



INDIANA UNIVERSITY
SCHOOL OF DENTISTRY

RESEARCH DAY 2022

April 4, 2022

Featuring Keynote Speaker:
Nisha D'Silva, BDS, MSD, PhD
*Oral Cancer:
Subverting the Microenvironment*

30th
ANNUAL

IL-10
GM-CSF
TNF α
TGF β

CONGRATULATIONS

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



The Delta Dental Foundation is proud to support programs and services that improve oral and overall health, promote health equity, and enhance the quality of life in our communities.

DELTA DENTAL
FOUNDATION

www.deltadental.foundation





BRASSELER
USA[®]

Your Trusted Leader in Dental Instrumentation for Over 40 Years

Visit our website at BrasselerUSA.com

To order call 888.239.5190 or fax 888.610.1937.

©2019 Brasseler USA. All rights reserved. Printed in the U.S.A.



B-4920 01.20

THANK YOU TO OUR SPONSORS

IUSD RESEARCH DAY

DENTISTS ARE RETIRING LATER*

How will this impact
your exit strategy?

You've had to invest years
and make significant
sacrifices to get to this
point in your career.

If you are a practice owner, you
have the added job of running a
small business, with all the highs
and lows of managing people
and resources.

With six decades of experience
guiding dental professionals
in important aspects of their
financial life, we can help you
make informed decisions so that
you can move a step closer to
the retirement you envision.

Let's set up a time to speak.

800.345.6040

info@treloaronline.com

**Treloar
& Heisel**
FINANCIAL SERVICES FOR THE
DENTAL AND MEDICAL PROFESSIONAL

Treloar & Heisel, Treloar & Heisel Wealth Management, and Treloar & Heisel Property and Casualty
are all divisions of Treloar & Heisel, Inc.

Investment Advice offered through WCG Wealth Advisors, LLC, a Registered Investment Advisor
doing business as Treloar & Heisel Wealth Management. Treloar & Heisel Wealth Management has
offered wealth management and financial planning services since 2016. Treloar & Heisel Wealth
Management is a separate entity from The Wealth Consulting Group and WCG Wealth Advisors, LLC.

Insurance products offered separately through Treloar & Heisel Inc.

www.treloaronline.com



TreloarHeisel



TreloarHeisel



Treloar and Heisel Inc.



TH-210047

* According to the ADA Health Policy Institute, on average, in 2017 a dentist retired at 58.9 years, while in 2001 a dentist retired around age 65.
Source: www.ada.org/en/publications/ada-news/2018-archive/august/0801-average-dentist-retires-later

IUSD RESEARCH DAY PROCEEDINGS

VOLUME 30

APRIL 4, 2022

CONTENTS	PAGE
Event Program	2
About the Keynote Speaker	3
Letter of Welcome -- Dean Murdoch-Kinch	4
Letter of Welcome -- INAADO CR	5
Letter of Welcome -- IUSD Student Research Group	6
Student Research Group Photo	7
Commemorating 30 Years of Research Day	8
Research Day Planning Committee	10
Research Awards 2022	11
Abstracts of Research and Clinical Case Poster Presentations	12
Index to Presenters and Mentors	51
Previous Year Summary	52
Exhibitors and Sponsors	53
INAADO CR Contributors	54

Cover design by Terry Wilson.
Student Research Group photo by Caleb Clements.
Research Day monograph prepared by Keli Seering.

Research Day Event Program

IU School of Dentistry

Monday April 4, 2022

11:00 a.m. to 4:30 p.m.	Visit Vendor Exhibits		Library DS 128
11:00 a.m. to 1:30 p.m.	View Poster Displays		1st Floor, Main Street, 3rd Floor
1:00 p.m.	Musical Performance	IU School of Dentistry Faculty	DS 114 and Livestream
1:30 p.m.	Welcome Remarks and Keynote Speaker Introduction	Dr. Carol Anne Murdoch-Kinch Dean, IU School of Dentistry	DS 114 and Livestream
1:40 p.m.	Keynote Address: <i>Oral Cancer: Subverting the Microenvironment</i>	Dr. Nisha J. D'Silva Professor, University of Michigan School of Dentistry	DS 114 and Livestream
2:25 p.m.	IU School of Dentistry Research Updates	Dr. Tien-Min Gabriel Chu Associate Dean for Research, IU School of Dentistry	DS 114 and Livestream
2:30 p.m.	NIDCR Research Opportunities	Dr. Belinda Hauser Intramural Training Director, NIDCR Office of Training and Education	DS 114 and Livestream
2:40 p.m.	Faculty Presentation: <i>Informatics Role in Enhancing Oral and Overall Health</i>	Dr. Thankam Thyvalikakath Director of Dental Informatics, IU School of Dentistry	DS 114 and Livestream
3:10 p.m.	Announcement of Faculty and Staff Awards	Dr. Carol Anne Murdoch-Kinch Dean, IU School of Dentistry	DS 114 and Livestream
3:20 p.m.	Announcement of Student Research Awards	Dr. Angela Bruzzaniti Director of Dental Student Research, IU School of Dentistry	DS 114 and Livestream
3:40 p.m.	Announcement of Research Day Poster Presentation Awards	Dr. Simone Duarte Associate Professor, IU School of Dentistry, President, IN-AADOCR	DS 114 and Livestream
4:10 p.m.	Closing Remarks	Dr. Simone Duarte Associate Professor, IU School of Dentistry, President, IN-AADOCR	DS 114 and Livestream
4:10 p.m.	Student Raffle	All students may participate	DS 114

ABOUT OUR KEYNOTE SPEAKER DR. NISHA D'SILVA



Nisha D'Silva, BDS, MSD, PhD is the Donald Kerr Endowed Collegiate Professor at the University of Michigan School of Dentistry. She is also Professor of Pathology at the University of Michigan Medical School and a member of the University of Michigan Rogel Cancer Center. Dr. D'Silva is a clinician-scientist; her translational research in head and neck cancer focuses on biomarkers and molecular mechanisms of tumor progression and treatment resistance. She has been the principal investigator of National Institutes of Health (NIH) grants and is currently funded by the National Institute of Dental and Craniofacial Research/NIH Sustaining Outstanding Achievement in Research award.

She received the Distinguished Scientist Award for Oral Medicine and Pathology Research from the International Association of Dental Research, and the Rod Cawson Prize from the International Association of Oral Pathologists and the Royal College of Physicians and Surgeons of Glasgow. She is a Fellow of the American Association of Dental Research. Dr. D'Silva is a Diplomate of the American Board of Oral and Maxillofacial Pathology, which is her area of clinical practice. She enjoys teaching and mentoring and is a recipient of university and national mentorship awards.

Dr. D'Silva's keynote address presentation title is *Oral Cancer: Subverting the Microenvironment*. Head and neck squamous cell carcinoma (HNSCC) is the 6th most common cancer in the world, with about 600,000 new cases diagnosed each year. Invasion is a critical phenotype for development and progression of HNSCC. Elucidation of the mechanisms of invasion could provide novel treatment strategies for HNSCC. Mechanistic studies in HNSCC and the clinical relevance of these findings will be discussed.



April 2, 2022

Indiana University School of Dentistry Colleagues and Friends:

Welcome to the 30th Annual Indiana University School of Dentistry (IUSD) Research Day!

We are most proud of our longstanding traditions of excellence in research and discovery, the foundation of the dental profession. The search for truth and new knowledge is at the heart of our mission to improve the oral health of the people of the state of Indiana and around the world through excellence in education, patient care, research, and community engagement. Participating in research and other forms of scholarship enhances the education of our students by exposing them to the thrill of discovery of new knowledge and providing opportunities for them to disseminate this knowledge through presentations and publications. For most, it will deepen their understanding of the science foundation of dentistry and enrich their clinical practice. For others, it will ignite a passion for another career path – to impact the world through dental research.

I am very proud of all of our student investigators and their faculty research mentors who are presenting their work today. Our annual Research Day is the day we showcase their science, appreciate the breadth of our work and its impact, and celebrate our investigators for their accomplishments and contributions to advance oral health through excellence in research.

This year we are pleased to be back in person once again, after a 2- year hiatus. We are excited to welcome our keynote speaker, Dr. Nisha D'Silva, back to Indiana University School of Dentistry, to share her research with us. Her journey started here when she was a resident in oral and maxillofacial pathology; now she is a world class leader in the science of oral carcinogenesis and metastasis, biomarker discovery and cancer therapeutics. Perhaps we have another such young investigator among us now- ready to launch their career in dental, oral and craniofacial research!

I want to thank the Research Day planning committee and the Indiana section of the American Association for Dental Research for producing today's event. I also want to give special thanks to our generous event sponsors.

Enjoy!

Carol Anne Murdoch-Kinch, DDS, PhD
Dean



March 18, 2022

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 would like to welcome you to the Indiana University School of Dentistry (IUSD) 30th Annual Research Day.

The Indiana Section is the regional link to the national (AADOCR) and the international (IADR) associations for dental research. The primary objective of the IN-AADOCR is to promote and advance basic and clinical research in all areas of dental, oral, and craniofacial sciences, including oral cavity, its adjacent structures, and the relationship to the body as a whole. Together, by utilization of this knowledge, we hope to advance dental science by developing new and better options for oral health, prevention, and treatment of oral diseases, as well as pathologies of the head and neck. Furthermore, these activities intended to foster better communication and cooperation among professionals – from basic science researchers to clinicians – to engage and share this knowledge for the benefit of all.

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. By itself, Research Day offers an opportunity for investigators to present and highlight advances in basic and clinical dental, oral, and craniofacial research to their peers and in a public forum, right here, at our IUSD. Furthermore, Research Day offers a chance for attendees to interact with faculty and student investigators in addition to various sponsors and vendors. It's a unique opportunity to celebrate the science that happens every day at IUSD.

With that, I would like to thank all members of the Research Day Committee for their hard work and precious efforts toward this annual tradition at IUSD. Furthermore, I would also like to thank those who participated in the judging of research. Finally, I want to thank all of you who are attending the 30th IUSD Research Day and encourage you to contemplate the research being performed by your fellow peers and colleagues.

Sincerely yours,

Simone Duarte, DDS, MS, PhD
President, IN-AADOCR

Dear Research Day Attendees:

Welcome to the 30th Annual Indiana University School of Dentistry Research Day!

IUSD is proud to have so many hard-working student researchers and incredible faculty mentors. As you will see from today's programming, IUSD is home to experts in many fields including dental biomaterials, bone remodeling, oral biology, tissue engineering, preventative dentistry, and much more. Advancements in patient care, dental education, and the practice of dentistry begins with research. Involvement in dental research is an essential component of evidence-based dentistry!

I want to congratulate all of our student researchers for their dedication and achievements over the past year and encourage you all to continue on your quest for knowledge.

Additionally, if you are interested in seeing more IUSD Student Research, please join us at our biweekly Student Research Presentation Program (SRPP). These presentations take place on Wednesdays at 5:15pm via Zoom.

Sincerely yours,



Marcus Levitan
President
IUSD Student Research Group



Justina Obumneme Anigbo
Vice President
IUSD Student Research Group



Niki Geibi Dehnashi
Secretary/Treasurer
IUSD Student Research Group



Brittany Gehlhausen
Newsletter Editor
IUSD Student Research Group

IUSD STUDENT RESEARCH GROUP 2021-2022



FRONT ROW (L to R): Chandler Walker, Naomi Riley, Mikki Jaramillo, Aparna Chintapalli, Tiffany Figueroa, Katie Chester, Angela Bruzzaniti, Richard Gregory, Brittany Gehlhausen, Anupama Sharma, Andrew Doan, Marcus Levitan, Mauro Tudares

MIDDLE ROW 1 (L to R): Justina Anigbo, Ashley Karczewski, Alyssa Zhao, Navia Novosel, Mona Arrageg

MIDDLE ROW 2 (L to R): Alexa Dresner, Carrie Lane, Divya Acharya, Mariam Hanna, Alyssa Whalen, Giovanna Denucci

BACK ROW (L to R): Sydney Hall, Rhea Khatra, Raphael Raganit, Dan Godfrey, Sam Caskey, Guillermo Tamayo-Cabeza, Parkham Karimi, Sarah Canady, Loai Hazzazi

COMMEMORATING 30 YEARS OF RESEARCH DAY



Photo 1: Dr. Stookey (right) with fourth-year student John Shank at the 1st Annual Research Day event.

In fall 1992, Dr. George Stookey, then Associate Dean for Research, gathered IUSD research faculty to discuss the idea of showcasing our student and faculty research at a new event called Research Day.

The organizers of the first Research Day included the Indiana Section of the American Association for Dental Research (AADR) officers – Drs. RoseMarie Jones, president; Jeffrey Dean, vice president; Melissa Mau, secretary/treasurer; Chris Miller, counselor/newsletter editor; Mark Mallatt, alternate counselor; James McDonald and Kichuel Park, Student Research Group faculty advisors; and Byron Olson, immediate past president) – as well as Dr. Chris Hughes and myself.

The timing of these first planning sessions was precipitated by a growing research emphasis in the school with the recruitment of new federally funded researchers. Additionally, our school's external research funding had doubled in the previous three years from \$2.36 million in 1988-1989 to \$5.16 million in 1991-1992. With the approval of then Dean Dr. William Gilmore, Dr. Stookey and this committee organized IUSD's first Research Day on March 25, 1993. Ms. Sue Crum, the school's veteran communicator, was instrumental in keeping our group on task as she was responsible for producing the program proceedings monograph.

Our first program was a success! Students and faculty presented 112 posters and table clinics. In fact, the basic format of Research Day has not changed in these past 30 years, with a heavy emphasis on students presenting their faculty-supervised research projects, preceded by a keynote speaker and awards for the best student posters. The president of the Indiana Section of the American Association for Dental, Oral and Craniofacial Research (AADOCR; previously known as AADR) chairs the organizing committee, augmented by additional AADOCR officers and other research-intensive faculty. I have had the pleasure of serving on the organizing committee for these entire 30 years and have enjoyed watching Research Day grow in stature and relevance to our school's research mission.



Photo 2: Orthodontic graduate student Dr. Grant Bailey presenting poster to Dean Gilmore at the first Research Day.

The first keynote speaker was Dr. Janet Hock, faculty member and Eli Lilly researcher. Subsequent years the keynote speaker often was the national AADR president. Over these 30 years, an amazing number of students have presented their hard work at Research Day, with a total of 2,428 presentations (1,763 research posters and 665 table clinics). Typically, there are approximately 70-80 presentations each year. In this 30th year, we have 93 presentations, perhaps reflecting our return to full operations after the past two years of COVID restrictions. At every Research Day, dental students, postgraduate residents, PhD students – and for the past 10-15 years, dental hygiene students – have presented their research projects. Indeed, all postgraduate residents and PhD students are required to present their research.



Photo 3: Linda Miller, OHRI laboratory animal technologist, with Marie Wilson, OHRI dental research technician at the 1st Annual Research Day event.

The venue for our first Research Day was the IUPUI University Conference Center. We remained there for several years before moving to the dental school, and most recently to the IUPUI Campus Center. We particularly commemorate this milestone of hosting 30 consecutive Research Days by remembering our founding leader, Dr. George Stookey, who passed away earlier this year. He would be so proud of what IUSD Research Day has become. As Dr. RoseMarie Jones said at the end of her welcome message in the first Research Day program, “Hopefully, our success this year will warrant continuing this event for years to come!” How prophetic!

Richard L. Gregory, PhD

Associate Dean for Graduate Education
 Director, PhD Dental Science Program
 Professor of Biomedical Sciences and Comprehensive Care
 and Pathology and Laboratory Medicine
 IU School of Dentistry and IU School of Medicine

Research Day Planning Committee

Nicole Alderson
Hadeel M. Ayoub
Angela Bruzzaniti
Samuel T. Caskey
Tien-Min Gabriel Chu
Giovanna Denucci
Simone Duarte, Chair
Ygal Ehrlich
Roxana Fuentes
Thrya Gadah
Richard Gregory
Yusuke Hamada
Ashley Karczewski
Frank Lippert
Lisa Maxwell
Sheryl McGinnis
Drashty Mody
Dean Carol A. Murdoch-Kinch
Beatriz Panariello
Kamolphob Phasuk
Lisa Schunk
Keli Seering
Adam Smith
Sabrina Feitosa Sochacki
Mythily Srinivasan
Yasuyoshi Ueki
Chandler Walker
Terry Wilson

Officers

Indiana Section American Association for Dental, Oral, and Craniofacial Research

President: Simone Duarte
Vice President: Sabrina Sochacki
Secretary/Treasurer: Chandler Walker
Councilor: Anderson Hara
Chair Research Award Judging Committee: Kamolphob Phasuk
Chair Staff Award Judging Committee: Kamolphob Phasuk

Officers

IUSD Student Research Group

President: Marcus Levitan
Vice President: Justina Obumneme Anigbo
Secretary/Treasurer: Niki Gheibi Dehnashi
Newsletter Editor: Brittany Elizabeth Gehlhausen
Faculty Adviser: Angela Bruzzaniti

**Recognizing Excellence
2022 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

Maynard K. Hine Award for Excellence in Dental Research

Staff

IN-AADR 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

King Saud University Distinguished Research Faculty Travel Award

Research Poster Presentations

CARIOLOGY

- P1 Catalase and Glucosyltransferase's Role Against Photodynamic Therapy on Dual-species Biofilms.** G. DENUCCI^{*1}, B.H.D. PANARIELLO¹, B.A. GARCIA², J. ABRANCHES², S. DUARTE¹
(¹Indiana University School of Dentistry, ²University of Florida)

Objectives: Since photodynamic therapy (aPDT) generates reactive oxygen species, this study aimed to explore the role of catalase enzyme produced by *Candida albicans* and of glucans produced by *Streptococcus mutans* glucosyltransferases B/C (gtf B/C) in dual-species biofilms in the survival to the antimicrobial effect of aPDT. Methods: *C. albicans* SC5314 (CA) wild-type, *C. albicans* RBW43 cat1Δ (CAΔcat) mutant strain, *S. mutans* UA159 (SM) wild-type and *S. mutans* UR159ΔgtfB/C (SMΔgtf) mutant strain were used in different permutations: SM+CA, SM+CAΔcat, SMΔgtf+Δcat, SMΔgtf+CA. These different combinations of dual-species biofilms were grown on hydroxyapatite discs for 48 h. Established biofilms were then treated with one of the five treatment groups: H₂O for one minute, Toluidine Blue-O 44 μM (TBO) for five minutes, red light (RL; 635 nm) for 1 min (87.6 J/cm²), TBO+RL (aPDT), or 0.25% H₂O₂ for 90 minutes. Biofilms were processed, plated and colony forming units (CFUs) enumerated after 48h incubation. Results: One-way ANOVA and Tukey's post-hoc test (α=0.05) showed that for SM+CA and SMΔgtf + CA, aPDT did not have a significant effect on the survival of the strains (p≥0.05) with average log₁₀ CFU/mL values for aPDT of 6.2 ± 0.6 (SM), 4.33 ± 0.5 (CA) and 6.6 ± 0.3 (SMΔgtf), 5 ± 0.5 (CA) respectively, while for SM+Δcat and SMΔgtf + CAΔcat, aPDT treatment had a significant effect on *S. mutans* when compared to the controls (H₂O, TBO, and RL) (p≤0.05) with average log₁₀ CFU/mL values for aPDT of 4.9 ± 0.6 (SM); 4.4 ± 0.05 (Δcat) and 4.71 ± 1.1 (SMΔgtf), 4.5 ± 0.6 (CAΔcat) respectively. Conclusion: Catalase enzyme produced by *C. albicans* exercises protection for biofilm against aPDT.

- P2 Daily Fluoride Intake in a Cohort of Mexican Adolescents.** G. TAMAYO-CABEZA^{*1}, T.V. MUÑOZ-ROCHA², A. MANTILLA-RODRÍGUEZ¹, M.M. TÉLLEZ-ROJO², A. CANTORAL³, K.E. PETERSON⁴, H. HU⁵, E.A. MARTÍNEZ-MIER¹ (¹Indiana University School of Dentistry, ²Center for Nutrition and Health Research, National Institute of Public Health, Mexico, ³Universidad Iberoamericana, Mexico, ⁴University of Michigan School of Public Health, ⁵University of Southern California)

Objective: To describe the fluoride intake from foods, water, and other beverages consumed by the participants of the Early Life Exposures in Mexico to ENvironmental Toxicants (ELEMENT) Cohort. Methods: A cross-sectional analysis of 550 adolescents (ages 10-18) participating in the ELEMENT cohort. Food and beverage samples were purchased in the largest supermarket chains and local markets in Mexico City. A food frequency questionnaire (FFQ) was used to estimate the daily intake of each food and beverage. Drinking water samples were collected (n=764) from the households of the participants. Water sources were identified through a questionnaire applied during the visits. A combination of fluoride ion-specific electrode was used to analyze the samples, at least in duplicate, and estimate fluoride concentrations. Results: The average fluoride intake from foods, drinking water, and other beverages was 0.020 ± 0.01 mg/kg bw/day. Participants in the age group of 10 to 13 years old had a higher mean fluoride intake of 0.022 ± 0.01 mg/kg bw/day compared to the other age groups (p<0.001). The average self-reported water consumption of the participants was 664 ± 552 ml/day. The overall mean fluoride concentration in drinking water samples was 0.14 ± 0.10 mcg/ml. Well water samples showed the highest mean value of 0.28 ± 0.06 mcg/ml. Mean fluoride intake from drinking water was estimated to be 0.10 ± 0.13 mg/day. High-water consumers showed a mean intake of 0.19 ± 0.18 mg/day. Conclusion: Mean fluoride intake values from foods, drinking water, and other beverages in this study were consistent with dietary fluoride averages reported by previous studies. It is recommended that other fluoride sources be assessed to estimate total fluoride intake and provide a complete analysis of overexposure risk. (Supported by the grants R01ES021446, R01ES007821, P42-ES05947, and P30ES017885 from the US National Institute of Environmental Health Sciences (NIEHS) and the grant P01ES022844/RD83543601 from NIEHS/US Environmental Protection Agency, by the National Institute of Public Health/Ministry of Health of Mexico)

DENTAL EDUCATION

P3 3D Printed Model for Preclinical Training in Oral Radiology. A. ZHAO^{*1}, A. WEISS¹, W. MELLO², G. LIEDKE², V. DUTRA¹ (¹Indiana University School of Dentistry, ²Federal University of Santa Maria)

Objective: 3D printing is experiencing significant growth in the teaching and learning process. Therefore, this study aims to present a 3D printed skull model for preclinical intraoral radiographic practice. Study Design: Two 3D printed mannequins were created, one using an STL file of a skull was edited using two 3D modeling software (Meshmixer and Netfabb). A second mannequin was designed directly from the segmented patient's CBCT data and then converted into an STL file; both mannequins were printed using FDM (Fused Deposition Modeling) technology and PLA (polylactic acid) filament. The printed skull bones were attached, and the mandible was articulated to the articular fossa of the temporal bone; the teeth were inserted into the alveoli. Intraoral radiographs of both mannequins were taken using a digital sensor (RVG 5100, Carestream). Results: 3D printed mannequins showed satisfactory radiographic appearance, allowing geometric representation of each intraoral radiographic projection, regardless of STL file origin. Anatomical structures, such as the periodontal ligament space, zygomatic process of the maxilla, and intermaxillary suture, were represented. The material cost of the printed prototype was \$34.00. Conclusion: The use of 3D printed models is presented as an alternative to artificial commercial phantoms for the preclinical training of intraoral radiographic techniques, combining the radiographic projection's quality, the possibility of model manipulation, and an affordable price.

P4 Dental Students' Perceptions of Indiana University's Interprofessional Education Curriculum. E. ANDERSON*, L. ROMITO (Indiana University School of Dentistry)

The study purpose was to evaluate dental students' knowledge and perceptions of the Team Education Advancing Collaboration in Healthcare (TEACH!) IPE curriculum. Methods: During Fall 2021, an email providing study information and a link to the confidential 16-item Qualtrics survey was sent to the DDS Classes of 2022, 2023, and 2024. Survey items asked about students' attitudes on IPE (Q1-Q5), perceptions of TEACH! (Q6-Q11), knowledge and familiarity with TEACH! (Q12-14), and demographics (Q15-Q16). Survey items were formatted as multiple choice, open-ended, and responses on a 5-point scale. At 21 and 28 days following the initial release of the survey, reminder emails were sent. A Qualtrics report was provided with collated, deidentified data. Results: The response rate for full completion of this survey was 8% (n=27). Responses received by cohort were Class of 2024 (n=13), Class of 2023 (n=9), and Class of 2024 (n=5). While 26 of respondents strongly agreed/agreed that patients benefit from IPE training (mean 4.31), 19 strongly agreed/agreed that it is an important part of the dental school curriculum (mean 3.83). Additionally, 16 respondents stated that they would welcome the opportunity for small group projects with other health sciences students (mean 3.48), and 14 students strongly agreed/agreed upon satisfaction with their TEACH! interactive experiences (mean 3.45). While 17 students strongly agreed/agreed that they are familiar with the TEACH! curriculum (mean 3.52), only one student correctly listed the core competencies foundational to the curriculum. Students perceived medicine, dental hygiene, pharmacy, and nutrition students as most relevant to collaborate with in TEACH! events. Conclusion: The results suggest that while most student respondents acknowledged that IPE enhances patient care and is a necessary component of a dental school curriculum, fewer students demonstrated knowledge about the curriculum and reported being satisfied with their TEACH! experiences.

P5 Career Satisfaction of Female Healthcare Educators: a Retrospective Study. C. LILES*, K.T. STEWART (Indiana University School of Dentistry)

Background: Educators are essential for developing healthcare professionals, but faculty turnover remains high due to suboptimal job satisfaction, especially among female faculty. Assessing job satisfaction among female educators is critical for identifying strategies to increase retention and decrease female faculty attrition. Methods: A cross-sectional, web-based Qualtrics survey was disseminated to faculty at Indiana University Schools of Medicine and Dentistry. Survey content was stratified into 7 domains: general demographic information, overall satisfaction, research satisfaction, leadership and professional development, work environment, distance/virtual learning due to COVID-19, and overall assessment. Categorical variables were tested using Kruskal-Wallis tests and continuous variables were tested using Wilcoxon Rank Sum tests. Statistical significance was set at 5%. Results: The survey was sent to 2,854 faculty, with 1209 [41.7%] being female. Of this sample, 163 female

participants completed the survey. Ten surveys were incomplete, giving a sample size of 153 (12.7% response rate). There were 133 medical and 20 dental respondents respectively. Respondents 20-40 years old were less satisfied with opportunities for professional development ($p=0.018$), mentorship opportunities ($p=0.008$), and overall response to the COVID-19 pandemic ($p=0.023$) as compared to females >40 years old. Non-full time faculty were more dissatisfied with their compensation than their full time counterparts ($p=0.028$). Females working for <1 year felt a greater sense of appreciation at work ($p=0.016$) and sense of respect ($p=0.007$) as compared to those in academics for 1-5 years. Across all disciplines, it was identified that females experienced a high level of stress on a typical day of work ($p=0.04$). Finally, approximately 40% of respondents answered that they would not or were unsure of their desire to re-enter the profession. Conclusion: Many variables influence job satisfaction, especially among female educators. Institutions must be proactive with assessing influential factors and employing strategies to improve satisfaction and female faculty retention in healthcare academia.

DENTAL INFORMATICS

P6 An Approach to Determining Sjogren's Syndrome Patients' Oral Health Longitudinally. C.A. WALTON^{*1}, G.M. VEERAMALLA¹, G.F. GOMEZ¹, M. WANG¹, T.P. THYVALIKAKATH^{1,2} (¹Indiana University School of Dentistry, ²Regenstrief Institute)

Objective: Determine the feasibility of characterizing Sjogren's Syndrome patients' (SSPs) oral health longitudinally through a retrospective review of electronic dental and health record (EDR-EHR) data. In addition, we aimed to identify whether discrepancies exist between structured and unstructured EDR data. Methods: We identified 71 positive SSPs using linked EDR-EHR data. Manual review of 9 patients' unstructured EDR clinical notes in eHOST (extensible Human Oracle Suite of Tools) was used to develop annotation guidelines. We retrieved structured EDR data including procedure codes and dates of visits. Annotation project schema composed of five classes was defined to represent the major oral hard tissue findings: "Decay", "Missing", "Filling", "Tooth number", and "Fractured tooth", along with their attributes and relationships. Two annotators independently annotated clinical notes for 5 SSPs. Inter-annotator agreement (IAA) reports were computed and annotation discrepancies moderated through discussion and consensus. Results: Positive-specific agreement between the two annotators achieved an overall F-measure of 75% for encoding oral hard tissue findings. Between 2005 and 2019, a total of 65 dental visits, 147 clinical notes, and 30 different procedure codes were documented for the 5 SSPs. The most common procedures were restorative (20%) and extractions (19.6%). A total of 25 decayed teeth and 15 filled teeth were identified through annotation of clinical notes and followed for progression. 60% of decayed teeth had secondary caries. 40% of decayed teeth and 20% of filled teeth progressed to missing, causing the majority (80%) of patients to receive partial or complete dentures. Filled teeth findings from unstructured EDR data matched 100% with structured data, but no decayed teeth findings were found as structured data. Conclusion: These results demonstrate the feasibility of applying an NLP annotation tool to clinical text for the purpose of extracting information that may otherwise be excluded from structured EDR data. (NIH/NIDCR grant R21 DE027786-02)

P7 Diagnostic Algorithm From Prognostic Markers and Comorbidities in Sjogren's Syndrome Patients. G.F. GOMEZ^{*1,2}, D. RAJENDRAN¹, J.C. SMITH², A.G. VILHAUER², M. WANG¹, G.J. ECKERT³, S.J. GRANNIS^{2,3}, S.T. HUGENBERG^{3,4}, S. ZUNT¹, D.T. ZERO¹, T.P. THYVALIKAKATH^{1,2} (¹Indiana University School of Dentistry, ²Regenstrief Institute, ³Indiana University School of Medicine, ⁴Indiana University Health)

Objectives: Early diagnosis of Sjogren's Syndrome (SS) is challenging because of various manifestations of phenotypic features and comorbidities. The objective of this research was to develop a diagnostic algorithm through unique combinations of subjective symptoms and objective signs consisting of prognostic markers and associated co-morbidities. Methods: Matched electronic dental and health records (EDR-EHR) of patients with a diagnostic code for SS from the Indiana University School of Dentistry from January 2005 to December 2020 were obtained. We determined the combinations of the presenting symptoms and signs in the clinical notes that could serve as prognostic markers for the diagnostic algorithm. Prevalence of other autoimmune and comorbidities associated with the condition was also determined by grouping individual diagnostic codes. Results: Out of 406

patients, for the positively diagnosed (N=95), the first order of combination of symptoms and signs with the highest prevalence were dry mouth and dry eye with Anti- SSA (Ro) and antinuclear (ANA) autoantibodies, representing about 22%, followed by 15.79% including Anti-SSB (La) and RF, and the third order of combination did not have Anti-SSB representing 11.58%. Dry mouth, dry eye, Anti-SSA, ANA were common in positively diagnosed combinations. Forty percent of negatively diagnosed did not have any symptoms/signs but had a mention of diagnostic code. The highest prevalence of dryness in the mouth, eye, ANA, RF were seen in 64% of the uncertain patients. Rheumatoid arthritis (RA) (N=145, 35.7%), Systemic lupus erythematosus (SLE) (N=152, 37.4%), and pain in joints, limbs were the most reported comorbidities followed by hypertension, depression, and bipolar disorder. Conclusion: It is critical that diagnosis of SS is not overlooked or missed due to clinical manifestations common to SS and other comorbid conditions such as RA and SLE. Our study elucidated the preliminary predictive combinations for early diagnosis of SS patients to prevent further complications. (NIH/NIDCR grant R21 DE027786-02)

P8 How Essential Is Patient Medical History for Dental Care? S. LI^{*1}, A. RAJAPURI^{1,2}, G.F. GOMEZ¹, H. XU³, T.P. THYVALIKAKATH^{1,2} (¹Indiana University School of Dentistry, ²Regenstrief Institute, ³Indiana University School of Medicine)

Objectives: Determine the importance of a patient's medical history during dental care, the strengths and weaknesses of the current medical data gathering methods, and the providers' perceptions of accessing patient-specific medical information via community or regional health information exchanges (HIE). Methods: We administered an online survey with the Indiana Dental Association (IDA) dentists from March 19-April 30, 2021. The survey was designed and administrated in Qualtrics Experience Management platform. It included 27 questions covering three topics: demographics, information gathering, and exchange of patient medical information. All responses were anonymous. Results: We sent emails to 2,148 IDA members and received 161 completed responses (7.5%). 63.4% were male participants, 34.8% female, and 1.9% preferred not to report. 74.5% of respondents were general practitioners and 25.5% dental specialists. 79.5% respondents reported using an electronic dental record for patient care. 89.4% respondents considered patients' medical histories extremely important during dental care. The top three most wanted information types were medical conditions/diagnosis, current medications, and allergies. Paper-based health history form (78.8%) is the most used method to collect patients' medical histories, following by online health history forms (38.5%). However, only 8.1% respondents considered these forms highly reliable, 61.5% moderately reliable, and 30.4% not very reliable. 98.1% respondents chose to contact medical providers (medical consult) to collect additional information. However, respondents reported challenges when contacting medical providers, include requiring multiple attempts (60.2%), not receiving information on time (49.7%), and non-responding physician offices (41.0%). 70.2% respondents considered access to a regional health information exchange (HIE) useful and are willing to use it. Conclusions: Patients' medical histories are essential for dental clinicians to provide high quality dental care. The most used collecting process is patient-reported medical histories with optional medical consults. However, dental clinicians encounter challenges. HIE provided a new option for optimizing this information collecting process.

DENTAL MATERIALS

P9 Translucency Parameter and Transmittance Relationship in Zirconia at Different Shades.
P. KARIMI*, T.G. CHU (Indiana University School of Dentistry)

The purpose is to evaluate the relationship between the transmittance light intensity and translucency parameter at different shades in the high translucency (HT) lithium disilicate glass ceramic (LDGC). LDGC (IPS e.max CAD) in three shades at A1, A2, and A3 were used. 75 disc-shaped ceramic specimens were prepared from the CAD/CAM material blocks. The e.max CAD ingots were cut and polished into thicknesses of 1, 1.25, 1.50, 1.75, and 2 mm. Five samples were used for each shade (A1, A2, and A3) and thickness (1, 1.25, 1.5, 1.75, and 2 mm) combination. The L^* , a^* , b^* values of each sample were measured using a spectrophotometer (CM-2600D, Konica Minolta) on black and white background and TP_{00} was calculated using the CIEDE2000 Lab formula. Light transmission through the samples was measured utilizing a resin calibrator (MARC Resin Calibrator, BlueLight). The TP_{00} , average light intensity, reflectance, and absorption coefficient of e.max CAD at different thickness and

shades were measured. The correlation between TP₀₀, shade, and thickness were explored using regression analysis. From our data, we found that there is inverse relationship between the thickness of e.max CAD and the translucency parameter. As the thickness of e.max CAD increases the light transmittance decreases. As the shade changes from light to darker red-brown color in e.max CAD the absorption coefficient and reflectance increase. As expected, light transmittance is shade dependent. However, the shade dependence of TP₀₀ was only found in 1-, 1.25-, and 1.75-mm samples, but not in 1.5- and 2-mm samples.

P10 Drug Release and MMP-inhibition Assessment of EGCG-encapsulated HNT Dental Adhesive.

S. ALHIJJJ*, J.A. PLATT, L.J. WINDSOR (Indiana University School of Dentistry)

Introduction: The degradation of the resin-dentin interface after restoration placement is multifactorial and can be attributed in part to matrix metalloproteinases (MMPs) and enzymatic activities associated with recurrent and secondary caries progression. The purpose of the study was to evaluate the drug release and MMP-9 inhibition of EGCG-encapsulated HNT dental adhesives to protect the collagen fibrils at the hybrid layer against degradation by proteolytic activity after restoration placement. Methods: EGCG (95% pure extract; Sigma-Aldrich) and Halloysite Nanotubes (HNTs; Dragonite HP) were used to prepare three combinations (EGCG, EGCG-encapsulated HNT, and EGCG-free HNT) to be incorporated in the dental adhesive (Adper Scotchbond Multi-Purpose, 3M Oral Care). UV-vis spectrometer was used to detect the EGCG release overtime and drug loading efficiency. MMP mediated β -casein (BCN) cleavage rate assays were used to determine the potency of the EGCG in adhesive eluates to inhibit MMP-9 activities. Results: The encapsulation efficiency calculations revealed that the HNTs could hold 21.35% ($\pm 4.6\%$) of the EGCG. A statistically significant positive influence of adding HNTs was found in the drug release analysis measured up to 8 weeks ($p < 0.05$). MMP mediated β -casein cleavage rate assays results indicated a significant decrease in MMP-9 activities for EGCG compared to non-EGCG adhesive groups ($p < 0.05$). Conclusion: Within the limitation of the study, the results suggest that EGCG-encapsulated HNT was capable of inhibiting MMPs and may contribute to the long-term preservation of restorations through slow and controlled release of EGCG compound to maintain the dentin-resin interface's integrity.

P11 Evaluation of Biofilm Growth and Surface Properties for Provisional Restoration. M. ARRAGEG*, W. KIETTIPIRODOM, K. PHASUK, A. ARATA, I. VIAN, R.L. GREGORY, S. DUARTE, W. LIN, J. LEVON, S.F. SOCHACKI (Indiana University School of Dentistry)

The purpose of this in vitro study was to investigate the effects of different aging protocols that simulate oral conditions with/without simulating toothbrushing on the contact angle, surface roughness, and biofilm count on a bis-acrylic based provisional restoration material (Protemp™ Plus, 3M, St. Paul, MN, USA), one of the newest and currently available Bis-acryl composite resins. Resin discs (n=36) 15 mm diameter and 1.2 mm thickness were prepared for each aging protocol: no aging control group (CT); artificial saliva (AS); citric acid (CA); CT+toothbrushing (CTT); AS+toothbrushing (AST); and CA+toothbrushing (CAT). All groups were submitted to the aging protocol at 37°C for 7 days. Then the CTT, AST, and CAT groups were submitted to simulated toothbrushing. Surface roughness Ra₀, Ra₁, and Ra₂ were assessed using a non-contact profilometer and dedicated software. The contact angle was determined using the sessile drop method by using an automated contact angle device. Specimens were incubated with *Streptococcus mutans* for 24 hours and the biofilm was dislodged. Two dilutions of resuspended biofilm were incubated on blood agar plates and colony-forming units (CFU) values were measured. Two-way ANOVA and A Kruskal-Wallis tests were used to analyze the results. There were no significant CFU value differences between experimental groups ($p=0.27$). There was no correlation between surface roughness values and CFU. The effect of aging on roughness was not significant with brushing ($p=0.070$) but was significant without brushing ($p=0.041$). The effect of aging on contact angle values was significant ($p=0.002$): Citric acid had a significantly lower contact angle than artificial saliva ($p=0.004$) and control ($p=0.004$), but artificial saliva and control were not significantly different ($p=0.55$). The interaction effect between aging and toothbrushing on contact angle was not significant ($p=0.37$). The results indicate that aging protocols have no significant effect on *Streptococcus mutans* biofilm accumulated on a bis-acrylic based provisional restoration material.

P12 Characterization of a Chlorhexidine-Encapsulated Surface-Modified Nanotube Incorporated Into a Resin-Composite. S. CASKEY*, A. KARCZEWSKI, R.L. GREGORY, J.A. PLATT, S.F. SOCHACKI

Objective: To characterize and evaluate the protocol for a bulkfill-flowable resin-composite containing 3-aminopropyltriethoxysilane (APTES, Silane) surface-modified halloysite-clay nanotubes (HNTs) encapsulated with chlorhexidine (CHX) for use as a restorative in high caries-risk patients. Methods: Five groups were evaluated: BF (3M Filtek Flowable BulkFill), HNT (BF+ 5wt.%HNT), HNT/CHX (BF+ 5wt.%HNT, 10vol.% CHX), silH₂O (BF+ 5wt.%HNT, 10vol.% CHX, 6vol.% APTES[H₂O]) and silEtOH (BF+ 5wt.%HNT, 10vol.% CHX, 6vol.% APTES [EtOH]). Silanized HNTs were loaded with CHX and incorporated into a resin-composite at varied weight percentages (0wt%, 1wt%, 2.5wt%, 5wt%) then specimens were light cured following manufacturer's instructions. Mechanical properties (n=6/group) (UTS, Ultimate Tensile Strength; FS, Flexural Strength; FM, Flexural modulus; DC%, degree of conversion) were determined. Antimicrobial properties are being evaluated against *Streptococcus mutans* (UA179). Data was statistically analyzed for each test (p<0.05). Results: The optimal weight percentage of HNT, shown by mechanical strength, in our material was 5wt%. Groups BF and HNT presented higher FS compared to HNT/CHX, silH₂O and silEtOH. No statistical difference was seen in FM or DC%. Microbiological assays are ongoing to evaluate the antimicrobial properties. Conclusion: After assessment of CHX release, it was determined that the method used for CHX encapsulation requires further optimization. The method was deeply evaluated and the cause for the lack of CHX release was identified. Further studies to optimize the mechanical and biological properties of this material are ongoing. Currently, our material would have limitations as a clinical resin-composite but could prove a promising restorative intervention in populations with high caries-risk.

MICROBIOLOGY / IMMUNOLOGY / ORAL BIOLOGY

P13 Inhibitory Effect of Theobromine on *Streptococcus mutans* Biofilm Formation. L. HAZZAZI*, R.L. GREGORY (Indiana University School of Dentistry)

Objective: Theobromine is a major component of the cocoa bean and is believed to have antimicrobial effects. The aim of our study was to investigate the effect of theobromine concentrations on the biofilm formation of the cariogenic bacteria *Streptococcus mutans*. Methods: *S. mutans* strain (UA159) was inoculated into a 96-well microtiter plate and was tested with various concentrations of theobromine (0, 0.078, 0.156, 0.3125, 0.625, 1.25, 2.5, 5, 10, 20 mg/ml). For inhibition of biofilm formation, crystal violet biofilm staining absorbance values were recorded using a microplate spectrophotometer at 490 nm. Results: One-way ANOVA was used to compare the theobromine concentrations for differences in biofilm measurements ($\alpha = 5\%$) and the analyses were performed using SAS version 9.4. When compared to the 0-theobromine control, the addition of theobromine resulted in significant reduction (p<0.05) in the biofilm formation for all concentrations except for 0.156 mg/ml. Conclusion: The results of this study demonstrated the effect of theobromine on *S. mutans* biofilm formation. However, further investigation is still needed to investigate theobromine potential as an anticaries agent.

P14 Inhibiting Aggregation of Oral Microorganisms Using Invertase and Dextranase. S. ALHAFFAR*, R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans is a cariogenic bacterium due to its ability to bind tooth surfaces and produce lactic acid, demineralizing enamel. Biofilm that performs this is composed of bacterial cells and extracellular polysaccharides (EPS) that cells secrete, which serve to hold the biofilm together and help it adhere to enamel. Coaggregation is a protective mechanism where genetically distinct microorganisms adhere to each other in suspension. During candida infections and in the presence of dental plaque, microorganisms form complex biofilms that result in structural and metabolic co-dependence. *C. albicans* has the ability to adhere to and colonize denture surfaces in coaggregation with *S. mutans*. The process of coaggregation typically involves protein/carbohydrate interactions of microorganisms, primarily composed of polymers which can be cleaved using sugar-hydrolyzing enzymes such as invertase and dextranase. A crystal violet staining assay was used to demonstrate significant inhibition (p < 0.05) of *S. mutans* biofilm formation in samples treated with invertase (40% decrease) and dextranase (55%), with dextranase demonstrating significantly larger inhibition. Additionally, a phenol-sulfuric acid assay was used to confirm that the action of the enzymes involved a significant reduction of EPS in the treated biofilm samples. And lastly, it has been demonstrated that the enzymes exhibit an inhibitory effect on the growth of *C. albicans*.

Current efforts utilize visual, microscopic, and spectrophotometric methods to investigate whether these enzymes inhibit coaggregation of *S. mutans* and *C. albicans* by cleaving sugars in EPS that allow the two microbes to aggregate in the oral cavity and form a complex biofilm. The results of this research determined that invertase and dextranase significantly reduced the structural and metabolic co-dependence that occurs from these interactions, thereby reducing overall biofilm mass and symptoms that may develop. Visual and spectrophotometric analysis demonstrate that the enzymes do reduce the coaggregation that occurs between the two organisms.

P15 Comparison of Two Commercial Antibacterial Agents Against Pathogenic Bacteria. A. BRIDWELL*, C. BATRA, R.L. GREGORY, Y. HAMADA (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.

P16 Investigating the Effects of Preselin-1 on Osteoclasts in Mice. K. CHESTER*¹, J.M. HONG¹, M. VANG¹, R. VIDAL², A. BRUZZANITI¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Introduction: Alzheimer disease (AD) affects 44 million people globally and is characterized by dementia and declined cognitive function. Longitudinal studies have indicated that individuals with dementia demonstrate decreased bone mineral density (BMD) and increased incidence of fall and fracture. A single L166P genetic mutation of presenilin-1 (PSEN1) suggested a consequence of familial AD. Given the prominence of bone changes in AD patients, previous studies have investigated changes in the bone mass properties in PSEN1-L166P knock-in mice (PSEN1-KI), a mouse model of familial AD. Female PSEN1-KI mice demonstrated lower BMD. The objective of the current study was to understand the cellular mechanism, and in particular the role of osteoclasts in the low bone mass of PSEN1-KI female mice. Hypothesis: Female PSEN1-KI mice will show elevated osteoclast number, contributing to low bone mass. Method: Histological sections of the distal femur from male and female wild-type (WT) and PSEN1KI mice at 18-weeks (N=6/group) were stained for tartrate-resistant acid phosphatase. The measurement of osteoclast surface to bone surface (BS) (Oc.S/BS) and osteoclast number/BS (Oc.N/BS) was determined using Bioquant software, with significance by student t-test set at $p < 0.05$. Results: Although micro-CT demonstrated lower bone mass in female PSEN1-KI, Oc.S/BS and Oc.N/BS were similar between in PSEN1-KI versus wild-type. No changes were observed in PSEN1-KI male mice as expected. Conclusion: It is possible that the observed bone mass changes in female PSEN1-KI mice occurred at an earlier age and may not be correlated with the osteoclast histology assessed at 18-weeks. Alternatively, the bone phenotype could be caused by defects in osteoblasts and/or osteocytes leading to a reduction in bone formation. Future histology will investigate osteoblast activity in PSEN1-KI mice, as well as osteoclast and osteoblast activity in younger mice. Understanding the cellular mechanisms may lead to therapeutic advances to improve bone mass in AD patients.

P17 TLR2 Signaling in the Osteocyte Regulates *P. gingivalis*-induced Alveolar Bone Loss. A. DOAN*¹, T. YOSHIMOTO¹, M. KITAKA¹, E. GREENFIELD², Y. UEKI¹ (¹Indiana University School of Medicine, ²Indiana University School of Dentistry)

There is still a critical need for identifying new treatment strategies for alveolar bone loss in periodontitis. The goal of this study is to identify new therapeutic targets for bone loss caused by oral bacterial infection. Osteocytes are the most abundant bone cells embedded in the bone matrix. One of the key features of osteocytes is that they are a primary source of RANKL, an essential cytokine for osteoclast differentiation. In an experimental periodontitis model, mice with targeted RANKL deletion in osteocytes exhibit a rescue from alveolar bone resorption, suggesting that osteocyte-derived RANKL is necessary for osteoclast induction in periodontitis. Nevertheless, underlying mechanisms of how oral bacterial infection induces RANKL in alveolar bone osteocytes have never been identified. Toll-like receptors (TLRs) are a family of pattern recognition receptors that play critical roles in the host recognition of bacterial pathogens. Previous *in vitro* studies showed that TLR2 stimulation by bacterial pathogen-associated molecular patterns (PAMPs) increases RANKL in osteoblasts, which are osteocyte precursors. Particularly, TLR2-deficient mice protect against alveolar bone resorption in *P. gingivalis* (*Pg*)-induced periodontitis in mice. Together, we hypothesized that activation of the TLR2 signaling in osteocytes is responsible for bone loss in *Pg*-induced periodontitis by inducing RANKL. We discovered that alveolar bone osteocytes express TLR2 by immunohistochemical staining. To determine if activation of the TLR2 signaling in osteocytes impacts alveolar bone loss in periodontitis, we generated osteocyte-specific TLR2 knockout mice using the *Dmp1-Cre* promoter and orally infected the mice with *Pg*. MicroCT analysis revealed that *Dmp1-Cre; Tlr2^{fl/fl}* mice exhibited significantly decreased CEJ-ABC distance and alveolar bone loss compared to *Tlr2^{fl/fl}* mice. qPCR analysis found that RANKL expression is decreased in jawbones of the *Dmp1-Cre; Tlr2^{fl/fl}* mice. These data suggest that TLR2 signaling in osteocytes may be an emerging target to prevent and treat bone loss in periodontitis. (Supported by R01DE025870 and R01DE025870-06S1)

P18 Effect of Nicotine on *Streptococcus mutans* Biofilm on Orthodontic Brackets. A. DRESNER*, R.L. GREGORY (Indiana University School of Dentistry)

The effects of nicotine on *Streptococcus mutans* biofilm formation on stainless-steel orthodontic brackets was determined through bacterial plating. *S. mutans* is a facultative anaerobic, gram-positive bacterium commonly found in the oral cavity and is a significant contributor to tooth decay. Previously, *S. mutans* growth and biofilm formation in tissue culture plates was observed to increase in the presence of nicotine. Our hypothesis was that nicotine would upregulate biofilm formation on brackets. In this experiment, *S. mutans* was grown in tryptic soy broth (TSB) overnight. The following day, 1, 2 and 4 mg/mL of nicotine was diluted in tryptic soy broth with sucrose (TSBS) in a six well plate with controls consisting of TSBS alone. Four brackets were placed in each well and incubated overnight to allow for biofilm development on the brackets. The next day, the brackets were removed, the biofilm on the brackets were sonicated, and vortexed. Dilutions of the removed biofilm cells were made in saline and plated on blood agar plates. The plates were incubated for 48 hours, and the colonies enumerated. The data revealed that 1, 2, and 4 mg/mL of nicotine did not significantly alter the number of *S. mutans* in the biofilm adherent to the brackets. However, 1 mg/mL of nicotine indicated a trend toward increasing the number of *S. mutans* by 144.4% of the 0-nicotine control. In addition, 4 mg/mL of nicotine demonstrated that the number of *S. mutans* decreased by 6% compared to the 0-nicotine control. In conclusion, orthodontic patients that are light smokers (analogous to the 1 mg/mL of nicotine) will have some effect on *S. mutans* biofilm formation attached to their brackets.

P19 Effect of Nicotine on *S. mutans* Type 4 Collagen Binding. A. WHALEN*, R.L. GREGORY (Indiana University School of Dentistry)

Streptococcus mutans is a gram-positive bacteria found commonly in dental caries, and has an association with systemic diseases, such as endocarditis and atherosclerosis (AT). In the presence of nicotine, *S. mutans* growth and biofilm formation has been shown to increase. A direct relationship is seen until the concentration of nicotine reaches 32 mg/mL, at which *S. mutans* dies. However, the relationship between *S. mutans* and systemic disease such as AT is not fully understood. This study aimed to determine the effect of nicotine on upregulation of *S. mutans* binding receptors to type 4 collagen. *S. mutans* was cultivated in tryptic soy broth (TSB) overnight. *S. mutans* was then grown in TSB containing 0, 1, 2, 4, 8, and 32 mg/mL concentrations of nicotine. The following

day, the nicotine-treated *S. mutans* was transferred into 6 well plates coated with type 4 collagen to assess binding to collagen after a 30-minute incubation. After scrapping the bound *S. mutans* cells from the collagen-coated plates, blood agar plates were used to enumerate *S. mutans* that had bound to the type 4 collagen. An automated colony counter was used to count the number of *S. mutans* colonies present. When comparing the number of *S. mutans* colonies from nicotine treated groups to a control group of 0 mg/mL nicotine, concentrations of nicotine (1-4 mg/mL) demonstrated significantly increased *S. mutans* attachment to collagen ($p < 0.05$). Thus, *S. mutans* type 4 collagen binding receptors were upregulated in the presence of nicotine. This upregulation increased as the concentration of nicotine increased; to the extent of 8 mg/mL in which *S. mutans* presence began to decrease. There was little *S. mutans* growth present at a nicotine concentration of 32 mg/mL. These results provide further confirmation of the role of nicotine and *S. mutans* in the collagen binding associated with AT.

P20 Effect of Nicotine on Halitosis Organisms Growth and VSC Production. D. ACHARYA*, R.L. GREGORY (Indiana University School of Dentistry)

Porphyromonas gingivalis (PG) and *Fusobacterium nucleatum* (FN) are common pathogenic oral bacteria known to produce halitosis by synthesizing volatile sulfur compounds (VSC). The etiology of halitosis is multifactorial, however, VSC are known to be responsible for the foul odor detected in the oral cavity when the VSC levels are significant. Moreover, nicotine is known to interfere with bacterial growth by altering their metabolic activity. The ability of these bacteria to produce VSC in response to nicotine is the focus of the study. The objective of this study was to measure the amount of VSC produced by the two bacteria at various nicotine concentrations (0-32 mg/ml) after 48 h of incubation. A halimeter was used to measure the VSC levels and investigate if any correlation existed between VSC production at the various nicotine concentrations. Both species produced significant amounts ($p < 0.05$) of VSC without nicotine compared to the media only control. Nicotine had an effect on VSC production in both PG and FN. A distinct increasing trend in VSC production was observed from 0 up to the 4 mg/ml concentration. Alternatively, it exhibited decreasing VSC production from 4 to 32 mg/ml of nicotine. In conclusion, nicotine stimulates VSC production in PG and FN up to a certain concentration (4 mg/ml) and higher concentrations of nicotine have the ability to kill the bacteria which consequently results in reduction of VSC levels. Thus, smoking or consuming nicotine containing products promotes the growth of VSC producing bacteria in the oral cavity which would increase VSC production leading to halitosis.

P21 Effects of Cannabidiol and Bacterial Lipopolysaccharides on Human Periodontal Ligament Fibroblasts. S. HALL*, A.A. AZABI, L.J. WINDSOR (Indiana University School of Dentistry)

Cannabis sativa, also known as marijuana, is a common substance used in recreational settings. Cannabidiol (CBD) is a major component of cannabis, however it does not have any psychoactive effects. Evidence exists that suggests CBD may potentially have anti-inflammatory properties within the body and possibly in the oral cavity. However, limited research exists examining these effects in the oral cavity in conjunction with Bacterial Lipopolysaccharides (LPS). The purpose of this study was to evaluate the effects of CBD and Bacterial Lipopolysaccharides on human periodontal ligament fibroblasts (HPLFs). HPLFs are crucial in maintaining a healthy periodontal attachment because they are the connectors between cementum, tooth structure, and alveolar bone. HPLFs were treated with CBD (1 μ M) or LPS (1 μ g/ml) or a combination of the two. The untreated HPLFs were used as a control. Effects from these treatments on cell proliferation and cytotoxicity were examined using water soluble tetrazolium-1 (WST-1) and lactate dehydrogenase (LDH) assays, respectively. The data for the WST-1 (CBD, $p=0.869$; LPS, $p=0.920$; CBD+LPS, $p=0.998$) and LDH (CBD, $p=1$; LPS, $p=0.949$; CBD+LPS, $p=0.960$) assays were not statistically significant, but they did show that the experimental concentrations did not greatly affect cell proliferation and were not significantly toxic to the cells. Future experiments will examine the effects of CBD on the cytokine expression from HPDLs when stimulated with LPS.

P22 Characterization of Bone Phenotype of OGRL1 Knock-out Mice. S. COGHLAN*, M. KITAKA, T. YOSHIMOTO, Y. UEKI (Indiana University School of Dentistry)

Cherubism, a condition in children characterized by expansile destruction of jawbones, is caused by autosomal dominant gain-of-function mutations of the gene *SH3BP2*. We have previously demonstrated that the *SH3BP2* cherubism mutation increased the number and activity of osteoclasts resulting in bone loss in mice. Recently, two consanguineous families with cherubism-like lesions without *SH3BP2* mutation were identified. Exome

sequencing discovered homozygous mutations in the gene encoding opioid growth factor receptor-like 1 (*OGFRL1*) only in affected individuals. However, the function of *OGFRL1* is unknown. As identified mutations introduce an early frame-shift mutation or a premature stop codon to the *OGFRL1*, we hypothesized that loss-of-function of *OGFRL1* is responsible for autosomal recessive (AR) forms of cherubism and that the mice lacking *OGFRL1* exhibit increased osteoclastogenesis leading to osteopenia as seen in SH3BP2 cherubism mice. We created *OGFRL1* knock-out (KO) mice, and tibiae isolated from the KO mice of 12 weeks old were analyzed with μ CT. After μ CT analysis, the samples were paraffin-embedded, sectioned, and TRAP-stained to visualize osteoclasts. Histomorphometry of trabecular bone at proximal tibia was performed on the TRAP-stained sections to quantitate parameters for osteoclasts (N.Oc/BS and Oc.S/BS) using the ImageJ. Unexpectedly, we did not see a reduction of bone mass or increased osteoclast formation in KO mice compared to wild-type control mice. Contrarily, male KO mice showed thicker trabecular bone than wild-type controls. Histomorphometry of osteoblasts revealed slightly increased Ob.S/BS in male KO mice, which may explain the thickened trabecular bone in male KO mice. On the other hand, all the parameters in female KO mice were comparable to the wild-type females. These data suggest that a dominant-negative function of *OGFRL1*, but not loss of function, may be a cause of AR cherubism, and *OGFRL1* is a previously unrecognized male-specific regulator of osteoblast function. (This study is supported by NIDCR)

P23 Effect of AITC on *Streptococcus mutans* Initial and Established Biofilm. R. FLETCHER*, R.L. GREGORY (Indiana University School of Dentistry)

The Brassica or cruciferous plant family are widely known for their antimicrobial and antioxidant effects. Brassicas or mustard greens account for a vast plant genus including many common household vegetables like broccoli, horseradish, cabbage, cauliflower, kale and brussels sprouts. Their antimicrobial effects are due to their production of volatile isothiocyanates through a reaction of myrosinase enzyme and glucosinolates proceeding from plant tissue damage. To study the various foods that impact oral biofilm formation in the mouth, this study considered the effects of brassica tissues: broccoli extracts, horseradish powder and allyl isothiocyanates (AITC's) on *S. mutans* biofilm formation. This investigation chose *S. mutans* strain UA159 since it is a common and well-studied cariogenic bacterium. *S. mutans* cultures were combined with various concentrations of broccoli extract, horseradish and AITC's and incubated overnight in 96 well microtiter plates. These wells were measured for overall *S. mutans* growth and stained with crystal violet to measure initial biofilm formation. The absorbance was measured using a spectrophotometer. Broccoli extract did not affect biofilm formation. However, AITC's and horseradish consistently demonstrated significant initial biofilm inhibition ($p < 0.05$) between 2.5-10 mg/ml for AITC and 0.31-5% for horseradish powder solutions, respectively. Additionally, 24 hour established biofilms of *S. mutans* were exposed to horseradish and AITC's. AITC's and horseradish powder extracts demonstrated no difference on the established biofilms with the same range of concentrations that reduced initial biofilm formation (2.5-10 mg/ml of AITC and 0.31-5% of horseradish powder). AITC's and horseradish powder suppressed *S. mutans* growth and initial biofilm formation but did little to affect established biofilms. Based on these data, brassica tissues are unlikely to cause fewer caries and periodontal disease in individuals that consume them since they are unlikely to penetrate 24 hour established biofilms.

P24 sACE2 and PRR Expression in Saliva of Symptomatic COVID-19 Patients. M.M. JARAMILLO*, M. SRINIVASAN, T. THYVALIKAKATH (Indiana University School of Dentistry)

The novel virus, SARS-CoV2, causing the multisystem disease COVID-19, has infected 47 million individuals in the United States. To enter the host cells, SARS-CoV2 binds to the angiotensin converting enzyme-2 (ACE2) on the surface of epithelial cells. Following viral entry, a metalloprotease ADAM-17, cleaves the extracellular domain of ACE2, resulting in soluble ACE2 (sACE2). Functionally, sACE2 can bind and sequester SARS-CoV2, modulating disease expression. Pattern recognition receptors (PRRs) can recognize viral particles, activating the innate immune system. This project's objective was to quantitate and compare the sACE2 in the saliva of SARS-CoV2 infected and healthy individuals. Since COVID-19 commonly presents with oral manifestations, such as xerostomia and dysgeusia, we postulated that sACE2 and PRRs in saliva will be elevated in active SARS-CoV2 infection. Saliva samples were collected from 30 hospitalized COVID-19 patients diagnosed via nasopharyngeal swabs and admitted to the IU hospital system. The control group included age-matched saliva samples from the salivary research laboratory at IUSD. The saliva samples were analyzed using the CoviDrop ELISA assay to

measures the binding activity of sACE2 and a PCR assay to calculate the cycle threshold of sACE and PRRs. The COVID-19 positive saliva samples exhibited significantly lower sACE2 and significantly higher PRR gene expression as compared with age-matched control saliva samples. Conclusion: The observations of lower sACE2 in COVID-19 saliva could be attributed to the sequestration of SARS-CoV2 as our cohort included severe COVID-19 cases with potentially high viral shedding. The observations of elevated PRRs in COVID-19 saliva may correlate with the common oral symptom of dysgeusia, as PRR upregulation accelerate taste bud exfoliation. Despite the small sample size, we may speculate that in the process of disease development, sACE2 in saliva could be higher in early or asymptomatic stages and decrease with the increasing viral load in the local environment.

P25 Impact of RANKL Deficiency in Osteoblast-Lineage Cells on Tooth Eruption. M. LEVITAN*, M. KITTAKA, Y. UEKI (Indiana University School of Dentistry)

Osteocalcin (Ocn)-Cre transgenic mice are commonly used for conditionally knocking out genes in osteoblast lineage cells. A previous study has shown that an absence of tooth eruption can occur in *Ocn-Cre Rankl^{fl/fl}* mice. These mice lack RANKL, which is an essential inducer of osteoclastogenesis, in *Ocn*-expressing cells. However, the tooth type- and sex-specificity of the phenotype remains unknown. The goal of this experiment was to confirm these findings, develop a scoring system for mouse tooth eruption studies, and further classify the pattern of altered eruption in *Ocn-Cre Rankl^{fl/fl}* mice. We hypothesized that our self-developed scoring system would be able to confirm altered eruption of teeth in mice with the *Ocn-Cre Rankl^{fl/fl}* genotype and incisors eruption would be more affected than molar eruption. The *Ocn-Cre Rankl^{fl/fl}* (n=20) and control *Rankl^{fl/fl}* (n=21) mice were sacrificed at 28 days of age and were fixed in 4% paraformaldehyde solution. The jaws were separated, and tooth eruption was examined via stereomicroscope. Each tooth was assigned a score from 0–3 based on its level of eruption (0=no visible eruption, 1=cusp tips emerging from the gingiva, 2=partially erupted crown, 3=fully erupted crown). Student's t-test and Cohen's d were used for statistical analysis with a cutoff value of 0.05. We found that incisor eruption is affected more than molar eruption ($p < 0.0001$ vs. 0.03, effect size= 1.85 vs. 0.69). In addition, male mice are affected more than female mice ($p = 0.0001$ vs. 0.17, effect size= 2.18 vs. 0.61). In conclusion, our scoring system was able to describe the severity of altered tooth eruption in *Ocn-Cre Rankl^{fl/fl}* mice. Further, incisor eruption was affected more than molar eruption, and conditional knocking out of RANKL in *Ocn*-expressing cells had a greater effect on male mice than female mice. (Supported by NIDCR 1R21DE030561-01 and 5R01DE025870-06 and IUSD's SRG Fellowship 2021-2022)

P26 Cannabidiol and Cigarette Smoke Condensate on Human Periodontal Ligament Fibroblasts. R. RAGANIT*, L.J. WINDSOR, A.A. AZABI (Indiana University School of Dentistry)

Cannabis sativa, more commonly known as marijuana, and tobacco smoke are drugs that are frequently used recreationally. Cannabidiol (CBD) is the second major component of cannabis sativa and is a non-psychoactive constituent. There is evidence suggesting that CBD modulates the inflammatory responses within the body. However, there is limited research examining these effects in the oral cavity and in conjunction with cigarette smokers. The purpose of this study was to evaluate the effects of CBD and cigarette smoke condensate (CSC) on human periodontal ligament fibroblasts (HPLFs). HPLFs are a key component in maintaining a healthy periodontal attachment as they facilitate the connection between cementum tooth structure and alveolar bone. HPLFs were treated with either CBD (1 μ M), CSC (100 μ g/ml), or a combination. Untreated HPLFs were used as a control. The effects of these treatments on cell proliferation and cytotoxicity were assessed using water-soluble tetrazolium-1 (WST) and lactate dehydrogenase (LDH) assays, respectively. Data for the WST-1 (CBD, $p = 0.296$; CSC, $p = 0.903$; and CBD + CSC, $p = 0.537$) and LDH (CBD, $p = 0.392$; CSC, $p = 0.973$; and CBD + CSC, $p = 0.999$) assays showed that the tested concentrations did not significantly affect cell proliferation and were not significantly toxic to the cells. Future experiments will study the effects of CBD on the cytokine expression from HPDLs when stimulated with CSC.

P27 Effects of Listerine and Red Bull on *Streptococcus mutans* Biofilm. J. MONNOT*, R.L. GREGORY
(Indiana University School of Dentistry)

Purpose: The purpose of this study was to investigate the effect of Red Bull, a common beverage consumed by teenage orthodontic patients, on *Streptococcus mutans* biofilm. This study also investigates the effects of Listerine Total Care Anticavity Mouthwash, an ADA-certified mouthwash for individuals undergoing orthodontic treatment, on *S. mutans* biofilm. Methods: *S. mutans* strain UA159 and various dilutions of Red Bull and Listerine made in tryptic soy broth supplemented with 1% sucrose (TSBS) were utilized in this experiment. 50 µl of overnight *S. mutans* broth culture in tryptic soy broth (TSB) was incubated with different dilutions of Red Bull and Listerine as well as a control of TSBS only for 24 hours in 6-well culture plates. The resulting biofilm from the 6-well plates was washed, collected, diluted, and plated on blood agar plates. Lastly, an automated colony counter was used to determine the colony forming units per ml (CFU/ml). The data collected from two experiments was combined to determine the percent of control (CFU/ml) for both Listerine and Red Bull. Results: The 1:3 dilutions of Listerine and Red Bull inhibited *S. mutans* biofilm and exhibited significantly less CFU/ml when compared to the control ($p < 0.5$). Conclusions: At high concentrations, both Listerine and Red Bull inhibit *S. mutans* biofilm growth. The inhibition exhibited by Red Bull is likely due to the high caffeine content (111 mg), which has been shown to inhibit *S. mutans* biofilm formation. However, Red Bull contains 37 g of sucrose which contributes to its cariogenic nature. Listerine contains several ingredients known to inhibit *S. mutans* biofilm formation including fluoride, alcohol, and menthol. This study concludes that Listerine Total Care Anticavity Mouthwash can be used as a viable option for inhibiting *S. mutans* biofilm formation and thus preventing dental caries in individuals undergoing orthodontic treatment.

P28 Cannabidiol Effects on MMP Expression From Cigarette Smoke Responsive Fibroblasts. N. GHEIBI DEHNASHI*, A.A. AZABI, K. AL NASR ALLAH, L.J. WINDSOR (Indiana University School of Dentistry)

The recent increase in usage of Cannabidiol (CBD) oil has raised questions about its potential effects in the oral cavity due to its sublingual placement. CBD has shown some therapeutic benefits that includes anti-inflammatory, pain relief, anti-convulsive and anti-neoplastic. The anti-inflammatory effects are of interest due to the host-mediated inflammatory responses in periodontitis, which results in subsequent loss of the periodontal ligament, alveolar bone, cementum and gingiva. A primary risk factor for periodontal disease is tobacco, which increases the expression of matrix metalloproteinases (MMPs) from human gingival fibroblasts (HGFs) that leads to increased cell mediated collagen degradation. The purpose of this *in-vitro* study was to investigate the effects of CBD on cigarette smoke condensate (CSC) treated HGFs compared to untreated. Commercially purchased HGFs were treated with 100 µg/ml CSC for 3 days and were collected and analyzed by gelatin zymography to determine if CSC increased MMP-1 production from HGFs compared to untreated cells. WST-1 and LDH assays of CBD treated HGFs were assessed to determine the highest non-toxic level and that did not affect cell growth, respectively. HGFs were incubated with CBD (31.4 µg/mL), CSC, CBD and CSC, or nothing. The conditioned media were collected for analyses for changes in MMP expression by MMP protein arrays. HGFs increased MMP-1 production when treated with CSC. The highest non-toxic level examined of CBD that did not affect cell growth was 31.4 µg/ml. Additionally, gingival tissue excised due to non-pathological etiology (crown lengthening) will be used to grow HGFs to be examined using the same methods previously used with commercial HGFs. The rationale for repeating the experiments is the commercial HGFs appeared to express cytokines without any stimuli suggesting they were stimulated without the addition of any stimulus. Therefore, the original aim of testing HGFs remains unanswered. We hypothesize CBD will decrease the expression of MMPs from CSC-treated HGFs.

P29 Osteoclast Dysfunction Leads to High Bone Mass in Pyk2-KO Females. H. SWINSON*¹, J. HONG¹, P. ELENISTE¹, A. BRUZZANITI¹, M. ALLEN² (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Bone mass and bone quality is maintained through the interaction of three cell types, osteoclasts, osteoblasts, and osteocytes. An imbalance of activity can lead to diseases such as osteoporosis and osteopetrosis, which are categorized by decreased or increased bone mass, respectively. Pyk2 is a tyrosine kinase which has been shown to promote osteoblast activity and decrease osteoclast activity *in vitro*. It was shown that female Pyk2 global knockout mice (Pyk2-KO) exhibit increased bone mass. Estrogen is critical for the regulation of bone mass, and previous data demonstrated that estrogen stimulates Pyk2-KO osteoblast activity *in vitro*. However, the bone

phenotype of Pyk2-KO male mice, and the role of Pyk2 in osteoclast activity is not known. Our hypothesis is that global Pyk2 deletion increases osteoclast activity in female mice. Femoral cancellous bone mass of 16-week-old male and female Pyk2-KO and littermate (WT) mice was determined by micro-CT (n=6-8 mice/group). Changes in TRAP-stained osteoclast number in the proximal tibia were analyzed by histomorphology using Bioquant (n=5-6/group). Pyk2-KO females exhibited statistically higher cancellous bone volume/tissue volume (BV/TV), trabecular number (Tb.N), and thickness (Tb.Th) compared to WT females ($p < 0.01$). Trabecular spacing (Tb.Sp) was reduced compared to WT. In contrast, Pyk2-KO male showed no change in cancellous bone mass compared to WT males. WT female mice had statistically higher osteoclast number/bone surface (Oc.N/BS) compared to Pyk2-KO females ($p < 0.05$), whereas no changes were observed in Pyk2-KO males. Our data suggest that Pyk2 deletion leads to a female-specific increase in bone mass, which is driven in part by decreased osteoclast activity *in vivo*. These findings suggest inhibitors of Pyk2 may provide therapeutic avenues to increase bone mass. Future investigations will examine the specific role of estrogen on osteoclast and osteoblast activity *in vivo* in Pyk2-KO female versus male mice.

P30 Antibacterial Activities of Cannabidiol Against *Streptococcus mutans* Biofilm. A.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. Many chemical agents have been proven to be effective against dental biofilm. However, side effects and penetration efficiency remain an issue. Herbal and plant extracts, on the other hand, have long been used to combat oral diseases. 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, in tryptic soy broth (TSB) supplemented with 1% sucrose with different concentrations of CBD and methanol were evaluated. The minimum biofilm inhibitory concentration (MBIC) and the minimum bactericidal concentrations (MBC) were assessed based on the optical density and bacterial colony formation, respectively. CBD concentrations ≥ 2.5 $\mu\text{g/mL}$ exhibited significant inhibition ($p < 0.05$) against *S. mutans* biofilm growth. Therefore, a CBD concentration of 2.5 $\mu\text{g/mL}$ was determined to be the MBIC, while the MBC was 5 $\mu\text{g/mL}$. The findings of this study demonstrated that CBD has an antibacterial effect against *S. mutans*. Further studies should examine the potential effects of CBD against dental biofilm formation.

P31 Low-Temperature Plasma Disinfects Titanium Surfaces Contaminated With Peri-Implantitis-Related Mature Biofilms. B.H.D. PANARIELLO*¹, G.J. ECKERT², P.G. COELHO³, S. DUARTE¹
(¹Indiana University School of Dentistry, ²Indiana University School of Medicine, ³New York University College of Dentistry)

Screw-shaped design and microstructure of implants make mechanical debridement unable to altogether remove biofilms. Optimal biofilm removal with adequate periodontal therapy is needed to treat peri-implantitis effectively. Low-temperature Plasma (LTP) has been recognized as a powerful tool for biomedicine. It is site-specific, provides a quick bactericidal response, antimicrobial resistance is less likely to occur, and is tissue-safe. We evaluated LTP disinfection against 14- and 21-day-old peri-implantitis-related biofilms formed on titanium discs and 21-day-old biofilms created on implants surfaces (Straumann® Ti-SLA). *Actinomyces naeslundii* (ATCC 12104), *Porphyromonas gingivalis* (ATCC W83), *Streptococcus oralis* (ATCC 35037), and *Veillonella dispar* (ATCC 17748) growing in brain heart infusion broth with 1% yeast extract, hemine (0.5 mg/mL) and menadione (5 mg/mL) were kept at 37°C in anaerobic conditions for 24-h. Bacteria were then mixed at the same ratio at $\sim 10^5$ CFU/mL (OD=0.01). The mixed suspension was transferred to 24-well plates containing titanium discs or implants. Medium was replaced daily. Biofilms on titanium discs were treated with LTP for 1, 3, and 5 min at 3 or 10 mm from plasma-tip to sample. Controls were no treatment (Negative Control=NC) and argon-flow at the same conditions. Positive

controls were 14 µg/mL amoxicillin and 140 µg/mL metronidazole individually or combined, and 0.12% chlorhexidine (CHX). For the implants, 21-day-old biofilm was formed, and treatments were NC, CHX, and LTP for 1 min at 3 mm per quadrant. Biofilms were evaluated by colony-forming units (CFU) and confocal laser scanning microscopy (CLSM). Wilcoxon Signed-Rank and Wilcoxon Rank-Sum ($\alpha=0.05$) were used for statistical analysis. LTP application at 3 mm starting from 1-min significantly reduced CFU on titanium discs and implants compared to NC ($p\leq 0.047$). CLSM corroborated these results. Therefore, 1-min exposure to LTP at 3 mm effectively disinfect titanium discs and implants contaminated with peri-implantitis-related mature biofilms, being a promising co-adjuvant for treating peri-implantitis. (Supported by NIH/NIDCR Grant No. 1R21DE028929-01)

P32 Red Raspberry Juice and Ellagic Acid on *Streptococcus mutans* Biofilm. T. FIGUEROA*, R.L. GREGORY (Indiana University School of Dentistry)

Objectives: *Streptococcus mutans* is an oral bacterium commonly attributed to the formation of caries on teeth. Red raspberries (RR) contain polyphenols such as ellagic acid (EA) that have antimicrobial effects and inhibit bacterial growth. It is known that nicotine usage increases oral biofilm and the formation of *S. mutans* biofilm, thereby causing an increase in dental caries compared to a non-smoker. In low concentrations, nicotine increases *S. mutans* in oral and in vitro biofilms and decreases at high nicotine concentrations. The objective of this experiment was to determine if RR juice, EA and EA/nicotine affects *S. mutans* biofilm formation. Lactate dehydrogenase (LDH) is an enzyme in the glycolytic pathway of *S. mutans* leading to formation of lactic acid responsible for demineralizing enamel surfaces. In order to ascertain the mechanism of action of raspberry juice on *S. mutans* biofilm, the effect of RR on *S. mutans* LDH activity was determined. Methods: *S. mutans* UA159 was treated with pure RR juice diluted 0-25% with TSBS, EA (0.78-50 µg/mL), 12.5 µg/mL EA with nicotine (0-32 mg/mL), and nicotine alone. The LDH assay was conducted using pure RR juice dilutions. Growth effects of biofilm were measured in 96 well microtiter plates over a 24 hour period. Total absorbance and planktonic cells were measured and biofilm was determined using a crystal violet biofilm staining assay. Results: The results indicated that RR juice and EA in high concentrations significantly inhibits ($p<0.05$) the growth of *S. mutans* biofilm and LDH activity. EA combined with nicotine was partially able to inhibit growth when nicotine was present in lower concentrations. Conclusion: These results provide confirmation that RR and EA are effective antibiofilm agents, possibly by inhibition of LDH activity and may be useful in reducing dental caries in smokers.

P33 Effect of TSBS Dilutions and Curcumin on *Streptococcus mutans* Biofilm. R. KHATRA*, R.L. GREGORY (Indiana University School of Dentistry)

Oral health is vital to an individual's overall health as studies have shown that untreated oral diseases can increase the risk of adverse health conditions. *Streptococcus mutans* is a bacterium that is commonly found in the oral cavity. *S. mutans* is known to produce biofilm, also known as dental plaque, on tooth surfaces. As sucrose is metabolized, this bacterium forms a significant amount of lactic acid which breaks down enamel causing dental caries in humans. The purpose of this study was to investigate the correlation between *S. mutans* bacterial biofilm growth with different concentrations of tryptic soy broth + 1% sucrose (TSBS) alone simulating a low protein diet, curcumin alone, and curcumin combined with 100% TSBS. Curcumin, the active ingredient found in turmeric, and TSBS have been known to affect the growth of this bacterium when combined. Studies have shown that vegans who ingest curcumin produce a significantly less amount of biofilm. The agents along with the bacteria were incubated for 24 hours followed by a crystal violet biofilm staining assay. Results demonstrated that reduced TSBS concentrations do not inhibit the growth of *S. mutans in vitro*. On the other hand, curcumin dilutions ranging from 0-10 mg/ml significantly inhibits ($p<0.05$) *S. mutans* biofilm formation at 0.625 mg/ml, but demonstrates significantly higher biofilm formation at 2.5 mg/ml compared to 0 mg/ml. The combination of curcumin and TSBS demonstrated significantly reduced biofilm formation. These results indicate that an individual who is vegan and ingests lower protein with curcumin may have less *S. mutans* in their dental plaque and subsequently lower incidence of dental caries.

P34 Effect of Hemoglobin Coated Silver Nanoparticles on *Porphyromonas gingivalis* Biofilms. N.H. KOKSAL^{1*}, B.H.D. PANARIELLO¹, B.P. SIVASUBRAMANIAM², G.C. DENUCCI¹, A. WEI², S. DUARTE¹
(¹Indiana University School of Dentistry, ²Purdue University)

Silver (Ag) is readily available and has a microbicidal effect; moreover, it does not adversely impact the human body. It is known that Ag ions induce reactive oxygen species (ROS). Overproduction of ROS causes impairments in DNA, lipids, and protein, eventually leading to cell death and progressive aging of an organism generation in bacteria. Ag ions bind to halide ions, such as chloride and precipitate; therefore, their microbicidal activity is shortened when used directly. Ag nanoparticles (NPs) have been recently synthesized to overcome this issue. The objective of this pilot study was to identify the effect of hemoglobin (Hb) coated Ag-NPs on the biofilm of *Porphyromonas gingivalis* (*Pg*), a bacterium frequently associated with periodontal and peri-implant diseases. *P. gingivalis* (ATCC-W83) was reactivated in blood agar and cultivated in brain heart infusion (BHI) broth supplemented with hemin and menadione for 24-h at 37°C in anaerobic conditions. Then, *Pg* suspension was adjusted to 10⁷ CFU/mL (OD_{600nm}). Hb-AgNPs were incorporated in two different ways (G1) Hb-AgNPs were mixed with *P. gingivalis* before biofilm formation in the proportion of 1 part of Hb-AgNPs to 10 parts of BHI supplemented media and Hb-AgNPs were added daily with media exchange for five days (n=3); (G2) Hb-AgNPs were introduced (1:10) at the fourth day of biofilm formation staying in contact with the biofilm for 24-h. Biofilms without incorporating Hb-AgNPs were used as negative controls (NC). The incorporation of Hb-AgNPs into the biofilms was characterized using Scanning electron Microscopy (SEM). Bacterial viability was measured by colony-forming units (CFU). Our results (mean ± SD) showed that the incorporation of nanoparticles in G1 (1.5±2.1Log₁₀CFU/mL) or G2 (2.7±0.6Log₁₀CFU/mL) considerably reduced the viability of *Pg* in the biofilms compared to the NC (6.7±0.1Log₁₀CFU/mL). SEM corroborates these results. In conclusion, Hb-AgNPs showed promising results in reducing *Pg* biofilms.

P35 Nfkb and CTMP Expression in a Muscle Atrophy Model. V. PHILLIPS*, J. WANG, C. MUMAW, P. KAVURI, M. SRINIVASAN, C.L. WALKER (Indiana University School of Dentistry)

Amyotrophic lateral sclerosis (ALS) is a fatal neurodegenerative disease characterized by progressive muscle paralysis and atrophy. It is known that Akt stops the transcription of specific ligases involved in the degeneration of muscle cells. Downregulation of Akt phosphorylation leads to an increase in proteins and cell processes associated with muscle degeneration. The reasons why Akt signaling is diminished in muscle tissue in ALS is not clear. We have previously identified that carboxyl-terminal modulator protein (CTMP, also known as Them4), is a negative regulator of Akt and is significantly elevated during late stages of ALS muscular atrophy in mouse models. We have determined that the loss of CTMP decreases muscle atrophy and upregulates Akt signaling indicating a key role for CTMP in mediating neurogenic muscle atrophy. Tumor Necrosis Factor-α (TNF-α) is an inflammatory cytokine associated with muscle atrophy in ALS. Our previous research demonstrated that TNF-α stimulation of in vitro mouse myotubes increased CTMP expression. TNF-α also increases nuclear factor kappa beta (NFκB) activity and nuclear localization. In the present study, we hypothesized that TNF-α mediated NFκB activation leads to increased CTMP expression as a mechanism for downregulated Akt signaling and muscle degeneration. We tested this hypothesis by treating mouse C2C12 myotubes with TNF-α while obstructing NFκB activity with a small molecule and examined CTMP expression with Western blot analysis. We observed that TNF-α significantly increased NFκB activity and nuclear localization in differentiated C2C12 myotubes. Our recent findings suggest blocking NFκB activity in TNF-α treated myotubes reduces CTMP expression. In conclusion, our study provides new insight into the regulation of CTMP expression in muscle atrophy. (This study was supported by funding provided by Neurodegenerative Disease Research, Inc.)

P36 Effect of Nicotine and EGCG on *Scardovia wiggsiae* Biofilm Formation. N. RILEY*¹, R.L. GREGORY² (¹Indiana University-Purdue University Indianapolis, ²Indiana University School of Dentistry)

Background/Purpose: *Scardovia wiggsiae* is associated with dental caries, along with *Streptococcus mutans*. Patients who smoke have an increased risk of caries and oral diseases. Epigallocatechin gallate (EGCG) is a polyphenol found in green tea. This substance has demonstrated inhibitory properties on *S. mutans* in the presence of nicotine. Studies have shown a correlation between the consumption of coffee containing EGCG and nicotine use. However, there is a lack of evidence supporting the relationship between *S. wiggsiae* and nicotine. The purpose of this study was to investigate the effects of nicotine on *S. wiggsiae* biofilm formation in the presence

of EGCG. Materials/ Methods: *S. wiggisiae* biofilm was grown anaerobically overnight at 37°C using brain-heart infusion broth supplemented with 5 g yeast extract/L (BHI-YE) plus 5% vitamin K & hemin. The culture was used as an inoculum to grow *S. wiggisiae* biofilm in a 96 well microtiter plate. Samples were incubated with nicotine (0-32 mg/mL) and EGCG (0-1.33 mg/mL) for 24 h. After incubation, biofilm was analyzed using a biofilm crystal violet staining assay. Results: 16 mg/mL of nicotine was determined to be the minimum biofilm inhibitory concentration (MBIC). The MBIC of EGCG was established to be 0.333 mg/mL. The minimum inhibitory concentration (MIC) of nicotine was determined to be 8 mg/mL. The MIC of EGCG could not be analyzed due to the pink hue of EGCG which masked the total absorbance of the bacterium. The MBC of nicotine was determined to be 16 mg/mL. In the presence of both EGCG and nicotine, *S. wiggisiae* biofilm was significantly inhibited ($p < 0.05$). Conclusion: The findings exhibit that EGCG, and nicotine inhibited *S. wiggisiae* biofilm formation at higher concentrations. This data suggests that EGCG may be effective at inhibiting nicotine enhanced *S. wiggisiae* biofilm formation and therefore reduce the severity of caries lesions within smokers.

ORAL DISEASE PREVENTION AND DIAGNOSIS

P37 CyclinD1 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 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 can predict the likelihood of OED progression is vital as it can enable a more accurate prediction of malignant transformation. Our recent study demonstrated that cornulin expression is significantly low in patients whose OED progressed to OSCC compared to patients with non-progressive OED that retained the same histopathologic grade across two biopsies. The objective of this current study is to determine the expression of cyclinD1 in patients whose OED progressed into OSCC compared to non-progressive OED patients, thereby, identifying a panel of biomarkers that can predict the progression of potentially malignant oral epithelial lesions. Methods: Following database review of Oral Pathology Group at Indiana University School of Dentistry and Oral Pathology Consultants at Ohio State University College of Dentistry, 10 patients with OED that progressed into OSCC (progressive group) and 10 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 initial biopsy and subsequent biopsy that progressed to OSCC. No difference in cyclinD1 expression was observed between 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)

ORAL RADIOLOGY

P38 Influence of CBCT Voxel Resolution Measuring the Cortical Plate. D.T. SANTOS*, P. WONG, Y. HAMADA, V. DUTRA (Indiana University School of Dentistry)

It is important to understand the limitations of measuring thin objects before planning for implant surgery or bone graft procedures because a partial volume effect might impact the accuracy of the measurements. This project aims to evaluate the accuracy of CBCT imaging on the detection of the buccal cortical cortex and the influence of voxel resolution. Five maxilla anterior segments with #6-11 were harvested and previously fixed in 10% formalin. Reference grooves have been placed at the cervical margins and along the approximated long axis of each tooth to standardize the measurements. Institutional review board (IRB) approval was obtained (IRB: 1911908477). The images were performed using a commercially available CBCT scanner (Planmeca, Helsinki, Finland) using 3

different voxel sizes (0.1mm, 0.2mm, and 0.4mm). A software package (Invivo 6, Anatomage, California, USA) was used to analyze and manipulate the images. The gold standard was obtained with histology slides digitized through a fluorescence microscope (BZ-9000; Keyence Corporation, Osaka, Japan) with objective lens (4X) and converted to digital image files (.tiff). Those images were transferred to an imaging software (ImagePro, Media Cybernetics®, Silver Spring, USA) for further analysis. Observer results were compared to gold standard measurements, and agreements were quantified by weighted Kappa statistics. The average cortical thickness in the histological sections was 0.402mm. The average CBCT (voxel size 0.1, 0.2, and 0.4) measurements were 0.396, 0.396, and 0.423, respectively. The results suggest CBCT measurements of buccal bone underestimate the bone thickness when using voxels of 0.1 and 0.2 and overestimate when using the 0.4 voxel size compared to the histological sections.

ORTHODONTICS / IMAGING / CRANIOFACIAL

P39 Three-dimensional CBCT Assessment of Facial Asymmetry in Cleft Lip/Palate Patients.

D. COMSTOCK*, A.A. GHONEIMA, T. HALL, K.T. STEWART (Indiana University School of Dentistry)

The purpose of this retrospective study was to investigate the severity of soft tissue facial asymmetry in patients with cleft lip and/or cleft palate (CLP) and assess if this soft tissue asymmetry correlates with the underlying hard tissue asymmetry. Eighty-seven patients with unilateral CLP that presented to the Indiana University School of Dentistry Craniofacial Anomaly (CFA) Orthodontic Clinic were included in this study. CBCT data from growing and non-growing males and females with CLP, who had previously been seen for initial records and/or orthodontic treatment in the CFA clinic, was measured and analyzed using Dolphin 3D imaging software. Measurements of key parameters (vermillion height, lip thickness, mouth symmetry, total facial height and width, mandibular AP position, mandibular symmetry, nose symmetry, and eye symmetry) were completed on each CBCT scan and statistical comparisons (t-tests, ANOVAs, Pearson correlation coefficients) were made between patients with right or left unilateral CLP. A two-sided 5% significance level was used for all statistical tests. The results demonstrated that differences in age, gender, cleft location, and ethnicity were all significantly correlated with asymmetries of the face ($p < 0.05$). Right-sided CLP patients had more significant asymmetries of the mouth ($p = 0.025$), facial width ($p = 0.025$), eyes ($p < 0.001$), and mandible ($p = 0.029$), with asymmetries being more pronounced on the cleft side of the face. Our pilot study showed significant asymmetry in basal mandibular hard tissue length, and this present study confirms that the mandibular soft tissue asymmetry overlying the skeletal asymmetry is correspondingly significant ($p < 0.001$). This research study demonstrated that the severity of the facial soft tissue asymmetry in CLP patients was coincident with the underlying mandibular skeletal asymmetry, with significant differences in respect to age, gender, cleft location, and ethnicity.

P40 Cephalometric Characteristics of an Orthodontic Extraction Patient Population. L. LEAVITT*, H. TURKKAHRAMAN (Indiana University School of Dentistry)

Objective: To analyze the cephalometric characteristics of an orthodontic patient population who were treated by extraction. **Methods:** The materials of this retrospective study consisted of lateral cephalometric radiographs of 172 Class I patients who were previously treated by orthodontic extractions at Indiana University School of Dentistry. Dolphin imaging software was used to trace and measure 8 of the most used cephalometric angles and measurements. Histograms were used to illustrate the major features of the distribution of cephalometric data.

Results: A normal distribution pattern was found for each measurement. Sella-Nasion-A point (SNA) angle was found to be between 79-84° in 45% of the patients. Sella-Nasion-B point (SNB) angle showed more variability with most of the patients (63%) between 74-82°. 54% of the patient population had an A point-Nasion-B point (ANB) angle between 2-4.5°. The majority of patients (51%) were found to have a Frankfort-Mandibular plane (FMA) angle between 22.5-31°. 48% of the population had an upper incisor-Sella Nasion (U1-SN) angle between 103-115°. The lower incisor-Mandibular plane (L1-MP) angle was found to be more variable, with 44% of the population

between 92.5-100°. 47% of the patients had an upper lip to E-plane measurement of -2.5 to -1 mm, while the lower lip to E-plane distance of 0 to 4 mm was found in 46% of the patients. Conclusion: Our results showed that, Class I extraction patients overwhelmingly have orthognathic maxilla, variable mandibular position, normal to hyperdivergent mandibles, normal to proclined upper incisors, proclined lower incisors, and protrusive upper and lower lips.

P41 Cephalometric Characteristics of Patients Receiving Non-Extraction Orthodontic Treatment at IUSD. T. MASON*, H. TURKKAHRAMAN (Indiana University School of Dentistry)

Background: Extraction of teeth is not an infrequent tool employed by orthodontists to aid in the resolution of crowding, protruding lips, excessive overjet, minimal overbites, and other components of malocclusion. The aim of this retrospective study was to find out cephalometric characteristics of an orthodontic patient population who were treated without any extraction. Materials and Methods: 204 cephalometric radiographs were traced of patients with ANB values from -0.4° to +5.4° who received comprehensive orthodontic treatment in which tooth extraction was not performed. To elucidate the skeletal, dental, and soft tissue characteristics common among these non-extraction orthodontic cases, their cephalometric measurements were collected and analyzed, comparing them to the American Board of Orthodontics (ABO) standard values for the same parameters. The percent of study values falling within ± 1 SD from the ABO average value (using the ABO standard deviation) should closely approximate 66% if study values nearly mirror those of the ABO values. Results: SNA, SNB, and SN-MP had 61%, 61%, and 62% of their values fall within the ABO ± 1 SD range, indicating that the analyzed patients had SNA, SNB, and SN-MP values similar to the ABO norms. However, U1-SN, L1-MP, upper lip to E-line, and lower lip to E-line deviated more significantly from the expected values, with only 44%, 53%, 51%, and 51% of their values falling within the ± 1 SD from the ABO norms. Conclusion: The data indicate that patients who received non-extraction orthodontic treatment in the IUSD Graduate Orthodontics Clinic have horizontal and vertical skeletal characteristics similar to ABO norms. However, these same patients have dental characteristics deviating more significantly from the ABO norms.

P42 Prediction of Pubertal Mandibular Growth by Machine Learning. T. WOOD*¹, M. DUNDAR², K.T. STEWART¹, J. ANIGBO¹, H. TURKKAHRAMAN¹, (¹Indiana University School of Dentistry, ²Indiana University Purdue University at Indianapolis)

Objective: The aim of the study was to develop several machine learning algorithms for predicting the amount and direction of pubertal mandibular growth in males. Materials and Methods: The digital cephalometric radiographs of 163 males with Class I Angle malocclusions, at three time points were obtained from growth studies maintained by the American Association of Orthodontists Foundation (AAOF) Craniofacial Growth Legacy Collection. Cephalograms had 42 points used for linear and angular measurements of the skull marked using Dolphin Imaging software. The obtained data was used to train and test several regression algorithms for predicting the output of mandibular length and Y axis angle at T3 from T1 alone, and from T1 and T2 together. 70% of cases were used for training and the remaining 30% were used to test the algorithms. Statistical significance was set at 5% for the study. Results and Conclusions: Y axis angle was predicted with a mean absolute error (MAE) of around 1.4 degrees when only data from T1 was used, which improves to 1.1 degrees when data from T2 was added to the analysis. Mandibular length was predicted with an MAE of 3.5mm and 3.1mm using data from T1 alone and T1 and T2 together, respectively. Among the linear models Lasso regression was found to be more promising both in terms of accuracy of predictions and interpretability. Among the nonlinear models, Random Forest was found to be more competitive, especially for the prediction of mandibular length. AI appears to be a promising tool for developing accurate algorithms to predict mandibular growth for adolescent patients.

PEDIATRIC DENTISTRY

P43 Comparing Caries Experience in Patients With Different Health Care Needs. R. MINHAS*, A. SCULLY (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.

P44 Analysis of Dental Claims to Evaluate the Impact of COVID-19. B. BAUER*¹, J.F. YEPES¹, L. VINSON¹, B. SANDERS¹, G.J. ECKERT² (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Coronavirus disease (COVID-19) has had a significant impact on the dental profession worldwide. Mitigation efforts to reduce the spread of the virus resulted in restrictions to providing routine dental care. The initial impact of COVID-19 continues to present unprecedented challenges for pediatric dentists and the pediatric dental population due to increased delays in providing elective dental treatment and decreased access to hospital operating rooms. The purpose of this study was to evaluate whether the postponement of dental elective procedures during the initial months of COVID-19 pandemic in children with Indiana Dental Medicaid increased the number of simple dental extractions, decreased restorative procedures, or both by analyzing data obtained from state-funded insurance dental claims. Paid dental claims collected from March 2019-December 2019 and March 2020-December 2020 were included in analysis for comparison. Deidentified children ages 2 to 13 years old were included in the study. Dental procedures were selected based on Current Dental Terminology (CDT) codes for simple dental extractions (D7140) and restorative procedures (D2140, D2150, D2330, D2331, D2332, D2335, D2390, D2391, D2392, D2930, D3120, D3110, and D3220). Although there were fewer total procedures completed in 2020, the relative number of extractions was higher in 2020 than in 2019 ($p<0.05$). On a monthly basis, there was a significantly higher rate of one-surface restorations and full-coverage restorations completed in 2019 as compared to 2020. The results of this study suggest changes in the procedures provided to pediatric dental patients after the initial shut down of COVID-19 and provides insight on the effects of delaying elective dental treatment in the pediatric population.

P45 Comparing Pulse Oximetry/Blood Pressure Measurements Based on Sensor Location. B. CIPICH*¹, J.F. YEPES¹, J. JONES¹, A. SCULLY¹, L. VINSON¹, G.J. ECKERT² (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Pulse oximeters and blood pressure cuffs are the standard equipment for patients who are to receive dental treatment with sedation or general anesthesia. Patient cooperation may complicate acquiring these measurements in children. For this reason, blood pressure cuffs are interchangeably placed on upper arm or lower calf and pulse oximeters on finger or toe. It has been assumed that pulse oximetry and blood pressure taken from these respective locations are comparable, however, there are a lack of studies that evaluate this in children. The objectives of this study are to: (1) determine if pulse oximeter location leads to variances in recorded measurement

and (2) to determine if blood pressure cuff location results in significantly different blood pressure recordings. Oxygen saturation and heart rate measured using a pulse oximeter on the foot and finger on the ipsilateral limb while patient is supine. Diastolic and systolic blood pressure measured using a non-invasive blood pressure monitor on upper arm and calf on the ipsilateral limb while patient is supine. Based on our preliminary results including 47 subjects, we have observed that calf blood pressure measurements have been routinely higher than arm blood pressure (BP) measurements. In our current study sample, calf BPs were higher than arm in 78.7% for systolic BP and 97.9% for diastolic BP. Although some oxygen saturation measurements between finger and toe in the same subject have varied, this has not been statistically significant. Additional statistical analysis will be performed following completion of data collection.

P46 Pooled Oxygen Concentration and Evaluating the Risk of Surgical Fires. K. CLARK*, J. JONES, J.F. YEPES, M. SAXEN, H. CLARK (Indiana University School of Dentistry)

Purpose: The purpose of this study is to identify time required for significant oxygen pooling to occur in a simulated oral cavity when replicating the oral environment during dental surgeries utilizing moderate or deep sedation. This study also aims to better understand the effects of both high-speed suction and Yankauer suction on fraction of inspired oxygen (FiO₂) concentrations, and whether either suction tip creates a greater difference in FiO₂ with its use. Methods: An acrylic dome was utilized to simulate the oral environment of a 10-year-old. In the front of the hemisphere, an entering was fabricated to replicate the opening of the mouth with two small holes above where the nasal cannula was placed. Suction tips were placed 20 mm into the mouth opening. 4 different data sets were recorded: high speed suction tip with no supplemental oxygen, high speed suction tip with supplemental oxygen at 3L/minute, Yankauer suction tip with no supplemental oxygen, and Yankauer suction tip with supplemental oxygen at 3L/minute. FiO₂ concentrations were recorded for 4 minutes: 2 without suction and 2 with suction. Results: Oxygen measurements got as high as 92% with supplemental oxygen. Oxygen measurements were significantly higher with supplemental oxygen than without supplemental oxygen for both suction methods for all time points (p<0.001). Oxygen measurements with supplemental oxygen were significantly lower for high-speed suction than Yankauer suction starting at 2.5 minutes and continuing through the remainder of the times (p<0.001). Conclusions: The results of this study show health professionals how dangerously high oxygen concentrations can get in a simulated oral cavity with supplemental oxygen. This study also shows how the high-speed suction tip is more effective than the Yankauer in lowering the oxygen concentrations back to safe levels, showing clinicians they should be using this suction during moderate sedation.

P47 Utilization of Amalgam or Resin Composite in Pediatric Dental Restorations. F.C. DENTINO*, J.F. YEPES, L. VINSON (Indiana University School of Dentistry and Riley Hospital for Children)

Purpose: The purpose of this study is to determine the frequency with which general and pediatric dentists utilize dental amalgam in primary and mixed dentition posterior restorations, and the trends in the use of these materials over the last decade. Methods: This study used data from commercial dental insurance claims to compare the use of amalgam and composite resin by general practitioners and pediatric dentists in posterior restorations of the first and second primary molars, and the first permanent molars. Paid dental claims collected nationwide from January 2010 up to March 2020 was included for analysis. De-identified data for children 3 to 12 years old was used. Dental procedures were selected based on Current Dental Terminology (CDT) codes for 1, 2, and 3-surface restorations, including both amalgam (D2140, D2150, and D2160) and resin composite (D2391, D2392, D2393). Data analysis was completed to evaluate the percentage of amalgams vs resins that are being placed by general practitioners as well as pediatric dentists. We also compiled data to evaluate any disparity in socioeconomic status as defined by median income of zip codes of practice where restoration was placed. Results: Complete results are pending statistical analysis. Partial statistical analysis suggests that composite resins are being used at an increasing frequency and the use of amalgam has declined. Conclusion: We expect to establish whether shifts in restorative trends have been statistically significant in the previous decade, and whether changes have been slower in areas of lower SES. This data could inform public policy with regards to discussions pertaining restrictions or outright bans on amalgam, and the impact this could have, particularly in low SES areas.

P48 Pediatric Phantom Dosimetry Evaluation of the Tru-Image Rectangular Collimator. A. MARTINEZ*, J.F. YEPES, J. JONES, P. WONG, K.B. JOHNSON, S. CANADY, Q. TANG (Indiana University School of Dentistry)

Purpose: The purpose of this study is to compare the effective dose (E) on a pediatric phantom when using the Tru-Image Rectangular Collimator and universal round collimator for two bitewing radiographs (right and left). **Methods:** Absorbed doses utilizing the Tru-Image Rectangular Collimator and universal round collimator were acquired using an anthropomorphic 10-year-old child phantom and optical stimulated luminescent dosimetry with 24 dosimeters in each set. Each set of dosimeters was exposed to a right and left bitewing with manufacturer's child settings. Fifty clinical exposures were completed for each set, and three sets were exposed for each type of collimator. Following exposure, the equivalent doses were calculated from various tissues within the head and neck region, and the effective doses were calculated utilizing the 2007 recommendations from the International Commission on Radiological Protection (ICRP). **Results:** The overall E for the Tru-Image Rectangular Collimator and universal round collimator, respectively, were 6.3 μ Sv and 25.3 μ Sv, and this difference is statistically significant ($P < .001$). The highest E for both collimators was delivered to the oral mucosa. When compared to the universal round collimator, the Tru-Image Rectangular Collimator has significant dose reduction at all locations (all $P < .05$). When normalized and adjusted to have the same source to end distance for each collimator, there was overall a 65% dose reduction with the rectangular collimator. **Conclusion:** The average effective dose was significantly reduced with the use of the Tru-Image Rectangular Collimator. Clinical use of this rectangular collimator should be considered in the pediatric population.

P49 Impact of COVID-19 on Dental Care for Pediatric Patients. J RECTOR*¹, A. SCULLY¹, J. JONES¹, J.F. YEPES¹, G. MAUPOME¹, G.J. ECKERT² (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

Introduction: The COVID-19 pandemic impeded access to dental care for pediatric patients and impacted finances of dental practices across the country. **Purpose:** The purpose of this study is to evaluate the impact of the COVID-19 pandemic on private dental insurance claims for pediatric dental care. **Methods:** Commercial dental insurance claims for patients in the United States under age 18 were obtained and analyzed. The claims dates ranged from January 1, 2019 to August 31, 2020. Total claims paid, average paid amount per visit, and number of visits were compared between provider specialties and patient age groups from 2020 to 2019. **Results:** Total paid claims and total number of visits per week were significantly lower in 2020 compared to 2019 from mid-March to mid-May ($P < .001$), with the exception of orthodontists who did not have a significant change in the number of visits per week ($P = .728$). There generally were no differences between 2019 and 2020 from mid-May through August ($P > .15$), with the exception of significantly lower total paid claims and total number of visits per week for specialties other than general dentists, pediatric dentists, or orthodontists in 2020 compared to 2019 ($P < .005$). Average paid amount per visit was significantly higher during the COVID shutdown period for 0–5-year-olds ($P < .001$), but significantly lower for all other ages when compared to 2019. **Conclusion:** Dental care was greatly reduced during the COVID shutdown period and was slower to recover for 'other' specialties. Younger patients ages 0-5 had more expensive dental visits during the shutdown period, which may indicate more emergent treatment needs as a result of barriers to routine care.

P50 Insurance Claim Data Trends in Pulp Therapy for Pediatric Patients. L. WHITE*¹, J.F. YEPES¹, G. MAUPOME¹, A. SCULLY¹, Q. TANG¹, M. MILANO², J. DEAN¹ (¹Indiana University School of Dentistry and Riley Hospital for Children, ²Augusta University)

Purpose: The purpose of this study was to identify changes in two specific pulp therapy treatments for pediatric patients during an 11-year period from January 1, 2010 to December 31, 2020. These changes were examined by patient's age, practitioner specialty and by which American Academy of Pediatric Dentistry (AAPD) national membership region the treatment was provided. **Methods:** Insurance data claims for children 2-12 years of age who had a pulpotomy and pulpectomy performed by general (GD) and pediatric dentists (PD) between 2010 and 2020 were extracted by P&R Dental Solutions, LLC, a dental data warehouse. The state where the provider was located was included in the extracted claim. **Results:** A total averaging just over six million children were seen yearly for the 11-year period from 2010-2020 by GDs and PDs combined. The rates of receiving a pulpotomy or pulpectomy procedure trended down from 2010 to 2020 (OR=0.97, 0.95, $p < .001$). PDs are more likely to perform

pulpotomy procedures than GDs (OR= 1.39, $p<.001$), but PDs are less likely to perform a pulpectomy procedure than GDs (OR= 0.23, $p<.001$). Younger patient age was a significant predictor for pulpotomy treatment for both GDs and PDs (OR= 0.85, 0.89, both $P<.001$). With increasing patient age, PDs had increased odds of performing a pulpectomy (OR=1.03, $p<.001$), while GDs had decreased odds (OR= 0.995, $p = 0.04$). When examining effects by the AAPD national membership region, trends remained consistent with the data above. Conclusion: The use of pulpotomy and pulpectomy therapy trended down from 2010-2020 amongst both GDs and PDs. These changes in pulp therapy practice might indicate a response to changing research and clinical guidelines on pulpal therapy suggesting that less invasive pulp therapy is just as successful, if not more so, than either pulpotomies or pulpectomies.

P51 Associations Between Pediatric Dental Residency Applicant Attributes and Matriculation Success. J. WILLHITE^{*1}, J. DEAN¹, V. JOHN¹, G.J. ECKERT², K.T. STEWART¹ (¹Indiana University School of Dentistry, ²Indiana University School of Medicine)

The number of individuals seeking advanced dental training continues to grow each application cycle, resulting in postdoctoral dental programs receiving an unprecedented number of applications. Previous studies have been unable to definitively identify applicant attributes that lead to matriculation within a program. The retrospective study aimed to investigate objective applicant parameters that correlate with an applicant's ability to match into a pediatric dental residency program. This project was reviewed by the IU Institutional Review Board and was designated as exempt. Deidentified applications (n=2502) from the 2017-2019 pediatric residency application cycles were collected from the ADEA PASS and National Matching Services platforms. Seven demographic and six objective academic parameters were analyzed using a Mann-Whitney U test and logistic regression analysis. Statistical significance was set at 5%. The data demonstrated that applicants most likely to match to a pediatric program were males ($p=0.003$), less than 30-years-old ($p<0.001$), who were US citizens ($p<0.001$), and from a US dental school ($p<0.001$). When considering scholastic parameters in the bivariate analysis, applicants were more likely to match with a program if they had a higher overall ADAT score ($p=0.002$) and clinical sciences score ($p=0.001$), along with a higher overall GPA ($p<0.001$). When considering individuals that matched with their first choice, younger applicants ($p<0.001$) were more successful. Due to the small number of applicants with reported scholastic scores (ADAT, GRE, and GPA) and the relatively small number of 1st choice matches in this subset, the results from the multivariable analysis models were not interpretable. The results suggest that applicants who are younger, US citizens with high achievement on the ADAT overall and specifically in clinical sciences, along with a high GPA are more likely to match. Only an applicant's age at the time of application was shown to influence whether an applicant matched with their preferred program.

PERIODONTICS

P52 Dimensions of Supracrestal Tissue Attachment in Human Maxillary Anterior Teeth. L. ROY*, Y. TANAKA, N. SANTOSH, Y. HAMADA (Indiana University School of Dentistry)

Background: The average measurement of the dentogingival junction which has served as a baseline to help practitioners secure the supracrestal tissue attachment in functional and esthetic crown lengthening surgeries. The dentogingival junction was subsequently defined as supracrestal tissue attachment (SCTA), formerly called biologic width. One of limitations of the previously reported SCTAs was it included all surfaces of teeth, and these were averaged into one value to represent the SCTA measurement of the entire dentition. To the best of our knowledge, no studies have reported SCTA measurements on solely the maxillary anterior facial and palatal surfaces. **Methods:** A total of five human dentate cadavers without clinical attachment loss nor altered passive eruption between tooth numbers six through eleven were utilized. Reference notches at the gingival margin of each tooth were prepared. All samples were processed to histology slides and digitalized into image files. The facial and palatal sides of junctional epithelium (JE) and connective tissue (CT) attachment of each tooth were measured with Image Pro software and recorded. Paired t-test was used to compare the facial and palatal sides

of each dimension of JE, CT and SCTA. Results: Mean facial JE and CT attachment was 1.17 ± 0.44 mm (range: 0.5-2.20 mm) and 1.28 ± 0.66 mm (range: 0.50-3.20 mm), respectively. Mean palatal JE and CT attachment was 1.14 ± 0.44 mm (range: 0.42-2.45 mm) and 1.34 ± 0.57 mm (range: 0.53-3.39 mm), respectively. There were no significant differences between facial and palatal epithelial attachment ($P=0.31$) or connective tissue attachment ($P=0.92$). The SCTA was 2.45 ± 0.82 mm on facial, and 2.48 ± 0.71 mm, and no significant differences were noted ($p=0.19$). Conclusion: Since slightly larger ranges of each JE, CT and SCTA were found, clinicians need to be aware of the importance of individualized SCTA.

P53 Comparison of Biofilm Formation on Titanium and Zirconia Dental Implants. L. CHIOU*, B.H.D. PANARIELLO, Y. HAMADA, R.L. GREGORY, S. BLANCHARD, S. DUARTE (Indiana University School of Dentistry)

Peri-implant diseases are emerging issues in contemporary implant dentistry. Progression of peri-implantitis with zirconia (Zr) implants was significantly slower than titanium (Ti) implants in a canine model. As biofilms play a critical role in peri-implant diseases, the characteristic of resisting bacterial adhesion would be ideal for dental implants. This study aimed to compare Ti and Zr implants regarding the amount of biofilm formation at different time frames and assess the distribution of biofilm on different aspects of dental implants. Biofilm was developed on commercially available Ti and Zr dental implants ($n=9$) with a peri-implant-related multispecies model with *Streptococcus oralis*, *Actinomyces naeslundii*, *Veillonella dispar*, and *Porphyromonas gingivalis*, for 3 and 14 days in anaerobic conditions. Quantitative assessment was performed with the measurement of total bacterial viability (colony forming units – CFU/mg). Scanning electron microscopy (SEM) was used to evaluate biofilm formation on different aspects of the implants. While 3-day-old biofilm on Ti implants was significantly higher ($p<0.001$) than that on Zr implants, Ti and Zr groups were not significantly different for 14-day-old biofilm ($p=0.534$). Visual analysis of SEM images demonstrated that 3-day-old biofilm on Zr implants was sparse while biofilm growth was observed for other groups. It appeared that less biofilm formed on the valley compared to the thread top for 3-day-old biofilm on Zr implants. The difference between the valley and the thread top became indistinguishable with the development of mature biofilm. In conclusion, while early formed biofilms show greater accumulation on titanium implants compared to zirconia implants, older biofilms between two groups are comparable. The macrostructure of dental implants may affect the distribution of biofilms during early biofilm development. (This study was partially funded by American Academy of Implant Dentistry Research Foundation and the NIDCR/NIH grant 1R21DE028929-01 PI Duarte)

P54 Comparison of Surface Roughness and Bacterial Adhesion Between Three Instruments. F.Y. HAROON*^{1,2}, R.L. GREGORY¹, A.T. HARA¹, S. BLANCHARD¹, Y. HAMADA¹ (¹Indiana University School of Dentistry, ²Roudebush VA Medical Center)

Background: “Ultrasonic Gracey Tip®” reportedly combines benefits of a piezoelectric device and manual curette. Objectives: To compare surface roughness outcomes between manual curettes, piezoelectric devices, and this novel device; to assess whether roughness will affect bacterial adherence. Materials and Methods: The groups were 1) Gracey curette, 2) Piezoelectric scaler, 3) “Ultrasonic Gracey Tip®”, and 4) untreated control. Roots from extracted human teeth were randomly assigned. Surface roughness (Ra, Rz) was measured before and after instrumentation. Specimens were inoculated with *S. mutans*. Various dilutions of resuspended biofilm were incubated and CFU values were measured. One-way ANOVA with pairwise comparisons was used for statistical analysis. Results: Experimental device resulted in significantly lower Ra and Rz compared to all other groups ($p<0.01$). The piezoelectric tip and control had higher Ra and Rz than the Gracey curette and experimental device ($p<0.05$). The Gracey curette and experimental device had significantly lower CFU compared to the control ($p<0.05$). There were no significant CFU differences between the Gracey curette and both the piezoelectric and experimental device tips. There were no significant CFU differences between piezoelectric tip and both experimental device and control. There was no correlation between Ra and CFU for Gracey curette, piezoelectric tip, and control. Lower Ra of the experimental device approached significance with lower CFU ($p=0.05$). Conclusions: Ultrasonic Gracey Tip® is effective at resulting in a significantly smoother surface compared to traditional instruments. CFU values with Ultrasonic Gracey Tip® were significantly lower than non-instrumented surfaces, but there were no significant differences compared to conventional methods. (Study partially funded by Indiana University's Graduate Student Research Committee Grant #20-16)

PRACTICE MANAGEMENT

- P55 Interprofessional Care for Temporomandibular Joint Disorders: The Patient's Perspective.**
N. NOVOSEL*, J. STEELE, H. AVILA, D. RAJENDRA, F. BATES, S. FUNK, M. DI GIOSIA, N. SANTOSH, C. YANG, N.S. MATTHEWS (Indiana University School of Dentistry)

Temporomandibular disorders encompass a group of musculoskeletal conditions that affect the temporomandibular joints (TMJ), masticatory muscles, and associated tissues. Clinical presentation includes pain, impaired function, crepitus, radiographic bony changes, and joint space narrowing. The Indiana University School of Dentistry TMJ Institute, established October 2021, is a multidisciplinary clinic designed to support the management of patients with challenging temporomandibular disorders. Professionals from oral and maxillofacial surgery, orofacial pain, physical therapy, orthodontics, prosthodontics, comprehensive care dentistry, psychiatry, and social work collaborate to create a customized, interprofessional consensus to patient care. Compared to traditional, siloed healthcare models, are patients diagnosed with TMJ dysfunction satisfied with the quality of care received from an interprofessional approach? The objective of this preliminary study is to determine the level of patient satisfaction at the Institute using a 5-Point Likert scale patient questionnaire. 27 questionnaires were distributed and 16 were collected. 44% of patients traveled over 50 miles to be seen at the Institute. 'Strongly agree' was the most selected response for each prompt. The exception was whether patients preferred to meet with each clinician individually, to which 'strongly disagree' or 'disagree' was the most popular response, indicating that an interprofessional approach was preferred. 31% 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 the various treatment options were fully explained. These answers suggest implementing more streamlined systems for executing treatment plans, improving role clarity among providers, and communicating more clearly with patients. The results reveal that most patients diagnosed with TMJ dysfunction were highly satisfied with the interprofessional approach used at the TMJ Institute. Our study suggests that positive patient satisfaction is an important factor in assessing the quality and efficacy of interprofessional, patient-centered clinic models.

PUBLIC HEALTH

- P56 Assessing the Effectiveness of HPV Web-based Modules Among Dental Students.**
A. CHINTAPALLI*¹, A. SHUKLA¹, M.K.A.B. AHMED², K. WELCH³, A. VILLA⁴ (¹Indiana University School of Dentistry, ²Indiana University-Purdue University Indianapolis, ³Team Maureen North Falmouth MA, ⁴University of California San Francisco)

Oropharyngeal cancers (OPC) associated with the Human Papillomavirus (HPV) are becoming increasingly prevalent, contributing significantly to the disease burden of cancer throughout the U.S. In efforts to improve preventive care practices against these viral and metastatic diseases, the role of dental professionals has evolved to include point of care opportunities in dental settings to increase knowledge and awareness regarding the pathogenic effects of HPV, and allow dentists to administer HPV vaccines in some states. The objective of this study was to assess the effectiveness of online learning modules in educating current dental and dental hygiene students about HPV vaccination and its implications with OPC. A pre-post survey was distributed to 142 dental professional students from various institutions. Most students reported having some baseline understanding of HPV even prior to accessing the modules. There was a statistically significant increase in the proportion of respondents who identified OPC ($p=0.01$), vaginal (0.02), vulvar (0.04), penile (0.01) to be associated with HPV after reviewing the modules. A gap in the understanding of HPV vaccine eligible groups was noted in almost half of the participants. Given the evolving nature of HPV pathogenicity, and the scope of practice of dental professionals, the findings of this study suggest that dental professional students may benefit from educational interventions that alleviate knowledge deficits regarding HPV and encourage preventive clinical practices among current and future dental workforce.

P57 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 critical in evaluating students' performance and learning outcomes, specifically in dentistry. This study analyzes 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, which is currently in progress. Our next steps include statistical analysis of the survey and completion of focus groups with the faculty of each of the selected eighteen courses. Current survey trends show mixed findings in regard to inclusion of dental public health competencies within IUSD 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).

P58 Acculturation and Oral Health in Mexican Women. A. SHARMA*^{1,2}, R.L GOBIN² (¹Indiana University School of Dentistry, ²University of Illinois)

Objective: Oral health disparities such as periodontitis and untreated tooth decay are more profound in the Mexican population. Research evidence suggests, acculturation positively affects oral health in Mexican men and children. Yet the effect of acculturation on the oral health of Mexican women remain unknown. The objective of this research is to examine the impact of acculturation on oral health (i.e., periodontitis and decayed teeth) among Mexican-American and Mexican immigrant women. Methods: We conducted a secondary analysis of cross-sectional data from 2014-15, 2015-16, and 2017-18 cycles of the National Health and Nutrition Examination Survey (NHANES). The sample included 1018 Hispanic women. We used crude and adjusted logistic regression models to examine the association among acculturation (measured by the length of stay in the United States, language spoken at home, and race) and oral health (measured by rates of periodontitis, decayed teeth, self-rated oral hygiene, and the date of last dental visit). Results: The crude statistical model showed that Mexican women (Mexican immigrants and Mexican-American) residing in the United States for more than 5 years had higher odds ($B = 2.29$ $p < .05$) of decayed teeth and a lower likelihood of periodontitis than Mexican women residing in the United States for less than 5 years. Mexican American women have a lower likelihood ($B = 0.99$, $p < .05$) of periodontitis and decayed teeth ($B = 0.78$, $p < .05$) than Non-American Mexican women. Mexican-American women self-rated their tooth and gum health 1.84 times poorer than non-Mexican American women. Conclusion: The results of this study suggest a significant positive association between length of stay in the United States and decayed teeth and periodontitis among Mexican women. Future studies should examine the factors that contribute to better oral health among Mexican women residing in the United States.

P59 Salivary AMP Levels in HIV-infected Children and Adolescents in Nairobi, Kenya. A.E. KARCZEWSKI*¹, M. KOWOLIK¹, Y. WANG², W.O. CHUNG³, A.M KEMOLI⁴, A.L. SEMINARIO³ (¹Indiana University School of Dentistry, ²University of California Los Angeles, ³University of Washington School of Dentistry, ⁴University of Nairobi School of Dental Sciences)

Objectives: Human cathelicidin LL-37 and Secretory-Leukocyte-Protease-Inhibitor (SLPI) are salivary antimicrobial peptides (AMPs) with broad-spectrum antimicrobial activity that participates in innate immunity against many oral diseases. The purpose of this study is to determine salivary concentration of these AMPs in children and adolescents living with HIV (CALHIV) to inform a later study evaluating a correlation between salivary AMPs and oral diseases in CALHIV. Methods: Salivary samples were collected from CALHIV ($n=76$) at the Kenyatta National Hospital. Study participants were recruited from two other pediatric HIV studies: Optimizing-Pediatric-HIV-1 Study (OPH) where antiretroviral-therapy (ART) was initiated <12 months, and Pediatric-Adherence-Study (PAD), a cohort that began ART >24 months. Participant demographics, HIV status, and CD4 cell counts were obtained from these databases. LL-37 and SLPI concentrations were analyzed with Enzyme-Linked Immunosorbent Assay (ELISA) and compared between cohorts. Data was statistically analyzed ($p<.05$).

Results: The average age of the participants at the oral exam was 13.3 ± 3.4 y, with 36 females and 40 males. Participants had been on ART for 11.6 ± 1.7 y. Median CD4 count was 954cells/mm³. The mean LL-37 salivary concentration of OPH early-ART cohort was significantly lower than that of PAD late-ART cohort (18.6 ng/ml vs 32.8ng/ml, $p=0.0129$). Average SLPI concentrations were 288.6 ± 282.6 ng/ml. The OPH early-ART cohort was significantly associated lower LL-37 and SLPI salivary concentration, controlling of sex and CD4 count ($p=0.0036$, $p=0.037$ respectively). There was a weak-moderate correlation of SLPI concentrations with subject age and length of ART. Regression analysis indicated that late cohort had 185.14 ± 65.81 ng/ml ($p=0.0063$) more salivary SLPI levels than the early cohort. Conclusion: Salivary LL-37 and SLPI concentrations were found to be higher in CALHIV in the late-ART cohort and had a correlation with age and years spent on ART. Higher AMP concentrations can indicate a higher prevalence of oral diseases, prompting further research and public-health interventions to improve the innate immunity of CALHIV.

P60 Caregiver Oral Health Literacy, Pediatric Oral Health Status: Systematic Review. K.T. STEWART^{*1}, V.W. MCCARLIE², B.N. SMITH³, L.E. FOGARTY², S.E. VOSSERS², J.E. BLOSS² (¹Indiana University School of Dentistry, ²East Carolina University School of Dental Medicine, ³University of North Carolina Adams School of Dentistry)

Objective: The primary aim is to determine whether there is an association between caregiver oral health literacy and the oral health status of children. Methods: All bibliographic databases with relevant information on the proposed question were evaluated and included biomedical research literature (MEDLINE via PubMed and Embase), allied health, nursing and dental literature (CINAHL Complete), and social sciences/scientific literature (SCOPUS). A grey literature search was also completed to screen for additional articles or abstracts. The subject terms and keywords assessed for the main concept domains included: oral health literacy, oral health, parents or caregivers, and children. Inclusion criteria included: 1) children 11-years-old or younger, 2) use of a validated oral health literacy instrument, and 3) studies specifically evaluating caregiver oral health literacy and oral health status in children. A comprehensive list of search terms was iteratively developed by the team and reviewed by a second librarian. After duplicate removal, 4,705 studies were screened at the title and abstract level by at least two independent reviewers using the systematic review management software Covidence. Five hundred twenty-six studies were identified and included in the full text screening process. As of February 2022, 41 full text reviews have been completed by at least two independent team members, with 15 articles meeting the specified inclusion criteria. Preliminary Results: For articles that were excluded from the review, the most identified reason was not specifically addressing both caregiver oral health literacy and children oral health status together. Of the full text articles meeting the inclusion criteria (36.5%), most suggest a connection between caregiver oral health literacy and the oral health status of children. Preliminary Conclusions: Based on the articles reviewed to date, there appears to be a positive association between caregiver oral health literacy and children oral health status across diverse countries and cultures.

P61 The Association of Cigarette Smoking and Dental Visits Among Adults. B.A. ARMAH^{*1,2}, I. ALHUSSAIN¹, W. ALGHAMDI¹, A. ALANSARI¹, M. NAZIR¹, N.B. COOK² (¹Imam Abdulrahman Bin Faisal University KSA, ²Indiana University School of Dentistry)

Cigarette smoking is considered a main predisposing factor for multiple oral conditions such as halitosis, periodontal disease, tooth loss and oral cancer. In previously conducted studies, it was concluded that smokers were less likely to visit a dentist than non-smokers. To our knowledge studies are inadequate among young Saudi adults. The aim of the study was to assess the association between visits to the dentist and frequency of smoking among young Saudi adults. A cross-sectional study was carried-out in University of Dammam (UOD), Saudi Arabia from February to April, 2017. The sampling technique was stratified random sample by gender and academic track. The study included first year students studying in UOD. The translated Arabic version of WHO questionnaire was used. It was pilot tested on 20 student who were not participants in the study. The survey included questions about time and reason of last dental visit (outcome) and frequency of smoking (exposure). Descriptive analysis was used. Level of significant was tested by Chi-square. P value = 0.05 was considered statically significant. The data was entered as SPSS file. The sample size was 2594 (response rate= 1922, 74.09%) with (56.2%) female and (43.8%) male. The mean age of the sample was 20 (SD=1.9). The prevalence of smoking within the sample was 11.3%. The two major reasons for dental visit were for treatment (37.7%) and pain (34.4%). Our result shows

that 39.2% of non-smokers had a visit within 6 months. On the other hand, 30% of daily smokers and 35.8% of rarely smokers had a visit within 6 months. Also 50% of daily smokers and 41% of rarely smokers had their last visit over a year. Whereas 33% of the non-smokers visited the dentist over a year (P value=0.01). The results suggested that non-smokers are more likely to visit dentists than smokers.

P62 Oral Health Influences in Saudi Arabia From 2017 National Survey. N. ABOGAZALAH^{*1}, C.T. YIANNOUTSOS², J.F. YEPES¹, E.A. MARTINEZ-MIER¹ (¹Indiana University School of Dentistry, ²R.M. Fairbanks School of Public Health)

Objective: To explore the distal and proximal influences on oral health in the Kingdom of Saudi Arabia (KSA) by utilizing data from a national demographic and health survey (DHS) conducted in 2017. Methods: The 2017 KSA DHS used an innovative multistage stratified random-sampling technique to select the population sample by using primary health care centers' (PHCs) catchment areas as the primary sampling unit. Over 45,000 household heads plus a family member were interviewed. A conceptual framework for distal and proximal oral health influences specific to the KSA was adapted based on the oral health surveillance model. Cross-tabulation and Chi-square tests were performed with consideration for sample weights to provide estimates representative for the KSA population. Frequencies and weighted percentages for each variable reflecting each construct were reported. Results: The total number of individuals included in the analysis was n = 55,511, ages ranging between 2 and >65 years. Lack of dental care when needed was reported for 22.5% of the population (males= 20.8%/females=24.7%). Proportion of population from Central, West, East, South, and North regions who reported available dental care services when needed was 62.3%, 58.0%, 58.9%, 62.3%, and 60.1%, respectively. PHCs were the most regular source for dental care (55.1%). In total, 48.3% visited the dentist at least once last year (males= 49.4% /females= 46.8%). Dental pain was the most common reason for last dental visit (69.0%), while only 6.4% reported visited the dentist for routine. Only 15.3% reported brushing their teeth at least twice per day (males= 14.6% /females= 16.4%). Conclusion: Two major oral health influences previously reported to have a significant negative influence on oral health, namely, limited routine dental check-up visits and inadequate oral hygiene, were present among KSA residents. Further inferential study is needed to investigate such influence on oral health status within the KSA population.

TISSUE REGENERATION AND REPAIR

P63 Kalirin Deletion in Osteoclasts Causes Sexually Dimorphic Bone Mass Changes. D. GODFREY*, J.M. HONG, M. TUDARES, A. BRUZZANITI (Indiana University School of Dentistry)

Osteoclasts are cells within bone that are responsible for degrading and remodeling the structure of the bone, and together with osteoblasts and osteocytes are responsible for controlling bone mass and quality. Kalirin, a GDP/GTP-exchange factor originally described in neurons, has been identified to have a significant effect on bone density. We reported that global Kalirin deletion in mice (Kal-KO) significantly reduces bone mass, which is due in part to increased osteoclast activity as well as decreased mineral deposition by osteoblasts. The objective of this study was to determine the skeletal effect of deleting Kalirin in osteoclasts. We crossed Kalirin-floxed mice with Cre-mice expressing tartrate resistant acid phosphates (TRAP) to generate Kalirin-TRAP knockout mice, lacking Kalirin in osteoclast progenitors and mature osteoclasts. Male and female Kalirin-TRAP mice and Kalirin-floxed littermates were analyzed *in-vivo* at 8-weeks (n=10-17) and 14-weeks (n=8-14) for changes in femoral bone mineral content (BMC; mg) and bone area (cm²) using a Lunar PIXImus Densitometer. Female Kalirin-TRAP mice showed a significant ($p<0.05$) decrease in BMC (-6.29%) and bone area (-7.51%) only at 14-weeks, consistent with the low bone mass previously reported for Kal-KO females. In contrast, male Kalirin-TRAP mice did not exhibit a change in either of these parameters at 8-weeks or 14-weeks, compared to 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 in osteoclasts 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.

P64 A Pyk2 Inhibitor Promotes Bone Formation and Attenuates Resorption In-vitro. M. TUDARES*, J.M. HONG, A. BRUZZANITI (Indiana University School of Dentistry)

Alveolar bone resorption can result in increased tooth movement and edentulism. Ideal interventions for restoring alveolar bone mass should decrease osteoclast (OC) activity and stimulate osteoblast (OB) activity. Pyk2 is a tyrosine kinase important for cytoskeletal regulation. Global Pyk2 deletion in mice results in bone gain due to increased OB activity and decreased OC resorption. Therefore, pharmacologic Pyk2 inhibitors have the potential to reduce bone loss and promote bone gain. Hypothesis: The Pyk2 inhibitor PF-4618433 will stimulate osteogenesis of dental pulp stem cells (DPSCs) and reduce osteoclastogenesis in-vitro. Methods: Human DPSCs cultured for 14 days in osteogenic media containing 50 µg/ml ascorbic acid and 5 mM β-glycerophosphate were treated with a Pyk2 inhibitor (PF-4618433, 0-0.6 µM), or a selective inhibitor of the related tyrosine kinase, FAK (PF-04554878, 0-1.2 µM). Osteoblast formation was determined by quantification of alkaline phosphatase (ALP) activity, mineral deposition (Ca²⁺), and *Col1a* mRNA expression. To test osteoclastogenesis, non-adherent bone marrow cells from C57BL/6 mice were cultured in 10 ng/ml MCSF and 80 ng/ml RANKL for ~7 days. The inhibitors were added 24 hours after cell plating and the media was changed every 2 days. Mature, multi-nucleated OCs were stained for tartrate-resistant acid phosphatase (TRAP) and counted. Results: DPSCs treated with PF-4618433 exhibited a dose-dependent increase in ALP and Ca²⁺ deposition compared to 0 µM control (*p*<0.05). *Col1a* mRNA levels were higher in the 0.6 µM PF-4618433 group (*p*<0.05). DPSCs treated with PF-04554878 did not show statistically significant differences. OC formation decreased with increasing concentration of PF-4618433 but not PF-04554878. Conclusion: The Pyk2 inhibitor PF-4618433 stimulates osteogenic differentiation of DPSCs and decreases OC formation and could potentially be used to prevent or restore alveolar bone loss.

Clinical Case Report Presentations

CARIOLOGY

CC1 Anterior Resin Veneers Replacing Defective Porcelain Veneers. L. ALZHRANI*, N.B. COOK (Indiana University School of Dentistry)

Introduction: Ceramic veneers remain the gold standard for esthetics and longevity. However, direct resin veneers provide a more conservative approach, treatment can be completed in one visit without the need for temporization, and the cost to the patient is generally lower than ceramic veneers. To achieve optimum results, meticulous technique and proper isolation are essential. Case Presentation and Results: A 50-year-old female presented to IUSD Graduate Operative Dentistry Clinic for esthetic treatment for teeth 6-11 with a chief complaint: "I want a unified smile with a natural color". Clinical Examination revealed porcelain veneers on teeth 6-11 that were placed 15 years ago with multiple repairs with resins. It was determined that the existing porcelain veneers were indicated for replacement. Due to the patients' economic situation, it was decided to replace them with direct resin veneers. A diagnostic wax-up was made, a clinical mock-up was performed, and a shade was selected. Starting with teeth #8,9 and moving distally, the porcelain veneers were removed and replaced with direct resin veneers. Clinical steps for the resin veneers included etching with 37% phosphoric acid, bonding with OptiBond Solo Plus and the placement of enamel shade 3M™ Filtek™ Supreme A1E resin composite. Initially a lingual shell was formed, guided by an Exaflex® Putty index fabricated from the diagnostic wax-up. Then facial resin was applied in increments. Finishing and polishing was done using 3M™ Sof-Lex™ extra thin and 3M™ Sof-Lex™ Diamond Polishing Spiral System. Occlusion was checked and post-operative instructions were provided to the patient. Conclusion: Resin veneers are a conservative option for replacing defective porcelain veneers when new porcelain veneers are not feasible. For many esthetic problems resin veneers provide an economical alternative.

DENTAL HYGIENE

CC2 The Impact of COVID-19 on Oral Health. P. COLSON*, L. KLEI, L. MAXWELL (Indiana University School of Dentistry)

Objective: Due to the COVID-19 pandemic, dental practices everywhere were forced to close their doors. As a result, appointments were canceled leaving patients that were seeking routine care with no other options. Once practices had opened back up, many patients were too nervous to go to the dentist in fear of being exposed to the virus. Patients were choosing to delay routine dental visits and only calling once they were in pain or were experiencing a problem. Once these patients had finally felt comfortable enough to come back, their oral health conditions had worsened severely. The purpose of this study is to assess the effect that COVID-19 had on oral health and the detrimental effects it is still posing to patient care. Methods: We performed a literature search using a variety of reliable resources such as the World Health Organization (WHO), Oral Health Workforce Research Center (OHWRC), PubMed, and the Centers for Disease Control and Prevention (CDC). Conclusion: Around 77% of countries' oral health services were affected due to COVID-19, which was among the highest of all healthcare services. This report will assess the repercussions that COVID-19 has had on oral health and the negative effects that it continues to have.

CC3 How Being Visually Impaired Affects a Patient's Oral Health. P. DIETZ*, M. GASKILL, A. RIECK (Indiana University School of Dentistry)

Throughout history the disabled population has been sidelined when it comes to receiving adequate health care services. The best way to try and improve this is to understand the barriers that the visually impaired population face when trying to receive medical treatment. The objective of the investigation is to examine visually impaired individuals and their total oral hygiene health including access to dental care and at home oral hygiene. The overall goal is to examine the restrictions placed upon this specific population and the effects it has on their oral health, as well as suggesting options to better treat this type of patient as a dental practitioner. Experimental methods include investigating prior collected data and interviewing a visually impaired patient. The findings include that visually impaired patients often only seek dental treatment when in pain due to dental caries, dentures, or oral sores, they are not able to detect early signs of oral disease, require supervision to maintain oral hygiene methods and identification of oral disease, lack proper transportation to and from appointments, and often do not have the financial funds for regular treatment. As dental practitioners it is essential that offices are conducive to treat the visually impaired, adaptations to normal procedures are made to ensure that the patient can be independent in their home care, and special training is received on how to properly accommodate the patient.

CC4 Treatment and Management of Dental Patients Exhibiting Dry Mouth. I. YOUNG*, M. WILLIAMS, A. RIECK (Indiana University School of Dentistry)

Objective: To raise awareness of the damaging effects dry mouth and xerostomia have on the oral cavity. As dental professionals, it is our duty to our patients to be able to identify dry mouths and educate our patients on its treatment and management. Background: Dry mouth syndrome affects 30% of the US population and is a common complaint of dental hygiene patients. Proper salivary flow is crucial to oral health as it aids in mastication, swallowing, lubrication, digestion, and caries prevention. Treatment: When dry mouth is suspected, a salivary flow test should be performed chairside. If it is determined that the patient does exhibit measurable hyposalivation, the recommendations for treatment and dry mouth management include increasing hydration through water and the addition of oral lubricants such as milk, or other dry mouth relief products such as sprays or lozenges. Prescription fluoride rinses, toothpaste, and professionally applied fluoride treatments are one way of managing caries. In addition, patients with measurable hyposalivation may be prescribed salivary stimulants such as Cevimeline and Pilocarpine. Conclusion: Dental professionals must be knowledgeable in the clinical signs and symptoms of dry mouth and the proper management of dry mouth syndrome and hyposalivation.

CC5 Modification of Dental Hygiene Care in a Blind Patient. J. CLOSSER*, A. OWENS, T. RADER (Indiana University School of Dentistry)

Objective: This clinical presentation is to discuss the modifications in treatment for a patient who is visually impaired. Background Information: A 78-year-old African American male patient presented to the Dental Hygiene clinic for a periodontal maintenance appointment. Significant findings in the medical history include treatment of hypertension, hyperlipidemia, and chronic obstructive pulmonary disease (COPD). Current medications include Losartan, Simvastatin, Prednisone, Symbicort, and Buspirone. This patient is also blind, in a wheelchair, and on oxygen twenty-four hours a day due to his history of smoking that eventually led to COPD. Clinical Examination: The patient clinically presented with generalized healthy gingiva as evidenced by light pink, firm, and blunted papilla with a bleeding score of 5%. Periodontally, he presented with a reduced periodontium in a successfully treated periodontitis patient. Radiographically, the patient presented with bone loss in the mid third of the root. This patient had a plaque score of 35%, brushing only once daily, no use of a mouth rinse, and flossing a few times a week. Due to his blindness, the patient has trouble with brushing and flossing correctly. DH Care Plan: The patient received full mouth debridement and modified oral hygiene instructions. Recommendations of the Bass Method and use of Super Floss were made using descriptive words for the patient to better understand. Quality communication was important, and adjustments were made to ensure the best care for this patient. Conclusion: A blind patient presented to the hygiene clinic with mild plaque build-up and successful non-surgical periodontal treatment. Educating the patient on how to properly use the Bass Method and C-shaped flossing was critical to help maintain periodontal health. We conclude that educating the blind patient in oral hygiene instructions is critical to maintain periodontal health, which can be achieved by using the hand-on-hand technique, braille, and proper communication.

CC6 Limited Access to Dental Care as a Child and Periodontitis. B. CONRAD*, O. MARTIN, P. RETTIG (Indiana University School of Dentistry)

Introduction: The objective of this clinical case presentation is to discuss how the lack of access to dental care at a young age influences periodontitis later in life. Background: A 37-year-old male presented to the dental hygiene clinic as a new patient with a negative medical history. The patient had previously been seen at a medical center in Kentucky in early 2021 for a prophylaxis cleaning. The patient had limited regular preventive care growing up; however, he now seeks dental care regularly. Assessment: Patient presented with generalized marginal plaque-induced gingivitis as evidenced by dark pink, cratered, spongy gingiva, and a bleeding score of 21%. The periodontal description revealed stage 3 periodontitis as evidenced by mid-third root bone loss and probing depth > 6 mm and grade A as evidenced by being a non-smoker and non-diabetic. The patient's plaque score averaged 22.3% over the course of his treatment and generalized moderate to heavy subgingival calculus was detected. The patient stated he was thoroughly educated on his treatment plan. Dental Hygiene Care Plan: Patient received scaling and root planning in all four quadrants, a tissue re-evaluation, and vast oral hygiene instruction. Evaluation: At the tissue re-evaluation, there was a significant number of areas with no improvement in tissue response. The patient's pre- and post- treatment periodontal charting, gingival description, and young age were taken into consideration during this evaluation. Therefore, the patient was referred to the Graduate Periodontal department for further assessment. Conclusion: From the review of the evidence-based literature, there is a correlation in that having minimal dental care as a young child can lead to having periodontitis as a young adult. This outcome can lead to severe bone loss and destruction of the periodontium at an earlier onset, despite prioritizing receiving dental care as an adult.

CC7 Seeking Dental Care Outside the United States: A Case Report. B. CREAMER*, H. HAFENBREIDEL, L. MAXWELL (Indiana University School of Dentistry)

Objective: To demonstrate the differences between quality and cost of restorative treatment and crown placement in the United States compared to other countries. Background: An adult female presented to the endodontist with a chief complaint of pain in the upper left quadrant. A comprehensive exam identified tooth numbers #2, 3, and 10 all presented asymptomatic apical periodontitis and tooth numbers #4, 6, 7, 13 all had symptomatic apical periodontitis. Dental History: This patient flew to South America for extensive dental restorative procedures. The patient's rationale for going out of country was due to the substantial cost savings she received compared to the cost she would have incurred had the treatment been done in the United States. Based on the findings of the

comprehensive dental exam, the patient is in the process of having retrograde root fillings completed on each tooth that was previously endodontically treated in South America. Based on empirical research and this case, cost tends to be lower in other countries, which could play a role in the quality of dental treatment, however cost is not the only determinant of quality of dental care. Conclusion: This case report suggests that lower cost of dental treatment does not always lead to effective long-term results, however more research is needed to come to this conclusion.

CC8 Association Between Diabetes Mellitus and Dental Implant Complications. A. HEIN*, M. JOBITO, L. LANDES (Indiana University School of Dentistry)

The aim of this study is to identify and explore the possible association between diabetes mellitus and complications of dental implants. Dental implants are an extremely common procedure to replace missing teeth since their development in 1952. Reviewing the risk factors associated with dental implants and systemic diseases can help determine the success or failure of an implant overtime. There are many systemic diseases that may play a role in implant failures and complications but one of the main systemic diseases associated with dental implant complications is diabetes mellitus. With an implant patient who has diabetes mellitus, it is very important to keep the patient's diabetes well-controlled and to control the dental biofilm in order to prevent alveolar bone loss around the implants. If a patient with dental implants has uncontrolled diabetes there is a much greater chance of dental implant complications and possible implant failure. In this case study we reviewed the case of a 54-year-old Caucasian male who presented to Indiana University School of Dentistry dental hygiene clinic with localized peri-implantitis on #19 and #20 as evidenced by probing depths up to 6mm, bleeding on probing, and 3mm radiographic bone loss. The patient's medical history identifies that he had Type II Diabetes Mellitus with an HbA1c score of 7.4. In this case study, we explored the association between peri-implantitis and Type II Diabetes Mellitus. In conclusion, this case report saw a likely association between diabetes mellitus and complications of dental implants, including peri-implantitis and peri-implant mucositis.

CC9 The Benefits of Scaling and Root Planning on Mobile Teeth. M. MAWHORTER*, L. WILSON, L. LANDES (Indiana University School of Dentistry)

The objective of this clinical case study is to determine if scaling and root planning is beneficial in reducing the mobility of teeth that have become mobile due to periodontitis. A 64-year-old male presented to the dental hygiene clinic with a chief complaint of "I am here for a dental cleaning." This patient was previously seen in the periodontal clinic for treatment of periodontitis. He was then referred to the dental hygiene clinic at Indiana University School of Dentistry. When seen in the hygiene clinic, it had been nearly 11 months since his last periodontal maintenance appointment. Medical history states that the patient has hypertension, stents, and hyperlipidemia which are well controlled with medications. The clinical examination showed Stage 4, Grade B periodontitis on the remaining 6 teeth as evidenced by probing depths up to 5mm, less than ten opposing teeth, radiographic bone loss extending to the middle third of the root, destruction in line with the amount of biofilm present and class 1 mobility on teeth #22 and #27. The patient has a full maxillary denture and a partial denture for the mandible. The patient's oral hygiene habits were brushing a couple times a week, never flossing, and never using mouthwash. The hygiene care plan included oral hygiene instructions, full mouth scaling and root planning, and a tissue re-evaluation after 4-6 weeks of healing. At the tissue re-evaluation, the patients probing depths improved and #22 and #27 were no longer mobile. In conclusion, the treatment of scaling and root planning for this patient was beneficial in reducing the mobility of #22 and #27 that had become mobile due to periodontitis.

CC10 Dental Hygiene Care for the Patient with Mucous Membrane Pemphigoid. M. ROBERTS*, M. ROMERO, T. RADER (Indiana University School of Dentistry)

Mucous membrane pemphigoid (MMP) is a rare autoimmune disease that is characterized by blistering lesions on the mucous membranes and skin. Areas commonly involved include the oral cavity, particularly the gingiva which manifests as erythematous lesions, blisters, and desquamative gingivitis. Objective: To determine how to care for patients affected by mucous membrane pemphigoid as the dental hygienist. Background: A 69-year-old African American female presented to the Dental Hygiene clinic for a dental prophylaxis and comprehensive exam. The medical history revealed that the patient had mucous membrane pemphigoid, type II diabetes mellitus, hypertension, rheumatoid arthritis, osteoporosis, feelings of depression, and Sjogren's syndrome. Assessment:

The patient presented clinically with generalized plaque-induced, marginal gingivitis as evidenced by dark pink, spongy gingiva, and bulbous papilla with a bleeding score of 28 that is modified by mucous membrane pemphigoid. The patient presented with a generalized healthy periodontium as evidenced by 1-3mm of clinical attachment levels, with localized 4mm of clinical attachment levels due to inflammation and healthy bone levels. The patient's chief complaint was the generalized stain she noticed on her teeth. The DH Care Plan: Dental prophylaxis with an emphasis on gentle technique, patient education and oral hygiene instruction, and continuance of regular dental visits. Results: As a result of this investigation, we have learned the importance of routine dental care and the use of gentle technique when treating a patient with MMP. We have explored the need for modified oral hygiene instruction due to desquamative gingivitis and gingival pain to adapt for this patient's specific needs. Conclusion: The patient reports that receiving regular dental care and adopting the use of an electric toothbrush has helped improve her symptoms related to mucous membrane pemphigoid.

CC11 The Prevention of Caries Utilizing Dietary Counseling and Fluoride Exposures. S. SCHALL*, C. MAJORS, L. MAXWELL (Indiana University School of Dentistry)

Objective: To demonstrate the value of fluoride exposures and dietary counseling in patients with a high caries risk. Background: An adult female patient presented for a 6-month recall prophylaxis. Patient has a history of decay, frequent consumption of fermentable carbohydrates, visible dental plaque, and poor oral hygiene habits. The patient had generalized, marginal, plaque induced gingivitis on a healthy periodontium. Images taken in 2021 showed evidence of active decay on the occlusal of tooth #31. The patient's caries risk was further assessed by reviewing a 3 consecutive day food diary and reviewing a caries risk questionnaire. The findings signified that the patient was at a high caries risk and would benefit from dietary counseling and continuous fluoride exposures. Treatment Plan: Adult prophylaxis, plaque score, oral hygiene instructions, and a dietary counseling presentation to review the findings of the 3-day diary were provided. The presentation covered dietary recommendations to reduce the frequency of fermentable carbohydrate exposures and oral hygiene suggestions to lower her caries risk. The DH2 student recommended that the patient switch to a sugar substitute to sweeten her beverages, limit the frequency of fermentable carbohydrate consumption, brush two times a day with a fluoride toothpaste, incorporate a fluoride oral rinse daily, and receive two professional fluoride treatments a year. Conclusion: The relationship between refined sugar and dental caries formation has been well documented in the literature. However, recent data has indicated that this relationship is not as strong as it used to be, before the widespread use of fluoride. Therefore, an approach that combines dietary counseling with a regimen consisting of the use of professionally applied and at home fluoride should not be overlooked.

ENDODONTICS

CC12 Management of Endodontic Infection and Internal Bleaching in a Central Incisor. L. GEBRU*, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry)

Tooth discoloration is an esthetic problem that often results from pulpal infection. Endodontic treatment is required prior to whitening the crown with intra-coronal bleaching. Endodontic treatment and whitening of a discolored endodontically infected tooth are presented. Case Report: A 26-year-old female presented for endodontic treatment in #8. The tooth was asymptomatic, but she was bothered by the discoloration. Dental History: She remembers falling on her face as a child. With time, #8 became discolored, contrasting the shade of adjacent teeth. The patient's medical history is noncontributory. Intra-Oral Exam: #8 was discolored with an intact incisal resin restoration. Diastemas are present in the incisor teeth. Sensibility testing: #8 did not respond to cold testing or electric pulp testing. The apical area was tender to palpation. X-ray: #8 incisal resin restoration was present. The canal was visible. Discontinuities were present in the lamina dura and a periapical radiolucency was seen. Diagnosis: #8 was diagnosed a pulpal necrosis with symptomatic apical periodontitis. Treatment: Local anesthesia was administered via local infiltration with 2% lidocaine (1:100k epinephrine). After tooth isolation, the pulp chamber was accessed. The pulp was found to be necrotic. Chemo-mechanical shaping of the canal was done with hand files and rotary Nickel-Titanium files up to size 40.04. The canal was irrigated with 6% sodium hypochlorite. An intra-canal medicament of calcium hydroxide was placed for 10 days. The canal was obturated using cold lateral condensation with gutta-percha and Grossman's cement. Intra-Coronal Bleaching: A slurry -

“wet sand” consistency of carbamide peroxide powder was placed in the access and grey Cavit was used for the temporary filling. After two weeks the patient was satisfied with the result and the access was permanently sealed with a resin restoration. Conclusion: Tooth discoloration can reflect pulpal necrosis. Root canal treatment and intra-coronal bleaching can address the infection and improve the esthetics.

CC13 Labial Access Opening in Incisor Teeth in Malocclusion: An Alternative Approach. T. WHITFIELD*, A. HOY, Y. EHRLICH, A. BESWICK, N. WARNER (Indiana University School of Dentistry)

The ideal endodontic access allows us to identify the canal orifices, achieve unstrained straight-line access and conserve tooth structure. In incisor teeth with malocclusion a labial access may be an alternative access approach. Case-1: A 73-yr male presented for endodontic diagnosis and treatment of #6. I/O: #6: Discolored crown rotated at 180 degrees. Testing: Cold 0, Percussion 0, Palpation 2. Probing Depth: WNL. X-ray CBCT: #6, canal visible. CBCT: Apical break in cortical buccal bone. PARL Dx: #6 Necrosis with symptomatic apical periodontitis. Tx: Local anesthesia was achieved with 2% lido (1:100k epinephrine). After isolation the pulp chamber accessed through the facial surface. The pulp was necrotic. WL was determined and chemo-mechanical shaping was done with hand files and rotary NiTi files to size 40.04. 6% NaOCl was used for irrigation. After the canal was medicated for 10 days with Ca(OH)₂ it was obturated with gutta-percha (GP) and Grossman's cement using cold lateral condensation. The access was restored with resin. Case-2: A 73-yr female presented for endodontic dx and tx of #25. I/O: #25: Accentuated lingual inclination with deep cervical caries #25: Cervical caries with cavitation. Testing: Cold 3, Percussion 0, Palpation 0. Probing depth: WNL. X-ray: #25: Caries approaching the pulp. PARL Diagnosis: #25 Irreversible pulpitis with symptomatic apical periodontitis. Tx: Local anesthesia was achieved with 2% lido (1:100k epinephrine). After isolation the pulp chamber accessed through the facial surface. The pulp was hyperemic. WL was determined and chemo-mechanical shaping was done with hand files and rotary NiTi files to size 30.04 and 6% NaOCl was used for irrigation. After the canal was medicated for 10 days with Ca(OH)₂ it was obturated with GP and Grossman's cement using cold lateral condensation. The access was restored with a resin. Conclusion: Labial endodontic access is an option to access anterior teeth in malocclusion needing RCT.

CC14 Root Canal Treatment of a Radix Entomolaris: A Case Report. P. ALENA*, K. SPOLNIK, J. BRINGAS, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry Graduate Endodontic Department)

Introduction: Successful endodontic treatments involve the recognition of morphologic anomalies when present. The radix entomolaris relates to a mandibular first molar having an additional (disto-lingual) root, most commonly found in populations with Mongolian traits. This disto-lingual root is often anatomically different than its disto-buccal counterpart and certain precautions/treatment modifications should be taken to conservatively treat these teeth. This case details the treatment of a radix entomolaris following a primary endodontic infection. Case presentation and results: A 47 y/o female presented for the evaluation and treatment of tooth #30 that included sinus tracts on the buccal/lingual gingiva and the lingual gingival sulcus. Tooth #30 was diagnosed as pulpal necrosis w/ chronic apical abscess and root canal treatment was initiated. Following a single round of calcium hydroxide as an intracanal medicament, the sinus tracts resolved and the obturation was completed. The 6-month follow-up revealed an asymptomatic patient with complete soft tissue healing and radiographic evidence of partial bone healing. Conclusion: The proper identification and conservative endodontic treatment modifications of a morphologically complex mandibular molar can lead to healing both clinically and radiographically.

CC15 Management of an Antibiotic Resistant Buccal Space Infection Following Endodontic Flare-up. W. CROSBY*¹, K. SPOLNIK¹, J. BRINGAS¹, Y. EHRLICH¹, L. BROOKS² (¹Indiana University School of Dentistry, ²Roudebush Veterans Affairs Medical Center)

Introduction: Endodontic flare-up is a complication of root canal therapy and is typically managed with oral antibiotics and non-opioid analgesics with rapid resolution. In rare occasions infection can advance due to delayed intervention, host factors, or antimicrobial resistance and present significant risk to the patient. In this case report, endodontic flare-up preceded a buccal space infection requiring interdisciplinary management. Methods: A 50-year-old male presented to the Roudebush VA Medical Center dental clinic for evaluation of severe left posterior maxillary tooth pain. Tooth #14 was diagnosed symptomatic irreversible pulpitis with symptomatic apical periodontitis and endodontic treatment was initiated. A flare-up developed which quickly progressed to a buccal space infection. It was nonresponsive to oral antibiotics and surgical intervention. The patient was admitted to the

hospital with intravenous antibiotic administration failing to prevent further spread of the infection to the infraorbital and infratemporal spaces. Coordination with the hospital's infectious disease physician resulted in administration of the "reserve antibiotic" linezolid and ultimately led to resolution of the infection. Conclusion: This case report demonstrates the need for timely identification and management of post-operative complications and highlights the importance of antibiotic stewardship due to the increasing prevalence of antimicrobial resistance.

CC16 Endodontics Management of the Patient with Hyperkalemic Periodic Paralysis. A. GOHIL*, K. SPOLNIK, J. BRINGAS, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry)

Introduction: Hyperkalemic Periodic Paralysis is a rare genetic condition that presents as episodic skeletal muscle weakness and paralysis. Currently, there is limited evidence on the dental management of patients diagnosed with Periodic Paralysis. Due to the mechanism of local anesthetics binding to and inactivating voltage-gated sodium channels, it is unknown whether their use will exacerbate Hyperkalemic Periodic Paralysis. Methods: A 55-year-old, symptomatic, male referred to IUSD by private dentist for evaluation and treatment of #30 due to his complex medical history. Consultation with patient's Neurologist to determine if non-surgical root canal treatment is advisable with local anesthesia and/or general anesthesia. After literature search, it was determined that the use of local anesthetics was deemed safe to administer without the need for general anesthesia. Nonsurgical endodontic treatment of tooth #30 was performed over 3 appointments. Conclusion: One must understand the importance of interdisciplinary communication for safe and predictable treatment outcomes.

CC17 Iatrogenic Subcutaneous Facial Emphysema During Post-Space Fabrication: Case Report. J. WU*, K. SPOLNIK, J. BRINGAS, Y. EHRLICH, N. WARNER (Indiana University School of Dentistry)

Introduction: During routine dental treatment, iatrogenic injuries to the patient can occur for a variety of causes. Though rare, subcutaneous emphysema can occur when air is forced underneath tissue leading to immediate swelling and crepitus on palpation. Proper management of such injuries is crucial as these injuries pose the risk of spread to facial planes along the periorbital, mediastinal, pericardial, and thoracic spaces. Subcutaneous emphysema can result in serious complications, and although long-term morbidity is rare, early recognition and proper management is critical. Case Presentation and Results: A 25-year-old female presented for evaluation and treatment of tooth #8 following perforation. The patient had been seen in the undergraduate clinics the same day and experienced iatrogenic subcutaneous facial emphysema after facial perforation of tooth #8 during attempted post-space fabrication. The patient was appointed same day in the Grad Endodontic clinic where a CBCT scan was taken, the perforation was repaired, and for management of the subcutaneous facial emphysema. The patient returned to our clinic 9 days later with complete resolution of facial swelling and for post-space fabrication. Conclusion: The use of high-speed air-driven handpieces and air water syringes warrants proper caution when performing routine dental procedures. When it arises, quick diagnosis and management of subcutaneous emphysema is crucial to prevent further complications.

ORTHODONTICS / IMAGING / CRANIOFACIAL

CC18 Clinical Considerations in Utilizing Dental Substitutions in the Esthetic Zone. D. ALBRIGHT*, R. BAYLES, K.T. STEWART (Indiana University School of Dentistry)

Background: Missing teeth in the esthetic zone, whether congenitally or due to disease or trauma, can be challenging to manage. In addition to the esthetic and functional demands within each individual case, patient desires and financial constraints play significant roles in the decision-making and treatment planning process. This case highlights many of these issues, as it involves multiple dental substitutions within the esthetic zone. Patient Background: A 12.4-year-old female patient presented to the IUSD Graduate Orthodontic Clinic with a chief complaint of "I don't like the space between my front teeth". She had a Class II subdivision right malocclusion, apparently missing tooth #8. Much of the space for tooth #8 had been lost due to mesial drifting of the teeth on her maxillary right side. Her father related a history of oral surgery in the maxillary anterior region at age 8, which removed a compound odontoma. Teeth #7 and 8 were unerupted at that time, significantly impacted by the presence of the odontoma. Eventually, tooth #7 erupted, but #8 remained horizontally impacted. The tooth did not appear to be in good position for recovery, so treatment plan options involved removal of that tooth. It was decided

to substitute every tooth on the patient's right side one full tooth forward of its normal position. Special emphasis was placed on interdisciplinary communication and bracket choice/placement to ensure the optimal positioning of the teeth for future contouring and restorations. Sequential tooth movement was utilized to maintain midline coincidence and preserve anchorage. Conclusion: Successful management of the optics and esthetics of dental substitutions in the esthetic zone often requires orthodontic treatment, with careful attention to differences in crown and root morphologies, gingival architecture, tooth color, and axial inclination details.

CC19 Resolution of Anterior Open Bite with Extractions and Tongue Habit Correction. A. FALASZ*, M. FRAZIER (Indiana University School of Dentistry)

Closure of anterior open bites is a significant orthodontic challenge with prevalence ranging from 0.6-16 percent. Etiology is multi-factorial and includes parafunction, abnormal tongue posture, disturbance of growth pattern, mouth breathing, and congenital diseases. Treatment modalities include monitoring, spontaneous correction, early interceptive treatment, habit elimination, non-extraction treatment, extraction treatment, miniscrew implants for posterior intrusion, and orthodontics combined with orthognathic surgery. Fortunately, studies show that treatment in the United States is effective with 84% of patients gaining full anterior overbite and 93% accomplishing overbite of at least the central incisors. This case demonstrates resolution of a severe anterior open bite in a high mandibular plane angle young adult patient with severe crowding. Extraction of first premolars with sequential retraction was utilized to eliminate crowding and allow bite closure via the "drawbridge effect." The patient's abnormal tongue posture was corrected via Tongue Tamers placed on anterior teeth. Positive overbite was achieved after 11 months of treatment and smile consonance greatly improved. Cephalometric superimposition reveals the open bite was closed via tipping and retraction of anterior teeth. Additional benefits such as lip retraction and reduction of muscular strain also occurred. Relapse, or the tendency of teeth to shift back to their original position, is a common problem and occurs to some extent in 40% of open bite treatments. Retention for this case will include Hawley and Essix style retainers combined with Tongue Tamers to maintain proper tongue posture, control posterior extrusion, and prevent relapse. Fortunately, extraction treatment that reclines and retracts incisors is noted to be more stable than non-extraction extrusion-based corrections. Conclusion: The patient's anterior open bite was successfully eliminated via extractions of first premolars for retraction of the anterior teeth according to the "drawbridge effect." The tongue habit was eliminated with Tongue Tamers.

PERIODONTICS

CC20 Full Mouth Regenerative Therapy for Severe Challenging Periodontal Defects. L. CHIOU*, Y. HAMADA (Indiana University School of Dentistry)

Introduction: Regenerative periodontal therapy has gained popularity and benefits have been documented in the literature. Specifically, a combination approach with multiple materials is suggested for defects with more challenging regenerative potential. This case report demonstrated the clinical and radiographic outcomes after regenerative procedures in a patient with aggressive form of periodontitis. Case Presentation and Results: A 30-year-old Asian female with ASA I presented to Graduate Periodontal Clinic. Initial periodontal examination revealed 4-6 mm and 7-10 mm of probing depths (PDs) on 61% and 12% of sites, respectively, generalized bleeding on probing (BOP), and intrabony defects on multiple teeth. About two-thirds of the teeth were categorized as Poor to Questionable prognosis. After scaling and root planing with systemic antibiotics, regenerative procedures were performed. Intrасulcular incisions were made on the facial and palatal/lingual aspects, and full thickness flap reflection was completed. With hand and ultrasonic instrumentation, granulation tissues were removed, and root surfaces were thoroughly root planed. Most of the defects were 1- or 2-wall defects. Following root conditioning with 17% EDTA, rhPDGF-BB-enhanced freeze-dried bone allograft was placed in the intrabony and furcation defects. Amnion-chorion membrane was used to cover the graft materials. Flaps were replaced and sutured, obtaining primary closure. All treated sites healed uneventfully. 5.5- to 8-month after the surgeries, PDs

were 1-4 mm with less than 10% BOP. Radiographic bone fill was achieved without the presence of intrabony defects. The periodontal prognoses for individual tooth improved in 69% of teeth and remained stable in 31% of teeth. Periodontal risk assessment indicated the change in the patient's risk, from high to moderate risk category. Conclusion: This case report showed regenerative periodontal therapy utilizing a combination approach is an effective treatment for periodontal defects with lower regenerative potential. The treatment outcomes were favorable and accompanied with the improvement of periodontal prognosis.

CC21 Maxillary Large Fenestration Defect: Resolution Through “Sandwich” Bone Augmentation Technique. B. HERRON*, Y. HAMADA (Indiana University School of Dentistry)

Introduction: Guided bone regeneration (GBR) has gained popularity to augment sites with insufficient bone volume. Biologic modifiers such as recombinant human platelet-derived growth factor (rhPDGF-BB) work to enhance the wound healing process through cellular recruitment and subsequent proliferation. This case report demonstrates enhanced biologic properties of a layered grafting technique with the use of a biologic modifier in a severe bony fenestration defect in the maxillary arch for implant site development. Case Results: A 65-year-old African American female displays clinically with buccal-palatal fenestration at edentulous site #11. CBCT revealed 6.09 x 7.55 mm bony fenestration from buccal to lingual surface with soft tissue connection with severe ridge deficiency on #11-12 area. Intrasulcular incision was created from #8 mesial to #13 distal with crestal incision on edentulous site. Full thickness mucoperiosteal flap was reflected. A split-thickness sharp dissection to separate the fenestration, and a buccal periosteal releasing incision was made. On the palatal surface, a porcine derived cross-linked collagen membrane was adapted to cover the entire fenestration. Bone substitutes were layered so that an outer layer of rhPDGF-BB-soaked deproteinized bovine bone matrix (DBBM) was on both buccal and palatal surfaces with rhPDGF-BB-soaked freeze-dried bone allograft (FDBA) placed at the core adjacent to the bony walls. Buccal DBBM was covered with a non-cross-linked collagen membrane and was stabilized with 5-0 polyglycolic acid/polycaprolactone sutures. Following periosteum releasing incision, flap edges were coronally-advanced and primary closure was achieved. Five months post operatively radiographic bone fill was confirmed via localized CBCT. Compared to pre-surgical measurements, bone augmentation proved successful and sufficient ridge dimensions for future implant placement. Conclusion: This case report revealed that a layered grafting approach with rhPDGF-BB can be successful in treating sites with limited remaining bony support, particularly buccal-palatal fenestrations.

CC22 Resolution of Osseous Defect via Amnion-Chorion Membrane “Sandwich” Technique. A. KITAYGORODSKIY*, Y. HAMADA (Indiana University School of Dentistry)

Introduction: One sequelae of periodontal disease is the loss of periodontal attachment due to localized inflammation. This may lead to the development of osseous defects surrounding the affected dentition. To improve the prognosis and survival of affected teeth, the clinician can attempt to resolve these defects through a combination of hard and soft tissue grafting procedures. The amnion-chorion membrane demonstrates anti-inflammatory and anti-bacterial properties, while sustaining a release of various growth factors. It can be utilized in a regenerative “sandwich” technique as a mitogen and chemotactic agent for surrounding cells, as well as a traditional barrier membrane that excludes epithelial downgrowth during tissue regeneration. Case Results: A 65-year old Caucasian female presented with Grade II mobility, probing depths of 6-7mm, and bleeding on probing at site #21. Following non-surgical therapy, regenerative therapy was initiated. After reflection of full-thickness mucoperiosteal flap, a deep and wide circumferential defect surrounding the buccal of #21 was visualized. After thorough debridement and planing of the root surface and application of 17% EDTA, amnion-chorion membrane was applied directly to the root. The osseous defects were filled with mineralized ground cortical bone and amnion-chorion membrane was utilized as a barrier over the bone substitute. The flap was coronally advanced and stabilized with sling and interrupted sutures. Ten months after therapy, #21 presents with buccal probing depths of 2-3mm, an increase in buccal gingival thickness, an increase in the height of the gingival margin relative to the CEJ, and complete radiographic bone fill. Compared to pre-surgical clinical findings, the circumferential osseous defect around #21 has resolved, with stable and healthy clinical parameters. Conclusion: The results of this case report demonstrate that the use of amnion-chorion membrane “sandwich” technique is useful in the resolution of periodontal defects around natural dentition, and that results can be maintained long-term.

CC23 An Alternative to Manage Mucosal Deformities Around Implants: Accordion Technique. H. NAMLI KILIC*, C. BATRA, S. BLANCHARD (Indiana University School of Dentistry)

Introduction: The presence of keratinized mucosa around implants is crucial to maintaining the health of peri-implant tissues. Free gingival grafts (FGG) are commonly used to reconstruct mucosal deformities around implants. This case report describes the use of an alternative FGG technique to reduce postoperative morbidity. Case Presentation and Results: A 43-year-old Caucasian female was referred to IUSD Graduate Periodontology Clinic for replacement of her missing teeth with dental implants. After clinical and radiographic examinations, severe atrophy of the bone and very shallow vestibule was noted on the mandibular anterior edentulous area. Guided bone regeneration (GBR) was performed to reconstruct bone tissue and #23,27 implants were placed 7 months after GBR. During the 4 months postoperative evaluation inadequate amount ($\leq 2\text{mm}$) of keratinized mucosa on the buccal aspect of implants was noticed. Also, movement of the lingual mucosa around the implants with lower lip movement due to severely shallow vestibule was noticed. FGG procedure was planned not only to increase the keratinized mucosa around the implant but also to deepen the buccal vestibule. Due to the required size of FGG, to reduce graft size harvested from the palate and accordingly postoperative morbidity, the accordion technique was used. A FGG was harvested from the right side of the palate, then the graft was expanded by alternate incisions in opposite sides of the graft, accordion technique described by Rateitschak in 1985, and sutured on the recipient side. Three months after the completion of the surgery, adequate amount ($\geq 2\text{mm}$) of keratinized mucosa was visible on the buccal aspect of implants and lingual mucosa was immobile during the lower lip movements. Conclusion: This case report demonstrated that the accordion technique was able to achieve to improve keratinized mucosa around implants, reduce postoperative morbidity on the donor side, and deepen the vestibule.

PROSTHODONTICS

CC24 Utilization of Printed Dentures With a Limited Prosthetic Space Patient. A. AL-FARAJ*, F. ABOUNASSIF, W.S. LIN (Indiana University School of Dentistry)

Introduction: 3D printing has improved the process of fabricating dental prosthesis by making it easier, faster, cheaper, and more predictable. This case report describes the prosthetic rehabilitation of an edentulous patient using printed dentures in order to fabricate a customized prostheses according to the patient's limited available space. History: A 22-year-old African American male was referred to IUSD Graduate Prosthodontic clinic for the fabrication of maxillary and mandibular complete dentures after the extraction of his remaining teeth due to decay and impaction. The patient was previously diagnosed with Immunodeficiency due to unknown origin which led to the limitation of his skeletal growth from a young age. Records were obtained with customized pediatric dental trays using irreversible hydrocolloid impression material. Maxillo-mandibular relationship were registered using occlusal rims fabricated by baseplate wax, casts were mounted to the articulator following facebow record. Then, mounted records were scanned, and teeth were digitally designed and printed using 3Shape Dental System. Teeth try-in were made to confirm midline, lip support, esthetic, and phonetics. Finally, maxillary and mandibular denture bases were printed and teeth were bonded using GC COMPOSITE PRIMER. Final dentures were delivered, the patient was able to regain function and was satisfied with the new esthetic. Conclusion: 3D printing technology aid in the ease of fabrication of dental prosthesis. Also, it helps overcome some of the limitations of the conventional method.

CC25 Fabrication of Maxillary CD Opposing Mandibular Overdenture on Subperiosteal Implant. H. AL-HUMOOD*, J. LEVON, C. YANG, W.S. LIN (Indiana University School of Dentistry)

Introduction: Subperiosteal implant, is a type of implant that is placed under the periosteum on the residual ridge to provide abutments for supporting a removable or fixed complete denture in a fully edentulous arch, this type of implants were often used in treating severely resorbed mandible, before the introduction of endosseous osseointegrated implants, it is rarely used nowadays, due to the low survival rate. This is a clinical report describing an 83 years old Caucasian female with fully edentulous maxilla and edentulous mandible with subperiosteal implant, treated with maxillary conventional complete denture and mandibular implant supported overdenture on subperiosteal implant, the patient was not satisfied with both dentures' retention, esthetics and complained from continuous food collection under the dentures especially under the mandibular overdenture.

Result: new upper complete denture and lower overdenture was fabricated with better retention, esthetics, and proper extension. Conclusion: This case report describes the steps of fabricating upper complete denture opposing lower overdenture on subperiosteal implant.

CC26 Resin-Bonded Fixed Dental Prosthesis Replacing Missing Lower Central Incisor. N. ALMAJED*, N.B. COOK (Indiana University School of Dentistry)

Introduction: The resin-bonded fixed dental prosthesis (RBFDP) is a minimally invasive option for replacing a missing incisor with tooth preparation limited to enamel on a single tooth. Case Presentation and Results: A 42-year-old Caucasian male was referred to IUSD Graduate Operative Dentistry Clinic for the restorative replacement of tooth #26 that was recently extracted due to external root resorption. Upon examination, it was determined that there was inadequate bone for placement of an implant. It was decided to fabricate an RBFDP using lithium disilicate ceramic bonded to the lingual of tooth #25. A diagnostic wax-up was made in the lab and a clinical mock-up performed. The patient agreed to the treatment option. After shade selection, preparation was completed on the lingual surface of the abutment tooth #25 at a depth of 0.5 mm. Final impression and bite registration were made and sent to the lab with photographs. Once the prosthesis was fabricated, a positioning splint was made to aid in holding the RBFDP in place during the bonding procedure. The RBFDP was tried in and the patient was satisfied with its shape and color. Bonding was done under dental dam isolation. The RBFDP was etched with hydrofluoric acid, then cleaned and silanated. Tooth #25 was etched, rinsed and dried, then a dual-cure dental adhesive was applied. Next, a dual-cure resin cement was placed on the abutment wing of the prosthesis. Then the prosthesis was seated using the positioning splint and light cured. Occlusion was checked and care instructions were provided to the patient. Conclusion: An RBFDP is a conservative option for replacing an incisor when an implant is not feasible or more aggressive tooth preparation for a conventional fixed partial denture is not desired.

CC27 Wear of Hader-Bar Clips Due to Denture Cleaning Solutions. A.MOKEEM*, W.S. LIN (Indiana University School of Dentistry)

Introduction: Implant-retained overdentures (IODs) have shown success rates to be as high as 94-100%, as they preserve hard and soft tissues and provide excellent retention and stability, natural phonetics and esthetics, and increased masticatory function. Bar attachment systems have adjustable metal clips for IODs, but the plastic clips are more popular because of their straightforward replacement, predictable retention values, lack of wear on the patrix and comparatively low cost. However, plastic clips have limitations, including deformation during insertion and removal of the prosthesis, degradation from cleaning agents that result in loss of retention and the need for periodic replacement. This case report describes the treatment of a patient with worn down Hader-clips due to mechanical deformation from the insertion and removal of the prosthesis, and the continued use of cleaning agents. Case presentation and Results: A 72-year-old male patient was referred to the Graduate Prosthodontic Clinic for prosthetic treatment. The patient's maxillary denture was missing #10 and the mandibular denture lacked retention and support due to the deformation of the yellow Hader-clip. It was decided after obtaining the patient's information and history of dentures to fabricate new prosthesis. Tissue stops and a metal framework was included in the design of the new mandibular denture for extra-support and strength. Red-rider clips were used for extra retention due to the deformation of the Hader-Bar. Conclusion: Post-Insertions instructions were given to the patient on how to maintain and clean the denture with less use of cleaning agents as per the study shows. A recall after three months from the delivery of the prosthesis was made, the attachments show no signs of wear and patient had no complaints of loss of retention. Patient was instructed to follow the instructions.

CC28 Digitally Designed Bar on Quad Zygomatic Implants. T. NAGAI*, C.C. YANG, D. MORTON, W.D. POLIDO, W.S. LIN (Indiana University School of Dentistry)

Introduction: In general, maxillary edentulous patients treated with dental implants are more challenging than mandibular due to the esthetic, anatomical, and biological demand, especially in situations with severe bone resorption. Zygomatic implants have been used with long-term favorable results for the rehabilitation of severe atrophy of the maxilla since Branemark first described its standard surgical technique. In this case report, we utilized a digital designed bar on quad zygomatic implants to rehabilitate a patient with extreme maxillary atrophy secondary to complications and failure of previous procedures. Case Presentation and Results: Relined existing

denture was used for dual CBCT scan to proceed with digital implants planning. Quad zygomatic implants were placed with favorable distribution according to the planning. After 4 months, a custom tray duplicated from CBCT scan denture was printed to make an open tray impression and inter-occlusal record. Digitally designed (3 Shape dental system) fixed denture was milled with PMMA as a denture prototype and a verification tool of the master cast. On the verified master cast, a milled titanium bar with 4 threaded locator attachments was designed, fabricated, and verified accuracy at chairside. After the try-in denture was verified in the patient's mouth, the denture was processed using heat polymerized acrylic resin with intrinsic characterization. Bar supported locator retained complete denture was evaluated and delivered following picking up of locator housings. Conclusion: Quad zygomatic implants restoration is a predictable treatment for the severe atrophic maxilla. Using 3D printing duplicating the diagnosed denture as a custom tray for an open tray impression and inter-occlusal record can be a standard workflow of full arch prostheses. Further application of combining analog with digital workflow would be possible with the same principles but different methods.

RESTORATIVE DENTISTRY

CC29 Interdisciplinary Approach for Minimally Invasive Esthetic Restorative Treatment. R.W. BUECHELE*, N.B. COOK, O. CAPIN, K.E. DIEFENDERFER (Indiana University School of Dentistry)

Introduction: Case report describing treatment for an esthetic outcome in a case of traumatic avulsion of the central incisors in early childhood. Case Presentation and Results: A 16-year-old Hispanic female was referred to the Graduate Operative Dentistry clinic for restoration of #7 and #10 after completion of orthodontic treatment. #7 and #10 were positioned in the spaces of #8 and #9 for direct resin composite veneer fabrication, with mesial and distal diastemata present. A diagnostic wax-up was completed to verify adequate spacing, a harmonious occlusal scheme, and an acceptable esthetic outcome from the current position of the teeth. The existing maxillary anterior shade match was unsatisfactory, so the patient underwent eight weeks of at-home bleaching using 10% carbamide peroxide in custom trays. The final shade was determined after discontinuing bleaching for two weeks to allow for color stabilization. A 7mm pseudo pocket was present on the mesial of #7 due to the orthodontic constriction of the anterior ridge, requiring surgical crown lengthening to minimize periodontal complications associated with subgingival resin and deep periodontal defects. After ten weeks' healing and completion of at-home bleaching, direct resin composite veneers were fabricated using a lingual silicone index fabricated from the diagnostic wax-up. Length and width dimensions were established using a lingual shelf application of resin; the facial surfaces were built incrementally in layers to include dentin, body, translucent and enamel shades. Follow-up evaluation occurred two weeks after treatment to verify shade match to the hydrated adjacent teeth and patient satisfaction with the outcome. These restorations are considered transitional until growth and development are complete, and re-evaluation has occurred. Conclusion: A multidisciplinary approach involving Orthodontics, Periodontics and Operative Dentistry resulted in an optimal esthetic and functional outcome for the anterior teeth, achieved by thorough examination, correct diagnosis, treatment planning and a diagnostic wax-up

Index to Primary Presenters and Mentors

Faculty mentors are italicized

ABOGAZALAH, P62	FLETCHER, P2	RAGANIT, P26
ACHARYA, P20	FRAZIER, CC19	RECTOR, P49
ALBRIGHT, CC18	GEBRU, CC12	RETTIG, CC6
ALENA, CC14	GEHLHAUSEN, P57	RIECK, CC3, CC4
ALFARAJ, CC24	GHEIBI DEHNASHI, P28	RILEY, P36
ALHAFFAR, P14	GODFREY, P63	ROBERTS, CC10
ALHIJJI, P10	GOHIL, CC16	ROMITO, P4
AL-HUMOOD, CC25	GREGORY, P11, P13, P14, P18,	ROY, P52
ALMAJED, CC26	P19, P20, P23, P27, P32, P33,	SANTOS, P38
ALZAHIRANI, CC1	P36	SANTOSH, P37
ANDERSON, P4	HALL, P21	SCHALL, CC11
ARRAGEG, P11	HAMADA, P52, P54, CC20,	SCULLY, P43, P49
AZABI, P11	CC21, CC22	SHARMA, P58
BA ARMAH, P61	HAROON, P54	SHUKLA, P56
BAUER, P44	HAZZAZI, P13	SOCHACKI, P11, P12
BATRA, P15, CC23	HEIN, CC8	SPOLNIK, CC14, CC15, CC16,
BRIDWELL, P15	HERRON, CC21	CC17
BRUZZANITI, P16, P29, P63,	JARAMILLO, P24	SRINIVASAN, P24
P64	JONES, P46	STEWART, P5, P39, P51, P60
BUECHELE, CC29	KARCZEWSKI, P59	SWINSON, P29
CASKEY, P12	KARIMI, P9	TAMAYO-CABEZA, P2
CHESTER, P16	KESSLER, P37	THYVALIKAKATH, P6, P7
CHINTAPALLI, P56	KHATRA, P33	TUDARES, P64
CHIOU, P53, CC20	KITAYGORODSKIY, CC22	TURKKAHRAMAN, P40, P41,
CHU, P9	KITAKA, P22	P42
CIPICH, P45	KOKSAL, P34	UEKI, P17, P25
CLARK, P46	LANDES, CC8, CC9	WALKER, P35
CLOSSER, CC5	LEAVITT, P40	WALTON, P6
COGHLAN, P22	LEVITAN, P25	WHALEN, P19
COLSON, CC2	LI, P8	WHITE, P50
COMSTOCK, P39	LILES, P5	WHITFIELD, CC13
CONRAD, CC6	LIN, CC24, CC25, CC27	WILHITE, P51
COOK, P61, CC1, CC26, CC29	MARTINEZ, P48	WINDSOR, P10, P21, P26, P28
CREAMER, CC7	MARTINEZ-MIER, P2, P57, P62	WOOD, P42
CROSBY, CC15	MASON, P41	WU, CC17
DEAN, P50	MATTHEWS, P55	YANG, CC28
DENTINO, P47	MAWHORTER, CC9	YEPES, P44, P45, P47, P48
DENUCCI, P1	MAXWELL, CC2, CC7, CC11	YOUNG, CC4
DIETZ, CC3	MINHAS, P43	ZHAO, P3
DOAN, P17	MOKEEM, CC27	
DRESNER, P18	MONNOT, P27	
DUARTE, P1, P31, P34, P53	NAGAI, CC28	
DUTRA, P3, P38	NAMLI KILIC, CC23	
EHRlich, CC12, CC13	NOVOSEL, P55	
FALASZ, CC19	PANARIELLO, P31	
FELIX GOMEZ, P7	PHILLIPS, P35	
FIGUEROA, P32	RADER, CC5, CC10	

Previous Year Summary

The Indiana University School of Dentistry's 29th annual Research Day was a hybrid virtual event held on April 12, 2021. The event featured almost 70 poster presentations, remarks from Dean Carol Anne Murdoch-Kinch and research updates from Dr. Tien-Min Gabriel Chu, associate dean for research. Dr. Marcelo Araujo, DDS, MS, PhD, CEO ADA Science & Research Institute, foundation and chief science officer, American Dental Association, served as keynote speaker. He discussed "The use of scientific strategy to support health policy and clinical practice." The award ceremony recognized the following distinguished faculty, staff, and students.

Dental Hygiene Students

Elizabeth A. Hughes Dental Hygiene Award, **Lindsey Owens** and **Yelena Fox**, Honorable Mention: **Tha Sung** and **Deborah Gregory**

Undergraduate Students

IN-AADR Undergraduate Student Award, **Olivia Hendzel**

Predoctoral Dental Students

Cyril S. Carr Research Scholarship, Co-winners: **Rebecca Shembarger** and **Sydney Twiggs**

AADR/Dentsply Sirona SCADA Award, **Mikki Jaramillo**

AADR Student Research Day Award, **Marcus Levitan**

King Saud University Travel Award for Excellence in Preventive Oral Health Care, **Rebecca Shembarger**

IDA Student Research Award, **Sydney Twiggs**

IN-AADR D4 Case Report Award, **Raziel Velgis**

Dean's Award for Research Excellence, **Sydney Twiggs**

Research Honors Program Certificate of Achievement, **Rebecca Shembarger** and **Sydney Twiggs**

Graduate Dental Students

King Saud University Ph.D. Student Travel Award, **Gina Castiblanco-Rubio**

King Saud University Travel Award for Best Clinical Case Report, **Chandni Batra** and **Takahiro Fujii**

Delta Dental Award for Innovation in Oral Care Research, **Katherine Ferry** and **Kasey Ryan**

Maynard K. Hine Award for Excellence in Dental Research, **Alice Anne Alcorn**

Staff

IN-AADR Research Staff Award, **Sheryl McGinnis**

Faculty

IU School of Dentistry Distinguished Faculty Award for Teaching, **Dr. Daniel Bennett**

IU School of Dentistry Distinguished Faculty Award for Research, **Dr. Thankam Thyvalikakath**

King Saud University Distinguished Research Faculty Travel Award, **Dr. Angela Bruzzaniti**

THANK YOU TO OUR SPONSORS AND EXHIBITORS FOR SUPPORTING IUSD RESEARCH DAY 2022!

PLANTINUM			
Delta Dental Foundation	Megan Schreier	mschreier@deltadentalmi.com	(517) 281-5738
GOLD			
Brasseler USA	Scott Kirk	scottkirk@brasselerusa.com	(800) 841-4522
LumaDent, Inc	Alex Betancourt	events@lumadent	(775) 829-4488
Treloar & Heisel	Luke Fehrs Andrew Rickard	lfehrs@th-online.net	(800) 345-6040
SILVER			
Biolase	Shelby Ruder Jim Buckley	sruder@biolase.com	(317) 412-5860
Contour Specialists Dental Lab	Mark Tritask	mjtritask@aol.com	(317) 706-8500
Designs for Vision	Julie Harder	info@dvimail.com	(800) 345-4009
GlaxoSmithKline	Monica Bronowicki	monica.bronowicki@gsk.com	(630) 927-8212
Henry Schein	Adam Hill	adam.hill@henryschein.com	(317) 606-9379
HuFriedyGroup	Julie Morrill	jmorrill@hu-friedy.com	(877) 321-4333
Indiana Dental Association	Jay Dziwlik	jay@indentall.org	(317) 634-2610
MedPro Group	Blake Podschine	blake.podschine@medpro.com	(260) 492-4697
Patterson Dental	Alex Jimenez	alex.jimenez@pattersondental.com	(317) 258-4360
Q-Optics	John Matthews	info@q-optics.com	(972) 298-2669
SurgiTel	Jeremy Lesh	jeremyl@surgitel.com	(734) 546-0661

Product samples graciously donated by: Johnson & Johnson Syneos Health, Wendy Swenson and Premier Dental, Vicki Hafer



IN-AADOCR CONTRIBUTORS

The Indiana Section of the American Association for Dental, Oral, and Craniofacial Research (IN-AADOCR) would like to recognize individuals who made a financial contribution to IN-AADOCR during the last calendar year. Your support is appreciated!

2021

Angela Bruzzaniti

Tien-Min Gabriel Chu

Richard Gregory

Yusuke Hamada

Frank Lippert

Jeffrey Platt

Sabrina Feitosa Sochacki

Mythily Srinivasan



NAVIGATE YOUR JOURNEY WITH HENRY SCHEIN

Rely on Henry Schein to provide the solutions, support, and education needed to start your career in dentistry. Fill out our new student registration form to stay up-to-date on the latest content and resources to help guide you through the next steps.



Waterlase Dentistry

Minimally Invasive, Patient-Friendly

- ★ The world's most trusted all-tissue laser designed specifically for dentistry — the #1 All-tissue Laser System sold globally
- ★ Over 80 FDA cleared indications
- ★ Minimally invasive and kinder to the tissue, with little to no anesthesia necessary for most procedures¹
- ★ Perform revenue generating everyday procedures on adults and kids, including restorative, frenectomy, gingivectomy, perio treatments, endodontics, crown lengthening and more!
- ★ 98% less aerosols than traditional high-speed handpieces¹



Learn more about Waterlase Dentistry at
www.Waterlase.com

1. Waterlase, Inc. 9/2012 B.O. AOR, INC. All rights reserved. 572079



THANK YOU
RESEARCH
DAY
SPONSORS
AND
EXHIBITORS

YOUR PARTNER IN PRACTICE

- Support for every step of your career
- Free and discounted CE
- Affordable health insurance for members and their families
- Leadership and volunteer opportunities



IDA INDIANA DENTAL
ASSOCIATION
www.indental.org



IUPUI
INDIANA UNIVERSITY
School of Dentistry