

INDIANA UNIVERSITY
SCHOOL OF DENTISTRY

RESEARCH DAY 2023



Keynote Speaker

Prerna Gopal, BDS, PhD



31st Annual
Monday April 10, 2023

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CONGRATULATIONS

to the Indiana University School of Dentistry
Research Day award recipients and participants.



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IUSD RESEARCH DAY PROCEEDINGS

VOLUME 31

APRIL 10, 2023

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Cover design by Terry Wilson.
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Research Day proceedings monograph prepared by Keli Seering.

Research Day Event Program

IU School of Dentistry

Monday April 10, 2023

11:00 a.m.	Vendor Exhibits Open	Sponsors and Exhibitors	DS 306
12:00 – 12:45 p.m.	Registration	Research Day Attendees	DS 114
12:45 – 12:50 p.m.	Welcome Remarks	Dr. Carol Anne Murdoch-Kinch Dean, IU School of Dentistry	DS 114
12:50 – 1:00 p.m.	IUSD Research Updates	Dr. Tien-Min Gabriel Chu Associate Dean for Research, IU School of Dentistry	DS 114
1:00-1:05 p.m.	Introduction of NIDCR Speaker	Drashty P. Mody DDS/PhD Student, IU School of Dentistry	DS 114
1:05-1:20 p.m.	NIDCR Intramural Research Training and Career Development Programs & Opportunities	Dr. Belinda Hauser Training Director, Office of Training and Education, NIH NIDCR	DS 114
1:20 – 1:25 p.m.	Introduction of Keynote Speaker	Dr. Chandler Walker Vice-President, Indiana Section of AADOCR	DS 114
1:25 – 2:05 p.m.	Keynote Address: What's the Deal with ADA Seal?	Dr. Perna Gopal Senior Manager, Microbiology and Chemistry, ADASRI Department of Applied Research	DS 114
2:05 – 2:15 p.m.	Announcement of Faculty and Staff Awards	Dr. Carol Anne Murdoch-Kinch Dean, IU School of Dentistry	DS 114
2:15 – 2:30 p.m.	Announcement of Student Research Awards	Dr. Angela Bruzzaniti Director of Student Research, PhD Training and Research Development, IU School of Dentistry	DS 114
2:30 – 3:00 p.m.	Announcement of Research Day Poster Presentation Awards	Dr. Chandler Walker Vice-President, Indiana Section of AADOCR	DS 114
3:00 – 4:30 p.m.	Research and Clinical Case Report Poster Presentations	Research Day Participants	DS 306
	Vendor Exhibits	Sponsors and Exhibitors	DS 306

ABOUT OUR KEYNOTE SPEAKER DR. PRERNA GOPAL



Prerna Gopal, BDS, PhD is a foreign trained dentist and an oral microbiologist with over 10 years' experience in the field. She received her dental degree from SRM University, India and her PhD in Oral Microbiology from Rutgers University, Newark, NJ. She is currently the Senior Manager of the American Dental Association's Seal of Acceptance Program, a prestigious program that evaluates and recognizes the safety and effectiveness of dental products.

Dr. Gopal's research focuses on the interactions between bacteria and oral tissues, and the role of the oral microbiome in health and disease. She is instrumental in using her dental and oral microbiology knowledge in designing clinical trials, with a particular focus on dental products and devices. She has been involved in numerous clinical trials throughout her career

with product development ranging from toothpaste, mouthwash to chewing gums. She is also recognized for her work in developing dental standards, including those related to infection control and patient safety.

Dr. Gopal is a member of several professional organizations, including the American Dental Association, the International Association for Dental Research, American Society for Testing and Materials and Association for the Advancement of Medical Instrumentation. Her years of experience and deep knowledge of the field make her a valuable resource for dental professionals, researchers, and industry leaders.

The keynote speaker presentation title is **What's the deal with ADA Seal?**. The ADA Seal of Acceptance has been the leading mark of dental product safety and efficacy for over 90 years. It was established to help dental professionals and consumers identify dental products that have been tested and found to meet strict criteria for safety and efficacy. Products submitted to the Seal Program need to meet the requirements in the International Organization for Standardization (ISO), American National Standards Institute/American Dental Association (ANSI/ADA) and American Society for Testing Materials (ASTM) standards.

These requirements include evaluation of physical properties, safety and efficacy testing of products ranging from toothpastes, oral rinses, toothbrushes, etc. to athletic mouthguards. To receive the Seal, products go through an extensive evaluation process including testing in house at the ADA Science and Research Institute as well as review of data submitted by the manufacturer, third party laboratories by an independent panel of dental experts.

Apart from testing the products, the program also helps fill the gap between national and international standards to evaluate oral products in the most clinically relevant scenario by designing *in vitro* models that mimic the oral cavity. Some of the current projects include testing of chewable tablets, denture adhesives and specialty toothbrushes. With plethora of OTC oral hygiene products available nowadays, the ADA Seal continues to serve as a gold standard in helping consumers choose products that are safe and effective.



April 10, 2023

Dear Indiana University School of Dentistry Colleagues and Friends:

Welcome to the 31st annual Indiana University School of Dentistry (IUSD) Research Day.

IUSD has a long and proud history of creating new knowledge through research and discovery to improve oral health for all. Scientific research and the discovery and creation of new knowledge is the cornerstone of the profession of dentistry.

I am so proud of our students and their faculty mentors who are presenting their research today. Our annual Research Day showcases their accomplishments and allows our students to develop a deeper understanding of the biomedical, behavioral, and clinical science foundations of the profession. The deep learning and meaningful experiences afforded by our student research program, fueled by our new young investigators' curiosity and critical thinking skills, can help establish the habits and tools needed for a life and career characterized by continual learning and sustained personal and professional growth.

We are most pleased and honored to welcome oral microbiologist Dr. Prerna Gopal, senior manager of the American Dental Association's Seal of Acceptance program, which evaluates and recognizes the safety and effectiveness of dental products. Dr. Gopal's research focuses on the interactions between bacteria and oral tissues and the role of the oral microbiome in health and disease. She applies her oral microbiology expertise in designing clinical trials for dental products and devices as well as developing dental standards for infection control and patient safety.

I offer my special thanks to the Research Day planning committee and the Indiana Section of the American Association for Dental, Oral, and Craniofacial Research for producing today's event. Thank you also to our event sponsors.

Very best wishes to all of the 31st Annual IUSD Research Day participants!

A handwritten signature in black ink that reads "Carol Anne Murdoch-Kinch".

Carol Anne Murdoch-Kinch, DDS, PhD, FDS RCDS(Ed)
Dean and Professor



April 10th, 2023

Dear Research Day Attendees,

On behalf of the Organizing Committee and the Indiana Section of the American Association for Dental, Oral, and Craniofacial Research (IN-AADOCR) I enthusiastically welcome you to the Indiana University School of Dentistry (IUSD) 31st Annual Research Day.

The Indiana Section is the regional link to the national (AADOCR) and the international (IADR) associations for dental research. The IN-AADOCR promotes the advancement of basic and clinical research in all areas of dental, oral, and craniofacial sciences, as well as the influence of craniofacial health and pathology on the rest of the body. Through knowledge gained from such research, we hope to advance dental science by developing new and better options for promoting oral health and preventing and treating oral diseases and pathologies of the head and neck. These efforts also aim to facilitate communication and cooperation among professionals - from basic science researchers to clinicians - to maximize the impact of this knowledge.

The IN-AADOCR sponsors and co-sponsors, with the remarkable support of IUSD, invited external and internal speakers from several dental disciplines, in addition to coordinating events for the annual Research Day. Research Day offers an opportunity for investigators and students to present and highlight advances in basic and clinical dental, oral, and craniofacial research to their peers and in a local public forum. Furthermore, attendees will be able to interact with various sponsors and vendors along with faculty and student investigators. The event represents a unique and valuable opportunity to celebrate the research performed at IUSD every day.

Thank you to all members of the Research Day Committee for their dedication and hard work for this annual tradition at IUSD. This year, we are delighted to welcome researchers from the IU-Fort Wayne Dental Hygiene Program to present their exciting research for the first time at Research Day. We are proud to include their contributions to Indiana dental research and to provide an opportunity to showcase their hard work. I would also like to thank those who participated as judges for the research competitions. Lastly, I want to thank all of you who are attending the 31st IUSD Research Day and encourage you to acknowledge and appreciate the research being conducted by your peers and colleagues.

Sincerely yours,

Sabrina Fritosa Sochacki

Sabrina F. Sochacki, DDS, PhD
President, IN-AADOCR

A handwritten signature in blue ink, appearing to read "Chandler L. Walker".

Chandler L. Walker, PhD
President-Elect, IN-AADOCR

IUSD Student Research Group 2022-2023



Pictured (from top, L-R) Row 1: Richard Gregory, Angela Bruzzaniti, Tetsuya Yoshimoto **Row 2:** Mizuho Kittaka, Carrie Walton **Row 3:** Alyssa Zhao, Noala Milhan **Row 4:** Bidii Ngala, Yasuyoshi Ueki **Row 5:** Mauro Tudares, Divya Acharya, Chase Perkins, Daniela Marin Cadavid **Row 6:** Kathleen Chiodo, Astrid Valdivia Tapia, Yayoi Teno, Navia Novosel, Sara Alhaffar, Ahmed Madani **Row 7:** E. Angeles Martinez Mier, Emily Hughes, Brittany Gehlhausen, Mikki Jaramillo, Guillermo Tamayo-Cabeza **Row 8:** Marcus Levitan, Mona Arrageg, Giovanna Denucci, Katie Chester, Marwa Elsharkasi, Zohreh Estaki

**IU School of Dentistry
Research Day Planning Committee**

Hadeel Mohammed Ayoub
Kari Blackley
Angela Bruzzaniti
Tien-Min Gabriel Chu
Giovanna Denucci
Vinicius Dutra
Grace Gomez Felix Gomez
Brittany Gehlhausen
Richard Gregory
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Abbey Rieck
Keli Seering
Sabrina Feitosa Sochacki, Chair
Yasuyoshi Ueki
Chandler Walker
Terry Wilson

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President-Elect: Chandler Walker
Secretary/Treasurer: Hadeel Mohammed Ayoub
Councilor: Simone Duarte
Chair Research Award Judging Committee: Sabrina Feitosa Sochacki
Chair Staff Award Judging Committee: Sabrina Feitosa Sochacki

**Officers 2022-2023
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Vice President: Brittany Elizabeth Gehlhausen
Secretary/Treasurer: Andrew Anh Phuong Doan
Newsletter Editor: Jose Ramon Herrera III
Faculty Adviser: Angela Bruzzaniti

**Recognizing Excellence
2023 Awards**

Dental Hygiene Students

Elizabeth A. Hughes Dental Hygiene Case Report Award

Undergraduate Students

IN-AADOCR Undergraduate Student Award

Predoctoral Dental Students

AADOCR Student Research Day Award

Cyril S. Carr Research Scholarship Award

Dean's Award for Research Excellence

Dentsply Sirona/AADOCR SCADA Award

IDA Student Research Award

IN-AADOCR Predoctoral Case Report Award

King Saud University Predoctoral Student Travel Award

Recognition Award for Outstanding Research Engagement

Research Honors Program Certificate of Achievement

Graduate Dental Students

Delta Dental Award for Innovation in Oral Care Research

IN-AADOCR Postdoctoral Fellow Award

King Saud University PhD Student Travel Award

King Saud University Travel Award for Best Clinical Case Report

King Saud University Travel Award for Graduate Research

Maynard K. Hine Award for Excellence in Dental Research

Staff

IN-AADOCR Research Staff Award

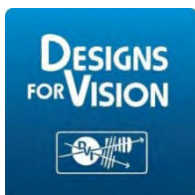
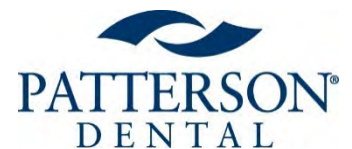
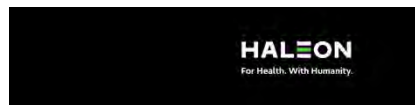
Faculty

IU School of Dentistry Alumni Association Distinguished Faculty Award for Teaching

IU School of Dentistry Alumni Association Distinguished Faculty Award for Research

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Research Poster Presentations CARIOLOGY

P01 Effect of Faucet-Mount Water Filters on Fluoride and Calcium Concentrations. A. ALJUAID^{*1,2}, F. LIPPERT², A. SOTO², L. AL DEHAILAN³ (1Taif University KSA, 2Indiana University School of Dentistry, 3Imam Abdulrahman Bin Faisal University KSA)

Fluoride and other minerals are present in drinking water in varying amounts either naturally or have been intentionally added. Minerals in water are important for the provision of electrolytes (calcium, magnesium, potassium) and for caries prevention (fluoride, calcium). However, the use of water filtration systems, which have become increasingly popular, can lead to a significant reduction in the concentration of some minerals in tap water. Objectives: to investigate the effect of faucet mount filters on fluoride and calcium concentrations in tap water. Methods: We investigated a convenience sample of 15 different brands of faucet mount water filters (PUR, Brita, Waterdrop, Culligan, Engdenton, DuPont, Instapure, iSpring, OEMIRY, IVO, SJ WAVE, WINGSOL, ZeroWater, AIBERLE, MIST) available in different home improvement retail stores in Indianapolis as well as on amazon.com. Water samples were collected prior to installation and after removal of the filters to determine fluoride and calcium baseline values. After mounting the filters, samples were collected at 1, 5, 10, 30, 50, 75, and 100 Liters of water have passed through each filter for fluoride and calcium analysis. Fluoride analysis was conducted by using a fluoride ion-specific electrode (Orion #96-909-00). Calcium analysis was carried out by atomic absorption spectrometer. Results: There were significantly lower ($p < 0.05$) fluoride and calcium levels in PUR, Brita, and AIBERLE filters compared to unfiltered water, while Waterdrop, WINGSOL, and MIST had higher levels of fluoride and calcium. Overall, differences between filtered vs. unfiltered water were small for fluoride (up to 4% reduction) but larger for calcium (up to 25% reduction). The results suggest that faucet mount filters may not affect fluoride concentrations in tap water in a clinically significant manner, but some may reduce calcium concentrations significantly.

P02 Temporal Longevity of Direct Dental Restorations in Sjögren's Disease Patients. G.F. GOMEZ^{*1,2}, T. GONZALEZ¹, O. CAPIN¹, L. WILLIS¹, A. RAJPURI¹, M. WANG¹, L. BOYD³, G.J. ECKERT³, D.T. ZERO¹, T.P. THYVALIKAKATH^{1,2} (1Indiana University School of Dentistry, 2Regenstrief Institute, 3Indiana University School of Medicine)

Objective: The survival rate of the tooth begins to deteriorate with every restorative replacement and consequently leads to tooth loss. The objective of our study was to determine the longevity of direct restorations placed in Sjögren's Disease (SD) patients compared to those placed in non-SD patients. Methods: Current dental terminology (CDT) codes were retrieved from 15 years of dental electronic records. Baseline CDT codes for restorative and preventive treatment including fluoride and failure codes including restorative, endodontics, surgical, and removable and fixed prosthodontics treatment procedures among SD patients and their controls were obtained. Summary statistics were used to characterize the study population. Univariate cox proportional hazard analysis was used to compare the time to failure of restorations. Kaplan Meier plots were generated to visualize survival time for SD patients and their controls. Results: A total of 144 patient records with at least one baseline restoration treatment code were included. At least one completed baseline procedural treatment code for direct restorations with amalgam, composites, or resins was found for 102 cases and forty-two controls. The SD cases were distributed as positive (21), negative (57), and uncertain (24). Average age among cases was 56years, 92% were females, 72% had no dental insurance, 59% had public insurance and 56% were Whites. A total of 529 restorations were present in SD patients and 140 among the corresponding controls. A hazard ratio of 2.99 for cases compared to controls showed a significantly ($p=0.002$) decreased time to restoration failure for SD patients than controls. Kaplan-Meier graphically represented that the probability of restoration survival rapidly declines among SDs. Among positive SDs, dental restorations failed more rapidly than their controls HR: 3.175 (1.376-7.326, p -value:0.007). Conclusion: Our findings show that direct restorations fail rapidly among SD patients. Preventive interventions should be continued after placement of restorations among SD patients.

P03 Fluoride Content in Table Salt from ELEMENT Cohorts in Mexico. G. TAMAYO-CABEZA^{*1}, A. MANTILLA-RODRIGUEZ¹, A. CANTORAL², M.M. TELLEZ-ROJO³, K.E. PETERSON⁴, H. HU⁵, E.A. MARTINEZ-MIER¹ (1Indiana University School of Dentistry, 2Universidad Iberoamericana Mexico, 3National Institute of Public Health Mexico, 4University of Michigan School of Public Health, 5University of Southern California)

Objective: To evaluate the fluoride content in table salt collected from participants of ELEMENT Cohorts in Mexico City and compare the fluoride content to the Official Mexican Norm's recommended range of fluoride concentration in salt (200 to 250 $\mu\text{g F/g}$). Methods: Salt samples (~one tablespoon) were collected from households of mother-offspring pairs participating in ELEMENT cohort studies. Salt samples' labels were reviewed and characteristics such as brand, whether they were fluoridated or containing fluoride in their ingredients, type of fluoride compound, as well as source (land or sea

origin) and grain's size (refined or coarse) were recorded. Salt samples were weighed to 2.0g and dissolved in 20.0mL deionized water by duplicates. One mL of each sample was mixed with 1.0mL TISAB II and analyzed using a combination fluoride Ion-Selective Electrode. Results: A total of 657 table salt samples from 14 distinct brands were analyzed for fluoride content and displayed a range from 0.016 to 477.9 µg F-/g and median (IQR) of 142.5(136.9) µg F-/g. The two most frequent brands were "Sal La Fina" and "Sal Elefante" which displayed median fluoride contents below the Norm's recommended range (<200 µg F-/g). Comparing the fluoride content in table salt samples labeled as containing fluoride (n=607) to the Mexican regulation, we found that 72.8% (n=442) had fluoride content below the recommended range and 13.8% (n= 84) were above the norm. Potassium fluoride was the most frequent fluoride compound (92.2%). Coarse salt samples showed a higher median (IQR) fluoride content (183.6 (170.2) µg F-/g) compared to refined salt 135.7(137.2) µg F-/g (p<0.001). Fluoride content in table salt displayed a broad variation. Adjustments to the existing monitoring program for fluoride content in salt in Mexico City would be of value, in addition to better managing its distribution in areas where multiple sources of fluoride are available. Supported by U.S. National Institute of Environmental Health Sciences (NIEHS)

P04 Assessment of Simulated Non-Carious Cervical Lesion by Tridimensional Digital Scanning. G.C. DENUCCI*¹, C.P. TURSSI², A.T. HARA¹ (¹Indiana University Schools of Dentistry, ²São Leopoldo Mandic Institute and Dental Research Center)

Objectives: Clinical assessment of non-carious cervical lesions (NCCLs) is difficult and based on subjective methods. We hypothesize that 3D digital intraoral scanners (IOS) can provide quantitative outcomes for detection and monitoring of NCCLs. This in vitro study verified the reliability of IOS to monitor dental loss of simulated NCCLs, in comparison to 3D optical profilometer (OP). Materials and methods: NCCLs were simulated using a laboratorial model and analyzed. Dental impressions were taken at baseline (BL) and after 35,000 and 65,000 brushing strokes (BS). Impressions were scanned with both OP (ProScan, Scantron) and IOS (TRIOS4, 3Shape). Generated 3D images were analyzed for volumetric tooth loss (mm³) by superimposition followed by subtraction analysis (BL-35,000 and BL-65,000). ProForm (Scantron) and WearCompare (Leeds Digital Dentistry) software were used for OP and IOS, respectively. Data were analyzed for agreement using intraclass correlation coefficient (ICC, alpha=0.05). Results: ICC (95% confidence interval) for agreement between IOS and OP overall was 0.962 (0.942-0.973), showing excellent reliability. Subsequently, IOS and OP ICC was 0.959 (0.947-0.968) after 35,000 BS, and 0.954 (0.897-0.975) after 65,000 BS without any distinction. At 35,000, without abrasive distinction, excellent correlation (ICC: 0.800 to 0.973) for all toothbrushes. Also, without toothbrush distinction excellent correlation for medium and high (ICC: 0.892, 0.924 respectively) abrasivity, but moderate correlation for low abrasivity (ICC: 0.641). At 65,000, without abrasive distinction, excellent correlation (ICC: 0.931 to 0.962) for all toothbrushes. Without toothbrush distinction, excellent correlation for all abrasive levels (ICC: 0.873 – 0.895). Conclusions: IOS associated to WearCompare demonstrated to be a reliable method to measure tooth structure loss in simulated NCCLs of different severity levels. Considering accessibility and ease-to-use, IOS can be a good alternative tool for in NCCL-simulation in vitro studies. Further studies should be carried out to explore IOS full potential for the clinical assessment and monitoring of NCCL.

P05 Effect of Bottled Water and Fluoride Toothpaste on Caries Remineralization. M. QAW*, A.T. HARA, L. AL DEHAILAN, F. LIPPERT (Indiana University School of Dentistry)

Objectives: The aim of this in vitro study was to evaluate the effects of some bottled water available in Indianapolis on fluoride toothpaste efficacy in enhancing caries lesion remineralization. Methodology: Early caries lesions were created in bovine enamel specimens and assigned to treatment groups based on Vickers surface microhardness (VHN). The present study followed a two (fluoride and fluoride-free toothpaste) by five (four bottled waters and tap water) factorial design. The treatment groups were bottled water with the following attributes: a) 309.9 ppm Ca, 1.20 ppm F; b) 118.4 ppm Ca, 0.16 ppm F; c) 1.00 ppm Ca, 1.01 ppm F; d) 0.1 ppm Ca, 0.04 ppm F, and tap water (48.7 ppm Ca, 0.7 ppm F). The five water groups were paired either with 1100 ppm fluoride or fluoride-free toothpaste, yielding 10 groups. Specimens were pH-cycled for 10 days with the daily regimen comprised of twice daily toothpaste slurry, with four exposures to water in between. Finally, VHN was measured again to calculate the extent of remineralization (ΔVHN). Data were analyzed using two-way ANOVA at a 5% significance level. Results: The two-way interaction between water and toothpaste was significant (p < 0.001). All groups except fluoride-free toothpaste/bottled water with 0.04 ppm F and 0.1 ppm Ca (p = 0.411) had significant increases in VHN after pH cycling (p ≤ 0.023). Fluoridated toothpaste illustrated a higher rate of remineralization compared to fluoride-free toothpaste (all p < 0.001). Bottled water with 1.20 ppm F and 309.9 ppm Ca exhibited the greatest extent of remineralization within fluoride and fluoride-free toothpaste groups. Conclusion: Within the limitation of this study, bottled water with high fluoride and high calcium might be beneficial for patients at high caries risk when used with fluoridated toothpaste.

P06 In vitro Effect of Mouthwashes on *Streptococcus mutans* Biofilm. A.C. VALDIVIA-TAPIA^{1,3}, F. LIPPERT¹, J.A. CURY³, A.P. RICOMINI-FILHO³, P.F. CASTELLUCCIO², R.L. GREGORY¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine, ³Piracicaba Dental School, University of Campinas, Piracicaba, São Paulo, Brazil)

Objective: To evaluate the efficacy of commercially available, fluoride-free mouthwashes sold in Indianapolis, IN, on *Streptococcus mutans* biofilm. Materials and methods: Eighty-one different mouthwashes were purchased in Indianapolis, Indiana, USA. A 24-h culture of *S. mutans* UA159 in microtiter plates was added to the mouthwashes prepared in Tryptic Soy broth supplemented with 1% sucrose (TSBS) in three different dilutions (1:3, 1:6, and 1:12) in quadruplicate. The minimum inhibitory concentrations (MIC), planktonic, and biofilm growth were evaluated. In addition, the growth for minimum bactericidal concentration (MBC) was evaluated using the culture, transferring it to blood agar plates and incubated for 48 h. Confocal laser scanning microscopy was developed for observed here the presence of life/dead bacteria in different treatments. For the analysis of the results, the mouthwashes were separated into 6 groups according to their ingredients (cetylpyridinium chloride/CPC, n=25; essential oils/EOs, n=10; hydrogen peroxide or sodium hexametaphosphate/W, n=12; organic ingredients/OI, n=15; zinc chloride/ZC, n=3; and others/O, n=16). ANOVA was performed with a significance level of 5%. Results: Regarding MIC, planktonic, and biofilm growth of *S. mutans*, there was a significant decrease for W and CPC (except in one product) groups. For the W group, all products with hydrogen peroxide had more inhibition in the *S. mutans* biofilm compared to EOs and CPC groups. For OI and O groups, there were different effects within the same group, resulting in a large amount of variability. For the ZC group, 1/3 products exhibited a significant inhibitory effect. Live/dead staining using fluorescent microscopy confirmed these results. Conclusion: Most of the products demonstrated an effect on *S. mutans* biofilm, especially in the lowest dilution (1:3). Mouthwashes containing CPC, hydrogen peroxide, or sodium hexametaphosphate have a more significant effect on *S. mutans* biofilm. Additional laboratory studies are necessary for evaluating the effect of these mouthwashes. [Acknowledgment: CAPES N° 88887.621140/2021-00; Santander Program "Mobilidade Internacional – DERI/PRPG-UNICAMP"| CAPES N° 001 | FUNCAMP N° Conv. 65/91]

Research Poster Presentations DENTAL EDUCATION

P07 A Competency-Based Orthodontic Education Model for IUSD IDP Students. M. KESSLER*, D. ALBRIGHT, S. CHO, K. STEWART (Indiana University School of Dentistry)

Purpose: The purpose of this project is to create a competency-based orthodontic education module to be incorporated into the T643 Dental Sciences for IDP course offered to the incoming International Dentist Program (IDP) students as part of their pre-clinical instruction at IUSD. The Commission on Dental Accreditation requires students matriculating into institutions that offer an advanced standing program (or IDP) receive an "individualized assessment and an appropriate curriculum plan, that results in the same standards of competence for graduation" as traditionally enrolled students. Methods: Two IDP cohorts will be participating in the study and analysis of the efficacy and desirability of this novel curriculum offering. The IDP 2024 students who are already enrolled in the traditional, fall 2022 D680 course will be given pre- and post-course Qualtrics surveys to collect demographic data, gauge orthodontic training and experience levels, and garner student feedback. The IDP 2025 cohort matriculating into IUSD in January 2023 will complete similar surveys, as well as take a comprehensive orthodontics pre-test to quantitatively measure their baseline orthodontic knowledge and develop individualized study plans for completing online coursework. Results: The two IDP cohorts (2024-15 students; 2025-15 students) were similar in age, sex, and countries of dental training. They differed significantly on their self-reported incoming orthodontic knowledge. The IDP 2025 cohort self-assessed a significantly greater knowledge base than the IDP 2024 cohort in all course lecture topic areas (12-33% higher), and they demonstrated good accuracy in their self-assessment of their baseline orthodontic knowledge based on their collective pre-test performance. When asked to consider a curriculum change to this new orthodontic education module, a majority of the IDP 2024 cohort expressed positive feedback to this concept (76.9%). Conclusion: Each IDP cohort is unique, so the development of customized, competency-based curriculum offerings is integral to meet CODA requirements and students' preference.

P08 Assessment of Early Clinical Experiences for Predoctoral Students at IUSD. A. BROUILLARD*, T. TREAT (Indiana University School of Dentistry)

The early clinical experience of a dental student is fundamental in preparing them to be competent and confident primary providers. The objective of this survey was to assess the state of early clinical experiences for predoctoral students at Indiana University School of Dentistry (IUSD) to ascertain student attitudes towards their personal early clinical experiences. An IRB-exempt (#17209) survey was distributed to all predoctoral students at IUSD via email using the survey instrument,

RedCap. Of the 100 respondents, 14 reported being D1 students, 19 were D2 students, 30 were D3 students, and 37 were D4 students. 67 respondents identified as females and 33 as males. When asked which of the following procedures (screening, COE/POE, radiographs, non-surgical periodontics, direct restorations, single tooth indirect restorations, fixed prosthodontics or implant therapy, removable prosthodontics, endodontics, any of these on a patient under 12 years old, or none of these) the student completed on a non-classmate patient as a D1, 90.5% of respondents answered none of these. When the same question was presented to D2s, 61.6% of respondents said none of these, 25.6% said radiographs, 19.8% said non-surgical periodontics, 11.8% said COE/POE, 5.8% said screening exam, and 1.2% said removable prosthodontics, and 1.2% said direct restorations. When asked, "do you feel students at IUSD first serve as primary provider too ___," 66.6% of respondents said too late, 16.0% said on time, 17.0% were unsure, and 1% said too early. 73.0% of respondents believe IUSD students should first serve as the primary provider during the D2 year, 16.0% believe it should be before the D2 year, and 11.0% said after the D2 year. Conclusion: IUSD students believe we start providing care too late and should start providing simpler procedures like screening exams, COEs/POEs, radiographs, local anesthesia, non-surgical periodontics, and direct restorations during the D2 years.

P09 Impact of Community-Based Dental Education on Clinical Independence Level. A. CHINTAPALLI*¹, T. TREAT¹, A. MANTILLA-RODRIGUEZ¹, L. AL DEHAILAN², P. THOMAS¹, A. SHUKLA¹ (¹Indiana University School of Dentistry, ²College of Dentistry, Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia)

Objectives: This study examines the impact of the of a two-week community-based dental education (CBDE) rotation on the level of clinical independence among predoctoral dental students at Indiana University School of Dentistry (IUSD). Methods: Assessments of predoctoral dental students' procedural independence level from the four (4) weeks immediately preceding each respective student's CBDE rotation were compared to assessments from the four (4) weeks immediately following their respective rotation. Descriptive statistics, assessment of sample normality, t-test and stepwise logistic regression were performed to present the difference in average independence scale scores for the participants in each of the clinical disciplines before and after the CBDE rotation as well as an average difference in the overall cumulative average scores of the participants. Results: Study participants' cumulative average independence scores significantly increased ($p=0.005$) following the CBDE rotation. Conclusions: Predoctoral dental students performed clinical activities significantly more independently immediately after their two-week CBDE rotation than immediately before. This study supports existing literature regarding the benefits of community rotation experiences upon dental school training outcomes. Further examination of CBDE and like programs across dental schools can provide insight into respective program adaptations and level of impact.

P10 Clinical Preparedness of New Dentists Entering the Military Workforce. K. CHIODO*¹, O. CAPIN¹, K. DIEFENDERFER¹, R. ADCOOK², N. COOK¹ (¹Indiana University School of Dentistry, ²Uniformed Services University of the Health Sciences)

Introduction: Preventive and restorative dental procedures constitute the majority of treatment provided daily in a general dentistry practice. Exploring new dentist proficiency in these foundational skills within one year of dental school graduation provides crucial information on the knowledge and skills new dentists receive from dental school. The military dental system is structured so that all new dentists have clinical oversight during their first year following graduation. Methods: An anonymous, electronic Qualtrics survey was sent to 201 new dentists in the U.S. Air Force, Army and Navy and their 32 clinical supervisors. Using a modified-Dreyfus model of skill acquisition, the new dentists completed a self-assessment of their ability to perform 20 preventive and restorative procedures. Clinical supervisors of the new dentists also completed a survey evaluating the proficiency level of the new dentists they oversee for the same procedures. 60 new dentists and 25 supervisors with responsibility for 151 new dentists responded to the survey. The proportion of competence ratings at a level of "competent," "proficient," or "expert" was estimated, along with a 95% confidence interval, and one-sample chi-square tests were used to compare the proportion against 50%. Results: Supervisor skill level ratings of the new dentists were significantly lower than dentist rating for 19 of the 20 dental procedures. Supervisors' ratings of competent or higher were significantly greater than 50% in Caries Diagnosis and treatment planning, caries risk assessment, Class III anterior composite resins and posterior composite resins. Overall, supervisors rated 72% of new dentists at Novice or Beginner skill level. Conclusions: Supervisors' skill level ratings of the new dentists were significantly lower than the new dentists' self-ratings for most procedures. 38% of new dentists were evaluated overall as competent in preventive and restorative procedures during the first year after dental graduation.

P11 Face-to-face vs. Virtual-OSCE Involving Behavioral Management of Visually Impaired SPs. S. MEKARTHY*¹, P. SHAKKARI¹, D. MODY², S. SCHRADER², O. AGUIRRE², D. ZAHL² (¹Indiana University-Purdue University Indianapolis Luddy School of Informatics, ²Indiana University School of Dentistry)

Many individuals with visual impairment do not seek out or maintain oral health care, a global public health concern. Meanwhile, dental students feel they lack training to manage special needs patients on biopsychosocial levels. Objective Structured Clinical Examinations (OSCE) can enhance student's relational and communicative practices needed for optimum clinical care for such patients. This retrospective IRB-approved scholarship of teaching and learning (SOTL) research project involved the comparative evaluation of communicative and behavioral effectiveness of 2nd-year (D2) dental students at IUSD in a 2019 face-to-face (FTF) (n=105) vs a 2020 virtual OSCE (VOSCE) (n=105). Verbal qualitative standardized patient (SP) feedback was evaluated using a Braun & Clarke thematic analysis model; overall rubric scores were analyzed using descriptive and inferential statistics to determine significant difference across groups. Overall, first time pass rates were high for both FTF (94.3%; 13.87 mean rating) and for VOSCEs (90.5%; 13.59 mean rating). There were no statistically significant differences between the rubric scores of two groups (5046.0, Z = -1.145, p=.252) However, some statistically significant difference (6.402, P=0.011) for FTF students (95.2%) vs VOSCE (84.8%) was observed for student's ability to give a "clear explanation of oral health." A qualitative grounded theory analysis of 142 (76 FTF vs 66 VOSCE) total SP comments yielded 3 major themes: student provided "clear explanations" (24.6% FTF vs. 33.7% VOSCE), took a "comprehensive health history", (21.9% FTF vs 18.3% VOSCE), and showed "sensitivity to patient's special needs" (53.5% FTF vs 48.1% VOSCE). Given the challenges of telehealth consultations, the themes from this analysis are critical for long-term evaluation of dental behavioral science learning outcomes. These results accentuate the need for integrating relationship-centered skills in the dental curriculum for successful special needs patient management.

P12 Influence of the COVID-19 Pandemic on Burnout and Mental Health. C. PERKINS*, K.T. STEWART (Indiana University School of Dentistry)

Introduction: The professional training experienced by dental students is characterized by extreme rigor. Previous research has documented that education associated challenges contribute to a significant amount of physical and emotional stress, increasing the risk of poor mental health. Additionally, it is widely recognized that the COVID-19 pandemic placed additional strain on individuals. Objective: This study sought to evaluate the impact of the pandemic on dental students' ability to integrate with each other and the school, and also to assess its impact on three components of the students' mental health: anxiety, depression, and burnout. Materials and Methods: Electronic surveys were created using validated instruments including the GAD-7, PHQ-9, and MBI-HSS, to assess general anxiety, depression and burnout respectively. Following IRB approval (#16973), the survey was disseminated using Qualtrics® to the IUSD Dental Classes of 2023, 2024, and 2025 over a 12 week period (Oct 2022-Jan 2023). Results: Three hundred eighteen dental students were invited to participate, and a response rate of 55% was obtained. Sixty-three percent of respondents self-identified as female. The Class of 2024 represented the largest group of all respondents (41%). Approximately 40% of respondents reported moderate to severe anxiety and 30% denoted moderate to severe depression. A students' perception that they were struggling more than their classmates demonstrated the strongest correlation with all mental health markers (r=0.35-0.45). The pandemic appeared to have the greatest effect on the Class of 2024's ability to connect with others (p=0.030). The Class of 2025 showed significantly higher scores for the GAD-7 Anxiety instrument (p=0.011), PHQ-9 Depression instrument (p=0.031), and lowest score for MBI-Personal Accomplishment instrument (p=0.028). Conclusion: These results suggest that the COVID-19 pandemic had some influence on student belonging and mental health.

P13 Impact of Private Practice Experience on Residency Performance. H.M. REED, L.A. VINSON, B.J. SANDERS, A. SCULLY (Indiana University School of Dentistry and Riley Hospital for Children)

Introduction: Pediatric dentistry has grown to be the most sought-after residency with the most applicants out of all the specialties. Predicting a resident's preparedness and clinical skills can be difficult. There are no studies in dentistry that have determined if there is a correlation between private practice experience prior to residency and its effects on residency performance. Objective: This study explored if there is a correlation between prior private practice experience and student's perceived preparedness and performance for pediatric dentistry residency. Methods: A 16 item survey was distributed to all current first year residents and program directors of CODA accredited pediatric dentistry programs. This survey asked questions regarding: resident demographics, residency program type, years of experience in private practice, confidence in skills, and their perceived level of difficulty of their program. Results: The response rate for program directors was 20.5 percent, while the response rate for first year residents was 12.5 percent. Program directors believed that residents with more experience have better operative skills (p=0.001) and better communication with parents (p=0.17). Male residents were more confident in operative skills, treating complex patients, communicating with parents, and skills when compared

to their peers. First year residents with more confidence in their skills were male, had more prior private practice experience, and lower dental school GPA. Conclusion: Male residents with prior practice experience are more confident in operative skills, treating complex patients, communicating with parents, and overall skills compared to their peers. More than half of the program directors thought the skills for operative and communication with parents was better or significantly better for those with prior practice experience.

Research Poster Presentations DENTAL HYGIENE

P14 The Relationship Between Methamphetamine and Oral Bacteria: A Narrative Review. R. BIDLACK*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Methamphetamine (meth) abuse is a chronic problem in our communities. The drug's destruction is seen throughout the body, with some of the most substantial effects seen in the oral cavity. The purpose of this narrative review is to explore the factors that increase the rate of dental disease in a person suffering from methamphetamine addiction and to help design a treatment protocol to help professionals manage these patients' conditions. Results: Meth mouth is characterized by rampant caries, typically on the smooth surfaces of dentition. This oral condition is typically intensified by meth users' compulsive behavior, including a high sugar content diet, recurrent bruxism, and a lack of frequent oral hygiene. Moreover, *Streptococcus mutans* (*S. Mutans*), the primary bacteria involved in the dental caries process, proliferate at a quicker rate when exposed to sucrose and meth. Conclusion: Meth users are an increased risk of developing dental caries due to proliferation of cariogenic bacteria. Prompt oral health care and appropriate after-care plans are needed to prevent the onset and progression of these oral conditions.

P15 Fluoride Varnish Reduces New White Spot Lesions in Orthodontic Population. E. BONE*, L. RICH, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: Orthodontic treatment can increase the risk of new white spot lesions. The presence of fixed appliances may interfere with optimal oral hygiene, resulting in new white spot lesions over time. Objective: To conduct a systematic review, we sought to determine whether the application of fluoride varnish compared to none will reduce the number of new white spot lesions in orthodontic populations. Methods: A systematic search was performed by two investigators separately on two databases: PubMed and EBSCO with keywords using: fluoride, orthodontics, supplements, as well as Boolean operators AND and OR. Filters used for both databases included systematic review and clinical trial. The strategy used was to screen articles with recent information regarding fluoride and orthodontics between 2015-2023 for both search engines. From the eligibility list, investigators manually searched and continued screening article titles and abstracts, excluding articles that were older and articles focusing on root absorption, but not caries or white spot lesions. Both reviewers screened each other's articles, finding longitudinal, randomized, and double blind controlled clinical trials regarding fluoride supplements and orthodontics. Results: A total of 74 records identified on PubMed and EBSCO. On PubMed 6 different abstracts were screened and on EBSCO 4 different abstract articles were screened. Total articles included from PubMed were 2 and total articles from EBSCO were 2. Results showed multiple applications of fluoride varnish seem to reduce white spot lesions in patients undergoing orthodontic treatment. Another trial demonstrated that both chitosan-based varnish and chlorhexidine-fluoride varnish reduced bacterial count, while the plaque pH remained neutral over six weeks. A different trial found that fluoride varnish is effective in reversing WSLs after debonding. Conclusion: Based on all collected information, fluoride varnish is effective in reducing the new number of white spot lesions in orthodontic patients.

P16 Oral Considerations for Visually Impaired Individuals: A Narrative Review. T. BOWIE*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Introduction: Nearly 93 million adults in the United States are at-risk for serious vision loss. Vision loss can significantly impact quality of life. Moreover, vision loss affects a patient's ability to accurately assess their own oral health and when to seek dental treatment. The purpose of this narrative review is to analyze oral complications of vision loss and discuss the major role of dental hygienists in the care of these patients. Discussion: There are many barriers to care for patients with vision loss, though when properly educated on dental care, patients fare a much better health outcome. Dental hygienists should focus on providing adequate home care instruction using different tools and methods to accommodate the patient's disability. Patients who perform correct home care techniques have the same outcome regardless of disabilities. Conclusion: There remains a significant health literacy gap for patients with vision loss, as they can't rely on their main senses to help evaluate effective care. Creating new methods, or adaptations to existing dental care should be the focus of future studies.

P17 Effects of Hydrogen Peroxide on Dental Caries: A Systematic Review. L. BROWN*, B. MILLER*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: Hydrogen peroxide has been commonly used as a tooth whitening agent. However, what effects does hydrogen peroxide have on carious lesions in the oral cavity? Objective: The purpose of this systematic review was to identify preventive and esthetic effects of hydrogen peroxide on dental caries. Methods: During this literature search, two specific databases were utilized: PubMed and CINAHL. The specific filters included publication date within the last five years and English language. When using these databases, the terms entered into the search engine were Hydrogen Peroxide AND Dental Caries. From these searches, the article titles and abstracts were screened and narrowed down from there based on qualifying criteria. Then, full text was reviewed for each qualifying article. We reduced bias by reading articles that support and oppose hydrogen peroxide preventing caries and also having two investigators conducting the search. Results: A total of one hundred and nine articles were found. Of the one hundred and nine articles, we screened thirty-seven articles using the title and abstract. Of the thirty-seven articles, thirty-three were excluded, and four were chosen to use for our systematic review based on their relevance and validity. Based on the results from our literature search, studies demonstrated hydrogen peroxide prevents the occurrence of new carious lesions. These articles concluded that hydrogen peroxide has an inhibitory effect against *S. mutans*, the bacteria responsible for forming caries. Additionally, the articles supported that hydrogen peroxide also reduces dark staining of arrested caries. Lastly, mouth rinses containing hydrogen peroxide had slightly better results on preventing biofilm formation when compared to mouth rinses without hydrogen peroxide. Conclusion: Overall, studies support that hydrogen peroxide has an inhibitory effect against *S. mutans*, reduces dark staining of arrested caries, and results in preventing biofilm formation in the oral cavity. Keywords: Hydrogen peroxide, dental caries

P18 Coconut Oil Pulling Effects on Plaque Accumulation and Bacterial Count. H. BROWN*, H. HARMON*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: A major causative factor to the development of periodontal disease is bacterial accumulation on tooth surfaces, which can lead to an innate immune response and subsequent inflammation. As society continues to pull away from more traditional and modern methods of brushing and flossing, oil pulling has become a popular holistic approach to achieve optimal oral health. Objective: To assess the effectiveness of coconut oil in reducing plaque and bleeding index and reducing bacterial counts. Methods: Search of studies between 2017 and 2023 were conducted through two databases: PubMed and EBSCOhost. Keywords that were used include “oil pulling AND dental”, “oil pulling AND oral health”, and finally “coconut oil AND plaque”. Titles and abstracts were screened and reviewed for relevance. Duplicate articles, non-English studies, and irrelevant topics were removed. Remaining articles were manually retrieved and viewed in full text which were selected based on applicability to topic. Results: A total of 35 articles were identified after eliminating duplicates. After reviewing titles and abstracts, 15 articles were selected for full-text review. Following full-text review, 5 articles met the eligibility criteria for the study. In study groups involving coconut oil pulling, 4 out of 5 included studies reported a significant decrease in bleeding and plaque indices and/or bacterial scores measured in colony forming units or CFU counts. The fifth study did not report a significant reduction in bacterial count with coconut oil pulling. The contents of these studies suggest potential use of oil pulling as an adjunct to oral care routines for those at risk for periodontal disease. Conclusion: The use of coconut oil pulling demonstrated reduction in bleeding and plaque accumulation and bacterial count. Future research evaluating the efficacy of oil pulling needs to be further investigated to increase reliability, external validity, and develop a more statistically significant conclusion.

P19 Exploring the Impact of Childhood Sexual Abuse on Oral Health. G. CARR*, H AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Being a victim of childhood sexual abuse (CSA) is a life-changing event and can be evident in the survivor's oral health. Traumatic situations, such as CSA, can increase a patient's risk of experiencing dental fear, which can negatively affect oral health and overall health. The purpose of this narrative review was to assess CSA, dental fear, and how to care for survivors or children being sexually abused. Discussion: CSA is exceedingly prevalent yet rarely reported. As a result, the numbers reported are likely to misrepresent the true impact of the issue. This is a global health problem affecting children, which increases their susceptibility to serious health conditions. Children who suffered CSA are more likely to suffer from dental fear as a result of their trauma leading to appointment avoidance. Therefore, using increased patient safety is of utmost importance during a dental appointment. Conclusion: Future research is needed concerning dental treatment modifications and/or strategies for CSA survivors. By doing so, dental professionals can help survivors feel more comfortable seeking dental care and promote trust and rapport. With an understanding of CSA and dental fear, dental professionals can provide better care and support for patients with a history of childhood sexual abuse.

P20 Efficacy and Safety of Silver Diamine Fluoride in Children. S. CHRISTNER*, M. SLOAN*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Objective: This systematic review evaluated the clinical efficiency of silver diamine fluoride (SDF) application in children ages 0-18. Our PICO question for this review was: Are active cavitated lesions in children (0-18 years old) prevented more significantly by the application of silver diamine fluoride when compared to other fluorides and restorations without negative systemic effects? Methods: A search of articles was completed by two independent researchers on two separate databases: PubMed and MEDLINE (EBSCO). The articles found during the search were viewed and screened by title and abstract. The target age group was selected due to the presence of primary, mixed, and secondary dentition. Based on the articles that were reviewed, the comparison of SDF and other fluorides was observed, as well as any side effects of SDF application. Articles that had a publication date older than ten years, were not randomized controlled clinical trials, and non-English were excluded from this review. Our selection of studies is directly related to our topic: the use and effects of Silver Diamine Fluoride in children. We reduced bias in our searches by screening all articles in a consistent manner. Results: The initial search on this topic resulted in multiple articles. After removing duplicates and screening articles for relevance, four studies were included in this review. Upon initial thought of the topic, there was no thought of any harm in the use of silver diamine fluoride in children. SDF is shown to be safe to use on children. Effective arrestation of cavitated enamel and dentin lesions was seen, with little to no systemic side effects. Finally, SDF was found to be more effective than 5% sodium fluoride in dentin caries. Conclusion: Based on our findings SDF has no negative effects systemically and is effective at arresting cavitated lesions compared to other fluorides and restorations.

P21 The Relationship between Obstructive Sleep Apnea and Periodontal Disease. J. HUEY*, L. RINGENBERG*, H. AYOUB, A. LAMPHERE. (Indiana University School of Dentistry Fort Wayne)

Background: Many patients suffer from myofunctional disorders, including sleep apnea. Sleep apnea is a disorder in which a person's breathing continuously stops and starts in their sleep. Mouth breathing can affect the microbiome in the mouth, which can increase the risk of developing periodontal disease. The aim of this systematic review is to analyze the correlation between obstructive sleep apnea and periodontitis. Methods: The search was completed in January 2023 by two investigators, using PubMed and CINAHL databases. The articles discussing the relationship between obstructive sleep apnea and periodontal disease were case-studies, cross-sectionals, randomized control trials, meta-analyses, and systematic reviews. The keywords searched were obstructive sleep apnea AND periodontitis AND oral bacteria. The articles selected were published between 2012 and 2022. Results: A total of 31 articles were identified. After eliminating duplicates and reviewing titles and abstracts, 10 articles were selected for full-text review. Following full-text review, 6 articles met eligibility criteria for the study. Probing depths, radiographic bone loss, and clinical attachment loss were used to measure periodontal disease. Correlations were found between the greater severity of periodontal disease and the higher classification of obstructive sleep apnea. The P values of several studies were indicated as $p \leq 0.05$. Conclusion: Overall, there were statistically significant correlations between the severity of periodontal disease and severe obstructive sleep apnea, but research still lacks in defining causative effects and periodontal interventions to help reduce the risk of periodontal disease. Longitudinal follow-up studies are needed to determine the relationship between these conditions. Keywords: Sleep apnea, periodontitis

P22 Preventive Effects of MI Paste in Orthodontic White Spot Lesions. S. BELCHER*, A. JOHNSON*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: White spot lesions (WSLs) are a major side effect of orthodontic treatment. The use of brackets, wires, and glue interferes with proper plaque removal, hence, initiates demineralization. These WSLs are a cosmetic issue and a precursor to future caries. Objectives: This systematic review explores the effectiveness of MI Paste use (CPP-ACP: Casein Phosphopeptide-Amorphous Calcium Phosphate) against WSLs in orthodontic patients. Length and frequency of MI Paste use for clinical benefits were also evaluated. Methods: Three electronic databases, PubMed, MEDLINE with Full Text (EBSCO), and Academic Search Complete (EBSCO), were searched by two independent researchers. Keywords developed using Medical Subject Headings (MeSH) to search for articles included (MI Paste) AND (White spot lesions). Publications between January 2012 and December 2022 and English only were considered for this search. Search findings were manually screened according to the title and abstract. Irrelevant and non-English studies were eliminated. All studies considered eligible from the search criteria were included for full-text evaluation. The remaining articles were manually retrieved and viewed in full text, which was selected based on relevance. Results: A total of 24 articles were found. After screening titles and abstracts and reviewing full-text articles, four studies met the selection criteria and were included in this review. Results indicated a successful decrease in the number of WSLs with the use of MI Paste (CPP-ACP) before, during,

and after orthodontic treatment. This is achieved by preventing new lesions and increasing the mineral content of existing lesions. Moreover, the application of MI paste to existing lesions improves the appearance of demineralized enamel. Conclusion: CPP-ACP is an evidence-based, successful, preventive, therapeutic, and cosmetic approach against WSLs. Future studies are needed to explore its other anticaries properties.

P23 Oral Health Considerations of Individuals with Hypertension: A Narrative Review. M. RICE*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Hypertension puts individuals at risk for cardiovascular disease and stroke, which are some of the leading causes of death in the United States. Individuals with hypertension are at an increased risk of these conditions, as certain local anesthetics and anxiety prior to treatment can elevate blood pressure further. The purpose of this investigation is to examine the effects of hypertension on individuals with periodontitis. Results: There is a positive correlation in the severity of periodontitis in dental patients with hypertension, as well as greater stabilization of blood pressure following nonsurgical periodontal therapies. Modifiable risk factors such as obesity, physical inactivity, and substance abuse, as well as non-modifiable risk factors such as ethnicity, gender and age were also assessed as contributing variables to the severity of periodontitis. The oral effects of hypertensive medications were analyzed, and results show an increase in gingival hyperplasia, xerostomia, dry coughs, taste changes, and sinusitis compared to patients who are not on hypertensive medications. Conclusion: Suggestions for further research include an evaluation of periodontitis in countries with nationally low levels of hypertension across the population. The National Dental Hygiene Research Agenda (NDHRA) has a goal of health promotion and disease prevention, which is why relates to understanding the effects of hypertension on oral health. Dental hygienists help achieve this goal through preventive and therapeutic treatments, as well as public education.

P24 Oral Hygiene Care in Nursing Homes. M. RIDDLE*, M. SUTTON*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: Nursing home residents must rely on their caretakers to examine and maintain their oral health. Awareness of the importance of oral hygiene in a nursing facility is critical. Barriers to care faced by this population include lack of mobility, assistance, and health literacy. Objective: To ensure the measures taken by nursing home staff are effective in providing adequate oral health care. Methods: The databases used for the manuscript were PubMed and EBSCO MedLine. The searches were completed on February 21, 2023. The search strategy utilized the MeSH terms "Nursing home AND oral health AND staff". The inclusion/exclusion criteria for eligibility included randomized control trials, English only, and publication within 10 years. Two reviewers assessed each study independently. Results: A total of 310 articles were identified. After eliminating duplicates and reviewing titles and abstracts, 24 articles were selected for full-text review. After full-text analysis, 6 studies were included for data extraction. These studies utilized several measures to evaluate the effectiveness of oral hygiene care provided by nursing home staff. Conclusion: There is a lack of adequate oral care strategies utilized in nursing home facilities. By undergoing proper training, direct caregivers can positively impact and sustain nursing home residents' oral hygiene, and systemic health. Organized professional collaborative care can make a significant impact on the oral health of nursing home residents. Future studies should explore the emphasis and integration of oral hygiene care in nursing education programs.

P25 The Effect of Orofacial Myofunctional Therapy in Treating Sleep Apnea. S. OSTERMEYER*, C. THOMPSON*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: Obstructive Sleep Apnea (OSA) is a condition in which the muscles that support soft tissues of the throat, such as the tongue and soft palate, temporarily relax. The relaxation of these muscles causes the airway to be narrowed or closed, leading to oxygen intake being momentarily cut off. Orofacial Myofunctional Therapy (OMT) is a new option of treatment for Obstructive Sleep Apnea in which it utilizes exercises that improve the strength, positioning, and coordination of the mouth and throat muscles. Purpose: The aim of this systematic review is to determine the effects of OMT in reducing the number of sleep apnea and hypopnea episodes in patients diagnosed with OSA. The effects of OMT on OSA were studied using the apnea-hypopnea index (AHI). Method: Three databases (Pubmed, Google Scholar, CINAHL) and gray literature using keywords related to Orofacial Myofunctional Therapy, Obstructive Sleep Apnea, and Apnea-Hypopnea Index were searched. Two researchers independently assessed the articles according to the inclusion and exclusion criteria. Articles that included measurements of the AHI in sleep apnea patients who have undergone myofunctional therapy were the criteria to be included. Articles published more than 5 years ago, do not include AHI as a measurement, and articles including the use of an appliance in conjunction with myofunctional therapy were excluded. Results: Of the 160 records

identified from the initial search, 150 remained after duplicates were removed. Article screening removed 85 articles leaving a total of 12 articles eligible for inclusion and data extraction. The articles included meta-analyses, systematic reviews, and case reports. Conclusion: Of the 12 articles reviewed, 8 found a significant decrease in AHI of the subjects with OSA and had also undergone myofunctional therapy. The results indicated OMT could improve the condition of OSA by reducing the number of occurrences of disordered breathing during sleep. Keywords: Orofacial Myofunctional Therapy, Obstructive Sleep Apnea, Apnea-hypopnea Index (AHI)

P26 Oral Implications of E-Cigarette Use in Youth and Adolescent Populations: A Narrative Review. A. ADAMS*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Dental hygienists are primarily focused on providing preventive and therapeutic care related to the oral cavity, which can subsequently improve systemic health conditions. With the number of e-cigarette users under the age of eighteen increasing, it is important for hygienists to be aware of the risks involved with e-cigarette use. The purpose of the research is to highlight the impact that e-cigarette use has on the youth population's oral health. Results: Current data available on e-cigarettes and their ingredients must be taken with caution due to the inconsistency between brands. The risk of harm due to the metals found in these products vary depending on brand. The majority of e-cigarette marketing is aimed towards the youth populations. Common oral implications include increased risk of cancer, increased risk of periodontal disease, and increased risk of caries. Conclusion: With long term research not being available, the exact impact these devices have on the body is unknown. With each company using different products and including different ingredients, the negative health impacts can vary. Further research is needed concerning e cigarettes impact on periodontal health status, caries risk, and oral cancer risk.

P27 How Depression Manifests Orally: A Narrative Review. H GASKILL*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Depression is a mental health disorder that effects an individual's overall health. It can cause an increased risk in caries, medication induced xerostomia, and periodontal disease. Depression is a deep feeling of sadness and hopelessness that lasts longer than two weeks. These symptoms can alter an individual's day-to-day life in a way that causes emotional and physical complications. Discussion: Depression results in the change of behavior that negatively effects an individual's oral health. Some of these behaviors result in the decrease of self-care, maintenance, and treatment that is needed to achieve a healthy periodontium. An individual with depression may experience changes in diet, including high sugary foods and other non-nutritious foods that can increase the risk of decay. Medication induced xerostomia could lead to other factors such as difficulties in swallowing, speaking, and eating—ultimately, leading to additional discomfort. Conclusion: Dental hygienists should be able to develop an individualized care plan for each patient that suffers from this disorder. Motivational interviewing can be utilized to guide these individuals with unique decision and goal making related to oral health.

P28 Whitening Effects and Abrasiveness of Charcoal Containing Toothpastes. E. BOKEL*, M. GODFREY*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Tooth whitening has become a major request in clinical dental hygiene settings. Social media trends have shown influencers advocating for charcoal toothpaste and its reported outstanding whitening effects. Objective: The main objective of this systematic review was to review current studies on the use of charcoal toothpaste and analyze its safety and effectiveness. Methods: An electronic search was conducted utilizing two databases: Medline (EBSCO) and PubMed. The search included the terms (Charcoal toothpaste AND abrasiveness AND whitening), (Whitening of Permanent dentition AND abrasion), (Charcoal dentifrice AND Abrasion) and (Effects of charcoal toothpaste). Inclusion criteria were articles that were published between the years 2017-2022, written in English language, were either a systematic review of in vitro studies or an in vitro study, used permanent dentition, used charcoal toothpaste, and measured whitening and abrasiveness through colorimetric and a roughness test. After screening the titles and abstracts, articles that meet the inclusion criteria were read in full. Non-English studies, duplicate articles, and articles containing irrelevant topics were removed during the screening process and full text review. Results: A total of thirty-one articles resulted from the initial search, nineteen articles were read in full. Six studies were included after removing duplicates and screening articles for relevance to inclusion criteria. Based on the studies, there were mixed results on the effectiveness of charcoal toothpaste whitening ability. In most cases, charcoal toothpaste was not the most effective at removing stains or whitening the tooth surface compared to other whitening toothpastes like Colgate Luminous White. Looking into the safety and abrasiveness, most studies stated that charcoal toothpaste is highly abrasive. Conclusion: Charcoal toothpaste is highly abrasive and not more efficient in whitening teeth or removing stains, making it less viable compared to other whitening products.

P29 Effective Dental Hygiene Treatment for Adult Patients with Autism. A. LAY*, N. REAGIN, T. RADER
(Indiana University School of Dentistry)

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder characterized by strengths or deficits in three developmental areas: social skills, communication skills, and repetitive and restrictive behavior. 1 in 44 children have been diagnosed with ASD, yet as these children become adults, they struggle to find access to effective dental care according to the Autism Society. Objective: To raise awareness about autism spectrum disorder (ASD), its prevalence, and to educate upon this populations' need for effective dental treatment in the state of Indiana. Patients with ASD do not differ from other patients as far as their dental presentations or problems. Providing effective treatment requires a better understanding of the characteristics associated with ASDs, adequate provider education, and supportive evidence-based strategies to create a more positive, successful, and effective visit. Each patient with ASD has their own unique needs that require unique solutions. Creating a patient welcome packet and providing a survey questionnaire for patients or their caregivers to ask specific questions regarding the patient's abilities/deficits prior to the dental visit is just one way to improve the patient and provider experience exponentially. By utilizing the patient's questionnaire answers, the provider can define what must be changed in the care plan to optimize the visit. As stated in the Autism Society of Indiana Journal, "Autism is the fastest growing developmental disorder, yet most underfunded". The need is so great in the US that Delta Dental has provided grants for dental schools, like University of Michigan, and IU School of Dentistry to open clinics to provide specialty care for the adult special needs population. Conclusion: Providing education to the oral health provider, patient, and/or caregiver and utilizing different protocols, procedures, and techniques, we can provide tailored, effective care to patients with autism spectrum disorder.

P30 Correlation between Hearing Loss and Mental Health: A Narrative Review. T. REECE*, H. AYOUB,
A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Introduction: The National Dental Hygiene Research Agenda (NDHRA) is intended to guide dental hygienists with advancing the profession through research and new knowledge. We can address NDHRA on a client level by researching the association between hearing loss, mental health, and oral health. The overall goal of this narrative review is to address mental health disorders (MHD) associated with hearing loss. A secondary goal of this research is to review the dental hygiene process of care of patients with hearing loss and MHD. Discussion: Hearing loss and mental health are often correlated with one another. Losing the ability to hear can put individuals at a greater risk for developing MHD, such as anxiety and depression. Older adults with deafness are more likely to experience depression symptoms. Additionally, for those who already have mental health issues, hearing loss can worsen the problem. MHD can lead to inadequate oral hygiene practices and disinterest in preventive care. Conclusion: Hearing loss plays a significant role in the development of MHD. Dental providers must be trained to identify and accommodate individuals with hearing loss and/or MHD.

P31 The Effects of Aging and Importance of Oral Hygiene in the Geriatric Population: A Narrative Review.
A. ROSS*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: As the American population is steadily becoming dominated by older adults, it is imperative dental hygienists are prepared to address healthcare needs of this population. Comorbid conditions and complicated medical histories common in geriatric individuals can lead to adverse effects that manifest in the oral cavity. The purpose of this narrative review was to discuss the effects of aging and define the influence of oral hygiene in the geriatric population. Methods: A narrative summary of the literature that combines information found through manual searches, digital database searches, and searches of reputable sources. PubMed was used from September through February. Discussion: Older adults are more at risk for having health conditions that require multiple health professionals to be in collaboration to ensure optimal overall health. Arthritis, diabetes, heart disease, obesity, osteoporosis, and hypertension are common medical issues among patients over the age of 65. Barriers to care that this population faces includes transportation, lack of care takers, and financial hardships. In order to address barriers to care outreach services, including professionals who can provide care in long-term care facilities should be implemented. Conclusion: Preventative care appointments should be utilized regularly as patients move through the phases of life with a focus on patient education, in order to prevent the onset and progression of chronic conditions. Future studies should focus on how the scope of practice for Dental Hygienists can be used to promote oral hygiene within the geriatric population.

P32 Down Syndrome and Dental Care: Narrative Review. K. SIEMONS*, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Patients with Down Syndrome (DS) face challenges regarding their oral health including a higher likelihood of periodontal disease, poor oral hygiene, gingival tissue abnormalities, malocclusion, and congenitally missing teeth. The purpose of this narrative review is to understand how DS is caused, how it affects the oral cavity, explain how dental professionals/caregivers can care for these patients, and effective homecare strategies. Methods: Data was retrieved from PubMed from September 2022 through December 2022 regarding DS, its oral health implications, and how to treat/care for these patients. Discussion/Conclusion: An individual with DS may not be fully capable of performing their own oral hygiene routine. Therefore, caregivers for these patients are extremely valuable, as they will ultimately influence their overall oral health. Communication barriers, developmental delays, fear, and anxiety, all contribute to difficulties in treating a patient with DS. The many dental anomalies present within DS patients make them more susceptible to periodontitis, calculus buildup, BOP, gingival inflammation, and congenitally missing teeth. It is imperative that research regarding DS and the effects it has on the oral cavity is well known so these individuals can receive effective preventive and therapeutic care.

P33 The Impact ADHD Has on Oral Healthcare in Children: A Narrative Review. S. WILSON*, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Attention-deficit/hyperactivity disorder (ADHD) is one of the most common neurodevelopmental disorders affecting children (Ethlers, 2019). There is little information on study of ADHD and its connection to overall health. The objective of this clinical case report is to evaluate the impact ADHD can have on oral healthcare in children. Methods: Nine sources from PubMed database were used for this data extraction. Results: Children with ADHD present with poorer oral and general health status and higher plaque indices than those who do not have ADHD. The high rate of dental caries is believed to be related to less effective tooth-brushing because of their short attention span and difficulties to stay focused. The consumption of sugars and in-effective oral hygiene is an obstacle that children with ADHD and their parents/caregivers need to improve on. Conclusion: Preventive measures including patient education and the therapeutic use of fluoride is essential in patients with ADHD. Future research should focus on the impact of the effects intra- and inter- professional relationships can have on parents/caregivers of children with ADHD.

Research Poster Presentations DENTAL INFORMATICS

P34 A Scope Review on Patient Portal Design and Implementation. D. DEVIREDDY*, S. LI, T. THYVALIKAKATH (Indiana University School of Dentistry)

Many healthcare organizations, including dental providers, are using patient portals to improve quality and access to care. Examples of implemented patient portals studied include MyKanta and Epic MyChart. The objective of this study is to identify the advantages and challenges in existing patient portals and the key factors for a successful implementation. We performed a scope review in PubMed. The initial keywords “patient portal” and “dentistry” only yielded one paper. Thus, we expanded our search to cover other healthcare domains. Fifteen articles were chosen for review based on commonalities in the study findings and availability of content regarding portal usability. 3 major themes were extracted: the advantages, most needed features, and key influential factors for successful implementation. The most recognized advantage was increased patient participation and self-management. Additionally, patient portals can improve communication efficiency between patients and providers. The most needed features include browsing medical histories, viewing lab results and medical images, secure messaging to providers, appointment management, and paying bills. The greatest influential factor was patient literacy. Patients with limited health and/or digital literacy, vulnerable populations, lower income earners and marginalized groups are much less likely to engage with these platforms. Gaps in the comprehensibility of the information presented were also observed among portal users. Healthcare providers have a direct influence on the adoption and efficient use of patient portals and their collaborative participation in the design of patient portals may lead to digital inclusion and multi-faceted empowerment of patients beyond their treatment. Patient portals are considered promising tools to encourage patient engagement and improve the quality of care. However, studies on patient portals in dentistry were very limited. Developers and researchers should both learn from the best practices and challenges emerged in other healthcare domains and study the unique requirements for patient portals in dentistry.

P35 Influence of Age and Race on Severity of Sjögren's Disease. J. HERRERA*¹, B. KOLASANI¹, J. MAO², M. WANG¹, L. BOYD³, G.J. ECKERT³, G.F. GOMEZ^{1,2}, T. THYVALIKAKATH^{1,2} (¹Indiana University School of Dentistry, ²Regenstrief Inc., ³Indiana University School of Medicine)

Objectives: This retrospective cohort study aims to determine whether there is an interaction of age and race against the different classifications of Sjögren's Disease (SD) patients. Analysis was also performed to evaluate the influence of ethnicity, insurance, and gender. Methods: We retrieved 377 patient records with a diagnostic international classification of diseases (ICD) code for SD. Previously, they were classified as positive, negative, and uncertain based on their clinical characteristics. For the purposes of this study, the severity of SD was classified based on the presence of signs and symptoms. Presence of a confirmatory sign and symptom is considered severe, whereas lack of a confirmatory sign but presence of other signs and one symptom is classified as moderate. The mild category may have either a sign or a symptom, or neither. Multinomial logistic regression was conducted to predict the changes between age groups to an outcome that represents the severity of manifestations of the disease in Caucasians and African-Americans separately. Similarly, additional analysis was performed to examine the influence of age, race, ethnicity, insurance, and gender. Results: The odds in African-Americans are 1.8 times (CI:1.055-3.216; p-value = 0.032) the odds in Caucasians when presenting with severe signs and symptoms. Furthermore, Africans-Americans, aged 40-59 years, are at 0.12 lower odds (CI:0.017-0.816; p value =0.03) for severe manifestations as opposed to moderate when compared to patients less than 40 years. In the Caucasian population, there were no significant differences between age groups at the time of diagnosis and severity. Conclusions: There is an increased risk among African-Americans to present with more severe status of SD when compared to Caucasians. It is possible that African-Americans are diagnosed early because of the severity of their disease. Future studies will compare the results with non-SD patients. (NIH/NIDCR grant R21 DE027786-02)

P36 Progression of Dental Conditions in Sjogren's Syndrome Patients. C. WALTON*, M. WANG, L. BOYD, A. SINGH, J. HERERRA, M. ARRAGEG, G. VEERAMALLA, G. GOMEZ, G. ECKERT, T. THYVALIKAKATH (Indiana University School of Dentistry and Regenstrief Institute)

Objective: To determine the longitudinal progression of dental conditions in Sjogren's Syndrome Patients (SSP) and compare with a matched non-SSP control group. Methods: We used linked electronic dental and health records (EDR-EHR) data between January 2005 and December 2020 to identify patients with SS diagnostic codes (ICD9/10 CM). They were matched 1:1 to non-SSP controls. We developed annotation guidelines and defined classes for tooth number, decay, filling, and missing. Three annotators independently annotated EDR clinical notes for 20 SSP and corresponding controls. Inter-annotator agreement (IAA) was computed, and annotations reviewed. Clinical note data were combined with structured codes for dental procedures and existing conditions. 'Progression' was defined as longitudinal events from decay-filling-missing. Descriptive statistics were used to characterize progression of unique teeth in SSPs and non-SSP. Results: IAA of 75% was achieved. Average duration of EDR data of SSP was 4.45 years (Range:0-12 years). Total of 453 unique teeth were found in the 40 patients' EDR data. Of these 453 teeth, 148(32.7%) started as decayed, 147(32.4%) as filled, and 158(35%) as missing. Among decayed teeth, 77(51.3%) remained decayed, 48(32.4%) progressed to filling, and 23(15.5%) progressed to missing. Among filled teeth, 104(70.7%) remained filled, 6(4.1%) progressed to secondary decay, 7(4.8%) progressed to secondary decay and additional filling, and 30(20.4%) progressed to missing. Secondary decay was observed on 33(12.2%) SSP teeth and 7(3.8%) control teeth. SSP comprised 15(65.2%) of the 23 decayed teeth that progressed to missing and 26(86.7%) of the 30 filled teeth that progressed to missing. SSP made up 102(64.6%) of the 158 missing teeth. Conclusion: Analysis of structured and unstructured EDR data indicates that SSP experienced an increased number of teeth that progressed to decay, filling, and missing compared to non-SSP. The results underscore the significance of accessing dental patients' EHR to identify conditions that adversely affect their oral health. (NIH/NIDCR grant R21 DE027786-02)

Research Poster Presentations DENTAL MATERIALS

P37 Early Phase-Development Study on the Effects of Hyposalivation on Bond-Strength. E. HUGHES*, L.C. de LIMA, S. CASKEY, S.F. SOCHACKI (Indiana University School of Dentistry)

Objectives: (1) to develop a new laboratorial method that simulates the effects of hyposalivation on dental restorative materials; and (2) to evaluate the effect of simulated conditions of hyposalivation and normal saliva on the bond strength between restorative material and dentin using microtensile bond testing. Methods: The coronal portion of healthy molar teeth (IRB#15589) were cut off to expose dentin. The teeth were restored with one of the following restorative materials: (GI) Packable Glass Ionomer (GC Fuji IX GP® EXTRA, GC Corporation); and (HR) light-cured glass ionomer restorative

(GC Fuji II LC®, GC Corporation). Specimens were cut into beams (1.0 x 1.0 mm) for the microtensile test. Half of the beams were subject to normal salivatory conditions (immersed in artificial saliva) while the other half were stored in hyposalivation conditions (relative humidity). Microtensile testing was performed to determine the bond strength between dentin and restorative material. For the statistical analysis, Mann-Whitney test was used to check the difference between the two experimental models (normal and hyposalivation), for each group according to the microtensile values (in MPa) ($p < 0.05$). Results: No differences between normal and hyposalivation conditions were seen after the bonding test for both GI ($p = 0.091$) and HR ($p = 0.350$). For the group GI the medians (in MPa) were for normal salivation 7.2 [5.5-11.9] and hyposalivation 4.2 [1.28-8.35]. For HR normal salivation 10.75 [7.33-15.3] and hyposalivation 9.45 [4.58-11.8]. Conclusion: Based on the results of this pilot study, the evaluated experimental method could be helpful when simulating hyposalivation. However, more specimens might be required to detect differences among the experimental groups, as well as selecting a procedure with reduced difficulty. (Study funded by the SRG Fellowship (grant number: 23-761-24) and PI's research funds)

P38 Comparing Surface Characteristics of Denture Materials with Different Surface Treatments. H. ALOUTHAH*, F. LIPPERT, C.C. YANG, J. LEVON, W.S. LIN (Indiana University School of Dentistry)

This study investigated the effects of four denture manufacturing techniques/materials with two surface treatment protocols on surface hardness, wear resistance, surface roughness, and gloss of denture resin base materials. Four denture base resin materials (compression conventional, injection conventional, 3D-printed, and milled resins) with two different surface treatment protocols (polish and polish/surface coating) were utilized in this study. A total of 160 specimens ($n=10$) were tested in this study. Surface hardness, wear resistance, surface roughness, and gloss measurement tests were performed. Two-way and three-way ANOVAs were used with a two-sided 5% significance level for all tests. The conventional resin groups scored the highest surface hardness values (29.31 HV). The surface roughness values were significantly higher in the conventional resin groups ($P < .001$). Both the milled and 3D-printed groups showed lower surface roughness values. The polished groups had significantly more surface loss than the glazed groups. Surface gloss was decreased significantly after testing for all groups except the 3D printed polished group ($P = 0.113$). The 3D-printed polished group showed the best gloss stability before and after testing. The milled and 3D-printed groups showed favorable surface roughness and gloss values. The conventional resin groups showed the highest surface hardness values. The glazed resin groups showed overall superior surface properties compared to the polished resin groups. More studies on newly emerging denture base materials are needed to confirm or dispute these findings. (This project was supported by a research grant from The ACP Education Foundation)

P39 Effect of Sterilization Techniques on Flexural Strength of Dental Composites. M. ARRAGEG*, J. PLATT, R.L. GREGORY (Indiana University School of Dentistry)

Continuing improvement of restorative materials has led to the development of materials with antimicrobial activity. To investigate the effectiveness of these materials, several methods have been utilized to evaluate the effect of restorative materials on dental biofilm formation. Before testing biofilm growth, specimens should be sterilized. Sterilization of dental materials specimens may result in modification of the physical properties of materials. The purpose of this study was to assess the flexural strength of dental composites that were subjected to different sterilization techniques prior to antimicrobial testing. The materials investigated included: Activa Bioactive, Activa Presto (Pulpdent, Watertown, MA, USA), and G-aenial™ (GC America). Specimens (25 x 2 x 2 mm) for each tested material were subjected to four different sterilization methods: 30-minute exposure to ultraviolet, 30 minutes immersion in 70% ethanol, brief immersion in 70% ethanol+ passing the specimen through a flame, and no sterilization. Flexural strength after the sterilization processes was assessed by a 3-point bending flexural strength test. Data of each of the sterilization methods were analyzed by one-way ANOVA and Tukey's test (α -value = 0.05) compared to no sterilization. UV light and 70% ethanol had a negative effect on the flexural strength of Activa Presto ($p < 0.009$, $p < 0.002$, respectively) and G-aenial ($p < 0.004$, $p < 0.001$, respectively), and no significant effect was observed in the flexural strength of Active Bioactive. 70% ethanol+ Flame significantly reduced the flexural strength of Activa Bioactive ($p < 0.04$). The results of this study suggested that Active Presto and G-aenial™ can be sterilized by 70% ethanol+ flame, and Activa Bioactive can be sterilized either by UV light or 70% ethanol without any negative effect on flexural strength. The sterilization method should be determined carefully since the composition of the material may be modified by sterilization, and this modification might have an impact on the anti-microbial activity of the material.

P40 Effect of Different Desensitizer Agents on Dentin Permeability. S. CASKEY*¹, L.C. de LIMA², S. SOCHACKI¹
(¹Indiana University School of Dentistry, ²University of Sao Paulo Brazil)

Objective: To evaluate the relative efficacy of three commercially available dentin desensitizer agents to treat dentin hypersensitivity. Methods: Four groups were evaluated: a non-treatment group, a group treated with an agent containing sodium fluoride (Hema-Benz[®] desensitizer, Helathdent¹), a group treated with an agent containing 4% chlorhexidine (Hemaseal & Cide[®] desensitizer, Advantage Dental Products) and a group treated with an agent containing 5% glutaraldehyde (Gluma[®] desensitizer, Kulzer). Human dentin specimens were prepared (IRB = #16627; 1mm-thickness) and randomly assigned into the experimental groups (n=5). Specimens were then sonicated in EDTA (17%; 10 minutes) to remove the smear layer and open the dentinal tubules (simulating conditions of hypersensitive teeth). The respective treatment was applied to the test groups and the teeth were stored overnight under relative humidity (37° C). After treatment, they were submitted to an erosive challenge (citric acid 0.3% for 18 min, washed with water, and then storage artificial saliva for 20 hours). Dentin permeability (hydraulic conductance) was evaluated at baseline, 24h after treatment and after cycling. Two Way Analysis of Variance was used to compare the %LP between after treatment and after cycle. Results: There was no difference in the LP values among the groups at the baseline (p = 0.420). The %LP was converted to log to satisfy the premise of normal distribution. Two Way Analysis of Variance showed that there was a significant difference between %LP between the groups after treatment and after cycle. Tukey Test showed that CT group had higher %LP than the product containing 4% chlorhexidine (p = 0.001) and 5% glutaraldehyde (p = 0.048). Conclusion: Under the conditions tested, the treatment products containing 4% chlorhexidine and 5% glutaraldehyde were able to reduce dentin permeability.

P41 Experimental Resin-based Dental Material Containing β - Tricalcium Phosphate Nanoparticles. L.C. de LIMA*¹, F.R.O. SILVA², Í.E.L. VIANA¹, A.T. HARA³, T. SCARAMUCCI¹, S. SOCHACKI³ (¹University of Sao Paulo Brazil, ²Nuclear and Energy Research Institute - IPEN Brazil, ³Indiana University School of Dentistry)

Objectives: To synthesize and characterize a novel resin-based dental material (experimental adhesive) containing β -Tricalcium Phosphate (β -TCP) nanoparticles, as a promising material for controlling pain from dentin hypersensitivity. Methods: The variation factor (experimental adhesive) was tested in 5 levels: (1) Control - CT: experimental adhesive without β -TCP; (2) experimental adhesive with 10 wt.% β -TCP; (3) experimental adhesive with 15 wt.% β -TCP; (4) SBMP: commercial adhesive (Scotchbond Multi-Purpose, 3M ESPE), and (5) CFPB: commercial adhesive with fluoride (Clearfil SE Protect Bond, Kuraray Dental). The experimental dentin adhesives were prepared by mixing Bis-GMA, TEGDMA, HEMA (50/25/25 wt.%), photo-initiators and inhibitors. Degree of conversion (DC%, 10 and 20 sec, n=3); flexural strength (FS, in MPa) using bar-shaped specimens (25 mm x 2 mm x 2 mm, n=5); and hardness (KNOP) using disc-shaped specimens (10 mm x 2 mm, n = 5) were performed to analyze the mechanical properties. Analysis of variance (Two-Way and One-Way) and Tukey tests were used for statistical analyzes ($\alpha=0.05$). Results: For the degree of conversion, light-curing for 20 sec presented a higher DC% than curing for 10 sec (p<0.05), for all the groups. For the flexural strength, the experimental group with 15 wt.% β -TCP presented lower value than SBMP (p = 0.009). Commercial adhesives presented higher hardness values than all experimental groups (p<0.05). Conclusion: A novel resin-based dental material containing β -Tricalcium Phosphate nanoparticles was synthesized and presented acceptable mechanical properties. Further tests analyzing the cytotoxicity and the experimental material's ability to reduce dentin permeability are ongoing. (Supporting agency: grant #2022/00633-2, São Paulo Research Foundation (FAPESP), Brazil)

P42 Masticatory Wear Resistance Properties of Omnichroma Compared to Filtek Supreme Ultra. J. GUSSERT*, M. ARRAGEG, J. PLATT (Indiana University School of Dentistry)

One critical characteristic of filling materials is their ability to withstand masticatory wear comparable to that of natural tooth surfaces. Excessive surface loss of a restoration under normal function is a risk factor for secondary caries and the inappropriate distribution of occlusal forces. The objective of this study was to compare the wear characteristics of the nano-filled Omnichroma resin composite restorative material against a benchmark universal resin composite, Filtek Supreme Ultra. In one previous study, the flexural strength of Omnichroma was shown to be 22% lower than Filtek Supreme Ultra. Eight uniform samples of both resin composites were prepared for testing in an Alabama wear machine and subjected to 400,000 cycles of three body wear under 75 newtons of force. Volume loss was measured using a profilometer and statistical one-way analysis of variance produced a P-value of 0.197. The results suggest no significant difference in 3-body wear between Omnichroma and Filtek Supreme Ultra. (Supported by Indiana University Student Research Grant fellowship)

P43 Translucency Parameter and Transmittance Relationship in Zirconia at Different Shades. P. KARIMI*, T.G. CHU (Indiana University School of Dentistry)

Background: Dental caries is a dynamic disease of demineralization and remineralization, and the most common chronic disease of childhood. Purpose: The aim of the study is to compare the dmft/DMFT scores between patients with special health care needs and essentially negative (healthy) patients and analyze if there is a significant difference between the dmft/DMFT scores and individual decayed, missing, and filled scores. Methods: A total of 200 patients, 100 each from special health care needs and essentially negative patients were randomly selected. Data was obtained using Dentrix (American Fork, Utah), the electronic records management system at the Indiana University pediatric dental residency program. Inclusion criteria for chart selection were patients aged 0-12 at the Pediatric Dental Residency Clinic at Riley hospital for Children and patients who had an examination (CDT Codes D0150-comprehensive oral evaluation or D0120-periodic oral evaluation) at Riley's Children Hospital from Jan 2019-Dec 2019. Results: SHCN were significantly older than healthy patients, SCHN mean 7.47y and Healthy patients mean was 6.46y ($p < 0.001$). SHCN and healthy patients did not have significantly different dmft+DMFT ($p = 0.170$). In patients with at least 1 decayed, missing, or filled tooth, the percentages coming from decay, 11% for SCHN and 11% for healthy patients ($p = 0.410$), Missing 14% for SCHN and 19% for healthy ($p = 0.293$), or filled teeth, 75% for SCHN and 70% for healthy ($p = 0.083$) did not differ between groups. Conclusion: Special health care needs patients and healthy patients did not have a substantial difference in dmft/DMFT score. Patients with at least one decayed, missing or filled tooth did not differ in caries and treatment experience between the two groups.

Research Poster Presentations MICROBIOLOGY / IMMUNOLOGY / ORAL BIOLOGY

P44 Combined Effects of Nicotine and Caffeine on *Streptococcus mutans* Biofilm. BAKHAIDER*, R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans is the major causative factor of dental caries. Smokers have higher levels of caries lesions than non-smokers. Moreover, they consume caffeinated beverages more than do non-smokers. Previous studies have reported that nicotine significantly increases *S. mutans* biofilm formation. In contrast, caffeine has an inhibitory effect on *S. mutans* biofilm formation. This study aims to investigate the effects of various combinations of nicotine and caffeine on *S. mutans* biofilm growth *in vitro*. This study was conducted using 10 μ l of an overnight culture of *S. mutans* UA159 in tryptic soy broth (TSB) treated with 190 μ l of different concentrations of nicotine alone, caffeine alone ranging from 0-32 mg/ml, and the same concentrations of nicotine with 4 mg/ml of caffeine diluted in TSB supplemented with 1% sucrose in 96 well microtiter plates. Cultures were incubated for 24, h followed by a crystal violet biofilm staining assay. Total growth absorbance and biofilm growth were measured using a spectrophotometer. Minimum bactericidal concentration (MBC), minimum inhibitory concentration (MIC), and minimum biofilm inhibitory concentration (MBIC) were determined. One way ANOVA indicated that 4 and 8 mg/ml concentrations of nicotine significantly ($p < 0.05$) enhanced biofilm growth, while higher concentrations reduced biofilm formation. Caffeine concentrations at 4 mg/ml and above inhibited biofilm growth and demonstrated a less compact biofilm. The inclusion of caffeine with all tested nicotine concentrations had a significant effect on reducing biofilm formation. The MBC, MIC and MBIC for both agents were greater than 32 mg/ml. The results indicate that combining caffeine with nicotine will decrease the nicotine-enhancing effect on *S. mutans* biofilm. This suggests that tobacco users consuming caffeinated beverages may develop fewer caries lesions due to less *S. mutans* present in their dental plaque.

P45 Effectiveness of Vitamin C and Plasma Gas Against Experimental Candidosis. N.V.M MILHAN*^{1,2}, A.G. SAMPAIO^{1,2}, C.Y. KOGA-ITO¹, A. BRUZZANITI² (¹Institute of Science and Technology UNESP, ²Indiana University School of Dentistry)

It is well known that non-thermal atmospheric pressure plasma (NTPP) exerts antifungal properties while vitamin C has demonstrated local anti-inflammatory activity. The objective of this study is to investigate the effects of vitamin C and NTPP on the activity of macrophages and keratinocytes infected or not with *Candida albicans*. Mouse macrophage cells (RAW 264.7) were first exposed to different concentrations of vitamin C (0.312 – 5.0 mM) for 3 hours and the nontoxic concentrations identified through MTT assay. The cells were then infected with *C. albicans* (ATCC 18804) in the proportion of 5:1 (fungus/macrophages) and exposed to 0.6 mM vitamin C for 3 hours, after which the supernatants were collected and tested for the pro-inflammatory cytokine, TNF- α (ELISA assay). To evaluate cell viability after NTPP treatment, RAW 264.7 cells were tested through MTT assay after 2.5 min exposure to NTPP generated from helium gas. Absorbance data from viability tests were normalized to the untreated group (=100%) while the data from ELISA assay were converted to pg/mL and submitted to Kruskal-Wallis test. The results indicated that 0.6 mM vitamin C was not cytotoxic to RAW 264.7

cells and led to a decrease in the production of TNF- α ($p < 0.05$). In addition, helium NTPP was not cytotoxic after 2.5 min of exposure. In another part of the study, human gingival keratinocytes were evaluated through MTS assay after 15-60 sec of exposure to NTPP generated from argon gas (kINPen), resulting in a non-cytotoxic effect after 15 and 30 sec of exposure. It was concluded that 0.6 mM vitamin C may present an anti-inflammatory potential against cells infected by *C. albicans* and it should be studied associated with NTPP against candidosis using exposure times optimized for the available plasma equipment and inert gas. (Grants #2022/04598-7, #2021/00046-7, #2019/05856-7, São Paulo Research Foundation FAPESP)

P46 Inhibitory Effect of *Porphyromonas Gingivalis*-Derived dihydroceramide on Proliferation of OSCC. C. YAMADA*, A. NUSBAUM, B. NGALA, A. MOVILA (Indiana University School of Dentistry, Indiana Center for Musculoskeletal Health, Indiana University School of Medicine)

Objectives: While various groups demonstrated anticancer effects of endogenous host ceramides generated by healthy mammalian cells, the possible impact of oral bacterial-derived ceramides on the proliferation and migration of oral squamous carcinoma cells (OSCC) remains elusive. The key periodontal pathogen *Porphyromonas gingivalis* (*P. gingivalis*) produces a unique family of sphingolipid, phosphoethanolamine dihydroceramide (PEDHC). In this study, we aimed to evaluate the potential effect of sphingolipids derived from *P. gingivalis* on OSCC and healthy epithelial cells *in vitro*. Methods: To examine the proliferation effects of *P. gingivalis*-derived dihydroceramides on OSCC, human oral squamous carcinoma cell line OECM-1 was incubated with various concentrations of PEDHC, Live wild-type *P. gingivalis* strain W83 or dihydroceramide sphingolipids-Null mutant (W83 Δ PG1780) for 24 h. Then, cell proliferation and migration were analyzed using WST-1 assay, wound healing assay, and transmigration assay. The expressions of genes associated with cancer cell migration and invasion, including, SPHK1, S1PR1, S1PR3, IL-6, STAT3, NF κ B, MMP2, and ADAM17, were evaluated after 24 h of lipid treatment by q-PCR. The intracellular concentration of sphingolipids in OECM-1 cells were analyzed by liquid chromatography tandem mass spectrometry. Results: To our knowledge, PEDHC significantly inhibited proliferation of OECM-1 cells. OECM-1 cells demonstrated reduced wound-healing migration activities in response PEDHC. In addition, using transmigration assay, we also demonstrated that PEDHC significantly inhibited the invasion activity of OECM-1 cells *in vitro*. We observed that exposure of OECM-1 cells to PEDHC significantly reduced the amounts of Nf- κ B, MMP2, ADAM17 and IL-6 in OECM-1 cells. Furthermore, treatment with PEDHC significantly increased concentrations of intracellular dihydroceramide and ceramide in OECM-1 cells. Conclusions: The present study demonstrated for the first time that *P. gingivalis*-derived PEDHC has anti-proliferative effect on OECM-1 cells. (Support Funding Grant Number: AG-053615, AG-064003, AG-068595, DE-028699, and DE-027153)

P47 Effect of EGCG and Nicotine on Oral Bacterial Biofilm. D. ACHARYA*, R.L. GREGORY (Indiana University School of Dentistry)

The aim of this study was to assess the effect of EGCG on the biofilm formation of *Streptococcus sanguinis* and *Streptococcus gordonii*. In addition, this study compares the effects of EGCG plus various concentrations of nicotine exposure on *S. sanguis* and *S. gordonii* biofilms. *S. sanguis* and *S. gordonii* are major colonizers in oral biofilm development. Nicotine has been known to increase the formation of plaque, while EGCG has been demonstrated to reduce bacterial biofilm formation. Methods: *S. sanguis* and *S. gordonii* were treated with different concentrations of nicotine (0-32 mg/ml) in Tryptic Soy broth supplemented with 1% sucrose for 24 hours with 0.5 mg/ml EGCG and without EGCG. 0.5 mg/ml of EGCG was selected based on preliminary studies using various EGCG concentrations. The biofilm was stained with crystal violet to determine biofilm formation measured via absorbance using a spectrophotometer. Results: Both *S. sanguis* and *S. gordonii* demonstrated significantly less ($p < 0.05$) biofilm production in the presence of nicotine treated with 0.5 mg/ml of EGCG compared to the biofilm production without EGCG. Conclusion: This study demonstrated that the nicotine-induced bacterial biofilm formation is significantly reduced in the presence of EGCG. This provides additional evidence confirming the usefulness of EGCG in smokers.

P48 Cannabidiol Inhibits *Streptococcus Mutans* Biofilms Growth and Activities. A. AZABI*, L.J. WINDSOR, R.L. GREGORY (Indiana University School of Dentistry)

Despite advances in caries research, surgical treatment of tooth decay remains the most widely performed procedure in dentistry. Since caries is a multifactorial biofilm-mediated disease, preventive measures against dental caries aim to inhibit pathogenic biofilm formation on tooth surfaces. Cannabidiol (CBD), a *Cannabis sativa* extract, has shown antibacterial properties against various bacterial species, especially gram-positive cocci. This study aimed to evaluate the antibacterial efficacy of CBD against *Streptococcus mutans* biofilm. The growth of *S. mutans*, both planktonic and biofilm, treated with different concentrations of CBD was evaluated. The minimum biofilm inhibitory concentration (MBIC) and the minimum

bactericidal concentrations (MBC) of CBD were assessed. The effects of CBD on the production of extracellular polysaccharides (EPS), lactate dehydrogenase (LDH) production, and metabolic activities of the bacterial cells were evaluated. LIVE/DEAD™ fluorescent bacterial stain was used to evaluate the viability of the bacterial cells. CBD concentrations ≥ 2.5 $\mu\text{g/ml}$ exhibited significant inhibition ($p < 0.05$) against *S. mutans* biofilm growth. The minimum bactericidal concentration of CBD was 5 $\mu\text{g/ml}$. EPS production and biofilm metabolic activity were significantly reduced at concentrations ≥ 2.5 $\mu\text{g/ml}$. LDH activity was significantly lower at concentrations ≥ 1.25 $\mu\text{g/ml}$. Live/dead fluorescent images were consistent with the previous findings. These findings demonstrate that CBD has an antibacterial effect against *S. mutans*.

P49 Effects of Coconut Oil on *Streptococcus mutans* Biofilm Formation. K. BONTRAGER*, L. VINSON, S. DUARTE, G. ECKERT, R.L. GREGORY (Indiana University School of Dentistry and Riley Hospital for Children)

Purpose: The purpose of this study was to investigate the effects of coconut oil and gallic acid on *Streptococcus mutans* biofilm formation. Oil pulling is a traditional Indian folk remedy where oil is swished and forcibly pulled between the teeth to reduce plaque formation. It has the potential to prevent dental caries by disrupting *S. mutans* biofilm formation in part due to the presence of polyphenols found within coconut oil. Coconut oil specifically contains gallic acid, ferulic acid, quercetin, methyl catechin, dihydrokaempferol and myricetin glycoside. It was anticipated that coconut oil and gallic acid would have bactericidal effects on *S. mutans* as well as cause disruption of biofilm formation at the level of adhesion based on evidence provided by previous studies conducted on various polyphenols found within coconut oil. Methods: Lab based procedures were used to identify the minimum inhibitory concentration (MIC), minimum bactericidal concentration (MBC) and minimum biofilm inhibitory concentration (MBIC) of both coconut oil and gallic acid on *S. mutans*. Results: Complete results are pending statistical analysis. Partial statistical analysis performed thus far has revealed that coconut oil does not inhibit at any concentration with 4g/5mL of coconut oil in tryptic soy broth supplemented with 1% sucrose (TSBS). However, partial statistical analysis thus far does show a significant difference with inhibition at a 0.17% concentration or higher with 0.2g/(4.5mL + 0.5mL) of Gallic acid in TSBS + EtOH. Conclusion: The results of this study would allow us to determine whether coconut oil can be used to disrupt *S. mutans* biofilm and used in the prevention of dental caries through oil pulling.

P50 Effect of SDF on Nicotine-Induced *Streptococcus mutans* Biofilm. M. ELSHARKASI*, R.L. GREGORY (Indiana University School of Dentistry)

Silver diamine fluoride reagent (SDF) is used to prevent and arrest carious lesions. Yet the mechanism of its action is not fully reported. The antimicrobial effect of SDF was determined on an established nicotine-induced *Streptococcus mutans* biofilm, by measuring colony-forming units (CFU), different application times, and on extracellular polysaccharide (EPS) production. Materials and Methods: *S. mutans* biofilm was established with and without 2 mg/ml of nicotine in Tryptic Soy broth (TSB) supplemented with 1% sucrose (TSBS) for 24 h in six well plates. Nicotine and non-nicotine induced biofilm groups were treated with SDF for 1 min and washed. Non-SDF treated groups were used as a control. The biofilm was plated on blood agar plates and CFU were determined. In addition, different SDF application times (30 sec, 1, 2, and 3 min) were tested. For EPS production, *S. mutans* was incubated with and without 2 mg/ml of nicotine in TSBS for 24 h in 96 well plates. SDF groups were treated with SDF for 1 min and washed. A phenol/sulfuric acid assay was used to measure the total carbohydrate produced. Results: There was a significant effect ($p < .001$) of SDF on reducing CFU for both nicotine and non-nicotine groups. The different application times of SDF reduced CFU for all tested groups ($p < .001$). EPS production was significantly ($p < .001$) reduced with SDF application for the tested groups. Conclusions: The use of SDF with different application times disrupted established *S. mutans* biofilms. In addition, EPS production was reduced by application of SDF. This confirms the strong in vitro effect of SDF on *S. mutans* biofilm reported earlier by this laboratory, establishes the ability of a shorter SDF treatment time to be effective and suggests a possible mechanism of action for the inhibition of EPS production.

P51 Characterization of Gingival Tissue Changes in Mouse Ligature-Induced Periodontitis. M. LEVITAN*, M. KITAKA, T. YOSHIMOTO, Y. UEKI (Indiana University School of Dentistry, Indiana Center for Musculoskeletal Health)

Periodontitis is a common bacterially induced condition that results in inflammatory changes in the periodontium. The mouse ligature-induced periodontitis model (LIP) is a common way to study the progression of periodontal disease, however, morphological changes in gingival tissue when using LIP have not been well characterized. Silk sutures were placed on the left-maxillary second molar of 10-week-old C57BL/6 mice. Mice were euthanized 1, 2, 3, 5, 7, 10, or 14 days following ligature placement. Mice without ligature placement were used as day 0 control. Some mice were administered antibiotics during the experiment. These mice were treated with a broad-spectrum antibiotics cocktail consisting of Ampicillin (1.0 g/L),

vancomycin (0.5 g/L), and kanamycin (1.0 g/L) in drinking water plus daily administration of metronidazole by oral gavage (1.6 mg/200 µl) starting 5 days before the induction of LIP until endpoints (only for timepoints 3 and 5). Paraffin-embedded samples were sectioned at the midpoint of the second molar in the coronal plane. The sections were stained with H&E and used for analysis. For each sample, a 0.5mm line was drawn from the gingival sulcus in the palatal direction. The region of interest was the area of gingival tissue coronal to this line. Keratinized epithelium, nonkeratinized epithelium, and connective tissue were separately analyzed using ImageJ. There was an increase in connective tissue after day 1, an increase in nonkeratinized epithelium after day 2, and an increase in keratinized epithelium after day 5. The addition of antibiotics significantly decreased the tissue expansion of the nonkeratinized epithelium and connective tissue layers at days 3 and 5. In conclusion, the increase in gingival tissue in LIP is initially composed of expansion of connective tissue followed by epithelium expansion, and the soft tissue expansion seems to largely depend on a bacterial burden in LIP.

P52 Zymogen Granule 16B: An Acinar Protein Marking Salivary Tissue Damage. D.P. MODY^{1,2*}, A.C. DA SILVA,¹ R. SHARMA,¹ J. NGUYEN,¹ Y. WU³, A. WERNER³, J. MAYS¹ (¹NIH NIDCR Division of Intramural Research Oral Immunobiology Unit, ²Indiana University School of Dentistry, ³NIH NIDCR Division of Intramural Research Stem Cell Biochemistry Unit)

Chronic graft vs. host disease (cGVHD) commonly affects oral exocrine tissues including minor salivary glands (MSG). Recent work from our laboratory identified a significant reduction in protein content of zymogen granule 16B (ZG16B) at onset of salivary gland cGVHD compared to healthy donors. Little is known about the normal function of ZG16B in acinar or other exocrine cells. Hence, this project aims to evaluate the basal expression of ZG16B and its potential binding partners in different exocrine tissues. Single-cell RNA sequencing (scRNAseq) data was compared in two exocrine tissues: human pancreas (n=31, publicly available dataset) and MSG (n=13). In parallel, protein was quantitated in unstimulated saliva collected longitudinally from healthy human volunteers to assess the basal level of salivary ZG16b. Finally, investigation of binding partners was done *in vitro* using HEK293T cells were transfected with ZG16B and PAUF (a protein homolog of ZG16B) plasmids followed by immunoprecipitation (IP). Clustering analyses of MSG and pancreatic cells revealed differential expression patterns of ZG16B. ZG16B expression was highest in serous acinar cells in normal MSG. Conversely, in pancreas, ZG16B was localized to beta, delta and ductal cell clusters. In healthy humans, the basal protein concentration of ZG16B was 0.39-9.35 ng/ml. IP data suggest that both ZG16B and PAUF proteins are glycosylated post-transcriptionally, secreted into supernatant, and have a modest presence in the cell lysate. The size of both proteins is approximately 22 - 25kDA. Our preliminary results further define the location and interaction of ZG16B in two distinct exocrine tissues. The localization of ZG16B to different cell clusters of two exocrine tissues indicates functional differences that may be tissue specific. Work is ongoing to functionally validate predicted binding partners for ZG16B in tissue culture and patient samples to further define the implications of the loss of ZG16B expression in damaged salivary gland. (Supported by NIDCR Intramural Training Program)

P53 Effects of Isothiocyanates and Coriander Essential Oil Against Oral Pathogens. B. NGALAH^{*1,2}, A. HANSEN³, C. YAMADA¹, A. NUSBAUM¹, A. MOVILA¹, F.UWE², R.L. GREGORY (¹Indiana University School of Dentistry, ²BioPhytoMedical Drug Discovery and Development, Freiburg im Breisgau (Germany), ³Indiana University Bloomington)

Aims: This study evaluated the antimicrobial effect of coriander oil (CO) and isothiocyanates (ITC; Allyl, Benzyl and Phenyl-A-, B-, P-ITC) on *Streptococcus mutans* and *Porphyromonas gingivalis*. We evaluated inhibition of biofilm, metabolic activity and *S. mutans* exopolysaccharide formation. Methods: The composition of CO was determined by gas chromatography-mass spectrometry (GC-MS). CO and ITC were dissolved in 0.1% Tween 80. Different concentrations (0.0039-1%) of CO, ITC and CO-ITC were made in Tryptic soy broth (TSB) and with sucrose (TSBS). Broth dilution method was used to determine the minimum inhibitory concentration (MIC). Minimum biofilm inhibitory concentrations (MBIC) were established by staining biofilm with crystal violet. Checkerboard assay was used to evaluate combination effects. An XTT assay was used to determine the metabolic activity and a sulphuric acid-phenol assay for inhibition of *S. mutans* exopolysaccharide production. Results: CO was dominated by Linalool (65.5%) followed by 2-bornanone (6.16%) and Gamma-terpinene (4.31%). The least was Terpinen-4-ol (0.13%). The MIC of CO was determined to be 0.03125% for *P. gingivalis* and 0.0625% for ITC. Biofilm formation of *S. mutans* was significantly inhibited (p<0.05) by B-ITC at <0.0039%, while with CO-ITC at 0.0078%. The MBC of CO was 0.25% and for CO-B-ITC, the MBIC was 0.125% in *S. mutans*. The B-ITC MBC was >0.25%. Strong *S. mutans* exopolysaccharide inhibition was observed with ITC and CO at 0.0039%. CO reduced *S. mutans* metabolic activity at 0.125% and ITC at 0.0078%. Conclusion: CO and ITC are promising agents in prevention of both periodontal disease and dental caries. More studies on the molecular mechanism of action and clinical studies are required to provide further data to warrant development of products to help mitigate dental caries and periodontal disease occurrence.

Research Poster Presentations OCCLUSION

P54 21st Century High-tech Quackery. T.R. KATONA* (Indiana University School of Dentistry)

The highly touted state-of-the-art T-Scan digital occlusion analysis system (Tekscan, South Boston, MA, USA) is criticized for 2 fatal faults: inherent hardware limitations and heretofore unexplored flawed computational algorithm. Far more than traditional occlusion indicator strips (Accufilm I and II, Rudischhauser Thick and Thin, and Hanel Articulating Silk), T-Scan alters the actual occlusal surface-occlusal surface contact forces. Because of differences in thickness, stiffness and surface (friction), all of these products produce unique artefactual occlusions that they attempt to characterize. Thus, the numerous studies of the traditional paper, film and silk products yield conflicting and non-conclusive results, while T-Scan uses its measurements of the artefactual occlusion as input to their well promoted impressive digital clinical tools. Because it is proprietary, there has not been any scrutiny of T-Scan's numerical algorithms. With no information to the contrary, and without practical alternatives, it must be presumed that the T-Scan computations are based on basic Newtonian force and moment static equilibrium principles. The approach requires the complete characterization (magnitudes, directions and points of application (or the lines-of-action)) of the measured individual occlusal contact force vectors. T-Scan purports to measure 2 of these 3 essential force vector parameters, but one of them, the contact point locations, are localized relative to its flat undeformed sensor, not relative to the actual "cuspy" terrain of the occlusal surface. As noted above, the other measurement, force magnitude, is entirely artefactual. And finally, the T-scan sensor cannot provide force direction, so for computational purposes, the 3rd parameter, occlusal contact force direction, must be assumed. Thus, T-Scan relies on calculations that use artefactual occlusal contact force magnitudes, approximated artefactual contact point locations, and assumed force directions. Just one of these 3 shortcomings, by itself, is sufficient to declare that meaningful T-Scan analyses are impossible.

Research Poster Presentations ORAL DISEASE PREVENTION AND DIAGNOSIS

P55 Topical Fluoride Impact in Future Restorative Procedures: A Claim Study. H.J. JACKSON*, J.F. YEPES, A.C. SCULLY, L.A. VINSON, J.E. JONES, G.J. ECKERT, T. DOWNEY, G. MAUPOME (Indiana University School of Dentistry and Riley Hospital for Children)

Purpose: Due to the high prevalence of early childhood caries, prevention of this disease is necessary. One prevention method that is used to decrease the incidence of dental caries is topical fluoride. The purpose of this study is to investigate the impact of fluoride varnish and gel applications on future restorative dental treatment claims. Methods: The data for this study were obtained in conjunction with a dental data warehouse through a partnership agreement with Indiana University. A retrospective analysis of dental claims made over a nine-year span was completed. Data were extracted for patients 1 to 8 years old with topical fluoride application and its subsequent impact on restorative dental claims between 2010 and 2018. Results: The data included 672,889 patients in the analysis. Patients who received topical fluoride had significantly decreased numbers ($P < .001$) of restorative procedures and extractions per year than patients who did not receive topical fluoride. Additionally, the number of restorative procedures and extractions per year increased with patient age. Patients who did not receive topical fluoride and those who received it 0.1 to 1.4 times per year had significantly increased number ($P < .001$) of procedures or extractions and significantly decreased time ($P < .001$) to their first restorative procedure or extraction than patients who received fluoride 1.5 or more times per year. Conclusion: Increased frequency of fluoride varnishes and gel application result in decreased restorative/extraction dental claims and increased time to future restorative/extraction dental claims.

P56 Signs of Periodontitis and Altered Taste Are Related in COVID-19. M. JARAMILLO*, M. SRINIVASAN, T. THYVALIKAKATH (Indiana University School of Dentistry)

Objectives: COVID-19 is a multisystem disease characterized by hyper-inflammation. The acute phase lasts up to four weeks, with symptoms including dyspnea and dysgeusia. Long COVID-19 presents with persistent symptoms, including taste dysfunction. Periodontitis, similarly, results from chronic inflammation, manifesting as bleeding upon probing and bone loss. This project seeks to define the symptoms of long COVID-19 and evaluate the cross-section of taste perception and periodontitis. Methods: A survey collecting data on COVID-19 associated general and oral symptoms was sent to 13,300 participants who had previously been diagnosed with COVID-19 in the Indiana University Health System (IRB #15239). An analysis of symptom severity and combinations with respect to the number of COVID-19 positive tests was performed. Results: Of the 13,300 participants, 298 completed the survey, and 224 patients reported their willingness to submit saliva samples for further evaluation. 52 of these patients reported more than one positive test for COVID-19 infection. Myalgia

was reported as a common symptom in 15% of patients who had tested positive for COVID-19 once and in 25% of patients who had multiple positive COVID-19 infections. A similar pattern was seen with cough and joint pain. Conversely, chest pain was more commonly reported in patients who had tested positive for COVID-19 only once. Bleeding gums most or all of the time was more common in patients experiencing frequent myalgia (13% as compared to 8%) and in patients with multiple positive COVID-19 infections (25% as compared to 3%). 12 of the 172 patients with one positive COVID-19 infection had a combination of frequent myalgia, bleeding gums most or all of the time, and persistent symptoms for at least four weeks. Conclusion: Signs of periodontitis are common in long COVID-19, especially in patients reporting myalgia and those with multiple COVID-19 infections, reflecting the pathologic inflammation of both diseases.

P57 Cyclin D1 in Predicting Progression of Potentially Malignant Oral Epithelial Lesions. M. KESSLER*¹, K. MCNAMARA², J. KALMAR², N. SANTOSH¹ (¹Indiana University School of Dentistry, ²The Ohio State University College of Dentistry)

Objective: Timely diagnosis of oral squamous cell carcinoma (OSCC) is crucial as early-stage lesions have an 84% five-year survival rate while late-stage lesions have only a 39% survival rate. OSCC often develops from potentially malignant oral epithelial lesions exhibiting oral epithelial dysplasia (OED); however, not all OEDs progress into OSCC. Establishing a panel of biomarkers that predict the likelihood of OED progression is vital as it can enable a more accurate prediction of malignant transformation. Our recent studies have demonstrated that cornulin and CyclinD1 expression significantly decreases and increases, respectively, in patients whose OED progressed to OSCC compared to patients with non-progressive OEDs. The objective of this current study is to further validate the CyclinD1 expression in a newly identified patient cohort of progressive OED and non-progressive OED, thereby, providing more evidence of this biomarker's worth in aiding the prediction of progression of potentially malignant oral epithelial lesions. Methods: Following the database review of the Oral Pathology Group at Indiana University School of Dentistry, a new cohort of 5 patients with OED that progressed into OSCC (progressive group) and 5 patients with OED that retained the same histopathologic grade across two biopsies (non-progressive group) were identified. Following immunohistochemistry, cyclinD1 expression was analyzed using Aperio imagescope software and a histo-score was calculated based on the intensity of the staining and the percentage of positive cells. Repeated measures ANOVA was utilized for statistical analysis. Results: In the progressive group, CyclinD1 expression increased between the initial biopsy and subsequent biopsy that progressed to OSCC. No difference in CyclinD1 expression was observed between the initial biopsy and subsequent biopsy in the non-progressive group. Conclusion: CyclinD1 along with cornulin, may help identify high-risk OEDs which require more aggressive management, thereby facilitating personalized treatment in the prevention of OSCC. (Delta Dental Foundation Grant #4476233)

Research Poster Presentations ORTHODONTICS / IMAGING / CRANIOFACIAL

P58 Cephalometric Analyses by Deep Learning Artificial Intelligence and Human Augmentation Technique. A. ZHAO*, S. PANESAR, E. HOLLENSBE, A. WONG, G. ECKERT, V. DUTRA, H. TURKKAHRAMAN (Indiana University School of Dentistry)

The aim of this study was to evaluate the precision and accuracy of cephalometric analysis performed by AI with/without human augmentation of individuals with limited cephalometry experience compared to the analysis done by an experienced orthodontist and radiologist. Thirty lateral cephalometric radiographs of adult patients with Angle Class I malocclusions were obtained from the Indiana University School of Dentistry and uploaded into RadioCef software. A dental student and dentist with limited cephalometric experience and a deep learning AI software, CEFBOT (RadioMemory Ltd, Belo Horizonte, Brazil), identified 34 hard and soft tissue landmarks on the radiographs twice with at least one week in between. These landmarks were identified again by each examiner with aid from CEFBOT (AI/human augmentation method). The gold standard landmarks were established by consensus of an experienced orthodontist and dental radiologist. 10 linear and angular measurements were obtained from each radiograph. The measurements obtained by the examiners and AI were compared to those of the gold standard to evaluate accuracy. Intraclass correlation coefficients (ICCs) were used to evaluate precision. A paired-t-test was used to test for a significant mean difference from the gold standard. The distances from the gold standard were compared using repeated measures ANOVA. CEFBOT had the highest precision with a mean ICC of 0.97, while the dentist and dental student had a mean ICCs of 0.82 and 0.72, respectively. The AI/human augmentation method significantly improved the precision of the dentist (19.48%) and student (32.21%). The dentist demonstrated higher accuracy

than the student with a mean absolute error of 2.07 mm/° and 2.41 mm/°, respectively. The AI/human augmentation method improved the accuracy of both the dentist (38.81%) and student (38.20%). Deep learning AI powered automated cephalometric analysis demonstrates excellent precision and accuracy, and significantly improves the precision and accuracy of less experienced dentists and students.

P59 Artificial Intelligence-Driven Predictive Factors of Mandibular Growth. E.G. O'CONNELL*, M. PARRISH, T. WOOD, G. ECKERT, J. HUGHES, S. BADIRLI, H. TURKKAHRAMAN (Indiana University School of Dentistry)

The aim of this study was to compare Artificial Intelligence (AI) driven predictive factors of pubertal mandibular growth in both genders. Cephalometric radiographs of 339 subjects (176 females, 163 males) with Angle Class I molar relationship were collected from growth studies. Data were randomly distributed into two datasets. The training set consisted of 75% of the samples' data (254 samples) and the remaining 25% (85 samples) were allocated for the testing. A machine learning (ML) algorithm was trained using 45 data points from the traced images. Predicted mandibular growth measurements were calculated with Ridge method using input data from T1 alone (4-years prediction) and T1 & T2 combined (2-years prediction). The input features were normalized by the Min-Max scaler. Top 10 most important features for 2- and 4-years predictions of mandibular length (Co-Gn) and Y-axis were ranked and compared for any gender difference. Males and females shared the same 6 of the 10 predictive factors for the 2 years prediction of mandibular length. Even more divergence between the genders were found in 4 years prediction of mandibular length since only 2 out of 10 measurements were the same. For both 2- and 4-years prediction of mandibular length, age was found to be more important in females, while maxillary length was found to be more predictive in males. For the 2 years prediction of the Y-axis, only 4 of the 10 features were shared by both genders. 4-years predictive factors of Y-axis significantly differed between the genders, where more dentoalveolar features were selected in males. A combination of skeletal and dentoalveolar factors were picked up by the ML algorithms in short- and long-term prediction of the mandibular length and Y-axis. The results of this study showed a significant gender difference between the AI-driven predictive factors of mandibular growth.

P60 Precision and Accuracy of Cephalometric Measurements Performed by Artificial Intelligence. S. PANESAR*, A. ZHAO, E. HOLLENSBEE, A. WONG, G. ECKERT, V. DUTRA, H. TURKKAHRAMAN (Indiana University School of Dentistry)

Introduction: Artificial intelligence (AI) demonstrates potential in automating identification of cephalometric landmarks. Multiple studies have investigated the accuracy of deep learning AI techniques but lacked substantial training data and a comparison with dental professionals with varying experience. The rationale of this study was to assess the precision and accuracy of the cephalometric analyses performed by a fully automated deep learning AI software alone and with human augmentation. Materials and Methods: Thirty lateral cephalograms of adult patients were obtained from the Indiana University School of Dentistry electronic patient records. Four dental professionals with varying levels of experience (orthodontist, orthodontic resident, dentist, and a dental student) and a deep learning AI software identified 34 hard and soft tissue landmarks on the radiographs twice with at least one week in between. Each examiner repeated the process with the aid of AI (AI/human augmentation method). Cephalometric measurements were compared to a gold standard to evaluate accuracy. Precision was assessed by using intraclass correlation coefficients (ICCs). A paired-t-test was used to test for a significant mean difference from the gold standard. Results: AI software revealed the highest precision with a mean ICC of 0.97. AI/human augmentation method significantly improved precision of the orthodontist, resident, dentist and dental student by 3.0%, 2.7%, 28.8% and 23.5%, respectively. The orthodontist demonstrated the highest accuracy with a mean absolute error of 1.57 mm/°. AI/human augmentation method improved accuracy of the orthodontist, resident, dentist, and dental student by 12.9%, 18.9%, 41.6% and 34.2%, respectively. Conclusion: The tested deep learning AI software demonstrated an excellent precision and accuracy in automated cephalometric analysis. AI/human augmentation method improved precision and accuracy of the less experienced dental professionals and helped them reach an accuracy level to that of an experienced orthodontist.

P61 Predicting Pubertal Mandibular Growth in Females Utilizing Machine Learning. M. PARRISH*, E.G. O'CONNELL, G. ECKERT, J. HUGHES, S. BADIRLI, H. TURKKAHRAMAN (Indiana University School of Dentistry)

The aim of this study was to create an accurate Machine Learning (ML) algorithm for predicting the amount and direction of pubertal mandibular growth in females. Lateral cephalometric radiographs of 176 females with Angle Class I molar relationship, at three time points (T1:10, T2:12, and T3:14 years old), were collected from historical growth studies. The ML was trained using 45 data points from the traced images of 140 subjects. Predicted mandibular growth measurements were calculated using 7 machine learning methods using as input data from T1 alone (4 years prediction) and T1 & T2 combined

(2 years prediction) from the 36 subjects in the test set. Mean absolute error (MAE), and intraclass correlation coefficients (ICCs) were used to evaluate the accuracies of the algorithms. For all ML methods tested using input from T1 alone, the MAE for predicted mandibular length and Y-axis ranged from 3.21-4.00 mm and 1.19-5.12 degrees, respectively. When using input from T1 and T2, MAE for predicted mandibular length and Y-axis ranged from 2.78-5.40 mm and 0.88-1.48 degrees, respectively. Agreement between predicted and actual, assessed using ICCs, for Y-axis was good for all ML methods, with ICCs at least 0.84 using T1 data and at least 0.90 using T1 & T2 data for all methods except MLP regressor (ICC 0.79). Most of the ML methods were able to predict mandibular length and Y-axis within 3 mm and 1 degree range, respectively. In general, 2 years prediction were found to be more accurate than the 4 years prediction. MLP regressor and Linear Regression predictions have been found to be less accurate compared to other methods. The most important predictive factors were found to be the initial mandibular length, age, SNPg, lower face height for the mandibular length, and initial Y-axis, FMA, ANB, U1-NA, and Wits appraisal for the Y-axis.

P62 Dental Phenotypes and Morphological Variation in the Lower Face. S. TWIGGS*¹, N. HERRICK², F. WILKE², D. ALBRIGHT¹, S. WALSH², K.T. STEWART¹ (¹Indiana University School of Dentistry, ²Indiana University-Purdue University Indianapolis Department of Biology)

Objectives: Recent advances in our understanding of morphological face variation can be attributed to the use of three-dimensional facial imaging and advanced phenotyping techniques, such as a global-to-local, data-driven segmentation approach. Quantifying dental phenotypes and assessing their contribution towards variation and external appearance within particular regions of the face is extremely valuable, as it can help infer potential issues associated with dental abnormalities and allow its effect to be visualized. The objective of this study was to investigate the morphological relationship between teeth, bone and soft tissue in the lower half of the face using facial CBCT images. Specifically, we aimed to elucidate whether data-driven external soft tissue morphological variation can be partially explained by dentition. Experimental Methods: Following IRB approval (#1801992304), seventy-five subjects were recruited based on the established inclusion/exclusion criteria. Demographic and biometric data was acquired, along with a 13x17cm full field of view CBCT image. Using the CBCT image, eight hard-tissue phenotypes were measured using Dolphin Image Viewer and soft-tissue phenotypes were registered using Meshmonk. Covariates such as age, sex, height and weight were systematically removed from both the independent variables (teeth/bone) and dependent variables (soft tissue) using partial least squares regression. The associations between dental and hard tissue phenotypes were then statistically evaluated. Results: Observed visual differences were found when exploring and measuring the specific effect that extremes in teeth/bone formation may play on soft-tissue structure. A quantification of this relationship was also statistically assessed. This analysis was performed for all 24 segments of the lower half of the face. Conclusions: Correlations were measured between hard and soft tissue structures of the face with the use of CBCT imaging and 3D morphometrics. The results underscore the potential link between dental structures and the outward appearance of facial presentations. (This project is supported by the Indiana University School of Dentistry, Department of Orthodontics & Oral Facial Genetics and the Indiana University-Purdue University Indianapolis, Walsh FDP Lab)

P63 A Machine Learning Model for Predicting Orthodontic Treatment Duration. J. VOLOVIC*, S. BADIRLI, S. AHMAD, L. LEAVITT, T. MASON, G. ECKERT, D. ALBRIGHT, H. TURKKAHRAMAN (Indiana University School of Dentistry)

The purpose of this study was to create a machine learning (ML) algorithm that can predict orthodontic treatment duration. This retrospective study included 500 patients that completed comprehensive orthodontic treatment at the Indiana University School of Dentistry (IUSD). Sixty pre-treatment variables were gathered from the electronic practice management (Axium, Exan Software, Las Vegas, NV) and imaging software (Dolphin Imaging, Patterson Dental, Saint Paul, MN). The patient sample was used to train/test 10 different ML models. Descriptive statistics were provided for normalized and scaling groups for both true and absolute differences. One-way ANOVA with a random effect was used to test for the differences between the 10 methods for both normalized and scaling groups. Intraclass correlation coefficients (ICCs) were used for intra-examiner and inter-examiner agreement. Of the 54 quantitative variables, 46 (85.2%) had an ICC of 0.75 or greater for inter-examiner agreement. Intra-examiner repeatability was calculated and 44 (81.5%) of the variables had an ICC of 0.75 or greater. Of the 10 ML algorithms, XGBoost was the most accurate in predicting total treatment time with a mean absolute error (MAE) of 8.01. Extraction type, COVID, maxillary/mandibular crowding, intermaxillary relationship and soft tissue

profile were among the most important predictive features in determining treatment time. Gaussian Process Regression (GPR) and MLP Regressor models significantly differed from others in terms of accuracy ($P < .05$). All tested ML algorithms were able to predict the orthodontic treatment time within a clinically acceptable range. Although majority of algorithms performed in a similar manner, XGBoost and Support Vector Regression were the most accurate, while GPR and MLP Regression were the least. Extraction type, COVID, maxillary/mandibular crowding, intermaxillary relationship and soft tissue profile were found to be among the most predictive features in determining treatment time.

P64 Prediction of Pubertal Mandibular Growth in Males with Class II Malocclusion by Utilizing Machine Learning. G. ZAKHAR*, S. HAZIME, G. ECKERT, A. WONG, S. BADIRLI, H. TURKKAHRAMAN (Indiana University School of Dentistry)

The purpose of this study was to create an accurate machine learning (ML) algorithm which can predict the magnitude and direction of pubertal mandibular growth in males with Class II malocclusion. Lateral cephalometric radiographs of 124 males with Class II molar relationship, at three time points (T1: 12, T2: 14, T3: 16 years old) were collected from an online database of longitudinal growth studies. Each radiograph was traced, and the ML was trained using 45 data points from 94 subjects. Articulare-gnathion (Ar-Gn), condylion-gnathion (Co-Gn), and Y-axis were predicted using seven ML methods on 30 subjects. ML predicted T3 from T1 alone as well as T3 from T1 and T2 combined. Mean absolute errors (MAEs) were used to evaluate the accuracy of each algorithm. For all ML methods tested using input from T1 alone, the MAEs for Ar-Gn ranged from 2.3-5.6mm, 2.1-6.0mm for Co-Gn, and 0.8-2.74° for the Y-axis. For all ML methods tested using input from T1 and T2 combined, the MAEs for Ar-Gn ranged from 2.68-4.0mm, 2.3-5.2mm for Co-Gn, 1.2-1.71° for the Y-axis. Besides its length at earlier time points, the most predictive factors for mandibular length were found to be chronological age, lower/upper face heights, and upper incisor inclination. For the Y-Axis, the most predictive factors were found to be SN-MP, SN-Pog, SNB and SNA. Even with the limited sample size for algorithm training, ML methods were still able to predict mandibular length within 2mm and Y-axis within 1° range. The most predictive factors for mandibular length were initial mandibular length, chronological age, lower/upper face heights, and upper incisor inclination. Initial Y-Axis, SN-MP, SN-Pog, SNB and SNA were the most predictive factors for the Y-axis. Although ML techniques seem to be promising for the prediction of future growth, larger sample sizes are needed to improve the accuracies of them even further.

Research Poster Presentations PEDIATRIC DENTISTRY

P65 Aerosolization of *S. mutans* From Stainless-steel Crown Preparations. M. WESTBERG*, A.C. SCULLY, J.F. YEPES, J.E. JONES, G. ECKERT, R.L. GREGORY (Indiana University School of Dentistry and Riley Hospital for Children)

Purpose: The aim of this *in-vitro* study is to assess the effectiveness of three isolation methods used during an operative procedure performed by dentists on pediatric patients. It also assesses the distribution of *S. mutans* by aerosolization from the same procedure performed in a closed-room operatory. Methods: Melamine typodont teeth coated in laboratory-grown biofilm were prepared for stainless-steel crowns using 3 isolation methods with high-volume evacuation (HVE). Open petri dishes were placed in 5 locations throughout a closed-room operatory during preparation and 10 minutes immediately following. Bacterial colonies were counted after incubating each plate for 48 hours. The effects of isolation method and location on bacteria colony counts were analyzed using generalized estimating equation methods applied to negative binomial regression for count data. Results: Bacterial colony counts for teeth prepared with dental dam (DD) isolation were significantly higher than those prepared with a Dryshield (DS) and with no isolation at the assistant (A), operator face shield (FS), and patient (Pt) locations (all $p < 0.003$ or less). No significant differences were found among isolation methods for parent (Pa) or rear delivery (RD) locations. The location that produced the most bacterial colony counts with DD isolation were FS, followed by A, Pt, and then RD and Pa. Counts produced from teeth prepped with DS isolation were significantly higher at the Pt location than the A, FS, RD, and Pa locations. Conclusion: Of the three isolation methods tested, the DD allowed the highest quantity of bacterial colonies to form at locations nearest the site of the procedure (FS, A, Pt locations). DS isolation performed better than no isolation at limiting bacterial colony formation at the A location but performed similarly at limiting their formation at the Pt and FS locations. The RD and Pa locations rarely produced bacterial colonies, regardless of isolation method. (Financial support for this project was supplied by the graduate research committee at the Indiana University School of Dentistry)

P66 Occupational Noise Exposure in the Pediatric Dental Setting. M.E. BATES*, T. HSU, J.F. YEPES, K. PHASUK, C.M. DISCOLO, A.C. SCULLY (Indiana University School of Dentistry and Riley Hospital for Children)

Objective: Dental professionals are exposed to loud and high frequency noises as part of their daily work environment. In the pediatric environment, dental noises are coupled with cries and screams of children exhibiting pre-cooperative and noncooperative behavior. This study evaluates the noise levels recorded in a hospital-based pediatric dental clinic, and evaluates exposure of personnel to potentially hazardous noise levels. Methods: Data was collected with the use of a sound level meter (SLM) and a noise dosimeter. The SLM is used to measure background noise statistics for a given location. The locations studied by the SLM include: quiet room, open bay setting, oral sedation operatory, and operating room. The noise dosimeter measures personal sound exposure of the dentist, and was worn clipped near the left ear of a pediatric dental resident. The dosimeter records data closest to that perceived by the human ear. Data analysis includes summary of peak and average levels of noise exposure compared to OSHA thresholds and comparison of clinic settings using a two-sided ANOVA with a 5% significance level. Results: Initial data indicates personal daily exposure measuring 0.3%-9.2% of OSHA allowance, and peak decibels reaching 148.5 dB. The peak values reached at least 115 dB daily, with peak values reaching over 140 dBA on 15% days of data collection. Conclusion: Initial results suggest peak decibel readings as loud as nearby fireworks. Peak decibel values regularly reached the threshold of pain, occurring between 120-140 dB. The data gathered through this study provides valuable information regarding potentially hazardous noise levels that pediatric dental professionals are exposed to as part of daily work activity. (Research supported by Indiana University School of Dentistry Graduate Student Research Committee)

P67 Effects of Supplemental Oxygen Concentrations and Risk of Surgical Fires. A.R. KOLAR*, J.E. JONES, M.A. SAXEN, G. ECKERT, J.F. YEPES (Indiana University School of Dentistry and Riley Hospital for Children)

Background: During dental procedures using oxygen supplementation, a highly saturated oxygen environment is potentially created due to oxygen pooling in the oral cavity. High oxygen concentrations pose a serious threat due their link to increase flame ignition and prolonged flame. It is crucial to obtain a better understanding of the effects of supplemental oxygen during dental procedures and oxygen concentration levels in the oral cavity to prevent future surgical fires. Objective: To utilize an intraoral laboratory-based model to measure oxygen concentrations over time when delivering supplemental oxygen at 3 L/min. Design: Oxygen concentrations were recorded during lab-based procedures simulating oxygen supplementation of 3L/min to an oral cavity with the introduction of the high-speed dental suction tip, the Yankauer suction tip, and the standard fixed tip saliva ejector when introduced at specified times. Hypothesis: For test conditions in which supplemental oxygen is supplied per trial, FiO₂ measured in the oral cavity will reach levels >21%. We also hypothesize that oxygen pooling, if found, will be diminished equally with the introduction of the high-speed dental suction tip, the Yankauer suction tip, and the standard fixed tip saliva ejector when introduced at the specified times in the test protocol. Conclusions: The conclusions from this research will allow dental providers in a surgical setting to limit the pooling of oxygen in the oral cavity during procedures, in order to help eliminate the potential for surgical fires. (Research supported by Indiana University School of Dentistry Graduate Student Research Committee)

P68 Evaluation of Silver Diamine Fluoride Application in the Primary Dentition. J. SCHLOTZ*, A. SCULLY, J.F. YEPES, B. SANDERS, G. MAUPOME (Indiana University School of Dentistry)

Objective: The aim of this study is to use dental claims to longitudinally evaluate subsequent treatment outcomes of primary teeth that initially receive application of 38% silver diamine fluoride (SDF). Methods: Two cohorts from 2018 and 2019 were evaluated for >24 months. Data from children 12 years old and younger with at least one primary tooth initially treated with SDF were obtained from a commercial dental insurance claims warehouse. All subsequent treatment on each tooth was recorded. Results: Data from 46,884 patients [Mean(SD) Age [y]=5.7(2.3); male 48%; SDF-treated teeth=2.6(2.1)] were analyzed over >24 months. The odds of initial SDF-treated teeth receiving future additional treatment decreased with patient age ($P<.001$). Pediatric dentists provided initial SDF treatment more frequently than general dentists (67%). However, the odds of providing future additional treatment on SDF-treated teeth were lower for pediatric dentists (38%) than for general dentists (41%) ($P<.001$). The odds of future additional treatment were higher for primary posterior teeth (40%) than anterior teeth (23%) ($P<.001$). Lastly, the odds of future additional treatment were higher for teeth expected to exfoliate in greater than 2 years ($P<.001$). Conclusion: General dentists are more likely than pediatric dentists to provide additional treatment on primary teeth initially treated with silver diamine fluoride. Posterior primary teeth initially treated with SDF are more likely than anterior primary teeth to receive future additional treatment. Lastly, primary teeth initially treated with SDF with >2 years until anticipated exfoliation are more likely than teeth with <2 years until anticipated exfoliation to receive additional treatment. (Research supported by Indiana University School of Dentistry Graduate Student Research Committee and IRB Protocol #16312)

Research Poster Presentations PERIODONTICS

P69 Bacterially-Inflamed Osteocytes Promote Inflammatory Cell Migration In Vitro. A. DOAN*, T. YOSHIMOTO, M. KITTAKA, Y. UEKI (Indiana University School of Dentistry)

In an aging U.S. population, tooth loss in individuals with periodontitis have decreases in their quality of life due to difficulties in speaking, chewing, and swallowing. However, while many advances have been made, the destruction of alveolar bone in periodontitis is still very difficult to cure completely, even with the removal of bacterial plaque and infected lesions. Therefore, understanding the etiology of the diseases is very important to develop new curative therapies. Osteocytes are the most abundant cell type in bone and were once thought to be passive, inactive cells serving as placeholders within bone. However, in the last decade, it has been discovered that they are multifunctional. Their secretion factors can serve as targets to develop new therapeutics, such as anti-sclerostin and RANKL therapies for osteoporosis. It has also been revealed that numerous inflammatory factors are secreted from osteocytes in response to bacterial stimulation. Recently, we found that osteocytes express significantly higher levels of RANKL than osteoblasts in response to bacterial pathogen-associated molecular patterns (PAMPs) which stimulate the myeloid differentiation primary response gene 88 (MYD88) pathway. Furthermore, using genetically-modified mouse models, we discovered that the osteocyte MYD88 pathway directly regulates osteoclastogenesis and bone resorption in the *P.gingivalis*-induced periodontitis model (Yoshimoto et al., 2022 Nat Commun). In the current study, we hypothesized that osteocytes activated by the pathogenic component of bacteria regulate the migration of inflammatory cells. We discovered that the culture supernatant of osteocytes stimulated with Pam3CSK4 (a specific activator for the MYD88 pathway via TLR2) increased the chemotaxis of neutrophils and macrophages in vitro. These findings suggest that bacterially-inflamed osteocytes are involved in the recruitment of inflammatory cells in periodontitis. However, specific osteocyte-derived factors that regulate the recruitment of these immune cells remain to be identified. (Supported by R01DE025870 and R01DE025870-06S1)

P70 Comparison of Two Commercial Antibacterial Agents Against Pathogenic Bacteria A. BRIDWELL*, C. BATRA, R.L. GREGORY (Indiana University School of Dentistry)

Post-surgical complications are routinely encountered in daily practice, amongst which post-operative infection is the one most commonly observed. The overall prevalence of post-operative infections in a retrospective study was found to be 2%. Many antibacterial agents have been used as a part of the post-operative kit given to patients. Recently, two novel antibacterial rinses became available for marketing and use. The study objective was to compare the anti-bacterial action of CloSYS mouthwash (CLO) and herb-based mouth rinse, VEGA on *Streptococcus mutans* and *Porphyromonas gingivalis*. *S. mutans* and *P. gingivalis* were incubated with serial dilutions (1/4, 1/8, 1/16, 1/32 and 1/64) of the two anti-bacterial agents in their respective media. Minimum inhibitory and minimum bactericidal concentrations (MIC/MBC) were measured using a spectrophotometer (595 nm) and blood agar plates, respectively. CLO significantly inhibited the growth of *S. mutans* from the 1/4 to the 1/32 dilutions ($p < 0.05$) and *P. gingivalis* from 1/4 to the 1/16 dilutions ($p < 0.05$). VEGA significantly inhibited the growth of *S. mutans* from 1/4 to the 1/8 dilutions ($p < 0.05$). *S. mutans* MBC for CLO was determined to be 1/16 and *P. gingivalis* MBC for CLO was determined to be $< 1/4$. *S. mutans* MBC for VEGA was determined to be $< 1/4$. Within the limitations of the study, it can be concluded that CLO is both bacteriostatic and bactericidal towards *S. mutans* up to higher dilutions of 1/32. CLO is bacteriostatic towards *P. gingivalis* to the 1/16 dilution. VEGA was bacteriostatic to *S. mutans* only to the lower dilution of 1/8. The results of this study may be extrapolated for developing a post-surgical protocol. Future clinical studies to investigate the effects of these agents on fibroblasts for wound healing and patient reported outcomes need to be undertaken.

P71 The Effect of FOV of CBCT on Guided Implant Surgery. H.C. LEE*¹, L.L. CHIOU², C.C. YANG¹, W.S. LIN¹, V. DUTRA¹, Y. HAMADA³ (¹Indiana University School of Dentistry), ²University of Connecticut Health Center, ³University of California Los Angeles School of Dentistry)

Introduction: Although a smaller size field of view (FOV) of Cone-Beam Computed Tomography (CBCT) reduces radiation exposure, its effect on the accuracy of static computer-aided implant surgery (s-CAIS) remains unknown. Aim: The aim of this study were to evaluate the effects of the size of FOV on the accuracy of S-CAIS and to investigate if this effect is affected by the arch. Material and Method: The design of this study is a preclinical randomized controlled trial. A total of 32 implant sites on 8 identical CBCT scannable models (maxillae and mandibles) were randomly allocated to two FOV sizes: test (5cm x 5cm) and control (10cm x 10cm). All models were scanned with intraoral scanner (IOS). With the registration of the surface scan and CBCT image, a prosthetic-driven implant position was planned. Following the fabrication of surgical templates, a blinded surgeon placed all implants with the fully-guided s-CAIS protocol. The implant positions were captured by IOS with the scanbody attached. The angular deviation, 3D deviation at the crest and 3D deviation at the apex between

preplanned and actual implant positions were measured in implant planning software. Two-way ANOVA was used to analyze the effect of FOV and arch on the deviations. Results: The size of FOV did not show a significant effect ($p > 0.198$) on angular deviation, 3D deviation at crest and 3D deviation at apex. No significant difference was found when comparing the effect of size of FOV between the maxillary implants and mandibular implants. Conclusion: The use of small FOV CBCT provided comparable accuracy of static-guided implant surgery compared to the use of medium FOV CBCT. (Supported by Graduate Student Research Committee at IUSD and Periodontal Department of IUSD)

Research Poster Presentations PRACTICE MANAGEMENT

P72 Interprofessional Care for TMD: Psychosocial and Functional Treatment Outcomes. N. NOVOSEL*, M. DI GIOSIA, N.S. MATTHEWS (Indiana University School of Dentistry)

Temporomandibular disorders (TMD) encompass a group of musculoskeletal conditions that affect the temporomandibular joints (TMJ), masticatory muscles, and associated tissues. The Indiana University School of Dentistry TMJ Institute, established October 2021, is a multidisciplinary clinic designed to support the management of patients with challenging TMD. Professionals from dentistry, medicine, physical therapy and social work collaborate to create a customized, interprofessional consensus to patient care. For patients with a generic diagnosis of TMD, are psychosocial and clinical treatment outcomes improved when managed with an interprofessional care approach? The objective of this study is to compare psychosocial and functional symptoms of patients presenting to the Institute at initial and follow-up appointments, and to justify the efficacy of an interprofessional clinic model for TMD. We hypothesize that subjective accounts of anxiety, depression and pain should decrease, and jaw function should increase between initial and follow-up appointments. Preliminary data has been gathered to assess patient satisfaction after the initial appointment using a 5-Point Likert scale questionnaire. Between October 2021-February 2023, 51 questionnaires were distributed and 46 were collected. 48% of patients traveled over 50 miles. 'Strongly agree' was consistently the most selected response. The exception was whether patients preferred to meet with each clinician individually, to which 'disagree' and 'strongly disagree' was the most popular response, indicating that an interprofessional approach was preferred. 26% of patients disagreed or were neutral towards whether treatment progressed in a timely manner. One patient strongly disagreed that smooth coordination occurred between departments. Another disagreed with whether treatment options were clearly explained. Most patients diagnosed with TMD were highly satisfied with the interprofessional approach used at the TMJ Institute. The findings of our preliminary study support our primary study indicating that positive patient satisfaction is an important factor in assessing the quality and efficacy of interprofessional, patient-centered clinic models.

Research Poster Presentations PROSTHODONTICS

P73 Accuracy of Digital Duplication Scanning Methods for Complete Denture. A. ALEHAIDEB*, C.C. YANG, W.S. LIN, J. LEVON, T.M. CHU (Indiana University School of Dentistry)

The study aims to compare the accuracy of four digital scanning methods in duplicating a complete denture. The four scanning methods used were: cone beam computed tomography (CBCT), Dental Wings desktop scanner (DS), Trios intra-oral scanner (TIO), and Virtuo Vivo intra-oral scanner (VVIO). Each method was used to duplicate all the surfaces of a printed complete denture. The denture was scanned ten times in each group. The trueness (in root mean square, RMS) and precision (in standard deviation, SD) were calculated by comparing the combined, dentition, denture extension, and intaglio surfaces with the reference file. One-way analysis of variance and F-tests were used to test statistical differences ($\alpha=0.05$). For the scanning accuracy on the whole denture, CBCT showed the highest RMS (0.249 ± 0.020 mm) and lowest trueness than DS (0.124 ± 0.014 mm $P<0.001$), TIO (0.131 ± 0.006 mm $P<0.001$), and VVIO (0.227 ± 0.020 mm $P=0.017$), while DS and TIO showed smaller RMS than VVIO. For the trueness of dentition, denture extension, and intaglio surfaces, CBCT also showed highest mean RMS and lowest trueness among all groups ($P<0.001$). DS and TIO had smaller mean RMS and higher trueness among all groups in all surfaces ($P<0.001$, except VVIO in intaglio surface $P>0.005$). TIO had significantly lower within-group variability of RMS and highest precision among all groups in the combined surface. For dentition and denture extension surfaces, DS and TIO had similar within-group variability of RMS and lower than CBCT and VVIO. The result of the study showed that there were significant differences in the accuracy of the four scanning methods. The highest trueness was found in DS, and TIO, while CBCT had the lowest trueness. The TIO was more precise in the combined surfaces than other scanning methods, while DS and TIO were more precise in denture extension surface.

P74 Scanning Technique Effect on Shade Measurement by an Intraoral Scanner. E. AL KABA*, A. ALFARAJ, W.S. LIN (Indiana University School of Dentistry)

Introduction: Shade selection has always been a challenging task influencing esthetic outcomes in dentistry. Therefore, different instrumental methods have been developed and used with the aim to record shade to aid in the fabrication of a prosthesis with accurate esthetic results. The accuracy of different intraoral scanners has been examined in the literature. However, the results of such studies were based on scans taken in 2D format. Objective: To evaluate the accuracy of the color reading function of the 3Shape scanner in the 2D scan in comparison to the 3D scan. Materials and methods: The 3Shape scanner (Trios 4) color function was used for the purpose of this study. The IPS e.max Press/CAD HT Shade Guide was used and covered with VPS putty material to cover the metal part of the shade guide tap. This ensured a superior quality of the scan. 10 readings were recorded for each shade on a flat surface in a 2D scan and 10 other readings were recorded for the 3D scan. Reading for each shade was recorded in the middle third of the shade guide individual specimen. Fisher's Exact tests were used to compare 2D and 3D scanners for differences in shade distribution for each shade tab. Negative binomial generalized linear models were used to compare 2D and 3D scanners for differences in the number of shades present for each tab. Results: at 5% level of significance, statistical significance was found in shade A1 and D2 when comparing the two scanning techniques. The results of the negative binomial generalized linear model show that there was no dependence between the number of shades presented in each shade tab and the scanning technique. Conclusion: The clinician should not only rely on the color function in the 3Shape Scanner (Trios 4) when selecting restoration's shade.

Research Poster Presentations PUBLIC HEALTH

P75 Mapping of Dental Public Health Education at IUSD. B. GEHLHAUSEN*, E.A. MARTINEZ-MIER, A. SHUKLA (Indiana University School of Dentistry)

Competency-based education is a trusted approach to evaluate students' performance and learning outcomes, specifically in dentistry. This study will analyze how the Dental Public Health curriculum at Indiana University School of Dentistry (IUSD) adheres to the core dental public health competencies. To assess this question, a syllabi review was conducted to identify if IUSD complies with the American Association of Public Health Dentistry (AAPHD)'s Dental Public Health competencies. This was accomplished by creating an excel document that listed all 121 courses at IUSD. Before starting the review, all researchers completed a training case to agree on the method of syllabi review. Each syllabus was reviewed by two individuals using guiding questions to decide if the course would be included in the survey. Eighteen courses were selected to be included in the survey. Our next step includes completion of focus groups with the faculty of each of the selected eighteen courses. After obtaining the final results, this study aims to map the Dental Public Health curriculum at IUSD, propose curricular changes in support of these competencies, and bridge the gap between competencies and clinical practice through the development of entrustable professional activities (EPAs).

P76 Association Between Dental Fluorosis Severity and Dental Caries. T. POWELL*, G. CASTIBLANCO-RUBIO (Indiana University School of Dentistry Department of Dental Public Health and Informatics)

Dental enamel with fluorosis has a higher porosity compared to sound enamel, which may favor the development of biofilms and subsequently, dental caries. The purpose of this exploratory review was to conduct a non-systematic literature search to identify knowledge gaps in the relationship between moderate to severe dental fluorosis and dental caries. We searched the PubMed database for the following keywords: moderate and severe dental fluorosis, fluorotic enamel, and dental caries. Articles were independently assessed. Two *in-vitro*, three RCTS and two epidemiological designs (2006-2021) studying the relationship between moderate to severe dental fluorosis and dental caries were included. The first *in-vitro* study concluded moderate fluorosis makes enamel less resistant to dental caries due to higher porosity, whereas the second one found that severe fluorotic surface roughness contributes to the adhesion of *Streptococcus mutans*, favoring caries development. A RCT logistic regression model for caries showed higher fluorosis categories (TFI 5-6) were associated with increased odds (OR=6.81, p=0.001) of caries experience (D3>1). Another RCT concluded the highest DMFS (1.1+/-1.7) was found among severe opacities (DDE score 6). The third RCT concluded dental fluorosis is less likely to cause dental caries. A cross-sectional study revealed fluorosis TFI≥4 was more likely to have caries compared to TFI<3 (OR=1.93, 95%CI 1.06-3.53, logistic regression). Another cross-sectional study showed statistical significance (p<0.005, chi²) between prevalence of

dental caries and $TFI=0/TFI>1$. In conclusion with this exploratory literature review, we can conclude that there are inconsistencies between results from each study due to differing study designs, study goals, methods and environmental factors including saliva, dental biofilm, and fluoride. More homogeneous study designs exploring severe dental fluorosis and dental caries and controlling for confounders need to be conducted to gain a better understanding of the relationship between dental fluorosis and dental caries.

P77 Association of Periodontal Disease and Inequities with Long Haul COVID-19. S. ALHAFFAR*, M. SRINIVASAN, A. SHUKLA (Indiana University School of Dentistry)

In 2000, the Surgeon General's report highlighted that the mouth is a mirror for overall health of an individual and that disparities in oral health are directly proportionate to general health inequities. Among patients hospitalized due to COVID-19, diabetes and cardiovascular disease are the most common comorbidities; several studies support the association of these conditions with periodontal disease. The primary aim of this study is to assess the disproportionate impact of the COVID-19 pandemic on populations from lower socioeconomic statuses. The study also aims to assess association of self-reported periodontal disease with COVID-19 disease course and severity. A sample population of Indiana residents with positive diagnosis of SARS-CoV-2 were recruited. A validated survey tool was sent to this cohort inquiring about sociodemographic distribution; co-morbid conditions, current symptoms of "long haul COVID," course of their COVID-19 infection; history of periodontal disease, existing periodontal disease symptoms, and oral hygiene habits. A total of 276 individuals with history of positive COVID test were returned to the survey, and associations of participant characteristics and periodontal disease-related survey items with COVID-related survey items were evaluated using chi-square tests. Lowered sense of taste was associated with older age, worse health, more frequent bleeding gums, more frequent mobile/loose teeth, potential gum disease, more frequent toothaches, worse oral health, and history of teeth lost due to gum disease. Lowered sense of smell was associated with less education, being unemployed/disabled, worse health status, more frequent bleeding gums, more frequent toothaches, and lower oral health rating. History of hospitalization due to COVID-19 was associated with more frequent dental floss use and more frequent mouth rinsing. History of hospitalization due to COVID-19 was also associated with history of gum disease within the past 12 months.

Research Poster Presentations TISSUE REGENERATION AND REPAIR

P78 Characterization of Nedd4 Protein in Mouse and Human Differentiated Osteoblasts. D. MARIN*, J.M. HONG, A. BRUZZANITI (Indiana University School of Dentistry)

The Neural Precursor Cell-expressed Developmentally down-regulated protein 4 (Nedd4) is an E3 ubiquitin ligase involved in ubiquitination and proteosomal degradation. The role of Nedd4 in mineralized tissues is not defined. It was reported that Nedd4 transgenic mice show increased osteoblast proliferation and elevated bone mass (mice sex was not reported). Nedd4 is also being investigated as a target for $ER\alpha$ degradation in $ER+$ breast cancers. In tooth, it was reported that Nedd4 family regulate odontoblastic differentiation suggesting it may participate in the regeneration of the pulp-dentin complex. The objective of this study was to characterize Nedd4 protein expression in stromal osteoblasts from wild-type and Pyk2 knockout (Pyk2-KO) mice and from osteoblast-like cells differentiated from human dental pulp stem (hDPSC) cells at different differentiation days. Samples were collected and analyzed by SDS-PAGE and Western blotting. Nedd4 rabbit polyclonal antibody IgG was used for identifying Nedd4 expression normalized to β -actin, followed by densitometry analysis using ImageJ software. The results suggest that Nedd4 is expressed in mice and human osteoblasts. Nedd4 levels in stromal osteoblasts showed a peak increase at day 7, with Pyk2-KO osteoblasts showing higher Nedd4 levels at day 7, and lower levels by day 21, compared to WT osteoblasts. This study suggests that Pyk2 may regulate Nedd4 levels in osteoblasts, and as a consequence could affect degradation of $ER\alpha$. These studies are the first step for future studies to understand the interaction between Pyk2, Nedd4 and $ER\alpha$ proteins in osteoblasts and their role in regulating mineralized tissues. (Supported by Grant No. 1R01AR080076)

P79 Specific Domains of Kalirin Respond to Glucose and Alter Dendrite Length in Osteocytes. K. CHESTER*, J.M. HONG, A. BRUZZANITI (Indiana University School of Dentistry)

Background: Osteocytes communicate with one another and other bone cells via dendrites to regulate bone mass. However, the exact signaling mechanisms involved are not yet realized. Kalirin is a GTP/GDP exchange factor (GEF), first associated with the activity of neurons and neurological diseases. Kalirin was found to regulate neuronal dendrite length, morphology, and function. Dr. Bruzzaniti's group demonstrated that Kalirin is expressed in osteoclasts, osteoblasts, and osteocytes and that global Kalirin deletion leads to low bone mass in mice. Others reported that Kalirin contributes to glucose uptake in

skeletal muscle. Further studies supported the idea that the microenvironment affects osteocyte proliferation and maturation, including glucose concentrations. Hypothesis: We hypothesized Kalirin may regulate osteocyte proliferation and dendrite morphology in response to glucose. Methodology: MLO-Y4 osteocytic cells were cultured in 2.5% FBS/2.5% FCS at a plating density of 20K/well in a 24-well plate and transfected via lipofectamine and plus reagent with cDNA expressing the serine/threonine kinase (KIN) and GEF1 domains of Kalirin. An empty vector served as the negative control. 48 hours after transfection, the cells were cultured in media supplemented with 0 mM, 2.5 mM, or 25 mM glucose. Transfection efficiency, observed via Green Fluorescent Protein (GFP) expression, was confirmed to be ~80%. Dendrite length was measured via ImagePro software. Proliferation was measured via an MTS assay. Statistical analyses were performed by student t-Test and 2-way AVOVA. Results: Although MLO-Y4 cells expressing Kalirin KIN and GEF1 domains showed decreased overall proliferation compared to the vector control, high glucose increased MLO-Y4 proliferation, independent of Kalirin expression. Further, visual microscopic observation revealed longer dendrites in MLO-Y4 cells expressing the Kalirin domains, which were further increased with glucose. Conclusion: Glucose and Kalirin may involve common or overlapping signaling pathways which lead to dendrite lengthening in osteocytes. However, separate pathways regulate osteocyte proliferation.

P80 Adipose Stem Cell-Derived Secretome Therapy for Amyotrophic Lateral Sclerosis. Z. ESTAKI*, J. WANG, C.H. MUMAW, V. PHILLIPS, C. WALKER (Indiana University School of Dentistry)

Objective: Amyotrophic lateral sclerosis (ALS) is a devastating motor neuron (MN) disease with no cure. The involvement of numerous cellular and physiological processes and the complexity of the disease are significant obstacles to developing effective therapies. Thus a multifactorial approach like stem cell-based therapeutics is likely to be the most appropriate as it can target multiple mechanisms simultaneously. Adipose-derived stem cells (ASCs) are multipotent mesenchymal stem cells that can be obtained easily from adipose tissue. Stem cell secretomes contain various beneficial trophic factors and cytokines. In the present study, we hypothesized that administration of ASC secretome at late pre-symptomatic stages (PD70-P90) of disease would improve muscle function, and extend lifespan. Methods: The mSOD1G93A ALS mice were randomly assigned to an ASC secretome treatment group or a vehicle (basal medium) treatment group. The animals were then injected intraperitoneally (i.p.) with 200 μ L ASC secretome or vehicle from 70 to 90 days of age. Disease progression was evaluated by muscle performance tests and overall survival rate. Results: ASC secretome therapy at the late pre-symptomatic stage significantly improved muscle performance measured by limb extension and grip endurance ($p < 0.05$). ASC secretome therapy also prevented muscle atrophy, evident from greater wet muscle weight in ASC secretome-treated group compared to the vehicle-treated group ($p < 0.05$). Finally, ASC secretome administration significantly extended the lifespan in SOD1 mice ($p < 0.05$). Conclusion: This study shows the therapeutic benefits of systemic ASC secretome in experimental ALS, and establishes a foundation for future research into the treatment effects and mechanistic analyses of stem cell-based therapies in ALS.

P81 Kalirin Deletion in Osteoclasts Leads to Bone Loss. D. GODFREY*, J.M. HONG, M. TUDARES, A. BRUZZANITI (Indiana University School of Dentistry)

Osteoblasts, osteocytes, and osteoclasts collectively regulate bone mass, structure, and quality via remodeling. Kalirin, a GDP/GTP-exchange factor originally described in neurons, has been identified to have a significant effect on bone density. We previously elucidated the effect of global Kalirin deletion in mice, which revealed significant bone loss. The objective of the current study was to determine the skeletal effect of Kalirin deletion targeted to osteoclasts at different stages of osteoclastic differentiation. To this objective, Kalirin-floxed mice were crossed with Cre-mice expressing either tartrate resistant acid phosphates (TRAP) or Cathepsin K (CatK) to generate Kalirin-TRAP and Kalirin-CatK knockout mice, lacking Kalirin in osteoclast progenitors and mature osteoclasts, respectively. Male and female experimental mice and Kalirin-floxed littermates were analyzed *in-vivo* at 8-weeks ($n=10-17$), 14-weeks ($n=7-14$), and 24-weeks ($n=7-16$) for changes in femoral bone mineral content (BMC; mg) and bone area (cm^2) using a Lunar PIXImus Densitometer. Female Kalirin-TRAP mice showed a significant ($p < 0.05$) decrease in BMC (-6.49%) and bone area (-7.81%) only at 14-weeks. Similarly, female Kalirin-CatK mice showed a significant decrease in BMC (-7.21%) only at 14-weeks. In contrast, male Kalirin-TRAP mice and male Kalirin-CatK mice did not exhibit a significant change in these parameters, compared to genotype-, sex-, and age-matched littermates. Our data suggests Kalirin directly regulates bone mass through its actions on osteoclasts, in a female-specific and age-dependent manner. Future studies will investigate the Kalirin mechanism of action during inflammation and age-associated bone loss. These findings will elucidate Kalirin's complex role in regulating bone homeostasis and may lead to novel targets for the treatment of bone diseases in males and females. Through further investigation of Kalirin's role in bone regulation, a novel method of bone regulation may be discovered which would allow for significant improvement in the treatment of the periodontium.

P82 Effects of Pyk2 Deficiency and Estrogen Signaling on Osteoclast Activity. I. MASOOD*, A. BRUZZANITI, J.M. HONG, D.M. CADAVID (Indiana University School of Dentistry)

Osteoclasts are the primary cells involved in the process of bone resorption. Many bone diseases, including osteoporosis and periodontitis, involve increased osteoclast activity. Estrogen also plays a significant role in bone metabolism and the absence of estrogen leads to increased osteoclast activity, as is observed following menopause. The Pyk2 tyrosine kinase is a key protein involved in the regulation of osteoclast resorption activity. Absence of Pyk2 decreases osteoclast activity. Further, it was reported that Pyk2 deficient osteoblasts showed increased osteogenic activity *in vitro* in response to estrogen. The objective of this study is to establish a potential relationship between Pyk2 and the estrogen receptor (ER) alpha (ER α) and/or beta (ER β) in osteoclasts. In addition, we examined Nedd4 protein, which targets proteins, including the estrogen receptors for degradation. The overall hypothesis is that absence of Pyk2 may activate Nedd4 to degrade ER α , decreasing osteoclast resorption. Male and female wild type and Pyk2 knockout (KO) mice were used for bone marrow preparation. Bone marrow non-adherent cells are cultured in media with 10% FBS and RANKL and MCSF to induce osteoclast formation. After 5 days, mature osteoclasts were used for qPCR analysis. Statistical analysis involved student t-Test with $p < 0.05$. The results suggest an inverse relationship between Pyk2 and Nedd4. Specifically, in the absence of Pyk2, Nedd4 expression was upregulated. No differences in ER α and ER β mRNA levels were detected between WT and Pyk2-KO osteoclasts, which was consistent with previous data examining osteoblasts. Future studies will examine whether the increase in Nedd4 in Pyk2-KO osteoclasts regulates ER α and ER β degradation at the protein level by Western blotting, and the effects on osteoclast activity. This data will provide more information on the mechanisms that control osteoclast activity and will help to suggest future therapies for bone diseases, including preventing alveolar bone loss and restoring bone mass.

P83 Determining the Relationship Between NF κ B and CTMP in Muscle Atrophy. V.S. PHILLIPS*, J. WANG, C. MUMAW, P. KAVURI, E. MUANG, Z. ESTAKI, L. GOLDMAN, C.L. WALKER (Indiana University School of Dentistry)

Myotrophic lateral sclerosis (ALS), also known as Lou Gehrig's disease, is a fatal neurodegenerative disease identified by the progression of muscle paralysis. Akt is a key metabolic regulator in skeletal muscle and is negatively regulated by carboxyl-terminal modulator protein (CTMP). CTMP is significantly elevated during late-stage ALS muscular atrophy in mouse models. Tumor necrosis factor- α (TNF- α), an inflammatory molecule also associated with muscle atrophy, increases CTMP expression in cultured mouse muscle cells. TNF- α also activates the protein nuclear factor kappa B (NF κ B) and allows it to enter the nucleus. This study is a continuation of an ongoing project evaluating the relationship between NF κ B and CTMP proteins, and our hypothesis is that TNF- α -mediated NF κ B activation leads to upregulated CTMP expression and an increased progression of muscular atrophy. We have thoroughly investigated this premise by treating mouse myotubes with TNF- α while inhibiting NF κ B activity with a small molecule and examining subsequent CTMP expression via Western blot analysis. We also directly knocked down NF κ B using siRNA as well as examined the NF κ B-CTMP link through chromatin immunoprecipitation (ChIP). Our results indicate NF κ B regulates CTMP expression following TNF- α stimulation in mouse myotubes. However, results from the chromatin immunoprecipitation did not confirm that NF κ B increases CTMP through transcriptional activation. Future research will investigate the mechanism by which NF κ B regulates CTMP expression.

P84 Combined Effects of a Pyk2 Inhibitor and 17 β -estradiol on Osteoblasts. M. TUDARES*, J.M. HONG, A. BRUZZANITI (Indiana University School of Dentistry)

Objective: Osteoporosis increases the risk of fractures in postmenopausal women and elderly men. Improving current osteoporosis treatments may reduce fracture risk. 17 β -estradiol (E2) is an osteoprotective hormone that decreases after menopause, accelerating bone loss. Pyk2 is a tyrosine kinase normally expressed in bone cells that promotes bone resorption by osteoclasts while inhibiting osteoblast activity. We have demonstrated that PF-4618433 (PF-46), a selective pharmacological inhibitor of Pyk2, stimulates osteoblast activity, as measured by alkaline phosphatase (ALP) activity and mineral deposition (Ca $^{2+}$), and reduces osteoclast resorption *in vitro*. In the current study, we investigated the combined role of Pyk2 and E2 in osteoblasts *in vitro*. We hypothesize that a combination of PF-46 and E2 (PF-46/E2) will increase osteoblast activity *in vitro* compared to PF-46 alone. Methods: Neonatal calvarial cells from C57BL/6 mice (n=2/sex) were seeded at a density of 2×10^4 in 24-well plates using phenol red free α MEM with 10% FBS and 1% P/S (basic media). The next day, osteogenic media (basic media + 50 ug/ml ascorbic acid + 5 mM β -glycerophosphate) containing 0.6 μ M PF-46, 100 nM 17 β -estradiol (E2) or both were added with replenishments occurring every three days. ALP and Ca $^{2+}$ deposition were measured after 21-28 days. 2-way ANOVA was used for statistical analyses. Results: PF-46/E2 showed a trend

towards increased ALP and Ca²⁺ deposition in male and female osteoblasts, compared to PF-46 alone. Additionally, PF-46/E2 did not negatively impact the osteogenic effect of E2 alone (13.5 vs 14.7 for females $p>0.05$; 8.83 vs 14.98 for males $p>0.05$). Conclusions: PF-46 alone can be used to increase osteoblast activity and may equal the effects of E2 *in vitro*. Further studies will investigate alternative dosages of PF-46/E2 that may provide more tailored benefits to osteogenesis and may also include PF-46 combined with raloxifene, which is clinically used to prevent bone loss.

Clinical Case Report Poster Presentations DENTAL HYGIENE

CC01 Management of Dry Mouth in a Patient with Parkinson's. S. GASH*, M. WHEELER, A. RIECK (Indiana University School of Dentistry)

Introduction: In America, there are roughly 1.5 million people who suffer from Parkinson's disease, which is neurodegenerative disease caused by the loss of dopamine levels in the brain. Symptoms of Parkinson's include tremors, muscle rigidity, and cognitive deficits, and the prevalence of the disease increases among older populations. As the condition worsens, people with Parkinson's disease struggle with oral health management due to limited mobility and medications that impact the oral cavity and should be given recommendations based on their needs. The prevalence of self-reported drug-induced xerostomia ranges from 50-77%. Anti-Parkinson's agents that can induce dry mouth include Carbidopa, Levodopa, Amantadine, and Entacapone. Results: A patient with Parkinson's disease presented to the dental hygiene clinic for their recall appointment. The patient reported xerostomia and displayed clinical signs of hyposalivation as evidence by dry, fissured tongue and angular cheilitis likely induced by his anti-Parkinson's medications. During the assessment, the patient reported limited mobility while brushing and flossing and a diet that consisted of frequent exposures to sugars and other fermentable carbohydrates. Based on these findings a dental hygiene care was developed to address the patient's dry mouth discomfort and risk for dental caries. Based on research, products such as Biotene, water flossers, and electric toothbrushes have been shown to significantly improve the symptoms of dry mouth and reduce the risk for decay. Conclusion: Treatment for this patient is on-going, but with clinical studies and strong patient compliance, it can be anticipated that there will be improvement in patient comfortability and decreased caries risk.

CC02 Short-Term Effects of Nonsurgical Periodontal Therapy. M. GILLAM*, M. MCGRUFF, A. RIECK (Indiana University School of Dentistry)

A 53-year-old male presented to the dental hygiene clinic with a chief complaint of wanting a teeth cleaning. Upon clinical examination, the patient presented with generalized plaque-induced diffuse gingivitis as evidenced by red, bulbous, spongy tissue and a bleeding score of 37% with generalized heavy calculus seen both clinically and radiographically. The patient was diagnosed with Stage 3 Grade B periodontitis due to probing depths up to 6 mm, interdental loss up to 3 mm, generalized horizontal bone loss extending to the coronal third of the root, and an indirect evidence score of 0.53. The patient was treatment planned for one quadrant of nonsurgical periodontal therapy on teeth numbers two and three and given extensive oral hygiene instructions and patient education regarding periodontal disease and systemic health as part of the dental hygiene care plan. The results of the nonsurgical periodontal therapy were based on a comparison between the patient's initial periodontal evaluation and the tissue reevaluation that was performed six weeks after the nonsurgical periodontal therapy. At the tissue reevaluation, there was a significant improvement in probing depths, bleeding, and the state of gingival health. Treatment success was based on a pocket depth reduction of 1 to 2 mm and a reduction of bleeding on probing as a secondary outcome. The 4 to 6 mm pocket depths on tooth numbers 2 through 5 all reduced by at least 1 mm and the bleeding score of the quadrant that received nonsurgical periodontal therapy improved from 13% to 1%. Initial periodontal disease severity and the efficiency of hand scaling instrumentation along with the ultrasonic produced an effective outcome for the patient. Conclusion: Nonsurgical periodontal therapy in an adult patient with active periodontitis resulted in decreased probing depths and bleeding score.

CC03 Oral Clinical Signs of Obstructive Sleep Apnea: A Clinical Case Report. A. LESTER*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Obstructive sleep apnea is a disorder in which one's breathing becomes obstructed and clears multiple times while one sleeps. With this condition, air flow can be blocked from the lungs. This condition also attributes to lack of proper sleep, thus effecting mental and physical health. As dental professionals, it is important to identify these clinical signs and work with patients and their primary care physicians to maintain oral and systemic health. Case Description: The patient is a forty-nine-year-old male who suffers from hypertension and has a BMI of 35.2. Patient reported history of loud snoring while sleeping and poor quality of sleep. Clinically it was observed that the patient had an elongated soft palate. He also

had ankyloglossia, commonly known as tongue tied. Patient had multiple abfraction lesions, some of which were restored with Class V composites. Patient presented with no periodontal disease. Treatment included a set of 4 BWX, prophylaxis, and fluoride varnish. Patient was placed on a six-month recall. Conclusion: The evidentiary risk factors and oral clinical signs suggest this patient suffers from obstructive sleep apnea. Although, it cannot be formally diagnosed without a proper sleep study. Future studies should focus on the recognition of clinical indicators to aid in early detection of the condition.

CC04 Patient's Perspective of Ultrasonic Scaling: Case Report. J. WEAVER*, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Periodontal disease is a multifactorial chronic condition, which in the advanced stages can result in irreversible loss of periodontal structures. Dental hygienists employ preventive, therapeutic, and educational services to prevent the onset and progression of periodontal destruction. Both manual and ultrasonic instrumentation have been found to be clinically effective at reducing the burden of periodontal inflammation. However, research concerning patient perspective of the varying methods is limited. The purpose of this case report is to shed light on a patient's perspective of ultrasonic scaling. Case: A 45-year-old male presented for preventative dental hygiene care. Patient reports no dental care for approximately five years and no experience with ultrasonic scaling. Assessment findings include a low oral health literacy, generalized 4mm-5mm probing depths, bleeding index score of 30.5%, and initial radiographic bone loss. Patient was diagnosed with stage I grade A periodontitis. Based on assessment findings, a recommendation of non-surgical periodontal therapy was made. Education concerning the ultrasonic instrument was given prior to usage. After treatment the patient was asked to describe their comfort level with the noise of the ultrasonic, if they would recommend ultrasonic scaling to others, and if they are happy with the results of the treatment. Conclusion: Overall, the patient reported he was comfortable with ultrasonic scaling but was anxious at first with the noise of the ultrasonic scaler. Inquiring about patient perspectives allow dental hygienists to provide comfortable and effective clinical care, especially for patients that are hesitant in seeking care. Future studies should explore how to create a more comfortable experience for patients receiving care throughout ultrasonic instrumentation.

CC05 Modifying an Appointment for a Nonverbal Patient with Hypersensitivity Issues. A. ZREBIEC*, J. NICKLES, P. RETTIG (Indiana University School of Dentistry)

Objective: The objective of this clinical case study is to present suggestions for modifications for a patient who is nonverbal with hypersensitivity issues. Background: A 21-year-old white male presented to the dental hygiene clinic with a chief complaint of "I need to get my teeth cleaned." The patient's medical history presented with Gastroesophageal Reflux Disease, Asthma, and Rheumatoid Arthritis. Patient is also nonverbal and has hypersensitivity issues. Assessment: Examination revealed generalized plaque induced marginal gingivitis evidenced by red spongy gingiva with inflamed, bulbous and spongy interdental papilla with a bleeding score of 14%. The patient has no existing decay. Hygiene habits included only brushing in the morning, no flossing, and no mouth rinse. The patient's plaque score was 28%. He also has no supervision during his oral hygiene routine. DH Care Plan: The proposed care plan included an adult prophylaxis, dental exam, and topical fluoride varnish. Patient received oral hygiene instructions including the recommendations of super floss for his fixed retainers, reach flosser for flossing his posterior teeth, and Listerine Zero due to the symptoms of dry mouth. Evaluation: Appointment modifications were made to make him more comfortable. Due to the patient being nonverbal, we also communicated through his phone, and due to the patient having hypersensitivity issues, we could not polish him because the noise was too loud. Scaling him also made him uncomfortable due to the noise. Conclusion: Due to the patient being nonverbal with hypersensitivity issues, it was difficult for the patient to show and hear his oral hygiene recommendations, which in turn influenced his oral cavity. Patient will continue to be observed and will continue to come to his 6 month recall cleanings.

CC06 Parafunctional Habits Associated with Mandibular Tori and Temporomandibular Disorder. P. BRADY*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Tori is an uncommon benign bony growth in the oral cavity. When found on the mandible, it is common for them to occur bilaterally. In most patients the presence of tori is harmless; however, the presence of mandibular tori and parafunctional habits may influence the temporomandibular joint. Temporomandibular joint disorder (TMD) is a pain or tenderness in the jaw caused from injury or parafunctional habits such as grinding and clenching. The objective of this clinical case report is to highlight the possible effects of mandibular tori and parafunctional habits on TMD. Case: A 24-year-old male presented for a routine prophylaxis. He had no history of chronic medical conditions and does not take any medications. He presented with clinical signs of attrition and severe wear facets on the mesial buccal cusps of #19 and #30. Along with these findings, large prominent bilateral mandibular tori were noted. It was apparent that the tori were

interfering with the patient's daily oral hygiene. Disclosing solution revealed heavy biofilm accumulation on the teeth superior to the mandibular tori. The patient also acquired a slight deviation to the left side of the jaw upon closing. The patient then reported having tenderness in the jaw in the mornings after waking up. The suggestion was made to have a personalized bite guard manufactured to sleep in to prevent any further injury from occurring. Discussion & Conclusion: When mandibular tori are large, they can impede on daily oral hygiene regimens and cause excess strain on the mandible. Diagnosing TMD is crucial to the overall comfort and health of patients. When left untreated or undiagnosed it can cause severe pain and discomfort. It is a critical role of the dental hygienist to be able to assist in the early detection of temporomandibular joint disorders.

CC07 Benign Migratory Glossitis: A Clinical Case Report. M. CHATMAN*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Benign migratory glossitis (BMG), or geographic tongue, is one of the most prevalent oral mucosal lesions. The condition is characterized by sporadic red lesions that are enclosed by white borders. The tongue's natural papillae are not seen within the red patches. This condition brings about sensitivity within the oral cavity, often resulting in a burning sensation. This condition is usually seen in patients who are young adults but can occur at any age. Although the exact etiology is unknown, there are several risk factors that put individuals at risk for developing BMG. Case: A 22-year-old female presented with geographic tongue as well as slight-moderate gingivitis. The medical history was not significant. The patient suffers from an over sensitive tongue, which often restricts her diet. Intra-oral examination revealed red patchy lesions on the dorsal side of the tongue. The lesions were in various stages of healing with multiple locations. Since the clinical diagnosis was straightforward, a biopsy was not deemed necessary. The patient was reassured of the benign nature of the lesion. For symptomatic relief, topical application of Triamcinolone acetonide and use of Benzylidamine mouth wash for 10 days was advised. Etiology of BMG could not be established in this patient. Conclusion: BMG is a completely benign mucosal lesion that shows periods of exacerbation and remission. Additional studies are needed to confirm possible risk factors and preventive strategies.

CC08 Understanding and Managing Pregnancy Induced Gingivitis. M. DAY*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: Pregnancy-induced gingivitis is a common oral condition found among pregnant patients. A majority of pregnant women do not understand the cause, treatment, and effects of gingivitis on their oral-systemic health. Common oral implications include gingivitis, pregnancy granulomas, and periodontitis. Providing pregnant women with the knowledge of gingivitis through patient education can improve their oral health as well as their newborn child. Case Description: A 25-year-old female patient came to the IUFW dental clinic for routine preventive prophylaxis. The patient was in her 2nd trimester of pregnancy and showed signs of generalized gingivitis. Clinical findings included gingiva that was red and inflamed with light-moderate bleeding upon probing/scaling. The patient had a bleeding index of 9.5% and a plaque index of 52.5% prior to treatment. The patient also had fibrous gingiva around teeth 14, 30, and 31. The patient had two appointments at IUFW to receive a prophylaxis and patient education concerning her oral health and her unborn baby. She received information on the cause, treatment, and long-term effects of pregnancy-induced gingivitis. Conclusion: Patient education improves the oral health of women with pregnancy gingivitis and helps them manage/reverse the effects. Future longitudinal studies need to be completed to fully understand how health promotion and education programs can improve the oral health of patients and children.

CC09 The Correlation Between Low Income Minorities and Periodontitis. M. ECKSTEIN*, S. MELCHI, L. BILLING (Indiana University School of Dentistry)

Objective: To discuss how low-income and minorities are at a higher risk for periodontal diseases due to a lack of access to dental care. Background: A 38-year-old, Hispanic, and low-income male, presented to the clinic with a negative medical history. The patient has never sought dental care and had no exposure to preventive care growing up. The patient presented with generalized, plaque-induced marginal gingivitis and Stage 3, Grade C periodontitis. Intervention: The patient received 4 quadrants of scaling and root planing with local anesthetic, along with oral hygiene and dietary intervention. His treatment plan included a tissue re-evaluation for comparison of gingival and periodontal conditions before and after intervention. Outcome: The patient has collections due for treatment and did not return for the tissue re-evaluation. Recent studies have found that the most common barriers to access to dental care are finances and lack of dental insurance. Unfortunately, this greatly impacts low-income families and minorities. This can cause patients to wait to seek dental care until they experience severe dental pain and are then faced with the dilemma of an emergency extraction being the only option available for treatment. An extraction can end up being more costly than non-surgical periodontal therapy, causing an even greater

financial burden to those with low-income. Conclusion: The patient did not return for subsequent treatment due to the financial burden and lack of dental insurance. Research reports that patients with a dental insurance barrier to care were less likely to see a dentist at follow-up. This case report suggests that those that fall into the category of low income and racial/ethnic minority groups are at a disproportionately higher burden of oral diseases and disorders due to suboptimal access to quality oral health care.

CC10 Oral Hygiene Modifications in a Patient with Spina Bifida. D. GARCIA*, J. HIRTZEL, T. RADER (Indiana University School of Dentistry)

Spina bifida is a congenital neural tube defect that occurs during the first few weeks of pregnancy with an occurrence rate in the U.S. of 1 in every 2,758 births, according to the CDC. The severity of the condition depends on exactly where and to what extent the spinal cord is affected. In the most severe cases, the spinal cord itself protrudes through the back which causes neurological disabilities that can result in total paralysis of the legs. Objective: To utilize treatment modifications so the patient is comfortable and provide homecare instructions that include the caregiver and the patient. Background: A 28-year-old African American male who requires a full-time caretaker presented to the clinic for a dental prophylaxis and comprehensive examination. A medical history evaluation revealed that the patient has spina bifida which has left him paralyzed from the chest down, while the patient maintains functions of his head and arms, but with dexterity limitations. The patient also presents with one functioning kidney, hypertension, and a history of numerous surgeries. Assessment: The patient presented clinically with excessive calculus deposits, severe malocclusion, and generalized diffuse plaque-induced gingivitis as evidenced by fiery red, smooth, shiny gingiva with bulbous papilla, rolled margins, and generalized bleeding. Radiographic findings indicate healthy bone levels 1-2mm from cemento-enamel junction to crest of bone. Care Plan: Full-mouth debridement followed by dental prophylaxis. Detailed oral hygiene instructions with caretaker and patient that include a change from morning brushing to evening and incorporate the use of a floss holder to aid in interproximal plaque reduction. Conclusion: Treatment for this patient is ongoing, but the anticipated results from regular recalls and modified homecare instructions will reduce plaque and calculus formation which will improve overall health.

CC11 Seeking Dental Care Outside the United States: One Case of Dental Tourism. A. GONZALEZ*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Healthcare in the United States, particularly dental care is often too expensive and inaccessible for many low-income families, rural communities, and/or certain minority groups. This can lead to many Americans traveling to other countries to receive medical and dental care. Medical tourism is when a person travels to another country for medical care. The most frequent conditions treated in medical tourism are dentistry, cosmetic surgery, cardiac conditions, in-vitro fertility, weight loss, and dermatology. Each year millions of Americans participate in medical tourism (Dalen 2019). Medical tourists from the United States commonly travel to Mexico and Canada, as well as countries in Central America, South America, and the Caribbean. While healthcare might be less expensive in other countries, it is important to evaluate the similarities and differences in the quality of care and procedures. Case description: A 25-year-old Hispanic woman living in the United States presented to the IUFW Dental Hygiene clinic for routine preventive services. The medical history was not significant. Clinical examination revealed a healthy periodontium and dentition. She reports previous removal of #1 and #16, which were recommended for extraction due to impaction. Extractions were completed in Mexico approximately one year prior. The patient reported the cost of treatment being the primary reason for seeking care outside of the United States; however, she also has relatives living in Mexico, which deferred cost of transportation and lodging. Additionally, the patient is fluent in both the Spanish and English language. Clinical and radiographic examination did not reveal any adverse complications of the surgical procedure. Conclusion: The cost of dental care in Mexico appears to be a major beneficial factor. According to this case report, the procedures/protocols for dental treatment in Mexico may vary to the United States; however, larger scale studies are needed to confirm this finding.

CC12 Oral Effects from Use of a CPAP Machine. T. HAIMES*, S. BARGO, P. RETTIG (Indiana University School of Dentistry)

Objective: The objective of this case is to evaluate oral effects on a patient from use of a continuous positive airway pressure (CPAP) machine. Assessment: A 67-year-old patient presented to the hygiene clinic for a teeth cleaning and a complaint of dryness in the mouth, lips, and surrounding tissue. The patient has been seen for cleanings yearly to biyearly since June of 2013. Medical history includes history of sleep apnea, hypertension, diabetes mellitus Type II, depression, and seizures. Gingival description: Patient presents with generalized diffuse possible nonplaque-induced due to medication and plaque-induced gingivitis as evidenced by dark red, soft, loose, and bulbous tissue. The patient stated he brushes with a fluoridated toothpaste two times a day with an electric toothbrush and flosses a few times a week with a water flosser. The patient is classified as high caries risk due to multiple medications causing xerostomia and marginal defects around crowns. DH Plan: The patient is seen every 6 months for adult prophylaxis and fluoride treatments. At all future appointments an ultrasonic scaler will be used to help keep the oral cavity lubricated and the patient comfortable. Vaseline is needed and reapplied throughout his appointments. Evaluation: The goal is for the patient to continue with great oral hygiene at home proven by low plaque scores and to see a decrease of tissue inflammation. At the patient's next cleaning we would like to see fewer signs of xerostomia and less dryness in the lips and surrounding tissue. The patient was also encouraged to see his doctor to ensure the CPAP has a proper fit and is being maintained properly. Conclusion: The patient was encouraged to seek medical advice from his doctor in regards to his inflamed, flakey tissue around his mouth. The OTC medication Aquaphor is recommended to use until he is able to seek medical advice.

CC13 Effects of Increased Blood A1C Concentrations and Periodontitis Recurrence. A. KRIEG*, H. STRONG*, A. RIECK (Indiana University School of Dentistry)

This clinical case study discusses the impact of increased blood sugar levels and the effects on periodontium. A 75-year-old female presented to the dental hygiene clinic for a four-month periodontal maintenance appointment one month overdue. The patient reported an increase in her HbA1c to 6.6 compared to her last HbA1c of 6.1 at her previous recall. Clinical examination revealed generalized plaque induced gingivitis as evidenced by medium pink, spongy gingiva, and blunted papilla with a bleeding score of 21%. Periodontally the patient presented with Stage 3 Grade B periodontitis as evidenced by bone loss extending mid third root and beyond, probing depths of 1-5mm with 4-6mm CAL (levels) due to recession and with 3mm interdental loss and an HbA1c of 6.6. Her clinical examination revealed an increase in periodontal pocking on tooth numbers 30 and 31. Due to the increase in periodontal probing depths, bleeding, and inflammation the patient was treated with localized non-surgical periodontal therapy to eliminate etiologic agents responsible for the previously mentioned symptoms. At the patient's subsequent 4-month periodontal maintenance recall appointment, the patient's probing depths were re-evaluated to reveal a decrease in pocketing depths on teeth 30 and 31 from 5mm to 4mm. At this appointment, the patient's HbA1c value stabilized to a value of 6.1 based on blood work completed at her recent primary care appointment. From this patient's case, it re-confirms with research that a patient's periodontal health can be impacted by uncontrolled HbA1c concentration leading to recurrence of active periodontal disease. Research examined studies have shown that treatment of periodontitis reduces blood sugar levels in diabetic patients. In conclusion, it is important to educate patients about the systemic link between diabetes and periodontal disease in order to achieve optimal periodontal health.

CC14 The Importance of Establishing a Dental Home: A Case Report. M. MILLER*, H. AYOUB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Establishing a dental home, especially at a young age is crucial for optimal oral health. Having routine dental care can help to prevent caries, periodontal disease, and oral systemic health complications. There are many barriers to care that people may face such as location, expenses, lack of insurance, disabilities, and transportation. People in the United States are more likely to have poor oral health if they have any of these barriers to care. As dental health professionals, it is important to educate the community about preventive dental care. Case Description: A 20-year-old male that has not been to the dentist in seven years. This is due to a traumatic experience that occurred at a very young age. There is prevalence of caries, gingivitis, sensitivity, and an ASA II classification of due to extreme dental anxiety. This patient came in for radiographs, a prophylaxis, and fluoride treatment. A 6-month recall for preventive care will be performed to evaluate any progression and update the treatment plan as necessary. Conclusion: Preventive dental care provided by dental hygienists can significantly reduce the burden and severity of disease. To increase utilization of services, efforts such as interprofessional collaboration, direct access to care, and preventive education must be used to positively impact the community. Future studies that would be beneficial are focusing on the ways that dental care can be more accessible to the populations that lack it most.

CC15 Oral Systemic Link Between Diabetes and Periodontal Health: Clinical Case Report. L. PARKER*, H. AYUOB, A. LAMPHERE (Indiana University School of Dentistry Fort Wayne)

Background: Diabetes mellitus (DM) and periodontitis (PD) are linked together in many ways. Diabetic individuals with periodontal disease have shown a greater negative impact on their glycemic control over a period of time. Similarly, uncontrolled diabetes can lead to uncontrolled periodontal destruction. The objective of this case report is to emphasize how effective glycemic control and periodontal therapy play a key role in the incidence of clinical complications. Case: An 81-year-old male presented for dental hygiene treatment as a Type II diabetic patient. The patient has encountered this chronic condition for 37 years. At the time of dental treatment, the patient's blood glucose reading was 231 mg/dL. Attempts to test blood glucose levels via gingival crevicular fluid were made; however, collection and isolation of samples were very difficult to obtain. The patient displayed clinical attachment loss (CAL) ≥ 5 mm, probing depths (PD) ≥ 6 mm, and mostly horizontal bone loss, which extended to the middle third of root and beyond. The patient was diagnosed with Stage III Grade B periodontitis and was scheduled for treatment of Scaling and Root Planning/Non-Surgical Periodontal Therapy (SRP/NSPT) in three separate appointments. Conclusion/Implications: Treatment of periodontal disease leads to improved health outcomes for diabetic patients; therefore, dental hygienists are able to aid in the early detection and control of diabetes. Future studies should focus on effective data collection techniques by utilizing gingival crevicular fluid in order to aid in the early detection and control of diabetes.

CC16 Epilepsy and Periodontal Health: Case Report. M. THOMPSON*, A. LAMPHERE, H. AYUOB (Indiana University School of Dentistry Fort Wayne)

Background: Epilepsy is a serious brain condition that includes the recurrence of unprovoked seizures. Nearly 5 million people worldwide are diagnosed with epilepsy each year. Most epileptic patients are controlled with anti-epileptic drugs (AEDs). Patients taking AEDs have a higher risk of negative oral health risks such as gingival hyperplasia and gingivitis. However, evidence is limited on overall periodontal health in patients with epilepsy. Case description: A 20-year-old female patient previously diagnosed with epilepsy at the age of 14 years old presented at IUFW dental clinic to receive prophylaxis. Due to patients taking AEDs, including Lamotrigine and Levetiracetam, side effects were present providing negative gingival health. Patients' dental history was dated back two years ago, which patient admitted was their most previous prophylaxis. Data was gathered over two appointments including periodontal charting, bleeding index, and normal prophylaxis. Pseudo-pocketing was found due to inflammation and bleeding was present upon probing. Plaque-induced gingivitis was diagnosed. Conclusion: AEDs play a significant role in the oral health of epileptic patients. Patients must be educated on home care instructions to improve oral health.

CC17 Oral Hygiene Modifications for a Visually Impaired Person. T. VANCE*, V. HILT*, T. RADER (Indiana University School of Dentistry)

Visual impairment can form a barrier between patients' oral hygiene habits and lead to increased disease progression. Without our intervention, bad oral habits can continue and lead to worsening conditions. Objective: To determine how to modify treatment and oral hygiene instructions for a visually impaired person. Background: A 57-year-old Caucasian female presented to the Dental Hygiene clinic for a dental prophylaxis and periodic exam. The medical history revealed that this patient is completely visually impaired, temporomandibular joint pain, has history of breast cancer, chemotherapy, radiation, and tobacco use. Assessment: The patient presented clinically with generalized healthy gingiva as evidenced by pink, knife edge, firm gingiva, and localized plaque induced marginal gingivitis on #2-3, 14-15 as evidenced by medium pink, soft gingiva, and rolled margins and a bleeding score of 10%. The patient presents with gingivitis on a reduced periodontium in a successfully treated periodontitis patient as evidenced by 1-3mm CAL levels with 4-5mm CAL level due to recession and localized 4-6mm probing depths on #3 and #14 due to inflammation with generalized bone loss extending to the mid third root and beyond. The DH care plan: Dental prophylaxis, regular dental visits in 3-month intervals vs. 6 months, and emphasis on patient education for oral hygiene instruction. Results: From this patient experience, we have found many modifications we can make to accommodate the special needs that visually impaired individuals require. Conclusion: With the repetition of dental cleanings and continuous importance on patient technique and education it will lead to overall better oral hygiene in visually impaired patients.

CC18 Importance of Effective Extraoral Exams in Discovery of Abnormalities during Routine Dental Visits: A Case Report. A. VAZQUEZ*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Background: The detection of palpable swollen lymph nodes and the discovery abnormalities during a dental visit are infrequent. Because of this these abnormalities can be easily missed during an extraoral examination. The objective of this case report is to highlight the importance of an effective extraoral exam during a dental visit. Case: A 51-year-old women came in for a 6-month prophylaxis recall. During an extraoral exam a swollen and palpable submandibular lump was discovered. Patient reported having on and off pain when swallowing for the past year as well as an uncomfortable and sore oropharynx. Based on the characteristic appearance of the lump the patient was referred to their primary care physician. The patient's care physician requested a grayscale and color doppler imaging in the submandibular region at the site of palpable lesion. Result revealed a single prominent lymph node measuring 1.5 x 0.7 x 1.6 cm with thickened cortex at the site of palpable lesion, and a second smaller lymph node was discovered measuring 0.6 x 0.7 x 0.3 cm. Due to a high index of suspicion for malignancy and no comparison available, a CT neck with contrast scan was requested. Examination confirmed submental and submandibular lymph nodes present. Additionally, a retention cyst was discovered in the floor of the right maxillary sinus. Physician recommended further evaluation with and ear, nose, and throat (ENT) specialist. Patient is currently in the process of reaching out to ENT. No further results have been revealed. Discussion & Conclusion: The discovery and reporting of palpable lesions during an effective extraoral exams is an important service dental hygienist can provide patients. Many abnormalities can be discovered and referred for furthered evaluation, potentially leading to a successful outcome. For future studies the incorporation of multiple studies on this subject are needed to validate the number of abnormalities missed during extraoral exams. Additionally, research on the different techniques of extraoral exams should be explore, to verify whether this affects the outcome of missed abnormalities during extraoral exams.

CC19 Patient Exhibiting Observable Intrinsic Discoloration. P. WARFIELD*, A. LAMPHERE, H. AYOUB (Indiana University School of Dentistry Fort Wayne)

Tooth discoloration in patients is among one of the most common chief complaints. Staining can be caused by many different factors throughout a patient's life. There are two forms of stain—extrinsic and intrinsic. Extrinsic stain is on the surface of the tooth and typically caused by consumption of different dietary products. Intrinsic staining can be caused by congenital or systemic influences. Defect formation is caused by disturbances that affect the body during the development of the dentition. Some of the possible disturbances include metabolic conditions, infections, trauma, radiation, drugs, and chemicals. The objective of this clinical case report is to highlight variation in anatomy and the possible causes of the intrinsic staining. A 30-year-old woman, who presented with mild intrinsic staining as the chief complaint for her dentition. She reported a history of high fevers during tooth development ages. Based on the appearance the intrinsic stain, a diagnosis of enamel hypoplasia was made. Potential of professional tooth whitening or veneers in order to treat the complaint was discussed with the patient. At this time, the patient is waiting to start any treatment. Identifying intrinsic staining and possible causes is an important part of patient care. There are a wide range of potential causes described in the literature and the treatment of the condition varies between patient desires. Future research needs to address other preventive measures and treatment options.

Clinical Case Report Poster Presentations ENDODONTICS

CC20 Endodontic Infection in a Tooth with Severe Attrition: Case Report. W. CASTEDO*, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry)

In severe attrition, teeth can become endodontically infected even with no pulp exposure. PP: a 69-year-old Hispanic male was referred to the IUSD undergraduate endodontic clinic for diagnosis and treatment of #9, with all communication and consent completed in Spanish. Medical history: Non-contributory. I/O: Teeth #7,8,9,10 showed severe incisal attrition and edge-to-edge occlusion. No caries. The patient wore an old removable partial denture (RPD). The patient identified #9 as the offending tooth. Sensibility testing: Cold-(Endo-Ice): negative. Electric-Pulp-Test (EPT): negative. Percussion: 3 Palpation: 3. Control teeth: WNL X-ray: #9 intact crown with severe incisal attrition. Break in PDL in apical 1/3, PARL. Diagnosis: #9: Pulp Necrosis with Symptomatic Apical Periodontitis (SAP). Explained the treatment options in Spanish; patient consented to nonsurgical root canal treatment (NSRCT) for #9. Treatment: Obtained profound tissue anesthesia and isolated # 9 via a rubber dam. The chamber was accessed, pulp necrosis was noted, and determined the working length by using an EAL and x-ray. Shaped the with hand instruments and Profile™ rotary files to size #30.04 and rinsed with 6% NaOCl, and 17% EDTA. Endo-Activator™ was used to agitate solutions—a final rinse with sterile water and dried the tooth canal. Obturation was done using a cold lateral condensation technique with BC-HiFlo sealer. Access was sealed with pink

and grey Cavit™, and occlusion was adjusted. Discussion: Teeth with Intact crowns are known to become infected, and the portal of entry is likely through micro-cracks. Severe attrition may compromise the pulp and make it more susceptible to infection. Patient compliance was challenging; thus, the patient received NSRCT in a single visit. The patient was not available for follow-up. Conclusion: Endodontic infection and pulp necrosis may occur in intact teeth with attrition. The preferred endodontic treatment sequence in patients with low compliance is in a single visit, but it requires proper explanation.

CC21 Conservative Endodontic Treatment of an Infected Heavily Restored Tooth. B. BYINGTON*, Y. EHRLICH, K. SPOLNIK, N. WARNER, (Indiana University School of Dentistry)

Platelet Rich Fibrin (PRF) is rich in growth factors, degrades over time, and can be used to form a membrane to place over a bony crypt after Root End Surgery/Root End Filling (RES/REF). This case report describes the treatment of a maxillary premolar, diagnosed as previously treated with chronic apical abscess, containing a separated instrument retained in the apical third of the root. A 31-year-old female presented to the graduate endodontic clinic with the CC "I have a swelling next to my tooth". Tooth #4 was evaluated and a peri-apical radiolucency (PARL) was noted radiographically. After vitality testing tooth #4 was diagnosed as previously treated with a chronic apical abscess. A peri-apical image showed tooth #4 to have a large cast post and separated instrument in the apical third of the canal which could complicate non-surgical re-treatment. CBCT image revealed a single canal with a 4x4x7mm PARL that perforated the buccal plate. RES/REF was chosen as treatment of choice. A full-thickness mucoperiosteal flap was raised and osteotomy performed. Lesion tissue was enucleated and biopsy sample obtained. Resected ~3 mm of apex. Separated instrument was removed. Ferric sulfate utilized for hemostasis within crypt. Ultrasonic retro-prep made into canal space and root end filling placed with EndoSequence Root Repair Material (ERRM). Demineralized freeze-dried bone allograft (DFDBA) placed into the crypt followed by calcium sulfate. PRF membrane placed over crypt. Flap repositioned and sutured. At 1-week post-op, sutures removed, minimal erythema, no edema, and chronic apical abscess absent. At 1-month incision lines no longer visible and healing uneventful. Conclusion: This case report demonstrated that RES/REF with the application of a PRF membrane can contribute to the resolution of chronic apical abscess.

CC22 Regenerative Endodontic Treatment in a Traumatized Central Incisor. D. EIDELSTEIN*, K. SPOLNIK, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry)

Introduction: Treatment of immature teeth that have undergone trauma has improved significantly throughout recent years. Tissue engineering has allowed for endodontists to restore teeth with a necrotic pulp to return to a healthy state and continue to grow and develop. Regenerative endodontic procedures allow for regeneration of functional pulpal tissues. Regenerative endodontic therapy is formulated to replace damaged structures such as dentin and root structures, including the cells of the pulp-dentin complex. Objective: Restoration of pulpal function and completion of root development is the goal in an immature tooth. This case report describes the treatment of a trauma induced permanent central incisor with an immature apex with regenerative endodontic therapy. Methods: After the tooth was diagnosed with pulp necrosis with symptomatic apical periodontitis, the tooth was accessed and the necrotic pulp was present. Canal was subsequently disinfected with copious amounts of diluted sodium hypochlorite. An interim treatment of double antibiotic paste was placed. After 8 weeks, intracanal bleeding was mechanically stimulated from the apical tissue forming a blood clot that extended to the cemento-enamel junction. Biodentine is placed on top of the blood clot, followed by BC blue liner and composite. Conclusion: This case report confirms that successful regeneration of a previously necrotic immature tooth is possible.

CC23 Management of Infra-Orbital Space infection + acute Apical Abscess. K. LIN*, Y. EHRLICH, M. SOVANICH, N. WARNER (Indiana University School of Dentistry)

Periradicular abscesses and cellulitis occur when microbes invade periradicular tissues. An infected maxillary 1st premolar may cause an Infraorbital space (IS) infection. Objective: To report the management of an IS infection and an Acute Apical Abscess (AAA) from #13 with a necrotic pulp. Case Report: A 37-year-old male patient was referred to IUSD Undergraduate Endodontic Clinic. Extraoral Exam revealed swelling in the patient's left infraorbital area. Intra-Oral Exam showed: tooth #13: a distal carious lesion and a swelling apical to #13. Sensibility testing: #13 Cold and electric pulp tests were negative while control teeth responded within normal limits. #13 was sensitive to percussion and the swelling in the buccal vestibulum was fluctuant, swollen and tender to palpation. Diagnosis: #13 Pulpal necrosis, AAA and IS infection. Treatment: First appointment: Anesthesia obtained (lidocaine 2% w/ epinephrine 1:100k). Caries was removed, occlusal reduction performed. The pulp chamber was exposed, and pus drained out the chamber. Working length was established. The canal was shaped with hand instruments and rotary files to size #30.04 and irrigated with Sodium Hypochlorite (6%). Calcium hydroxide paste-(*UltraCal*) was placed in the canal as an Intra-Canal-Medicament (ICM). Incision and drainage (I&D) were

done, and further pus/exudate drained. Amoxicillin was prescribed. Second appointment: 8 days later, patient was asymptomatic and extraoral and intraoral swelling resolved. The root canal treatment (RCT) was completed and the canal obturated with gutta percha and Grossman's sealer using cold lateral condensation. The endodontic access was sealed with composite resin A3. Conclusion: IS infection can be managed by endodontic treatment, I&D and antibiotic therapy.

CC24 How to Identify and Treat C-shaped Canals: A Case Report. C. MINTZ*, E. EHRLICH, K. SPOLNIK, N. WARNER (Indiana University School of Dentistry)

C-shaped canals occur when the Hertwig epithelial root sheath fails to fuse on the buccal or lingual root surface. Most commonly seen in mandibular second molars, C-shaped root canal systems have also been identified in mandibular first molars, maxillary first and second molars, and mandibular first premolars. The objective of this case report is to present a c-shape canal system and introduce methods to properly disinfect and clean said systems. An 18-year old female presented to the graduate endodontic clinic for evaluation of #18. Tooth was diagnosed with previously initiated with symptomatic apical periodontitis. Cone beam CT revealed one c-shaped canal in the mesial and one canal in the distal with a decrease in bone density noted at the apex: 6mm X 5mm X 3mm. Distal and mesial canals join at the apex. Non-surgical endodontic therapy was completed in two appointments. At one year follow up, patient was asymptomatic, and no presence of a lesion was noted. The use of rotary instruments, ultrasonics, and the Endoactivator allowed us to thoroughly clean and disinfect the canals; however there are many novel irrigation systems that can be of assistance when cleaning out c-shaped canals, like the GentleWave, and the use of lasers. In conclusion, C-shaped canals are a challenging root canal anatomy that can be adequately instrumented and obturated if properly identified.

Clinical Case Report Poster Presentations ORAL DISEASE PREVENTION AND DIAGNOSIS

CC25 Caries Management after Head and Neck Radiation: A Case Report. D. ACHARYA*, S. CHO (Indiana University School of Dentistry)

Introduction: Radiation therapy in head and neck region leads to oral conditions such as mucositis and salivary gland dysfunction. In addition, radiation negatively affect dental tissues. Hyposalivation combined with an alteration in the immunologic function of saliva further predispose the irradiated patients to a pronounced increase in cariogenic microorganisms. This significantly increases the risk of caries, tooth loss and osteoradionecrosis. Radiation caries has a distinct characteristic of multiple circumferential cervical lesions with rapid progression. Caries risk assessment for patients planned for the high-dose radiation should be done prior to the initiation of radiation therapy and caries risk management plan should be established to prevent extraction. This case study highlights the dental management of patients with history of radiation therapy. Case presentation: A 42-year-old female presented to IUSD clinic for the management of caries with a history of radiation therapy for a throat cancer. The medical consult addresses a concern of an increased risk of osteoradionecrosis associated with tooth extractions. Various factors including number of active caries lesions, salivary flow rate, DMFT score, and past dental treatment were recorded. Patient was classified as an individual with a high caries risk status. A motivational interview was conducted and discussion regarding the importance of preventative measures was carried out. A plan to fabricate tray for at home fluoride treatment was established. The active caries extending on to the root surface was treated using open sandwich technique. Teeth exhibiting extensive decay were endodontically treated and restored to full contour. Conclusion: The proper caries risk management plan must be established pre and post radiation therapy. Timely treatment of active caries alongside other non-surgical caries management techniques including behavior modification must be used to manage dental caries in patients with history of radiation treatment.

Clinical Case Report Poster Presentations ORTHODONTICS / IMAGING / CRANIOFACIAL

CC26 Correcting Severe Skeletal Discrepancy with Orthognathic Surgery and Orthodontic Therapy. D. BAWA*, M. FRAZIER (Indiana University School of Dentistry)

Class 3 malocclusions represent around 5-6% of the dental malocclusions found in the global population. The cause of this malocclusion could include dental reasons, maxillary deficiency, mandibular excess, or a combination of these factors. Some Class 3 malocclusions can be corrected dentally with camouflage treatments and/or elastic wear. However, some patients with Class 3 malocclusions have skeletal discrepancies too severe to be corrected dentally, or they present with facial esthetics that indicate orthognathic surgery in conjunction with orthodontics for full correction of the malocclusion. Case Presentation: A 16-year-old patient presented to the IUSD orthodontics clinic with a chief complaint of "I have a

crossbite that I want corrected.” The patient initially presented with a Class 3 malocclusion and full anterior crossbite due to a combination of maxillary deficiency and mandibular excess. A comprehensive evaluation included a full assessment of facial esthetics, dental space analysis, skeletal position, and growth appraisal. Remaining growth is tracked utilizing serial cephalometric images and superimpositions. The patient’s teeth were initially aligned and leveled with fixed orthodontic appliances. Surgical models were obtained to simulate the surgical movements and ensure no interferences would be present during the time of surgery. Iow spaces were created between the lateral incisors and canines to allow the surgeons to avoid anterior interferences and achieve ideal anterior and posterior coupling. The patient received a one-piece LeFort I osteotomy and maxillary advancement. Iow spaces were closed post-surgery and the patient was detailed and finished. Conclusion: Over the course of 28 months, the patient’s severe skeletal discrepancy and facial esthetic concerns were addressed through collaborative interdisciplinary treatment, giving the patient a more functional Class I occlusion and improved facial esthetics.

CC27 Improving Bony Defects Through Orthodontic Treatment: A Case Report. R. RICHARDSON*,
H. TURKKAHRAMAN (Indiana University School of Dentistry)

With the evolution of radiographic imaging, cone beam computerized tomography (CBCT) images have become a great benefit to clinicians, as they seek to properly assess, diagnose, and treatment plan patients in an orthodontic setting. Orthodontic treatment, while beneficial in resolving dentoalveolar malocclusions, has potential detrimental side effects, such as dehiscences and fenestrations. These alveolar bony defects compromise the support for the teeth. With CBCT, the presence of these bony defects can be detected and properly managed. The aim of this case report is to demonstrate the improvement of bony defects in anterior teeth which have been displaced due to severe crowding. A 32-year-old male patient was referred to the orthodontic clinic at Indiana University School of Dentistry with the chief concern of crowding both in the upper and lower jaw. The oral examination of the patient revealed Angle Class I malocclusion with severe crowding. CBCT imaging shows dehiscence present on the facial surfaces of anterior teeth. In order to resolve this malocclusion, extractions of maxillary and mandibular first premolars with sequential retraction were utilized. A mini-implant-supported trans-palatal arch was used for reinforcing anchorage in the maxillary arch. The patient has been in treatment for 10 months and progress CBCT imaging shows an improvement in bone quality surrounding the anterior teeth and a reduction in the dehiscence of anterior teeth through the planned and executed orthodontic treatment. Conclusion: This case report shows that alveolar bone defects due to severe crowding and ectopic eruption can be improved with appropriate oral hygiene and well-planned orthodontic treatment.

CC28 Achieving Absolute Anchorage Utilizing a Mini-Screw Implant Supported Transpalatal Arch. S. TWIGGS*,
K.T. STEWART (Indiana University School of Dentistry)

Case Background: In orthodontic space closure, mini-screw implants offer numerous advantages when utilized as temporary anchorage devices. They can be loaded immediately, easily removed, and require less patient compliance. The following is a clinical example illustrating the use of a mini-screw implant to achieve absolute anchorage. A 13-year-old female patient presented with the chief complaint of “I want a straight smile. My teeth on the top and bottom in the front are crooked.” She had an Angle’s Class II Division 1 malocclusion with an excessive overjet of 9 mm and severe maxillary crowding of 8 mm. Based on her diagnosis, the clinical decision was made to extract her maxillary first premolars (#5 and #12) and retract her anterior teeth to resolve the crowding and alleviate the excessive overjet. The maxillary arch anchorage goal in this case was absolute anchorage, meaning minimal movement of the posterior dentition with maximum retraction of the anterior teeth. To achieve this goal, a mini-screw implant (MSI) supported transpalatal arch (TPA) was utilized in this case. Treatment rendered: Following the extraction of the maxillary first premolars, the patient presented for mini-screw implant placement and fabrication of TPA. Bicortical engagement of the 3M MSI (12 mm x 1.8 mm) was achieved and confirmed with cone-beam computed tomography (CBCT). The patient received maxillary and mandibular brackets and once in a posted stainless-steel wire, space closure was achieved with the use of NiTi coil springs. Conclusions: In a total of 14 months, the patient’s dentition has been aligned, leveled, and all spaces closed. Appropriate absolute anchorage was achieved with our MSI supported TPA with no complications. (This case is supported by the Indiana University School of Dentistry, Department of Orthodontics & Oral Facial Genetics)

Clinical Case Report Poster Presentations PERIODONTICS

CC29 Apical Peri-implantitis: Give a Chance or Remove the Implant? H. NAMLI KILIC*, V. JOHN. (Indiana University School of Dentistry)

Introduction: Apical peri-implantitis is defined as peri-apical lesion of implants and it is a rare complication. The etiology is yet unclear and treatment options are limited. This case report describes the debridement of the apical peri-implantitis and simultaneous guided bone regeneration (GBR) procedure to save the implant. Case Presentation and Results: A 45-year-old African male was referred to IUSD Graduate Periodontology Clinic for extraction of #9 and subsequent replacement with an implant. After clinical and radiographic examinations, #9 was diagnosed as non-restorable, and extraction and ridge preservation procedure was planned. #9 extraction and ridge preservation was performed. After a 3-month healing period, a bone level dental implant was planned digitally using a digital implant planning software and placed using fully guided approach. At 2-week postoperative appointment, swelling, redness and a fistula was noticed on the apical portion of the implant placement side. A periapical radiograph was taken and revealed that there is a peri-apical lesion related to the implant apex. Antibiotics were prescribed and patient was followed for 2 months. Soft tissue healing was completed including fistula, but radiographic examination demonstrated that periapical lesion was persistent. The treatment options proposed to the patient were debridement of the peri-apical portion of the implant and simultaneous GBR, or removal of the implant. Patient preferred to give a chance to his implant. Implant debridement and GBR procedure was performed. Ultrasonic and hand scalers were utilized for the implant debridement and combined with tetracycline for decontamination of the implant surface. Conclusion: This case report demonstrated that implant debridement and simultaneous GBR procedure was successful for the management of the apical peri-implantitis when the implant debridement and surface decontamination is thorough and careful.

CC30 Double Window Approach with Growth Factors for Lateral Sinus Augmentation. H. NAMLI KILIC*, C. BATRA (Indiana University School of Dentistry)

Introduction: The pneumatization of the maxillary sinus is one of the limitations for the dental implant placement on the posterior maxillary region. Sinus lift procedures, vertical or lateral window approach, are commonly performed to allow implant placement on this region. The sinus lift procedure might be challenging to perform due to atypical sinus anatomy such as sinus septa. This case report describes the alternative lateral window sinus lift approach due to sinus septa. Case Presentation and Results: A 28-year-old Middle Eastern male was referred to IUSD Graduate Periodontology Clinic for extraction of #13 and subsequent replacement with an implant. Patient presented with a current implant on #12 area placed in his home country, but the implant was never restored. After clinical and radiographic examinations, #13 was diagnosed as non-restorable, and extraction and ridge preservation procedure was planned. On implant #12, crestal bone loss was noticed. Patient was informed about the early bone loss around the implant and advised for explantation. Patient preferred to keep his current implant and get another implant on #13 position. #13 extraction and ridge preservation, and #12 implant debridement and GBR procedure was performed. During the CBCT examination for #13 implant planning, sinus elevation need was recognized. On the CBCT, sinus septa was noticed and it was interfering with the sinus lift approach. Also, bone loss progress was noticed on #12 implant. Patient was advised for #12 explantation at same time with sinus lift procedure. #12 explantation and GBR, and sinus lift was performed using growth factors to promote bone healing. 6 months later, #12 and 13 was replaced with dental implants successfully. Conclusion: This case report demonstrated that creating two windows for lateral window sinus lift procedure was able to achieve successful sinus membrane elevation by avoiding sinus septa without causing any complications.

CC31 Carbonate Apatite for Ridge Preservation: Histologic & Radiographic Evaluation. H.C. LEE*, Y. HAMADA (Indiana University School of Dentistry)

Introduction: Carbonate apatite (CA) possesses excellent osteoconductive ability and favorable resorption properties presumably due to its human-bone-like structure and its rough surface characteristic. This case report described the treatments of ridge preservation and augmentation with the use of commercially available CA. Case Presentation and result: A 68-year-old Caucasian male was referred to IUSD Graduate Periodontal Clinic for the replacement of fracture teeth (#10) with implant treatment. Cone Beam Computed Tomography (CBCT) images revealed that there was a root perforation related to post-placement with a 6mm x 6mm x4.5mm periapical lesion on #9. Besides, horizontal ridge deficiency was also noticed. A sulcular incision on the buccal aspect and a vertical releasing incision was made on the distal end. A Full-thickness flap was reflected. #9 and #10 were extracted in a minimally traumatic manner. The sockets were thoroughly debrided. Small size of CA particulate was grafted into extraction sockets, and medium size of CA particulate was placed on the buccal aspect for contour augmentation. The grafted site was covered by a non-cross-linked resorbable collagen

membrane. Buccal flap was repositioned. Six months after the surgery, CBCT was taken for implant planning. Implant surgery was performed, and two bone core biopsies were obtained with fully guided protocol. No additional bone augmentation was needed, and the insertion torque of both implants was greater than 30N/cm. Small amount of horizontal dimension loss were noted on #9 and #10. Minimum amount of vertical dimensional change was observed. Histological analysis revealed mean 88% of vital bone with mean 1% of residual CA particles with the core samples. Conclusion: This case report demonstrated the application of CA as a bone substitute for ridge preservation and augmentation was effective in reducing ridge dimensional loss and predictable bone gain with a favorable percentage of new bone formation.

CC32 Free Gingival Grafts: Managing Brushing Discomfort and Inadequate Keratinized Tissue. N. ROGERS*, V. JOHN, H. ALQALLAF (Indiana University School of Dentistry)

Introduction: Free gingival grafts are a good option in the management of areas lacking keratinized tissue that present with gingival recession and the attendant common complaints of brushing discomfort and tooth hypersensitivity. The objective of this case report is to present a patient treated with a free gingival graft. Case Report: A 63 yo Caucasian female presented to the Graduate Clinic with brushing discomfort and tooth hypersensitivity on teeth #23-27. The area presented with a thin tissue phenotype associated with gingival recession (RT2 defects) on the facial aspect of the teeth. Radiographs revealed 1-2mm of interproximal bone loss. Following a horizontal incision on teeth #23-27 a partial-thickness flap was reflected. The exposed root surfaces were debrided and a free gingival graft was harvested from the right palate. The graft was immediately placed in saline and CollaTape was trimmed and placed over the donor site and sutured using 5-0 chromic gut. The donor tissue was then adapted to the recipient bed and stabilized with single interrupted and periosteal anchoring sutures using 5-0 vicryl. Digital compression with a moist gauze was provided for 2 minutes. Sutures were removed at 2 weeks and the patient was followed up for 8 months. Keratinized tissue volume, gingival thickness, brushing comfort, and root hypersensitivity were monitored. Compared to pre-surgical findings, the free gingival graft successfully augmented both keratinized tissue volume and gingival thickness, reduced recession defect depth and root hypersensitivity, and alleviated the patient's brushing discomfort. Conclusion: This case report revealed that a free gingival graft can successfully increase keratinized tissue volume and gingival thickness to reduce brushing discomfort and provide partial root coverage in RT2 recession defects associated with a thin tissue phenotype commonly found in the anterior mandible.

Clinical Case Report Poster Presentations PROSTHODONTICS

CC33 Marriage of Old and New, Patient Appreciating the Value of Gold. W. CASTEDO*, B. HANES, R. TAYLOR, T. WYSE, K. SCHAUB (Indiana University School of Dentistry)

A 68-year-old female was initially referred to the predoctoral comprehensive care clinic for evaluation, treatment, and rehabilitation of only two lower right posterior implants (sites #30,31) placed by a private practice dentist. The patient has a medical history of well-managed asthma and hypertension, which she treats with medications. The patient recalls losing mandibular posterior teeth as an adolescent. Discussion: The patient was consulted regarding her restorative options during the initial prosthodontic treatment planning. The advantages and disadvantages of each alternative were highlighted and explained for the patient to decide which option fits her needs and wants best. The student dentist explained the benefits of gold for direct and indirect restorations. The patient completed the following treatment over 18 months: a gold crown on #3 and two implant crowns (#30,31) to re-establish the occlusal plane. Upon establishing right posterior occlusion, the patient elected to expand her treatment and have three additional implants placed and restored with gold crowns (#14,19,20) to balance her final occlusion. Subsequently, the patient returned to restore three separate defective amalgam restorations: #2 with three-surface onlay and occlusal gold foils on #13 and 21. Conclusion: Although amalgam, composite, ceramic, gold, or any combination of the four restoration materials would have been acceptable treatment options, the patient understood the advantages of gold in dental restorations: it closely mimics natural dentition in terms of coefficient of expansion, durability, malleability, and long-term success that does not abrade opposing dentition. Ultimately, the patient's value of gold restorations and the student's interest in exploring gold restorations drove the preferred treatment plan.

CC34 Conversion to an Implant-Supported Removable Denture in a Resorbed Mandibular Ridge: Case Report.

W. CASTEDO*, W.D. POLIDO, B. HANES, R. TAYLOR, K. SCHAUB (Indiana University School of Dentistry)

A 75-year-old male was initially referred to the predoctoral comprehensive care clinic for evaluation, treatment, and rehabilitation of both maxillary and mandibular arches by a private practice dentist. The patient presents with a maxillary denture and partially bony impacted thirds (#1,16), grossly decayed and non-restorable #21,22,25-28 still present. The patient's chief complaint is an ill-fitting maxillary denture and grossly decayed mandibular teeth with a severely resorbed ridge wanting rehabilitation. The patient has a history of heart disease, T2DM, ischemic stroke, and recent surgery because of neuropathy due to C3-4 compression. A medical consult was sent to the neurologist, who cleared the patient for dental treatment. Discussion: The patient expressed concern about ill-fitting dentures and wanted adequate retention and support for a prosthesis. The patient was consulted regarding his prosthodontic options and proposed treatment sequence. The advantages and disadvantages of each alternative were highlighted and explained. The patient elected to have the extraction of all remaining dentition and immediate implants placed at sites #22 and 27. After adequate tissue healing, the clinician fabricated a set of conventional maxillary and mandibular dentures while the implants healed. Once cleared from oral surgery, a "pick-up" technique was used to engage the osseointegrated implants and convert them to an implant-support removable dental prosthesis. Upon the successful transformation, a final relines was completed to account for bone remodeling over the twelve-month treatment sequence. Conclusion: Clinicians must thoroughly understand the fabrication of conventional complete dentures and staging requirements. Communication is critical across dental specialties regarding treatment goals, implant placement specifications, and, most importantly, managing patient expectations. Patients must recognize the treatment timeframe, denture stability from initial delivery to final relines, and treatment staging. The clinician is responsible for ensuring the elected treatment plan best fits the patient's expectations and that the patient understands the lengthy treatment sequence.

CC35 Re-Establishing Posterior Occlusion Using a Digital Workflow with Implant Placement. W. CASTEDO*,

M. THOMPSON, W.D. POLIDO, B. HANES, R. TAYLOR, K. SCHAUB (Indiana University School of Dentistry)

A 67-year-old female was initially referred to IUSD for evaluation, treatment, and rehabilitation of a symptomatic upper premolar (#4) and lower right molar (#30) by a private practice dentist with the recommendation for extractions. #4 presented with a failed cast post, core, and crown because of a vertical root fracture, and #30 noted an ill-fitting crown with open mesial margins and mid-buccal and -lingual class II furcation involvement. The patient recalled losing her lower posterior teeth many years ago and masticated primarily with her anterior teeth. The patient had a history of hip and knee replacements five years ago, requiring antibiotic prophylaxis per medical consult. Discussion: The Implant Center consulted her for immediate implant placement for #4. The graduate periodontal clinic suggested addressing the furcation involvement of #30 after the removal of the defective crown. She was evaluated to have inadequate bone at #18, 19, and 20 due to prolonged edentulism and understood the high financial investment required for bone grafting for multiple implants. The advantages and disadvantages of each alternative were explained for the patient to decide which option fit her needs and wants best. Once consulted from each specialty clinic, the patient returned for definitive treatment consisting of a gold crown on #30, a four-unit gold bridge spanning #17 through 21, ceramic crowns on #12 and 13, a gold crown on #14, a two-surface inlay for #5, and a gold crown on #29. The prosthodontic treatment sequence consisted of extracting and placing an implant at #4 while she remained in polymethylmethacrylate temporaries at #12, 13 and 14, allowing her to maintain ideal occlusion during implant placement. Conclusion: Leveraging the digital workflow across departments and the dental laboratory greatly aided the patient's rehabilitation by managing dynamic workflow changes in real-time with enhanced visualization capabilities, iteration control, and communication.

CC36 Mandibular Reconstruction with CAD/CAM Implant-Supported Bar Overdenture. W. LIU*, W.D. POLIDO, W.S. LIN (Indiana University School of Dentistry)

Purpose/Aim: To describe a clinical case report of using the CAD/CAM implant-supported bar overdenture to restore the fibula graft reconstructed mandible. Clinical procedure: The patient was a 51-year-old Caucasian female who had a mandibular reconstruction with a free vascularized fibula graft due to osteomyelitis after extractions. The patient denied having any medical condition. Treatment options were discussed with the patient, and she accepted the treatment with a mandibular implant-supported bar overdenture. A diagnostic tooth arrangement was used for the CBCT dual scan. Four tissue-level implants were placed in the mandible using static computer-aided implant surgery (s-CAIS) approach. After 3 months of submerged healing, the second stage surgery and skin graft debulking procedure were completed. The mandibular definitive impression was made with a custom tray using polyvinyl siloxane material. Implant-supported record base was used to record the maxillomandibular relationship and the definitive cast was verified with a verification device. Wax trial insertion was completed to evaluate occlusion, esthetics, and phonetics. The tooth arrangement was scanned with a laboratory scanner and used to design a milled titanium bar with attachments. CAD/CAM definitive mandibular implant-supported bar overdenture was then designed, manufactured, and delivered. Treatment outcome: The patient was followed up for 3 months, and no complications were observed. Conclusion: Combining analog and digital workflow is a predictable and applicable approach to restore fibula graft reconstructed mandible with a CAD/CAM implant-supported bar overdenture.

CC37 3D Printed Obturator and Complete Denture in Prosthodontic Rehabilitation. S. ALRASHED*, H. ALOUTHAH, B. ANDERSON, W.S. LIN, J. LEVON (Indiana University School of Dentistry)

This case report presents a clinical and laboratory approach to fabricating a 3D printed maxillary obturator and mandibular complete denture for a 25-year-old male with Treacher Collins and Pierre Robin syndromes. Treacher Collins syndrome (TCS) is a genetic disorder that affects craniofacial development. TCS is characterized by bilateral deformities of the orbital area, ears, and jaws. Convex facial profile, skeletal class II, hypoplastic maxillary and zygomatic bones, cleft palate, speech problem, anterior open bite, micrognathia, retrognathia of mandible. However, Pierre Robin syndrome (PRS) is a sequence of malformations that typically begins with micrognathia and progresses to glossoptosis and upper airway obstruction. It is commonly associated with a wide U-shaped palatal cleft. The patient was presented edentulous with a wide U-shaped palatal cleft for prosthodontic rehabilitation. Final impressions were obtained using polysulfide impression material. Record blocks on a processed base, maxillary and mandibular master casts were scanned separately and superimposed. The teeth setup was done digitally. Printed PMMA trial dentures were scanned after chair side adjustments. Pink denture bases were printed from pink acrylic, and teeth were milled and bonded. Digital design obturator allowed to create an appropriate bulb size and contour that avoids massive palatal undercuts and provides retention, stability, fewer adjustments, and less chair time with increased patient convenience. Contrary to the case with milling, 3D printing of obturators helps to fabricate complex designs and fine details. Furthermore, 3D printing allows fabricating prostheses with an overall height taller than the entire milling block.

CC38 Digital Denture in Patient with Limited Restorative Space: Case Report. M. SILMAN*, B. HANES, F.Y. SU (Indiana University School of Dentistry)

Objective: Digital technology broadens the workflow and fabrication methods in a complete denture. The clinical case report shows how the fabrication of monolithic digital dentures helps avoid the need of alveoloplasty for an edentulous patient with limited inter-arch and labial restorative space. Method: An edentulous 62-year-old female presented to the predoctoral clinic for comprehensive dental care. During the assessment, the patient had limited inter-arch and labial restorative spaces for a conventional denture despite having alveoloplasty. For this reason, conventional dentures were not a sufficient option for this patient. Due to the thickness of a conventional denture and methodology required, restoring the patient to a functional prosthesis was unattainable. In this scenario, a digital denture design could eliminate the need for additional alveoloplasty due to the inherent strength of a single monolithic PMMA unit. In the clinical appointments, the clinician fabricated conventional master impressions and occlusal wax rims to provide proper contour and VDO. After obtaining the patient's centric occlusion by an occlusal registration, the jaw relation record and the master cast were digitalized to create maxillary and mandibular dentures. Digital teeth were then set-up based on the clinical jaw relation that was recorded previously using the 3shape software. Once completed, 3D printing technology was utilized to fabricate a monolithic complete denture for both arches. Lastly, a gingival composite was added to improve the esthetics of the denture to produce a prosthesis that satisfied the patient esthetically. Result: From this study, utilizing a digital approach for fabricating a complete denture had immense advantages for both the patient and clinician. Because the digital fabrication process follows the same clinical procedure as a conventional denture, the clinician was still able to restore the patient in centric relation. In conclusion, the digital technology allowed the clinician to fabricate a prosthesis that was both functionally and esthetically successful

CC39 Composite Layering Milled Cr-Co Framework for Limited Restorative Space. N. ASAVANANT*, C.C. YANG, W.S. LIN (Indiana University School of Dentistry)

Restorative space is one of the most important factors for selecting prostheses design and material. In general, the requirement of interocclusal space for full-arch metal acrylic fixed restoration are at least 12 mm. Sometimes, we encounter situations where there is limited restorative space for this type of prosthesis. A 50-year-old female patient presented in Graduated Prosthodontics department with 4 lower implants placed with limited restorative space. Inadequate restorative space limited the option of metal acrylic fixed prosthesis, alternative prosthesis design was planned to achieve new full-arch implant supported fixed prosthesis. In this case report, vertical dimension and restorative space was verified. Limited restorative space was diagnosed. Mandibular teeth position was identified, then using CAD/CAM for design and manufacture for SRBB milled titanium bar with composite veneer for mandibular full-arch implant supported fixed prosthesis. Prosthodontics driven treatment plan is the foundation of implant treatment particularly with implant supported complete fixed prosthesis. Composite layering with Cr-Co framework is one of the options for full-arch fixed prosthesis with limited restorative space.

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Previous Year Summary

The Indiana University School of Dentistry's 30th annual Research Day was a hybrid event held on Monday April 4, 2022. The event featured 93 poster presentations, remarks from Dean Carol Anne Murdoch-Kinch, research updates from Dr. Tien-Min Gabriel Chu, associate dean for research, and updates from Dr. Angela Bruzzaniti, director of student research. Dr. Nisha D'Silva, professor at University of Michigan School of Dentistry, delivered the keynote address on subverting the microenvironment of oral cancer. The award ceremony recognized the following distinguished faculty, staff, and students.

Dental Hygiene Students

Elizabeth A. Hughes Dental Hygiene Case Report Award, **Jesse Closser** and **Allie Owens**; **Madison Roberts** and **Mackenzie Romero**

Undergraduate Students

IN-AADOCR Undergraduate Student Award, **Naomi Riley**

Predoctoral Dental Students

AADOCR Student Research Day Award, **Daniel Godfrey**

Cyril S. Carr Research Scholarship, **Ashley Karczewski**

Dean's Award for Research Excellence, **Niki Gheibi Dehnashi**

IDA Student Research Award, **Heather Swinson**

IN-AADOCR Predoctoral Clinical Case Report Award, **Tyler Whitfield** and **Alyssa Hoy**

King Saud University Predoctoral Student Travel Award, **Niki Gheibi Dehnashi**

Outstanding Participation in Research Certificate, **Brittany Gehlhausen** and **Andrew Doan (D2)**; **Carrie Walton** and **Justina Anigbo (D3)**; **Ashley Karczewski** and **Khaled Al Nasr Allah (D4)**

Research Honors Program Certificate of Achievement, **Niki Gheibi Dehnashi** and **Ashley Karczewski**

Student Competition for Advancing Dental Research and its Application (SCADA), **Michael Kessler**

Graduate Dental Students

Delta Dental Award for Innovation in Oral Care Research, **Tyler Wood** and **Lan-Lin Chiou**

IN-AADOCR Postdoctoral Fellow Award, **Beatriz Panariello**

Maynard K. Hine Award for Excellence in Dental Research, **Gina Castiblanco-Rubio**

King Saud University PhD Student Travel Award, **Mauro Tudares**

King Saud University Travel Award for Best Clinical Case Report, **Lan-Lin Chiou** and **Toshiki Nagai**

Staff

IN-AADOCR Research Staff Award, **Jude Wilkinson**

Faculty

IU School of Dentistry Distinguished Faculty Award for Teaching, **Dr. Ned Warner**

IU School of Dentistry Distinguished Faculty Award for Research, **Dr. Domenick Zero**

King Saud University Distinguished Research Faculty Travel Award, **Dr. Anderson Hara**

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