited for virtual surgical planning. Since most patients have an intact contralateral ear, it can be used to virtually model the ear that is missing due to cancer, trauma, or congenital defect. Imaging data may be acquired from the intact ear by a variety of 3-dimensional image capture methods including photogrammetry, and laser scanning. Once data is captured from the intact ear, it can be copied, mirrored, and placed in the appropriate position for virtual surgical implant planning and surgical guide design. At IUSD, the Department of Orthodontics collaborates with the Department of Prosthodontics to help scan facial prosthetic patients. Scanners include 3DMD Face extraoral photogrammetry, CareStream intraoral scanner, and a desktop laser scanner from OrthoInsight. Each technology has strengths and weaknesses when used for scanning facial features. This poster discusses those strengths and weaknesses in the context of an on-going clinical case from the Department of Prosthodontics. Conclusion: 3DMD Face photogrammetry is the recommended facial scanning technology due to the ease of use, speed of image acquisition, and acceptable anatomic detail registration. Although other options capture fine anatomic detail better, the significant advantages of 3DMD Face make this the preferred option for facial scanning in the virtual surgical planning of an implant supported auricular prosthesis. Conclusion: 3DMD Face photogrammetry is the recommended facial scanning technology due to ease of use, image acquisition speed, and acceptable anatomic detail registration. Although other scanning options capture fine anatomic detail better, the advantages of 3DMD Face make this the preferred option for facial scanning in virtual surgical planning for implant supported auricular prosthetics.

CC27 An Alternative Radiation Stent for Oral Cancer Patients. S.D. CHO*, N. ALQAHTANI, T. BELLICCHI, J. LEVON (Indiana University School of Dentistry)

Objective: To present an alternative method for the fabrication of the radiation stent that is relatively simple, fast, and economical while providing the patient with comfortable and effective medical device. The patient wears this stent during radiation treatment in order to maintain the same position of the treatment target area and at the same time minimizing the radiation exposure to the nearby healthy tissues. The process begins with alginate impressions of the dentition or the edentulous ridges and jaw

relationship records, capturing only intercusp positions. The stone casts are mounted in a simple hinge articulator. Soft night guard material that is 5 mm thick is used on the Biostar® positive pressure thermal-forming machine (Great Lakes Orthodontics, Tonawanda, New York) to produce a vacuum formed stent similar to the soft night guard on the stone casts. Several layers can be added using the same technique until the desired thickness for adjacent tissue separation is achieved. Then, the maxillary and mandibular parts are joined together by heating the material with an alcohol torch. The appliance is finished and polished. The appliance should be tried on the patient and adjusted as needed prior to deliver to the radiation oncologist. In the patient with very limited mouth opening, the adjustment must be done until the patient is able to place it in the mouth and take it out without too much discomfort. Conclusion: This simple, fast, economical and effective medical device provides the patient with the necessary positioning device similar to that made with hard acrylic resin, but with improved comfort. Patient comfort is critical to ensure completion of the course of planned radiation treatment.

CC28 CBCT Guided Surgery and CAD/CAM Immediate Implant Provisionalization in Esthetic Zone. P. KAWEEWONGPRASERT*, T. KISHIMOTO, K. PHASUK, J. LEVON (Indiana University School of Dentistry)

The objective of this report is to describe a digital approach for the utilization of Cone-Beam Computer Tomography (CBCT) guided surgery and computer-aided design and computer-aided manufacturing (CAD/CAM) of an immediate provisional restoration for use in the esthetic zone. Today, during surgical treatment planning the location for dental implant placement is determined by the proposed definitive prosthesis. Through the utilization of a CBCT scan, a digital scan impression, and a virtual diagnostic wax-up, the restorative dentist can enhance their ability via digital treatment planning to achieve an improved esthetic outcome. In this clinical case, dental implant planning software (Maven Pro) allowed for the integration of all available information and data. A CAD/CAM surgical template was prepared for the proper positioning of a dental implant (Straumann® Bone Level Roxolid® Narrow CrossFit®, USA). To increase stability, biocompatibility, and resistance to wear, CAD/CAM high-density polymers were utilized to fabricate a long-term provisional restoration. The customized CAD/CAM prefabricated interim screw-retained restorations was milled from PMMA-based acrylate resin (Straumann® Polycon® ae, USA) and cemented on prefabricated titanium base abutment (Straumann® Variobase™ Narrow Cross-Fit, USA). In conclusion, a successful clinical esthetic outcome was obtained via a combination of proper data collection, digital treatment planning, high accuracy surgical stent and a CAD/CAM interim screw-retained restoration.

CC29 Full Mouth Rehabilitation Utilizing a Hybrid Denture Prosthesis. J. SOTOMIL*, M. PORTER, J. LEVON (Indiana University School of Dentistry).

This clinical report describes the treatment of a 67 y/o male patient who presented to Graduate Prosthodontic Clinic for full mouth rehabilitation. Clinical examination revealed multiple missing teeth, supra eruption of lower anterior teeth, loss of VDO, multiple defective crowns and a “roller coaster” occlusal plane. Treatment consisted of placement of 4 implants in the maxillary arch and 6 implants in the mandibular arch. Implant and surgical guides were digitally fabricated taking into account the interocclusal space, the amount of available bone and the smile line. Patient’s remaining teeth were extracted and implants were placed and patient was sent home with immediate dentures. Implants were allowed to heal for 6 months and 2nd stage surgery was performed to expose the implants. Patient was then restored with a fixed detachable prosthesis. With careful evaluation of the patient and adequate treatment planning, good esthetics and successful restoration with a Hybrid Denture prosthesis was achieved.

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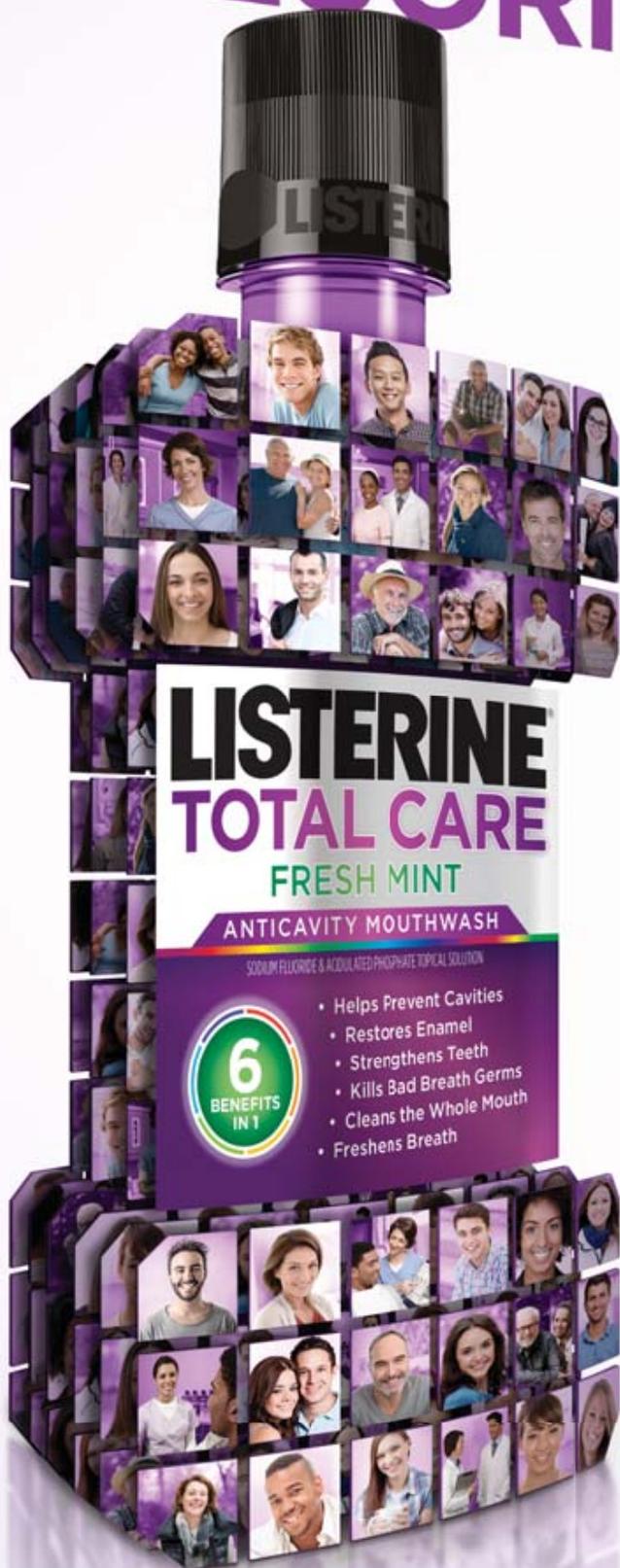
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