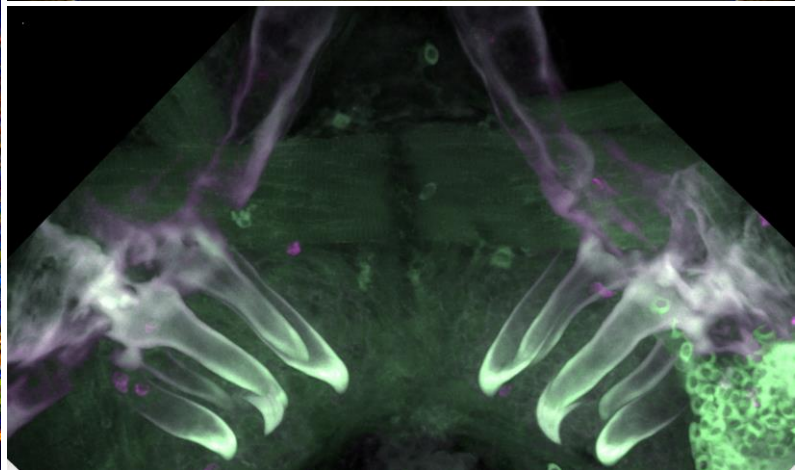
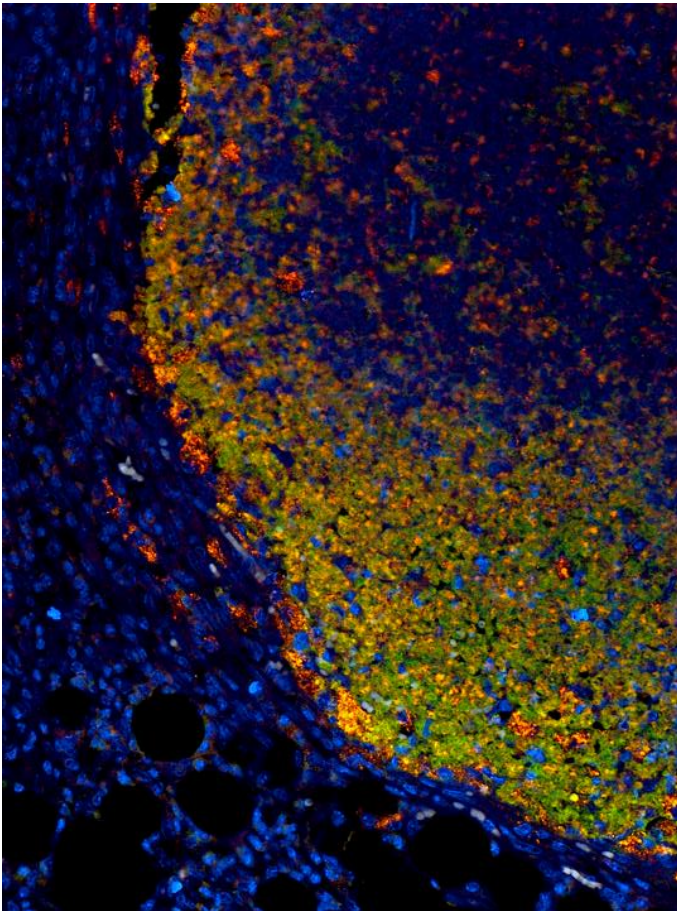




**ADAMS SCHOOL
OF DENTISTRY**

39th Annual Research Day



Wednesday, March 1, 2023

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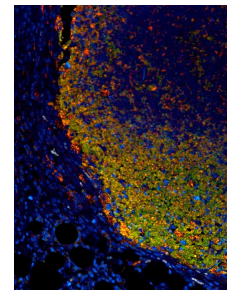
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Front cover images taken by:

Left:

Lance Thurlow, PhD, Assistant Professor, Adams School of Dentistry
Pictured is an immunohistochemistry micrograph of a methicillin-resistant *Staphylococcus aureus* (MRSA) abscess. The abscess tissue was stained with DAPI (blue) and antibodies for neutrophils (red) and the antimicrobial peptide LL-37 (green) indicate that neutrophils are the primary producers of LL-37 in MRSA infections. We are interested in the mechanisms employed by the host to combat MRSA infections.



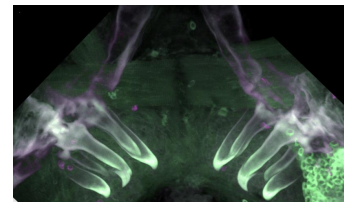
Top Right:

Darius Thompson, undergraduate researcher, Graves Lab
Colorized bright field high magnification images of ex vivo adult zebrafish teeth. We use zebrafish as a translational model to study the impact of early life stress on the developing dentition.



Bottom Right:

Christina Graves, PHD, Assistant Professor, Adams School of Dentistry
Larval zebrafish teeth imaged in the intratissue context using whole mount tissue clearing (iDISCO) and high resolution confocal imaging. Green signal is autofluorescence; magenta is labelling neural structures and the developing jaw.



Dear Colleagues,

Welcome to the **Adams School of Dentistry's 39th Annual Research Day**. The Adams School of Dentistry has a rich tradition of excellence in research, discovery, and innovation and remains committed to its ongoing support. Thank you for joining us in celebrating the accomplishments of our students, faculty, staff, research fellows, and our colleagues from around the University and the State. It will also be a day to celebrate the collaborations we hold with leading investigators on UNC-CH's campus, nationally, and internationally.

In addition to 44 oral and poster presentations, the day's events will include a keynote address by Dr. Jane Weintraub, President of the American Association of Dental, Oral and Craniofacial Research (AADOCR), and the R. Gary Rozier and Chester W. Douglass Distinguished Professor in Dental Public Health at the University of North Carolina at Chapel Hill Adams School of Dentistry.

It is our hope that you enjoy the day's activities designed to promote our ongoing quest for knowledge and fellowship surrounding research. I am extremely thankful for the organizing committee's efforts in orchestrating these activities. The organizing committee includes members from the Research Advisory Committee, the North Carolina Section of the AADOCR, and the local chapter of the Student Research Group. We are also thankful for the support from corporate partners and the Dental Foundation of North Carolina.

I am excited to share in the day's experiences with each of you,



Janet Guthmiller, DMD, PhD

Dean

Dr. Claude A. Adams Distinguished Professor,
Adams School of Dentistry

Dear Friends and Colleagues,

On behalf of the Research Day Organizing Committee, including members from the Research Advisory Committee, North Carolina Section of the American Association for Dental, Oral and Craniofacial Research (NC AADOCR) and the UNC Student Research Group (UNC SRG), it is our great pleasure to welcome you to the 39th UNC Adams School of Dentistry Research Day.

We have an excellent scientific program that includes Dr. Jane Weintraub, President of the American Association of Dental, Oral and Craniofacial Research (AADOCR), R. Gary Rozier and Chester W. Douglass Distinguished Professor in Dental Public Health at the University of North Carolina at Chapel Hill Adams School of Dentistry as the Keynote Speaker. The scientific program also includes posters and oral presentations, which definitely harness the excitement generated within the long history of the UNC Adams School of Dentistry Research Day!

The meeting will bring together the scientific community of UNC Adams School of Dentistry's students, faculty, staff, research fellows and visiting scholars, and many segments of the Dental, Oral and Craniofacial Research, to provide a unique opportunity for sharing the latest discoveries and ideas. We would like to especially thank all of our leaders, presenters, attendees, and event sponsors for supporting our researchers and helping make this a day full of scientific exchange and collaboration.

We look forward to an exciting meeting on March 1st, which promises great scientific debate and enjoyable social interaction. We hope you enjoy your day here at UNC Adams School of Dentistry celebrating the hard work of all of our researchers!

With best regards,



Lance Thurlow, PhD
Chair, Research Day
Organizing Committee



Apoena Ribeiro, DDS, MS, PhD
President, NC AADOCR



UNC Student Research Group Executive Board

L to R: **Back:** Jake Hunt (Journal Club Chair), Drake Imhoff (D1 Representative), Bijan Mahboubi (Advocacy Chair), Mounika Gadiraju (Newsletter Chair), Rachel Maynor (Secretary/Treasurer) **Front:** Margaret McGuire (Journal Club Chair), Nishma Vias (Vice President), Skylar McGaughey (President), Alice Song (Journal Club Chair), John Kwiatkowski (Newsletter Chair)

39th Research Day Keynote Presentation

Kirkland Auditorium, Koury Oral Health Sciences Building

UNC Adams School of Dentistry

12 pm – 1 pm, Wednesday, March 1, 2023

The Hunt to Understand and Prevent Oral Disease Clinical Trials, Tribulations and Other Research Adventures

Jane A. Weintraub, DDS, MPH

R. Gary Rozier and Chester W. Douglass Distinguished Professor,
American Association of Dental, Oral and Craniofacial Research President

Dr. Jane A. Weintraub is the 51st President of the American Association of Dental, Oral and Craniofacial Research (AADOCR). She is first R. Gary Rozier and Chester W. Douglass Distinguished Professor in Dental Public Health and former Dean at the University of North Carolina at Chapel Hill Adams School of Dentistry, and adjunct professor in the UNC Gillings School of Global Public Health. Dr. Weintraub is a diplomate of the American Board of Dental Public Health and past president of the American Association of Public Health Dentistry. Her epidemiology and health disparities research cuts across the lifespan with a focus on prevention and relationships among oral health, healthcare, and systemic disease.



She has received the International Association for Dental Research H. Trendley Dean Memorial Award for meritorious research in epidemiology and public health, the American Dental Association's Norton Ross Award for Clinical Research, the John W. Knutson Award from the American Public Health Association's Oral Health Section and many others.

Prior to her deanship, she had more than 25 years of continuous NIH/NIDCR funding. She currently has funding from NIDCR to study the oral health of older adults and from the CareQuest Institute for Oral Health to study teledentistry vs. onsite mobile dentistry for residents in North Carolina long-term care settings.

Dr. Weintraub earned her DDS at Stony Brook University and her MPH and public health training at Harvard University. She was inducted as a Fellow of both the American and International College of Dentistry and was in the first class of AADOCR Fellows. Earlier in her career, she practiced dentistry in Boston, MA.

Schedule of Events

Wednesday, March 1, 2023

Time	Activity and Location
7:00 am - 8:00 am	Poster and Vendor Set-up Main Street and Atrium, Koury Oral Health Science Building, Ground floor
8:00 am - 8:15 am	Welcome and Opening Remarks <i>Janet Guthmiller, DDS, PHD</i> West Lobby, Koury Oral Health Science Building, First floor
8:00 am - 4:30 pm	Posters and Vendor Exhibitions Open
8:00 am - 8:30 am	Welcome Breakfast (registration required) West Lobby, Koury Oral Health Science Building, First floor
8:30 am - 10:00 am	Poster Presentations Main Street, Koury Oral Health Sciences Building, Ground floor
10:15 am - 11:45 am	Oral Presentations Session #1 G405, Koury Oral Health Sciences Building, Ground floor
11:30 am - 12:00 pm	Boxed Lunch Pickup (registration required) West lobby, Koury Oral Health Science Building, First floor
12:00 pm- 1:00 pm	<i>Introduction by Janet Guthmiller, DDS, PHD</i> Keynote address: Jane A. Weintraub, DDS, MPH R. Gary Rozier and Chester W. Douglass Distinguished Professor, AADOCR President The Hunt to Understand and Prevent Oral Disease Clinical Trials, Tribulations and Other Research Adventures Kirkland Auditorium, Koury Oral Health Sciences Building, First floor
1:15 pm - 2:45 pm	Oral Presentations Session #2 G405, Koury Oral Health Sciences Building, Ground floor
3:00 pm- 4:45 pm	Oral Presentations Session #3 G405, Koury Oral Health Sciences Building, Ground floor
5:00 pm – 7:00pm	Closing Reception (registration required) West Lobby, Koury Oral Health Science Building, First floor
5:30 pm- 6:00 pm	<i>Closing Remarks: Janet Guthmiller, DDS, PHD</i> Awards Ceremony West Lobby, Koury Oral Health Science Building, First floor

Poster Presentations

08:30 am – 10:00 am

Abstract Number	Time	Presenter	Title
1	8:30 am	Teebok Choe	Success and survival of dental implants placed in a university setting
*2	9:15 am	Stephanie Companioni	Optimizing Donor Tooth Selection for Autotransplantation
*3	8:30 am	Sara Daniel	Using a digital platform to establish odontometric variation in a population
*4	9:15 am	Benjamin Darwitz	Glycolysis is Required for <i>Staphylococcus aureus</i> Virulence in Diabetic Co-infections
5	8:30 am	Sarah Dobson & Jasmine Nevil	Impact of the COVID-19 Pandemic on Orthodontic Treatment Motivations
6	9:15 am	Nare Ghaltakchyan	Longitudinal microbiome changes in supragingival biofilm transcriptomes induced by orthodontics
7	8:30 am	Mustafa Girnary	Digital Analysis of Internal Fit Variation in 3D-Printed Crown Patterns
8	9:15 am	Samantha Glover & Kylie Stickrath	Assessment of Eating Disorder Inclusion in Oral Health Curriculum
9	8:30 am	Steven Hancock	Influence of BMI and Craniofacial Development
10	9:15 am	Caroline Meier	Hybrid Pain Management Attenuates Acute Pain and Reduces Opioid Doses
*11	8:30 am	Do Kim	Retrospective assessment of endodontically treated teeth replaced by dental implants
12	9:15 am	Jennie Ledbetter	Self-Awareness and Evidence-Based Leadership Development for the Dental Hygiene Student
13	8:30 am	Adam Lietzan	Microbial Beta-Glucuronidase Activity is Associated with Periodontitis Severity
*14	9:15 am	Gabrielle Mascarin	Anti-biofilm effect of bromelain against pathogenic facultative anaerobes
15	8:30 am	Arlet Montes-Sanchez	The Hispanic Oral Health Prevention and Education Program
16	9:15 am	Zachary Mottinger	Dental Students' Perceptions Regarding Expanded Functions for Dental Hygienists
17	8:30 am	Christopher Naglieri	Retrospective Analysis of Peri-implant bone levels. A Pilot Study
*18	9:15 am	Emily Nan-Stallings	Ultrasound Application Effect on Surface roughness of Glass Ionomer Restorations

19	8:30 am	Erik Norloff	A Generational Look at Early-Life Stress and the Gut
20	9:15 am	Kimberly Sanders (Melissa Maas, Mary-Carty Pittmann, Meghan Corcoran)	Interprofessional Care Rotation: Retrospective Review of Medications and Psychosocial Barriers of Dental Students' Complex Cases
21	8:30 am	Yingning Sang	Characterization of Hypocretin Expression Along The Gum-to-Gut Axis in Zebrafish
22	9:15 am	Raven Selden	A Software-based Coding Approach for Pediatric Dental Anxiety
23	8:30 am	Abbigale Shumaker & Ellie Nanney	Identifying Factors Influencing Orthodontic Residency Program Selection
*24	9:15 am	Bree Smith	Machine Learning-Based Re-Appraisal of Caregivers' Health Literacy and Children's ECC
25	8:30 am	Stephanie Swords-Shaaf	Integrating Dental and Dental Hygiene in Predoctoral Clinical Education
*26	9:15 am	Nishma Vias	Biomarker Signatures Define Periodontal Disease Subtypes
27	8:30 am	Kelsey Yokovich	Culturally Attuned Care for Latinx Patients in Clinical Dental Education
28	9:15 am	Anna Zbroinska-Dickerson	Chronic Disease Management in Dental Hygiene Practice: a Qualitative Study

****Turner Award Finalists***

Oral Presentations Session #1

10:15 am – 11:45 am

Oral Presentations Session #1 G405, Koury Oral Health Sciences Building, Ground floor			
Abstract Number	Time	Presenter	Title
29	10:15	Leen AlQudah	Interobserver Reliability in Histopathologic Diagnosis of Oral Lichen Planus
30	10:30	Tomaz Alvves	IL-1 β modulation of inflammatory bone loss is sex-dependent
31	10:45	Erika Babikow	Oral Inflammatory Cytokine Response During Early SARS-CoV-2 Infection
*32	11:00	Christopher Genito	Impaired mTOR Signaling in Diabetic Immune Suppression
*33	11:15	Joy Gerasco	Antibiotics Alter Fibroblast-Osteoclast Signaling in Orthodontic Tooth Movement
11:30– 11:45		Oral Session 1 Discussion	

***Turner Award Finalists**

Oral Presentations Session #2

1:15 pm – 2:45 pm

Oral Presentations Session #2 G405, Koury Oral Health Sciences Building, Ground floor			
Abstract Number	Time	Presenter	Title
34	1:15	Thomas Hoopes	Mandibular Alveolar Bone Remodeling Following Maximum Incisor Retraction
35	1:30	Adam Hoxie	Micro-CT Mineral Density Profile to Assess Early Carious Lesion Activity
36	1:45	Johnathan LaPrade	Suboptimal Positioning with Panoramic and CBCT Imaging: Effects on Dose
*37	2:00	Kaixin Liang	Unraveling the cell death induced by SARS-CoV-2 in epithelial cells
*38	2:15	Bijian Mahboubi	PD-L1 gene therapy rescues Sjögren's syndrome symptoms in mice
2:30 – 2:45		Oral Session 2 Discussion	

***Turner Award Finalists**

Oral Presentations Session #3

3:00 pm – 4:45 pm

Oral Presentations Session #3 G405, Koury Oral Health Sciences Building, Ground floor			
Abstract Number	Time	Presenter	Title
*39	3:00	Skylar McGaughey	Skeletal Phenotype of Melanoregulin Mutant Mice as a Function of Age
*40	3:15	Shrestha Poojan	Gene-Environment Interactions in Early Childhood Caries
41	3:30	Shahab Siahpoosh	Culture-based versus DNA-sequencing for Determining Mutans Streptococci Caries Association
*42	3:45	Erika Silva	Evaluating Speech of Dentofacial Disharmony Patients through Vowel Formant Analysis
43	4:00	Selin Soyupak	Access and Dental Utilization Among Publicly Insured Pediatric Oncology Patients
*44	4:15	Auvi Tran	Evaluating Articulatory Variations of Dentofacial Disharmony Patients using Multi-taper Spectral Analysis
4:30 – 4:45 pm		Oral Session 3 Discussion	

****Turner Award Finalists***

Abstracts

Abstract # - 01 Success and survival of dental implants in a university setting

Teebok D. Choe¹, Ricardo Walter¹, Marta L. Musskopf¹, Patricia A. Miguez¹

¹Division of Comprehensive Oral Health, Adams School of Dentistry, The University of North Carolina at Chapel Hill

Objective: The purpose of this study is to assess the impact of experience and specialty training, on the success and survival of dental implants as part of the therapy for single-unit fixed restoration of missing teeth.

Experimental Methods: A retrospective study is being conducted using data from the electronic patient record system at the ASOD. The Institutional Review Board of the University of North Carolina at Chapel Hill has approved the study, protocol #22-2338. The Office of Computing and Information Systems provided the initial data, which has been manually reviewed by one evaluator (TC) who was previously calibrated to another collaborator with experience in retrospective studies (RW). Extracted from the patient's records were patients' demographics (e.g., gender), medical history (e.g., diabetes), dental history (e.g., periodontitis), social history (e.g., smoking), and information about the procedures. Implants' brand, size, length and design as well as whether grafting procedures were performed, and the implant was immediately placed or immediately loaded is being documented. Surgical and restorative providers are being recorded. Data on the restoration type and whether the implant was radiographed before restoration as well as whether an occlusal splint was fabricated are being assessed. A frailty statistical model will be applied to compare implant survival and success based on providers' experience (predoc, resident, faculty) and training (periodontology, prosthodontics, oral and maxillofacial surgery).

Results: After reviewing approximately 5000 records, we have incorporated 500 cases of single-unit implants and preliminary data shows no specific parameters associated with implant failure or radiographic bone loss.

Conclusion: Preliminary results show that there is no discernable difference in outcomes of implant survival and success based on the parameters outlined in this retrospective study.

Funding: University of North Carolina at Chapel Hill, Adams School of Dentistry

Abstract # - 02 Optimizing Donor Tooth Selection for Autotransplantation

Stephanie Companioni¹, Tung Nguyen¹, Kimon Divaris^{2,3}, John Christensen²

¹Division of Craniofacial and Surgical Care, University of North Carolina, Chapel Hill, North Carolina, United States

²Division of Pediatric and Public Health, University of North Carolina, Chapel Hill, North Carolina, United States

³Department of Epidemiology, University of North Carolina, Chapel Hill, North Carolina, United States

Objectives: The clinical management of growing patients with missing teeth in the anterior maxilla can be challenging due to limited treatment options and high esthetic demands. Tooth autotransplantation (AT) is a viable option for these cases. The selection of donor teeth has been reported to be driven by root development, existing malocclusion, and esthetics. The aim of this study was to add to the evidence base of tooth selection criteria for AT by examining candidate donor teeth root width and crown-root angles, two factors arguably important for surgical planning and esthetics.

Experimental Methods: Cementoenamel junction (CEJ) tooth width and crown-root angle measurements were made using Cone Beam Computed Tomography (CBCT) images of 30 children and adolescents of European descent (mean age=13 years, range=10-17 years; 63% male) from a private orthodontic practice. Measurements of maxillary central and lateral incisors (index teeth) were compared to measurements of upper second premolars, lower central incisors, and lower first and second premolars (candidate donor teeth). Analyses relied on descriptive statistics of mean within-subject differences between index and donor teeth and the proportion of individuals without clinically important differences (i.e., >1.5mm width deficit and >15 degrees crown-root angle difference).

Results: Lower first premolars were the most compatible teeth for the replacement of upper central incisors based on both width ($\geq 97\%$ of individuals) and angle measurements ($\geq 87\%$ of individuals), followed closely by second lower premolars. Lower central incisors were the most compatible for the replacement of upper laterals, among all individuals based on width and $\geq 90\%$ based on angle, whereas lower first premolars were somewhat less compatible.

Conclusions: The study offers evidence of within-person, CBCT-based root width dimension and crown-root angle compatibilities. This information can be considered in addition to existing tooth selection criteria for AT including Angle's classification, midline deviation, crowding severity, root development, and esthetics.

Funding: The investigators acknowledge partial funding support for the conduct of the study from the Southern Association of Orthodontists.

Abstract # - 03 Evaluating tooth-size discrepancy in a diverse population

Sara B. Daniel,¹ Christopher Wiesen,² John Christensen,³ Sylvia A. Frazier-Bowers⁴

¹Orthodontics Resident, The University of North Carolina at Chapel Hill, Department of Orthodontics

²Senior Statistical Research Consultant, Odum Institute for Research in Social Science, University of North Carolina at Chapel Hill

³Adjunct Clinical Professor, The University of North Carolina at Chapel Hill, Department of Pediatric Dentistry, and Private Practice in Pediatric Dentistry and Orthodontics

⁴Professor, Indiana University School of Dentistry, Department of Orthodontics and Oral Facial Genetics

Objectives: This study aimed to compare the prevalence of tooth size discrepancies using digital models and a digitally based cast analysis in our cohort based on 1) Angle's Classification, 2) gender, and 3) race.

Experimental Methods: The mesiodistal widths of teeth in 101 digital models were assessed using computerized odontometric software. A chi-square test was used to determine the prevalence of tooth size disproportions among the study groups. The differences between all three groups of the cohort were analyzed using a three-way analysis of variance (ANOVA).

Results: An overall Bolton tooth size discrepancy (TSD) prevalence of 36.6% was observed in our study cohort; 26.7% had an anterior Bolton TSD. No differences existed in the prevalence of tooth size discrepancies between male and female subjects as well as between the different malocclusion groups ($P > .05$). Caucasian subjects had a statistically significant smaller prevalence of TSD compared to Black and Hispanic patients ($P < .05$).

Conclusion: The prevalence results in this study illuminate how relatively common TSD is and underscores the importance of proper diagnosis. Our findings also suggest racial background may be an influential factor in the presence of TSD.

Funding: Southern Association of Orthodontists

Abstract # - 04 Glycolysis is Required for *Staphylococcus aureus* Virulence in Diabetic Co-infections

Benjamin Darwitz¹, Christopher Genito², Lance Thurlow^{1,2}

¹Department of Microbiology and Immunology, University of North Carolina at Chapel Hill

²Division of Oral and Craniofacial Health Sciences, Adams School of Dentistry, University of North Carolina at Chapel Hill

Objectives: Nearly 20% of the 37 million adults in the United States diagnosed with diabetes experience complications arising from skin and soft tissue infections (SSTIs). Diabetic SSTIs are often polymicrobial, with the bacterial pathogens *Staphylococcus aureus* and *Pseudomonas aeruginosa* being the most frequent source of infection. Once diabetic SSTIs are established, *S. aureus* penetrates deeper into tissues and disseminates to other areas of the body, causing conditions such as sepsis, endocarditis, and pneumonia. In diabetic wounds, both *P. aeruginosa* and *S. aureus* display increased virulence during co-infection. Thus, our objective was to determine how the glucose-rich microenvironment of diabetic tissues contributes to *S. aureus* and *P. aeruginosa* co-infection pathogenicity.

Experimental Methods: To investigate how elevated glucose concentrations alter *S. aureus* growth potential when exposed to *P. aeruginosa*-derived factors, we measured *S. aureus* growth over time when cultured in *P. aeruginosa* supernatant supplemented with or without glucose. To measure *in vivo* *S. aureus* and *P. aeruginosa* growth and tissue dissemination during co-infection, our lab employed a recently described subcutaneous catheter infection model using a novel co-infection approach in healthy and diabetic mice.

Results: *S. aureus* growth was greatly reduced when cultured in *P. aeruginosa* supernatant without glucose, but achieved wild-type levels in *P. aeruginosa* supernatant supplemented with physiologically-relevant glucose concentrations. Similarly, *S. aureus* growth was nearly restored to mono-infection levels during co-infection with *P. aeruginosa* in diabetic mice compared to co-infection in healthy mice. Furthermore, *S. aureus* mutants with negligible glycolytic activity displayed reduced tissue dissemination during mono- and co-infection of diabetic tissues compared to wild-type *S. aureus*.

Conclusions: These results show that elevated glucose concentrations confer resistance to *P. aeruginosa* factors that normally inhibit *S. aureus* growth. Furthermore, glycolytic activity is required for *S. aureus* growth and tissue dissemination during polymicrobial diabetic infections.

Funding: NIHR21AI151625LT

Abstract # - 05 Impact of the COVID-19 Pandemic on Orthodontic Treatment Motivations

Sarah Dobson*¹, Jasmine Nevil*¹, Laura Anne Jacox^{2,3}, Chris Wiesen⁴

¹Division of Comprehensive Oral Health, Adams School of Dentistry, University of North Carolina, 385 S. Columbia St, Chapel Hill, NC 27599, USA

² Orthodontics Group, Division of Craniofacial and Surgical Care, Adams School of Dentistry, University of North Carolina, 270 Brauer Hall, CB #270, Chapel Hill, NC 27599, USA

³ Division of Oral and Craniofacial Health Sciences, Adams School of Dentistry, University of North Carolina, 385 S Columbia St, CB #7455, Chapel Hill, NC 27599, USA

⁴ Howard W. Odum Institute for Research in Social Science, Davis Library, University of North Carolina, 208 Raleigh St, CB #3355, Chapel Hill, NC 27514, USA

*Equal contribution - both authors contributed equally to this work.

Objectives: As the COVID-19 virus spread, mask mandates, virtual meetings, and remote classrooms became societal norms. Increases in videoconferencing and social media usage resulted in people becoming more aware of their appearance. Historically, orthodontic treatment has been motivated by esthetic and functional concerns, but with the changes wrought by the pandemic, it is unknown how incentives and preferences for orthodontic care have changed. We aim to determine how the COVID-19 pandemic has impacted orthodontic treatment motivations. We hypothesize that adolescent and adult orthodontic patients will report increased interest in pursuing care for smile improvement compared to before the pandemic.

Experimental Methods: We tested this hypothesis using a 32-question, pre-tested, and validated survey of adolescent and adult patients. Participants are discretely approached and enrolled from the UNC Orthodontic Clinic waiting room. Participants are provided a QR code linked to the UNC Qualtrics survey to be scanned using their smartphone. All data are collected anonymously and stored securely, without patient identifying information. Survey data are assessed using descriptive and bivariate analyses.

Results: The majority of respondents indicated that the pandemic and subsequent changes in mask-wearing and video conferencing did not affect their orthodontic treatment motivations. Preliminary findings indicate that 69.6% of individuals believed the pandemic did not influence how critical they are of their teeth. Similarly, 67.3% of individuals believed that mask-wearing did not influence how critical they are of their teeth, while 66.7% of individuals believe that video conferencing did not influence how critical they are of their teeth.

Conclusions: Preliminary results indicate that the COVID-19 pandemic did not cause a shift in desires for orthodontic treatment. Findings will provide a picture of orthodontic treatment motivations in light of the changing landscape due to COVID-19.

Abstract # - 06 Longitudinal microbiome changes in supragingival biofilm transcriptomes induced by orthodontics

Nare Ghaltakhchyan^{1,2}, Erika Babikow¹, Taneisha Livingston³, Chuwen Liu², Yixiang Qu², Adam Hoxie¹, Taylor Sulkowski⁴, Clare Bocklage², Sherrill T. Phillips⁵, Apoena De Aguiar Ribeiro², Tate Harris Jackson⁶, Jeff Roach⁷, Di Wu², Kimon Divaris*⁸, Laura Anne Jacox*^{1,2}

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³ Selden Orthodontics, 10125 Hickorywood Hill Avenue, Huntersville, NC 28078

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⁵ GoHealth Clinical Research Unit, Division of Oral and Craniofacial Health Sciences, Adams School of Dentistry, Chapel Hill, NC 27599, USA

⁶ Align Technology, 3030 Slater Road, Morrisville, NC, 27560

⁷ Microbiome Core Facility, University of North Carolina School of Medicine, Chapel Hill, NC 27599-7450, USA

⁸ Division of Pediatric and Public Health, Adams School of Dentistry, University of North Carolina, 385 S Columbia St, CB #7455, Chapel Hill, NC 27599, USA

*Corresponding authors

Objectives: Common oral diseases are associated with dysbiotic shifts in the supragingival microbiome, yet most oral microbiome associations with clinical endpoints emanate from cross-sectional studies. Orthodontic treatment is an elective procedure that can be exploited to examine clinically relevant longitudinal changes in the composition and function of the supragingival microbiome prospectively.

Experimental Methods: We conducted a longitudinal cohort study among 24 adolescent orthodontic patients who underwent clinical examinations, saliva and plaque sampling before fixed appliance bonding and at 1, 6 and 12-weeks thereafter. Clinical indices included bleeding on probing (BOP), mean gingival index (GI), probing depths (PD), and plaque index (PI). To study the biologically (i.e., transcriptionally) active microbial communities, we extracted RNA from plaque and saliva for RNA-sequencing and established microbiome analysis bioinformatics pipelines. We examined longitudinal changes in microbiome beta-diversity using PERMANOVA tests and the relative abundance of candidate health- and disease-relevant microbial taxa using Kruskal–Wallis and Wilcoxon rank-sum tests.

Results: Clinical measures of oral health deteriorated over time—the proportion of sites with GI and PI \geq 1 increased by over 70% between pre-bonding and 12-weeks, while the proportion of sites with PD \geq 4mm increased 2.5-fold. Microbiome diversity temporarily decreased following bonding and then increased at 6- and 12-weeks thereafter. *Streptococcus sanguinis*, a health-associated species that antagonizes cariogenic pathogens, showed a lasting decrease in relative

abundance during orthodontic treatment. Contrarily, caries- and periodontal-disease associated taxa including *Selenomonas sputigena*, *Leptotrichia wadei*, and *Lachnoanaerobaculum saburreum*, increased in biofilm transcriptome abundance after bonding. Relative abundances of *Stomatobaculum longum* and *Mogibacterium diversum* in pre-bonding saliva was predictive of elevated BOP 12-weeks post-bonding, whereas *Neisseria subflava* was associated with lower BOP.

Conclusions: This study offers insights in longitudinal community and species-specific changes in the supragingival microbiome transcriptome during fixed orthodontic treatment, advancing our understanding of microbial dysbioses and identifying targets of future health-promoting clinical investigations.

Funding Acknowledgements:

This work was supported by the Southern Association of Orthodontists Research Award (to T.L.) and the American Association of Orthodontists Foundation (AAOF) Orthodontic Faculty Development Fellowship Award (to T.J.), the Resident Research Aid Awards (to E.B. and A.H.), and the Martin “Bud” Schulman Postdoctoral Fellowship Award (to L.J.). The project was funded by the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health (NIH), through Grant Award UL1TR002489 (to T.J.) and by the National Institutes of Dental and Craniofacial Research (NIDCR), NIH through a K08 award (to L.J.), with Grant Award 1K08DE030235-01A1. This work was supported by research grants from the NIH: NIDCR U01DE025046 (K.D.) and R03DE028983 (D.W.). The UNC Microbiome Core Facility is supported by the Center for Gastrointestinal Biology and Disease (CGIBD P30 DK034987) and the UNC Nutrition Obesity Research Center (NORC P30 DK056350).

Abstract # - 07 Digital Analysis of Internal Fit Variation in 3D-Printed Crown Patterns

Mustafa S Girnary¹, Tariq A Alsaifi¹, Madison D Malone¹, Neal M Quinn¹, Katherine L Grant¹, Wendy A Clark¹, Taiseer A Sulaiman¹, Ingeborg J De Kok¹

¹Department of Comprehensive Oral Health, Adams School of Dentistry, University of North Carolina at Chapel Hill

Objectives: The specific aim for this project is to analyze consistency and variation of printed crown resin patterns from different 3D-printers by internal fit variation. This project will help determine whether the cost of a 3D-printer significantly affects print quality in relation to a design control. The results from this study may influence dental laboratories’ choice in 3D-printer due to the expected quality of printed patterns.

Experimental Methods: A typodont tooth was prepared for a crown (with a shoulder margin) and scanned using a TRIOS 3, 3Shape intraoral scanner. A crown was digitally designed and the resulting STL file exported. Replicates were printed on the Carbon M2, Elegoo Mars 2 Pro, and Form 2 3D-printers using printer-specific resin materials. Crown patterns and prepared die

were scanned using the 3Shape scanner. The files were imported into a 3D analysis software (Geomagic Control X) and aligned to a master file using a best-fit algorithm. Internal fit was analyzed and minimum, maximum, and average deviations were reported in millimeters.

Results: The designed crown was considered the “standard” for this preliminary analysis and yielded an internal fit variation of 0.034mm (min: -0.453mm, max: 0.483mm) when digitally seated on the prepared die. The average internal fit variation of all resin patterns was 0.026±0.012mm (min: -0.527±0.024mm, max: 0.562±0.018mm) for the Carbon, 0.021±0.005mm (min: -0.437±0.185mm, max: 0.602±0.060mm) for the Elegoo, and 0.018±0.006mm (min: -0.320±0.107mm, max: 0.563±0.027mm) for the Form.

Conclusion: Preliminary analyses indicate no significant differences between internal fit variation measured on resin patterns from the different 3D-printers. This indicates that the printers perform similarly, however with only a single “control” design, further analyses must be conducted to assess statistical significance. Drawbacks include variations in material, printer calibration, and sample size. Next steps include replicating the study with a higher sample size and testing different margin designs.

Funding: This project is supported by the UNC-CH Adams School of Dentistry DDS Short-Term Research Fellowship.

Acknowledgements: We would like to thank Dr. Carolina R. Vera for her assistance with crown preparation and Dewey G. Chapa and Jessica C. Phippen for their assistance with digital crown design.

Abstract # - 08 Assessment of Eating Disorder Inclusion in Oral Health Curriculum

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Objective: This study sought to evaluate U.S. dental (DDS/DMD) and dental hygiene (DH) programs’ curricular content regarding eating disorder detection, intervention, and referral services.

Methods: A 25 item questionnaire was distributed via electronically via Qualtrics to 400 dental doctoral deans and dental hygiene program directors in the United States between June and December 2022. Responses were analyzed using descriptive statistics and comparisons

between DDS/DMD and DH programs were carried out using chi-squared and non-parametric tests (e.g., Wilcoxon).

Results: Complete responses were received from 11 DDS/DMD and 57 DH programs. The vast majority (96%) of programs included eating disorder-related courses and lectures, with DDS/DMD and DH programs devoting similar times on this topic (medians times were 135 and 90 minutes, respectively; $P=0.2$). Virtually all respondents (99%) agreed that early detection of eating disorders is important and oral health professionals have a crucial role in this regard. However, only half of programs reported referring patients for eating disorder-related evaluations, 32% had identified appropriate referral agencies, and only 9% had established a point person for such referrals. Most respondents (57%) suggested that the COVID pandemic worsened issues related to eating disorders.

Conclusions: The study's results affirm the importance of eating disorders as topic needing more attention in the oral health professionals' training curricula and highlight several areas where specific curricular interventions can be made.

Funding: Supported by UNC-Chapel Hill Adams School of Dentistry, Pediatric Dentistry DDS Research Fellowship

Abstract # - 09 Influence of BMI on Craniofacial Development in Post-Pubertal Adolescents

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Objectives: The prevalence of adolescent obesity has increased from 4.6% to 20.6% in the last 50 years. Understanding growth impacts of obesity is important to orthodontic treatment, as data has shown growth acceleration and increased pre-pubertal facial dimensions in children with elevated body mass index (BMI). The aim of this study is to identify if previous growth acceleration shifts timing of peak growth or results in larger post-treatment dimensions.

Experimental Methods: Cephalometric outcomes were assessed in obese and normal weight adolescents (age 12-18) (N=329, 170 obese (BMI>85%), 159 normal weight). Cephalometric

measures were obtained from pre-treatment (T1) and post-treatment (T2) records to measure change in growth and final craniofacial dimensions using a repeated measures ANOVA and linear regression models.

Results: Data showed that there was no significant change in growth from T1 to T2 between the overweight/obese and normal weight populations. Also, patients that started treatment with an increased BMI ended growth with larger craniofacial dimension than normal weight individuals. There is a linear correlation between an increase in BMI percentile and post-pubertal craniofacial measurements.

Conclusions: Results suggest orthodontic treatment can begin earlier in obese children to time care with peak growth.

Funding: Southern Association of Orthodontists Resident Research Award (Steven Hancock), National Institutes of Dental and Craniofacial Research (NIDCR), National Institutes of Health (NIH) through a K08 award (Laura Jacox)

Abstract # - 10 Hybrid Pain Management Attenuates Acute Pain and Reduces Opioid Doses

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Objective: Clinicians treating post-surgery acute pain after third molar removal must balance managing pain levels while limiting left-over opioid doses. The hypothesis for this study was that a hybrid-strategy would be successful in achieving these goals.

Methods: This prospective observational study included patients American Society of Anesthesiologists risk classification I or II, 18-35 years, with at least two mandibular third molars removed. Exclusion criteria were being treated for opioid addiction/abuse. All were treated with a multimodal analgesic protocol. Patients were given two prescriptions (Rx), each for 4 doses of Hydrocodone/APAP 5/325; one Rx could be filled on the day of surgery, the second on any subsequent day. Opioid Rx data were retrieved from the North Carolina Rx Sentry Prescription Drug Monitoring Program (PDMP). Pain scores and opioid use data were derived from a 14-day diary. The goal was median patients' pain levels ranked "little" or "none" 1-2/7 by postoperative day (POD) 3. Descriptive statistics analyzed data.

Results: Data were analyzed from 96 patients. 52 patients (54%) did not fill an opioid Rx. 27 patients (28%) filled one Rx and 17 patients (18%) filled two Rx. The patients who filled one Rx had 72 left-over doses, 67% of possible doses and patients who filled two Rx had 50 left-over doses, 37% of possible doses. Median patients' worst pain levels were 1-2/7 on POD 4; median patients' average pain on POD 3.

Conclusions: The hybrid-strategy reduced the possible number of opioid doses in circulation while minimizing the patients post-operative pain level.

Abstract # - 11 Retrospective assessment of endodontically treated teeth replaced by dental implants

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Objectives: The primary aim of the study was to investigate the profile of root canal treated teeth that were replaced by implants at the UNC School of Dentistry. The secondary aim was to identify the proportion of aforementioned teeth for which endodontic retreatment could have been a valid treatment option to retain them (Data not available yet).

Experimental Methods: The UNC SOD's database between 2004 and 2019 were searched for implant placement that replaced root canal treated teeth. Radiographs prior to extraction and clinical notes were examined to investigate the primary factor that led to the decision to extract the tooth. The presence of periapical radiolucency was documented and classified into three categories (no lesion, periapical, halo or J-shaped). Radiographs and clinical findings of cases in which persisting apical periodontitis was the primary reason for the extraction were provided to two experienced endodontists and requested to evaluate treatment options.

Results: Among the dental implants placed at UNC between 2004 and 2019 (11716), the number of implants that replaced existing teeth was 5229. Of the teeth replaced by implants, 29.3% (1564/5229) were found to be previously root canal treated. The primary reasons that led to a decision to extraction were, in descending order, recurrent caries associated with defective restoration (26.6%), fracture of coronal structure (21.5%), suspected/confirmed vertical root fracture (20.9%), compromised periodontal condition (13.8%), and persisting endodontic pathosis (2.4%).

Conclusion: Restoration failure was the most prevalent factor associated with the extraction of endodontically treated teeth, followed by vertical root fracture, periodontitis, and persisting apical periodontitis.

Funding: This study was not funded.

Abstract # - 12 Self-Awareness and Evidence-Based Leadership Development for the Dental Hygiene Student

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Objectives: An evolving healthcare system requires a well-prepared and diverse oral health workforce. Emerging evidence shows effective leadership skills are essential for all healthcare team members. In addition to enhancing professional attributes, leadership development (LD) contributes positively to team collaboration. While incorporated into CODA Standard 1-2, little is known regarding LD in dental hygiene education. The purpose of the study was to evaluate self-reported leadership behavior improvements in self-awareness and confidence following an LD seminar.

Methods: This pilot study used a convergent mixed-methods design. All second-year DH students (n=24) from the University of North Carolina (UNC) Adams School of Dentistry participated in a half-day LD seminar. Learners were asked to complete pre- and post-programmatic surveys that included Likert-scale items to measure self-awareness and leadership behaviors and open-ended questions exploring leadership perspectives. A DiSC personality assessment tool evaluated personal traits, followed by a hands-on interactive LD seminar. Descriptive statistics were used to analyze Likert responses, and an inductive coding process identified emergent themes. The Office of Human Research Ethics reviewed the study, which has determined that this submission does not require IRB approval.

Results: Of the 24 DH students, 91.7% (n=22) completed the survey. Open-ended responses supported perceptions regarding LD being essential to their curriculum and profession. Findings revealed that 100% (n=22) of participants felt the workshop helped them assess their professional values and increased self-awareness. Ninety-one percent (n=20) felt the workshop helped identify leadership capabilities. When comparing pre- and post-survey responses, learner confidence increased in defining leadership self-awareness (p=0.0074).

Conclusion: The results of this pilot study can provide insight into the design of LD programs. The LD program is both applicable and welcomed by participants, emphasizing the importance for their education and profession.

Funding: National Center for Dental Hygiene Research and Practice

Abstract # - 13 Microbial Beta-Glucuronidase Activity is Associated with Periodontitis Severity

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Objectives: Periodontitis is a chronic inflammatory disease associated with persistent oral microbial dysbiosis. The human β -glucuronidase (GUS) is released into the periodontal sulcus by neutrophils during inflammation and degrades extracellular matrix constituents of the periodontium. However, the human microbiome also encodes GUS proteins and their role in periodontal disease is poorly understood. In this study, we sought to characterize GUSs from the oral microbiome and determine if microbial GUS activity from oral samples is associated with periodontitis severity.

Experimental Methods: Using a bioinformatics approach, we first identified all microbial GUS proteins from the Human Oral Microbiome Database. GUS proteins from known periodontal pathogens were subsequently purified and assayed for activity using a reporter substrate and polysaccharides found in the periodontal extracellular matrix. Lastly, we obtained clinical samples from individuals with untreated periodontitis and assayed GUS activity in the presence and absence of a microbial GUS-selective inhibitor.

Results: Here we define the 53 unique GUSs in the human oral microbiome. Oral microbial GUS enzymes are more efficient polysaccharide degraders and processors of biomarker substrates than the human enzyme, particularly at pHs associated with disease progression. Using a microbial GUS-selective inhibitor, we show that GUS activity is reduced in clinical samples obtained from individuals with untreated periodontitis and that the degree of inhibition correlates with disease severity.

Conclusion: These results suggest that GUS activity from oral samples is a biomarker capable of capturing both host and microbial contributions to periodontitis.

Funding: NIH 3UL1TR002489-03S2 (ADL); NIH R01GM135218 and R01GM137286 (MRR)

Abstract # - 14 Anti-biofilm effect of bromelain against pathogenic facultative anaerobes

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Objectives: Periodontal disease (PD) and halitosis are the two prevalent conditions found in humans. This pilot study investigates the antimicrobial and anti-biofilm effect of bromelain (enzyme found in the pineapple plant) against facultative anaerobe pathogens from the oral cavity, *Escherichia coli* (EC) and *Klebsiella pneumoniae* (KP), associated with halitosis.

Methods: We used *S. gordonii* (Sg) as a commensal bacterium from dental biofilms. For initial identification of the inhibition effect of 11 different formulations in single species, bacterial suspensions were inoculated on MHA and TSA II. One drop of each formulation was placed over the bacterial lawn, then examined for zones of inhibition after 24h of incubation. For anti-biofilm formation over enamel, a thin layer of each formulation was applied over enamel-like hydroxyapatite pegs coated with filter-sterile human saliva. The pegs were inserted in 96 well-plates containing single or dual species for biofilm formation over 24 hours. Total biomass formation attached to the pegs was measured by crystal violet absorbance at 570 nm for semiquantitative analysis. Bacterial recovery from biofilm on pegs was obtained by biofilm removal dispersed by sonication and culture on TSA II agar.

Results: Sg growth was inhibited by formulations A-D and K; Kp and Ec were inhibited by formulations E-J. Formulations I and J showed the highest inhibitory effect against Kp and Ec (halo of 15mm and 12 mm, respectively). Formulations E-J showed the lowest biomass formation attached to the pegs (mean OD_{570nm} ranging from 0.4-0.6 nm). However, pure formulations (no bacteria inoculated) showed that they can be dyed with crystal violet. The lowest Kp and Ec recovery from pegs was observed from formulations A-B.

Conclusions: In this pilot study, formulations A and B showed better anti-biofilm formation on hydroxyapatite. Further experiments are necessary to access the effect of bromelain against established biofilms.

Funding: This project was not funded.

Abstract # - 15 The Hispanic Oral health Prevention and Education Program (H.O.P.E.)

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Objective: The Hispanic Oral health Prevention and Education Program (H.O.P.E.) focuses providing education, preventive measures, and minimally invasive procedures for the oral disease management among the Hispanic population in Siler City, NC. The H.O.P.E. project allows for the evaluation of individualized caries risk factors, and the delivery of education, and personalized value-based care. The aims of the project are to: (1) understand the behavioral and biological risk factors associated with dental caries in this population, and (2) observe changes in the risk factors (behavioral, and clinical) after implementation of the program.

Experimental Methods: We partnered with the Vidas de Esperanza dental clinic and collaborated with the NC Albert Schweitzer Fellowship Program to develop and implement the intervention. Information on behavioral risk factors obtained via dietary surveys, oral hygiene habits, medical and dental histories. During a comprehensive clinical examinations tooth-surface measures of caries were recorded, saliva and biofilm were collected to provide a caries risk assessment. Patients were enrolled in a program focused on prevention, education and minimally-invasive caries management, with 3-month and 6-month follow-ups.

Results: Between August 2021 and April 2022 a total of 72 patients were enrolled in the project, received oral hygiene instructions and a caries susceptibility test. Out of the 72, 30 patients completed their first recall appointment. We found that 35% of patients that completed their first recall appointment improved their oral health by one or two markers.

Conclusion: This pilot project has shown us that dental caries are prevalent in the Hispanic/Latinx population of Siler City NC. Compliance with at home surveys, follow-ups, and at home care recommendations were a major challenge in this project. Further revision of the program's structure and subsequent implementation with increased capacity for direct patient interaction is needed to further investigate the efficacy of this project.

Funding: NC Albert Schweitzer Fellowship, UNC Adams School of Dentistry DDS Short Term Research Fellowship

Abstract # -16 Dental Students' Perceptions Regarding Expanded Functions for Dental Hygienist

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Objectives: North Carolina's (NC) state legislature has granted dental hygienists (DHs) expanded functions, including the administration of local anesthesia, as a part of NC Senate Bill 146. The professional dental landscape in NC may lack dentists with experience working with expanded function DHs. The present study sought to gather the attitudes and opinions of current dental students on their clinical experiences with dental hygiene (DH) students who have completed local anesthesia training. This study further aimed to gain insight into the possible future utilization of expanded function DHs in NC.

Experimental Methods: Purposeful sampling was used to survey third year (DDS3) and fourth year (DDS4) dental students at the UNC Adams School of Dentistry (ASOD). The survey collected demographic and background information, knowledge about the DH profession, experiences with DH students in the clinical setting, and attitudes regarding expanded functions. Survey question types included multiple choice, Likert scale, and open ended. Descriptive statistics and thematic analysis were used to analyze survey results.

Results: Survey participants thus far (n=13) included four DDS3 and nine DDS4 students at ASOD. The majority (84.6%) of the respondents reported having shared clinical experiences with DH students, however only 18% reported working in a case involving local anesthesia administration. Students reported favorable opinions on the potential benefits of working with expanded function DHs in future practice related to willingness to hire (61.5%) and willingness to utilize for scaling and root planning (61.5%) or restorative procedures (61.5%). Respondents expressed agreement that utilizing expanded function DHs would increase future practice efficiency (76.9%) and outputs (76.9%).

Conclusion: Preliminary data showed that dental students expressed limited current knowledge and experience regarding DHs with expanded functions but perceived expanded function DHs as generally positive additions to the dental team due to the potential for increase in practice efficiency.

Funding Source: This project was supported by the Salisbury Family Excellence Fund administered by Honors Carolina.

Abstract # - 17 Retrospective Analysis of Peri-implant bone levels. Pilot Study

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Objectives: The primary purpose of this study was to evaluate the prevalence of peri-implant bone loss among all implants placed in a clinical setting at UNC-Adams School of Dentistry from 2004-2016. We have utilized the concept of Radiographic Bone Loss Detection Threshold (RBLDT) at 0.5 mm which is strongly associated with the clinical diagnosis of peri-implantitis to scout for peri-implant diseases in a large population. The secondary goal of the study is to evaluate the number of patients that meet the inclusion criteria to further identify the prevalence of peri-implant bone loss associated with different patient factors to design future retrospective analyses.

Experimental Methods: CDT codes were used to search electronic database (EPIC and EPR) to find subjects in which implant placement occurred. This retrospective review of electronic medical records was for all patients who received an implant at UNC between 2004 and 2009. Patients with radiographs taken between 2014 and 2019 (minimum of 5 years of loading) from which marginal bone levels can be interpreted will be selected to acquire 200 patients and compare the prevalence of peri-implant bone level with specific patient and implant factors.

Results: 200 patients met the inclusion criteria with RBLDT measured. The 200 patients that met the inclusion criteria were found after reviewing 3,900 available charts out of 8,950 provided for a rate of 5.13%. The available data extracted from each chart included implant brand, implant type, implant length, age, gender, operator, number of implants, smoking status, hygiene status, periodontal diagnosis, diabetes, bisphosphonate usage, and metabolic disease presence. When measured with RBLDT at 0.5mm, 40/200 (20.5%) were identified as having peri-implant bone loss.

Conclusions: Peri-implant bone loss was most closely related to patients having more than 4 implants, active and past smokers, and patients diagnosed periodontally as moderate-severe periodontitis.

Funding: No funding was received.

Abstract # - 18 Ultrasound Application Effect on Surface roughness of Glass Ionomer Restorations

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Objectives: To evaluate the influence of ultrasound application (UA) on surface roughness (SR) in resin-modified (RMGI) and conventional (GIC) glass ionomer cements using coherence scanning interferometry (CSI).

Experimental Methods: Standardized discs of each test restorative material, measuring 5mm (diameter) × 2mm (depth), were fabricated following the manufacturer's instructions. The six groups (n=5) tested were: RMGI Ketac Nano; Ketac Nano with UA; RMGI Fuji II LC; Fuji II LC with UA; GIC Fuji IX GP; and Fuji IX GP with UA. Ultrasound was applied for 15s at 28kHz (Cavitron Select SPS) with a dental scaler tip in contact with a Mylar strip that covered the restorative materials during the initial setting reaction. All specimens were made by a single operator. After 24h, SR (Sa) measurements of the surfaces were performed using a scanning white light interferometer (Zygo NewView 5000). All measurements were performed by a single operator, who was blinded to the procedures. SR results were analyzed by means of non-parametric Mann-Whitney U test/Kruskal-Wallis test. All tests were performed at a 0.05% significance level using the IBM SPSSⁱ Statistics v. 23.0.

Results: Mean SR (Ra, μm) \pm standard deviation were: RMGI Ketac Nano (0.137 \pm 0.085); Ketac Nano with UA (0.117 \pm 0.039); RMGI Fuji II LC (0.111 \pm 0.052); Fuji II LC with UA (0.065 \pm 0.027); GIC Fuji IX GP (0.454 \pm 0.363); and Fuji IX GP with UA (0.121 \pm 0.046). Statistical differences were found between groups with and without US application and between the restorative materials. The mean of all restorative materials without US was 0.234, whereas with US was 0.101 (p-value=0.046). Fuji II with UA presented the lowest SR, and Fuji IX without US the greatest SR.

Conclusions: A reduction in SR of GI materials occurs when US is applied during their initial setting reaction.

Funding: DFNC DDS Short-Term Research Fellowship, DFNC Operative Dentistry Fund

Abstract # - 19 A Generational Look at Early-Life Stress and the Gut

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Objectives: Previous studies in our lab revealed significant changes in the gut following chronic early-life stress exposure, including a loss of enteric neurons and changes in gene expression. This study utilized a zebrafish model to determine whether these biological changes from early-life stress were heritable, and if any of those effects were altered when applied to a generational situation.

Experimental Methods: We bred fish from a previous stress experiment and exposed the offspring to early-life stress for a total of three stressed generations. The offspring of stressed fish were separated into a stress and no stress group, which were both compared against a control from a naive lineage.

Results: We found the offspring of previously stressed fish to be significantly less viable, but observed no significant difference in enteric neuron density or standard length. Preliminary behavioral data suggests the sex of experimenters may alter fish behavior in a manner similar to rodents.

Conclusion: Ongoing experiments will assess for differences in gene expression and cortisol levels, and will directly examine the potential role of experimenter sex on behavior.

Funding: None to report

Abstract # - 20 Interprofessional Care Rotation: Retrospective Review of Dental Students' Complex Cases

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Objectives: Innovative partnerships between schools of dentistry, pharmacy, and social work at the University of North Carolina at Chapel Hill have led to creative interprofessional learning opportunities for learners from the three disciplines. This retrospective study assessed the

impact of a unique collaboration involving dental, pharmacy, and social work students participating in an interprofessional clinical care rotation by evaluating the patient population of clinical cases submitted with identified medication-related problems (MRPs) and psychosocial barriers and associated educational outcomes.

Experimental Methods: Third-year dental students during the spring of 2022 submitted medically complex patient cases active in their care for pharmacy and social work consultation based on patients' medical and medication histories. Social work and pharmacy students and their faculty preceptors reviewed the patient charts, identified concerns, and documented interactions with the dental students. Analysis of the 175 patient cases discussed will be described.

Results: Submitted patient case demographics were mean age of 57.8 years (53.7% female). The three most common type of medical conditions encountered and discussed were hypertension (57.7%), mental health conditions (50.2%), and inflammatory conditions (41.7%). Most common pharmacy interventions requested included oral health medication review, chronic disease state patient education, and medication history verification. Most common social work interventions requested included mental health navigation, patient financial resource strain, tobacco use, and dental anxiety. Discussion topics during the clinical rotation covered the complexities of the patients' medical conditions in the context of the dental environment.

Conclusion: The interprofessional clinical care rotation involving dentistry, pharmacy, and social work learners and faculty can serve as an interprofessional practice model that encourages deep clinical discussion regarding the wholistic health needs of dental patients, peer-to-peer learner teaching, and informs future implementation of dentistry collaborations with other health disciplines in the clinical setting.

Abstract # - 21 Characterization of Hypocretin Expression Along The Gum-to-Gut Axis in Zebrafish

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Objectives: Hypocretin modulates the circadian sleep/wake cycle, feeding behavior, and how organisms respond to stress. While hypocretin-containing neurons are found in the lateral hypothalamic (LH) area of the central nervous system, debate remains as to whether bona fide hypocretin producing neurons can be found in the enteric nervous system. Therefore, we are interested in determining whether hypocretin is only made by hypothalamus or also by other neurons. Instead of employing antibodies, which might be leaky or recognizing something else sending false signals, we obtained a transgenic hypocretin gfp expressing fish and looked its expression in the gut.

Experimental Methods: We used fluorescent microscopy to image transgenic hcrt:egfp+ zebrafish at different time points and also performed wholemount immunostaining (anti-gfp retrieval of endogenous gfp expression and co-labelled with a pan-neuronal antibody) and high resolution confocal imaging of ex vivo adult gut.

Results: Image analysis revealed abundant gfp+ hcrt expressing cells in the gut of adult zebrafish in the myenteric plexus layer, consistent with enteric nervous system expression of hcrt. The gfp+ cells also exhibit maximal-neighbor patterning and more densely populate the proximal gut.

Conclusions: To date, research on the existence of hypocretin-producing neurons in the enteric nervous system has been limited. Decades-old findings suggest a gut hcrt+ population may be present, but these studies have largely relied on antibody retrieval at a time when rigorous antibody validation was less commonplace than today. Our data, by relying on endogenous expression of gfp under the hcrt promoter, provides evidence for a bona fide hcrt+ population in the gut. In future studies, we plan to interrogate hcrt+ innervation in the pharyngeal jaw and teeth of zebrafish.

Abstract # - 22 A Software-based Coding Approach for Pediatric Dental Anxiety

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Objectives: Patients troubled by dental anxiety often exhibit disruptive behavior during appointments and avoid routine care, leading to adverse outcomes and reduced quality of life. Use of animal-assisted therapy (AAT) in pediatric dental populations holds promise for behavior management and reducing anxiety and pain perception. Our aim is to develop and validate an observation-based assessment scale that utilizes state-of-the-art coding software (Noldus Observer XT) to objectively evaluate non-pharmacological behavior management techniques in reducing anxiety.

Experimental Methods: Video and self-report anxiety and pain data were collected from a pilot evaluating use of AAT in pediatric dentistry. Enrolled subjects (N=20, age 7-14) were assigned to AAT or an active control prior to restorative dental care. A code book, behavioral scale, gold standard video, and user training guide were developed. Published scales, validated by Frankl Behavior scores, were referenced in defining initial codes, which were iteratively revised, until code book confirmation. The gold standard video was coded by 4 trained examiners for inter-rater agreement. Experimental videos were then analyzed by 3 blinded, calibrated judges with inter-rater agreement checked periodically.

Results: Experimental codes were validated against self-reported anxiety and pain measures. Results indicate that children who cried out, asked questions, and displayed behaviors such as looking at the dentists' fingertips/hands, clenching/grabbing, kicking, and heavy audible breathing had higher reported levels of anxiety and pain. In contrast, children who looked at dental equipment and moved their hands and fingers reported less anxiety and fear. Results also indicate adequate inter-examiner agreement ($\kappa \geq .80$) for coding anxiety in videos of pediatric dental procedures.

Conclusion: Data indicate development of an objective, validated observational coding scheme, called the Pediatric Dental Anxiety Coding Approach (PDACA). PDACA uses video analysis software to continuously quantify anxiety during pediatric dental procedures, with data integration across video, physiologic, and self-report measures. This approach holds promise for objectively assessing anxiety reduction approaches like AAT, in pediatric dental settings.

Funding: DDS Short-term Fellowship

Abstract # - 23 Identifying factors influencing orthodontic residency program selection.

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Objectives: The ‘student debt crisis’ has forced difficult decisions about pursuing orthodontic residency amidst growing education costs and deferred earnings. Studies over the past thirty years have identified finances as a secondary factor in residency program selection. We seek to understand how today’s applicants prioritize factors for applying to and ranking residency programs, in the current economic environment.

Experimental Methods: A mixed-methods study was conducted. Fifteen final-year dental students or first-year orthodontic residents were interviewed one-on-one, following a topic guide. Transcripts were analyzed using MAXQDA2022 to identify values, factors and influences related to program selection and ranking. Qualitative findings and previous studies provided the basis for a quantitative survey distributed to residency applicants in 2020-22. Data were analyzed with bivariate and descriptive statistics with stratification by debt group.

Results: Interviews highlighted the importance of program cost, location, interview experience, and clinical education. Surveys (N=237) identified the most desirable factors for program selection: satisfied residents, good interview impressions, low cost, strong clinical training with multiple techniques, high patient numbers, a strong reputation, and good clinical facilities with new technology. High-debt applicants view lower cost residencies as more desirable than low-debt applicants. Less desirable factors include programs that are hospital-based, certificate-only, research intensive and require considerable work after hours.

Conclusion: Clinical education and interview experiences are key for residency selection, consistent with prior studies, but program cost has grown in importance. Findings can help guide orthodontic programs in recruiting applicants and suggest a need to limit educational cost.

Funding: Southern Association of Orthodontists Research Award, American Association of Orthodontists Foundation (AAOF) Martin ‘Bud’ Schulman Postdoctoral/Junior Faculty Fellowship, and the NIH NIDCR K08 grant (K08DE030235).

Abstract # - 24 Machine Learning-Based Re-Appraisal of Caregivers' Health Literacy and Children's ECC

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Objective: Low oral health literacy (OHL) among young children's caregivers is known to be associated with worse perceived child oral health; however, evidence linking low OHL with clinically determined ECC in community-based studies is scant. We sought to quantify the association between low OHL and ECC via the application of a novel machine learning-based ECC imputation approach in a community-based study of OHL without clinical data.

Methods: We used caregiver-reported information on children's oral health status (OHS; excellent/very good/good/fair/poor), children's age, and caregivers' OHL (measured with the REALD-30 index, wherein scores <13 indicated low OHL) from 410 caregiver-child dyads (children's mean age=36 months; range=24-59 months) participating in the Carolina Oral Health Literacy (COHL) project. The machine learning algorithm for ECC was previously developed and benchmarked in a community-based cohort of 6,404 3-5-year-old children in the ZOE 2.0 study and 2,308 similarly aged children from NHANES and leveraged information on children's caregiver-reported OHS and age. Differences in ECC prevalence between low and higher OHL were quantified using prevalence ratios (PR) and 95% confidence intervals (CI) obtained with log-binomial regression. Analyses were undertaken using JMP Pro 17.0 (SAS Institute Inc., Cary, NC) and Stata v.17.0 (StataCorp, TX, USA).

Results: Eleven percent of children were predicted by the machine learning algorithm to be ECC cases, while the proportion of children with fair/poor caregiver-reported oral health was 7%. Low compared to higher caregiver OHL was associated with more-than-double prevalence of ECC (PR=2.3, 95% CI=1.3-3.9, p=0.002). This estimate was similar-in-magnitude but more precise compared to that obtained using caregiver-reported fair/poor child oral health as the analytical endpoint (PR=2.6, 95% CI=1.3-5.5, p=0.006).

Conclusions: Machine learning-based applications can augment questionnaire-based studies and existing datasets without ECC information. In this study, we confirmed the strong association between caregivers' health literacy and their young children's oral health.

Keywords: children; early childhood caries; health literacy; machine learning; prediction

Funding Sources: NIH/NIDCR - U01DE025046 and R01DE018045.

Abstract # - 25 Integrating Dental and Dental Hygiene in Predoctoral Clinical Education

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Objectives: The Oral Health Sustainability Program (OHSP) at the University of North Carolina Adams School of Dentistry aims to (1) prepare modern dental (DDS) and dental hygiene (DH) learners for practice (2) and promote intraprofessional collaborative care. The pilot study examined implementation of the OHSP in a predoctoral clinical setting and assessed learner attitudes toward team-based care.

Methods: IRB exemption was obtained. Data were collected via optional Qualtrics® surveys. Senior DDS and DH learners, DDS and DH clinical faculty, and recent DDS and DH alumni were asked to participate. Cohort-specific surveys included Likert scale and open-ended questions to gauge perceptions about the program. Data were analyzed using descriptive statistics and thematic analysis.

Results: Survey participants included DDS (N=34) and DH (N=21) learners, DDS and DH clinical faculty (N=33), and DDS and DH learner alumni (N=10). Six interrelated themes emerged: 1) attitudes, 2) communication, 3) logistics, 4) practice-readiness, 5) teamwork, and 6) time. Most (89.5%) agreed the program is valuable in developing practice-ready dentists and dental hygienists. Learners noted co-diagnosis and collaboration as practical learning to simulate private and group practice settings. Logistics of the program were a fundamental challenge for many participants and improvements are necessary to better mirror the environments learners will practice in upon graduation. Time management was also a challenge for DDS learner participants as they developed skills to perform periodic oral evaluations while managing their own patients.

Conclusion: The OHSP pilot study resulted in valuable feedback from all participants. Learners demonstrated positive attitudes toward adoption of the program as a permanent educational opportunity. Ongoing improvements should focus on logistics to benefit all stakeholders. The program is essential for equipping learners with the skills to work alongside one another in future practice.

Abstract # - 26 Biomarker Signatures Define Periodontal Disease Subtypes

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Objectives: Precision oral health seeks to expand on our understanding of periodontal disease heterogeneity and leverage it to optimize treatment selection based on individual biological needs. Our group has previously identified distinct plaque microbial signatures in individuals stratified by the data-driven Periodontal Profile Class (PPC) taxonomy. The goal of this study was to identify stable oral inflammatory “fingerprints” of periodontal disease subtypes based on longitudinal data.

Experimental Methods: We used de-identified periodontal clinical measurements and biomarker data (Luminex) obtained from the “Biomarkers of Periodontal Disease Progression” longitudinal study, which examined 400 individuals bimonthly over a 1-year period. Participants were PPC-stratified into Health, Mild, Moderate, and Severe disease. The longitudinal stability of 65 biomarkers derived from gingival crevicular fluid was evaluated by an area under the curve analysis. Periodontal biomarker signatures were derived via principal component analysis. The association between periodontal subphenotypes and novel biomarker signatures was tested using ANOVA and a conventional $p < 0.05$ statistical significance criterion. Signatures were validated in a random subsample ($n=180$) of the Dental-ARIC study.

Results: Seven biomarkers showed significant longitudinal stability over the 1-year study period, including IL-1 β , IL-6, IL-17, granulocyte colony-stimulating factor (G-CSF), interferon-gamma (IFN- γ), and monocyte chemoattractant protein-1 (MCP-1/CCL2) among all participants. Five periodontal biomarker signatures were created with these stable mediators. Periodontal Health ($n=65$) was negatively correlated with all seven biomarkers evaluated ($p < 0.001$). Mild ($n=97$) and Moderate disease ($n=100$) classes correlated with both an IL-1 β -dominated signature and an IL-6-G-CSF immunoregulatory signature ($p < 0.05$). Severe disease ($n=138$)

correlated with a RANTES-dominated signature, known for promoting immune infiltration ($p < 0.05$). Dental-ARIC data analysis confirmed that RANTES was a dominant biomarker in Severe disease.

Conclusions: These findings identify key inflammatory factors that characterize periodontal disease subtypes, which previously showed discriminative microbiological profiles. These findings may highlight altered inflammatory/immune responses underlying biological subtypes of periodontitis for targeted care.

Funding: NIDCR-K01DE027087 (JT Marchesan), University of North Carolina DDS Short-Term Research Fellowship (NP Vias), NIDCR-U01DE021127 (R Teles)

Abstract # - 27 Culturally Attuned Oral Health Care for Latinx Patients

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Objectives: We sought to evaluate the effectiveness of culturally attuned care in the Adams School of Dentistry (ASOD) student clinics. The importance of providing culturally attuned care has been shown to be imperative in addressing widespread health disparities for racial and ethnic minority populations across the United States. The Hispanic/Latinx population is the largest and fastest-growing non-majority ethnic group in the United States but bears one of the highest oral disease burdens in the country. Our objective is to improve the quality of culturally attuned care provided to Latinx and Hispanic patients in the ASOD student clinics via research-informed quality improvement efforts.

Experimental Methods: Faculty and students in the dental and dental hygiene programs who precept or provide care in the student clinics were surveyed regarding their knowledge, skills, and awareness of culturally attuned care using the *Cultural Competence Self-Awareness Survey*.

Results: There were 79 survey responses. Out of the 70 who identified themselves, 46 were students and 23 were faculty members, and 5 were other. Analysis of the survey responses is ongoing, and results are expected in late February. We will describe common themes across the data, focusing on the largest areas of improvement for knowledge, skills, and awareness of providing culturally attuned care. From these themes we will make specific quality improvement recommendations for oral health education, policy, and practice at the ASOD.

Conclusion: Quality improvement efforts related to culturally attuned care are critical to addressing oral health disparities for the Hispanic/Latinx population. Results from our survey of

oral health providers and oral health trainees will help us understand more about areas of improvement within our own institution and make specific recommendations for quality improvement efforts to target an increase in knowledge, skills, and abilities of providing culturally attuned care for our Hispanic/Latinx patients.

Funding: Not Applicable

Abstract # - 28 Chronic Disease Management in Dental Hygiene Practice: a Qualitative Study

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Objectives: This study aimed to understand NC dental hygienists' (DH) knowledge, attitudes, and practices related to CDM approaches in pediatric dental care and identify barriers to incorporating this new approach in their clinical practice as a standard of care.

Experimental Methods: Fifteen NC DHs with a minimum of 2 years post-licensure clinical dental experience and working with children 1-18 years of age were recruited for this qualitative research study. Participants were interviewed one-on-one via Zoom by a trained investigator using a semi-structured interview guide. Interviews were recorded, transcribed verbatim, coded, and analyzed using MAXQDA Plus software.

Results: Clinical practices reported by participating DHs align with the recommended CDM protocol but are not implemented as a standard of care for every patient. DHs reported knowledge of CDM in pediatric dental care ranged from "none" to "some." The most common perceived barriers to incorporating the CDM approach were: 1) insurance, 2) length of hygiene appointments, and 3) parents not engaged in their child's oral health. Participants expressed a positive attitude toward implementing CDM in their clinical practice as a standard of care.

Conclusion: Despite limited knowledge of CDM in pediatric dental care, DHs already apply some practices recommended by the CDM protocol when treating patients. Their positive attitude towards CDM is an excellent opportunity to implement this new approach as a standard in clinical patient care.

Funding: National Center for Dental Hygiene Research & Practice, Inc., and Crest and Oral-B.

Abstract # - 29 Interobserver Agreement in Histopathologic Diagnosis of Oral Lichen Planus

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Introduction: Oral lichen planus (OLP) is a chronic immune-mediated disorder with unknown etiology. Optimal OLP diagnosis takes both histopathological and clinical aspects into consideration. Diagnostic criteria for OLP have varied over the years. This study aimed to evaluate interobserver agreement using the 2016 the American Academy of Oral and Maxillofacial Pathology (AAOMP) diagnostic criteria.

Experimental Methods: This retrospective observational cohort study included 102 archived tissue samples received at the UNC Oral and Maxillofacial Pathology Laboratory and diagnosed as OLP or oral epithelial dysplasia (OED). Seventy-four OLP and 28 OED cases were retrieved. Three board certified oral and maxillofacial pathologists assessed the blinded cases individually. Each observer (observer A, B, C) was provided with the following clinical information: anatomic location, number of lesions (multiple versus solitary), sex, and age. Statistical analyses were conducted using SAS (SAS Institute Inc) version 9.4 with unweighted Cohen's kappa (k) test utilized to measure interobserver agreement in pairs.

Results: Responses were categorized as OLP versus OED. This study demonstrated a concordance with signout diagnosis of OLP using the 2016 AAOMP criteria of 77%, 43%, 91% for observers A, B, and C, respectively; whereas the concordance with signout diagnosis of OED for all observers was 93%. Interobserver agreement using Cohen's categories of k grading were as follows: Observers A and B: 0.42 (moderate), Observers B and C: 0.35 (fair), Observers A and C: 0.71 (substantial).

Conclusion: This study illustrates the range of variation that can occur between pathologists in the histopathologic diagnosis of OLP. Although some variation in interobserver agreement in OLP diagnosis was shown to occur in the study, the overall moderate agreement supports the use of 2016 AAOMP criteria. Importantly, the congruency of observers concerning the diagnosis of mild OED is significant as it supports the reliability of adequate existing histopathologic criteria for a premalignant condition.

Funding: The authors received no financial support for this research.

Abstract # - 30 Sex-dimorphic effects of IL-1 β modulation on periodontal bone loss

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Objectives: Determine the sex-based differences in IL-1 β expression and modulation during gingivitis and periodontitis.

Experimental Methods: Sex-differences comparison analysis of periodontal indexes and gingival crevicular fluid IL-1 β levels was performed in a cohort of elderly adults (n=6,182, Dental-ARIC). Human and murine gingival tissues were evaluated for levels and tissue distribution of inflammasome-associated components NLRP3, AIM2, ASC, and CASP1 and products IL1b and IL18, using qRT-PCR, immunofluorescence, and immunohistochemistry (n=30). Ex vivo human neutrophil cultures from females and males (n=35) were evaluated after LPS stimulation for activation markers CD11b and CD16 (flow cytometry) and IL-1b, MIP-1a/CCL3, TNF-a and IL-1a (ELISA). Ligature periodontitis was induced in WT, Asc^{-/-}, Il1b^{-/-}, Il18^{-/-} mice for both sexes. One day before ligature placement, mice were treated daily with caspase-1 inhibitor VX-765 (100mg/kg). Murine periodontal tissues were evaluated for the

number of neutrophils (MPO+ cell counts). Alveolar bone loss was evaluated by microCT analysis, osteoclasts (cathepsin K+ cells), and gingival expression of Rank, Rankl, and Opg.

Results: Cohort data revealed greater periodontal indexes for males when compared to females ($p < 0.05$). Men also presented higher IL-1 β levels in severe periodontal disease. Co-ASC was co-localized with IL-1 β in the inflammatory infiltrate of human and murine gingiva. Gingival expression of Il1b was significantly higher ($p < 0.05$) in males compared to females. Ex vivo neutrophils from males showed significantly higher activation markers CD11b and CD16 and secretion of IL-1 β and MIP-1a/CCL3 after LPS stimulation. Increased ligature-induced bone destruction was found in males when compared with females ($p < 0.05$). Asc-/- and Il1b-/- bone loss was impaired in males only. In males only, caspase-1 inhibition with VX-765 significantly diminished the Rankl:Opg and Rankl:Rank ratios in the periodontal lesion at 3 days ($p < 0.05$).

Conclusions: We hereby present evidence that inflammasome targeting of IL-1 β maturation prevents inflammatory bone destruction in a sex-dimorphic fashion.

Funding: This study was funded by the National Institutes of Health (NIH) KL2TR002490, K01DE02708713, R35CA232109, AI029564, and U19 AI067798, the American Association for Dental Research Anne D. Haffajee Award, the National Center for Advancing Translational Sciences NCATS UL1TR002489, R00DE0234804, R21DE029625 and The J. William Fulbright scholarship.

Abstract # - 31 Oral Inflammatory Cytokine Response During Early SARS-CoV-2 Infection

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Objectives: SARS-CoV-2 is transmitted through respiratory droplets and orthodontists are at risk of point-of-care transmission due to oral proximity, aerosol generation and high patient volumes. The oral cavity is a site of SARS-CoV-2 exposure and potential infection, with immune defenses serving as barriers to minimize viral replication. Yet, an understanding is lacking of how oral innate defense mechanisms are temporally regulated and relate to patient demographics.

Experimental Methods: We collected saliva from N=200 SARS-CoV-2+ patients and 30 uninfected controls for Luminex xMAP technology to detect 37 pro- and anti-inflammatory cytokines.

Results: Preliminary results identified six cytokines whose concentration significantly correlates to symptom onset date, including gp130, a receptor subunit of IL-6, a known driver of COVID-19 cytokine storm.

Conclusions: Identifying site-specific cytokine signatures has the potential to reveal diagnostic, prognostic, and therapeutic biomarkers for COVID-19.

Abstract # - 32 Impaired mTOR Signaling in Diabetic Immune Suppression

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Objectives: We sought to elucidate the mechanisms of immune suppression caused by diabetes. In particular, skin and soft tissue infection (SSTI) caused by *Staphylococcus aureus* is commonly severe in patients with diabetes. We have recently shown that innate immune cells cannot undergo respiratory burst in the diabetic environment, which contributes to severe disease through a phagocyte glucose transporter-associated mechanism. Given an established role for mTOR signaling in the production of respiratory burst from phagocytes, we aimed to establish a role for mTOR signaling in diabetic immune suppression.

Experimental Methods: Mice were subcutaneously infected with *S. aureus* to model SSTI. Diabetes was chemically induced in mice using streptozotocin. To study the role of mTOR, mice were treated with the specific inhibitor rapamycin. For *in vitro* mechanistic analysis, phagocytes were activated in the presence of rapamycin or in the absence of insulin and other growth factors.

Results: We observed suppression of mTOR activity via S6 phosphorylation in infected diabetic mice and insulin-deficient phagocytes. Inhibition of mTOR by rapamycin treatment phenocopied diabetes in mice during *S. aureus* SSTI with respect to increased bacterial burden, impaired respiratory burst, and inhibited GLUT1 expression. Cytokine and iNOS expression were preserved during infection in both diabetic mice and rapamycin-treated mice. *In vitro* analysis revealed decreased bactericidal potential, impaired respiratory burst, and decreased GLUT1 expression in phagocytes in the absence of insulin or when treated with mTOR inhibitor. NF- κ B activation via p65 nuclearization was similar to control phagocytes for both conditions.

Conclusions: Immune suppression caused by diabetes during *S. aureus* SSTI is attributed to a lack of respiratory burst from phagocytes at the site of infection caused by impaired mTOR signaling. Preservation of both p65 nuclearization upon activation and downstream cytokine and iNOS expression during infection support an NF- κ B-independent mechanism

Abstract # - 33 Antibiotics Alter Fibroblast-Osteoclast Signaling in Orthodontic Tooth Movement

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Objective: The primary objective of this research was to define the role of the antibiotics in OTM to better predict treatment outcomes in patients with modified microbial communities.

Experimental Methods: Human periodontal ligament fibroblasts were compressed in an orthodontic tooth movement model using glass discs designed to produce 1.7g/cm² of force. Cells were treated with doxycycline, an antibiotic commonly prescribed systemically long-term in adolescents to treat acne. Doxycycline and control-treated cells were additionally stimulated with bacterial-free-supernatant (BFS) from subgingival plaque from periodontally healthy and diseased sites. Pro-inflammatory cytokines were measured after 1, 3 or 10 days of compression using RT-PCR and ELISA. Supernatant media from fibroblasts was used to treat human monocyte cultures to determine osteoclastogenesis by quantification of TRAP+, multinucleated cells. Statistical significance was determined using one-way ANOVA with multiple comparisons. (p<0.05)

Results: Statistically significant reductions in RANK-L expression, a potent osteoclastogenic factor, were observed in cells treated with doxycycline under compression as compared to untreated compressed cells. (p<0.0001) Uncompressed doxycycline-treated cells expressed significant increases in pro-inflammatory cytokines IL-6 and TNF- α . (p<0.0001) Compression of doxycycline-treated fibroblasts reversed the pro-inflammatory effects of doxycycline to uncompressed levels.

Conclusions: This work suggests that doxycycline disrupts fibroblast-osteoclast signaling during orthodontic tooth movement.

Funding: Southern Association of Orthodontists Resident Research Award

Abstract # - 34 Mandibular Alveolar Bone Remodeling Following Maximum Incisor Retraction

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Objectives: The aim of this study was to evaluate the changes in crestal buccolingual alveolar bone width around mandibular incisors after maximum retraction using skeletal anchorage. Additionally, the study aimed to correlate the patterns of remodeling with initial bone width and the magnitude of retraction.

Experimental Methods: Pre- and post-treatment CBCT images of 61 consecutive patients with bimaxillary dentoalveolar protrusion treated with premolar extractions and a large amount of mandibular incisor retraction (>4 mm) using temporary anchorage devices (TADs) were retrospectively evaluated. 21 control patients treated with the same approach, but with mandibular incisor retraction <4mm, were likewise evaluated. 3D mandibular regional superimpositions were used to measure changes in mandibular alveolar width and the magnitude of mandibular incisor retraction during treatment.

Results: Average retraction of the mandibular incisors was 6.04mm. There was an average of 0.63mm and 0.49mm reduction in crestal alveolar bone width between the lower central incisors and at the midroot of the lower right central incisor, respectively. There was no statistically significant difference in bone remodeling when compared to the magnitude of incisor retraction at either measurement point ($p=.21$ and $p=.12$). However, there was a significant correlation between the initial bone width and amount of remodeling at both measurement points ($p<.00001$ and $p<.0001$).

Conclusions: On average, there is a reduction of buccolingual alveolar bone support around mandibular incisors when retracted maximally using skeletal anchorage. Thicker initial buccolingual bone width leads to greater reduction of width following retraction of mandibular incisors during treatment. There is no correlation between the amount of retraction of mandibular incisors and the amount of buccolingual remodeling that occurs during treatment.

Funding: Southern Association of Orthodontists

Abstract # - 35 Micro-CT Mineral Density Profile to Assess Early Carious Lesion Activity

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Objectives: Early caries diagnosis has a direct impact on treatment decisions in dentistry and requires identification of lesion activity: whether a carious lesion is active (progressively demineralizing) or arrested (not progressing/remineralizing). This study aimed to identify mineral density differences between active and arrested smooth surface enamel lesions, measured by micro-CT, and to validate those thresholds using a larger selection of teeth. This study aims to set micro-CT thresholds to help identify caries activity *ex vivo* for future reference standards.

Experimental methods: Extracted human permanent teeth (n=59) were selected. Each surface was examined for caries activity by calibrated individuals via visual-tactile examination using the International Caries Classification and Management System (ICCMS) activity criteria including sound surfaces (ICDAS 0) and non-cavitated smooth surface carious lesions (ICDAS 1-3). Each tooth was scanned via micro-CT, reconstructed using ImageJ software, and the deepest portion of the lesion was identified for each surface of interest. Using this slice, the mineral density was plotted against lesion depth. The area under the curve (AUC) was calculated and represented the loss of mineral density for the outermost 96 µm of enamel.

Results: AUC thresholds obtained from micro-CT were established to classify sound, remineralized, and demineralized surfaces against the gold standard examiner's lesion assessment of sound, inactive, and active lesions, respectively. The established AUC thresholds demonstrated 76.3% agreement with the assessment in identifying demineralized lesions (k=0.45), with high sensitivity (0.73) and specificity (0.77).

Conclusions: This study demonstrated quantifiable differences among demineralized lesions, remineralized lesions, and sound surfaces, which contributes to the establishment of micro-CT as a reference standard for caries activity that may be used to improve clinical and laboratorial dental caries evaluations.

Funding: University of North Carolina Adams School of Dentistry and Dental Foundation of North Carolina

Abstract # - 36 Suboptimal Positioning with Panoramic and CBCT Imaging: Effects on Dose

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Objectives: The aim of this study was to examine the effects of various changes in patient positioning on radiation exposure for panoramic and CBCT extraoral radiographic examinations. Specific objectives include measuring equivalent and effective dose (E) by means of radiation dosimetry with a tissue-equivalent phantom for each modality, with intentional changes in position to the craniofacial complex in the axial, coronal, and sagittal planes.

Experimental Methods: Panoramic and CBCT radiographic examinations at optimal positioning in addition to several suboptimal positions (anterior, posterior, and lateral shifts by 1 cm and rotation of the head in the axial and sagittal plane) were completed using an adult tissue-equivalent phantom. Dosimetry was acquired using optically stimulated luminescence (OSL) dosimeters placed at 24 anatomical sites in the head/neck region. Exposures were made with the RayScan Alpha Plus x-ray unit using the following exposure parameters (panoramic: 13.9 s, 80 kVp, 14 mA; CBCT: 14.0 s, 90 kVp, 11 mA). Five CBCT and ten panoramic exposures, respectively, were made to ensure adequate exposure to all sites of interest. Statistical significance was assessed with Tukey p-values (<0.05) and ANOVA analysis.

Results: No increases in E were determined for suboptimal panoramic conditions. E for anterior shift and posterior shift demonstrated statistically significant decreases when compared to optimal positioning ($P < 0.001$). For CBCT, no statistically significant increases or decreases for E were determined, although equivalent thyroid dose was significantly increased in comparison to optimal positioning when the chin was rotated down ($P = 0.003$).

Conclusions: Suboptimal positioning did not result in significant increases in E for either CBCT or panoramic imaging. Initial results suggest that downward rotation in the sagittal plane (i.e. tilting the chin down) may increase exposure to the thyroid gland for CBCT imaging. Additional investigation from smaller field CBCT scans is warranted.

Funding: N/A

Abstract # - 37 Unraveling the cell death induced by SARS-CoV-2 in epithelial cells

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Objectives: Till the end of 2022, the COVID-19 pandemic has affected people's lives worldwide, and SARS-CoV-2, the pathogen that caused the pandemic, has infected over 100 million people and claimed over 10 million deaths globally. Evidence has implicated that lung damage contributed to the inflammatory responses against SARS-CoV-2, but little is known about the cell death pathways activated by SARS-CoV-2 in lung epithelial cells.

Experimental Methods: To determine whether SARS-CoV-2 infection triggered cell death, A549 overexpressing ACE2 receptor cells or primary human airway epithelial cultures (HAEs) were infected with the SARS-CoV-2 Washington strain. The supernatant was collected, and the LDH assay was performed to determine the cell death percentage. Western blot and RT-PCR were performed with the samples collected from SARS-CoV-2 infected cells. Single-cell RNAseq was performed to determine the necroptotic gene expression in COVID-19 patients. To determine the cell death patterns triggered by SARS-CoV-2, confocal microscopy was performed after the infected cells were stained with p-MLKL or cleaved caspase-3.

Results: We found that SARS-CoV-2 triggered lytic cell death in both A549 overexpressing ACE2 cells and HAEs. Western blot analysis showed that both necroptosis and pyroptosis were activated. Unlike conventional pyroptosis which is mediated by GSDMD, the pyroptosis induced by SARS-CoV-2 in lung epithelial cells was GSDME mediated. RT-PCR and single-cell RNAseq showed that necroptotic genes were upregulated with SARS-CoV-2 infection. With confocal imaging, we found that p-MLKL relocated to the cell membrane and necroptosis was the predominant cell death pathway triggered by SARS-CoV-2 infection.

Conclusions: These data uncovered the cell death pattern triggered by SARS-CoV-2 in lung epithelial cells.

Funding: NIAID 1R56AI158314 and 1R01AI158314

Abstract # - 38 PD-L1 gene therapy rescues Sjögren's syndrome symptoms in mice.

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Objective: Sjögren's syndrome is the second most common autoimmune rheumatic disease characterized by lymphocytic infiltration of salivary and lacrimal exocrine glands. Dry eyes and mouth are the two most common symptoms with no effective treatment options. However, advancements in gene therapy technology to deliver and stably express genes for therapeutic utility have made it a promising approach to limit disease progression. PD-L1, a human encoded protein in the immune suppressive pathway, represents a promising candidate for AAV-mediated gene delivery. To combat progression of immune-mediated dry mouth, we exogenously expressed PD-L1 in Sjögren's syndrome mouse model salivary glands to dampen the immune response and effectively reduce lymphocytic infiltration.

Experimental Methods: A Sjögren's syndrome mouse model was generated by chemical induction using an adjuvant cocktail to stimulate an autoimmune response against salivary glands. ELISA was used to confirm the production of anti-Ro60 autoantibodies, a biomarker of autoimmune induction, in the treated mice. Salivary glands were then transduced with *PD-L1* packaged AAV particles to locally express PD-L1, which was verified by immunofluorescent staining. To see if PD-L1 protects Sjögren's syndrome mice from chronic progression of symptoms, over the course of a month, salivation and tear production was measured by Phenol Red Thread test. Additionally, lymphocytic infiltration was determined by Hematoxylin and Eosin staining.

Results: Immunized mice presented Sjögren's syndrome characteristics which include the autoimmune biomarker, lymphocytic infiltration, and reduction in salivary and lacrimal gland secretion. Compared to the empty particle control, exogenous expression of PD-L1 in mice significantly reduced these characteristics.

Conclusions: Delivery of *PD-L1* through AAV particles shows promise as a long-term and cost-effective gene therapy option for those suffering from Sjögren's syndrome. Further studies will focus on optimization, stable expression of *PD-L1*, and measuring additional markers of chronic progression of symptoms, such as MHCII, apoptosis, and α -fodrin.

Funding: NIH-5R01HL144661-03

Abstract # - 39 Skeletal Phenotype of Melanoregulin Mutant Mice with Aging

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Objectives: Studies documented the association of melanoregulin (MREG), a cargo-sorting protein, with its binding partner, the autophagic protein, microtubule-associated protein 1 light chain 3B (LC3B) in macrophages which could affect bone physiology due to the importance of autophagy in osteoclast differentiation. The study objectives include characterizing MREG knock out mice phenotype in terms of bone mass, histological bone microarchitecture, and bone marrow-derived osteoclast function to understand how lack of MREG affects bone with aging.

Methods: Mice femurs from MREG^{-/-} mice (on C57BL6/J) were harvested at 4 and 10 months and imaged by microcomputed tomography to assess bone mass parameters, femurs processed for histology by H&E staining for histomorphometry and TRAP staining for osteoclast numbers assessment. Further, mice bones were stained by osmium to assess lipid content. 11-month-old mice were also scanned via ECHO-MRI to characterize total lean vs. fat mass. Primary bone marrow-derived macrophages from 3-month-old mice were harvested to assess osteoclast function. Statistical analyses were performed with a sample size of 4-5 mice and ANOVA and t-tests were performed at 95% CI.

Results: Our data show MREG likely affects cell fate in the marrow. A significant reduction in adipose tissue and osteoclast numbers was found and bone marrow-derived cells showed reduced osteoclastic function. Male MREGs at 11 months presented a total lean mass significantly increased compared to controls per MRI. Osmium staining corroborated histological data where the fat/bone ratio was decreased in MREG compared to controls.

Conclusions: MREG deficiency seems to impair osteoclast numbers and function and favors lean mass preservation over fat accumulation in bones and body composition as mice age. This study will evolve into a project where we seek a deeper understanding of MREG mutation in bone and systemic metabolism which can provide future therapeutic modalities in inflammatory and metabolic diseases related to autophagy.

Funding: University of North Carolina, R01 DE022465-01A1 (KBB) and P30DK05630 (NORC)

Abstract # - 40 Gene-Environment Interactions in Early Childhood Caries

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Objectives: Early childhood caries (ECC) is known to be influenced by social and behavioral factors. While individual susceptibility/genetic factors are strongly theorized, they remain largely unexplored. In this study, we sought to identify ECC-associated interactions between two environmental risk factors [sugary snacks/beverage (SSB) consumption frequency and sub-optimal fluoride exposure in home water] and human genetic polymorphisms.

Experimental Methods: Information on ~14 million polymorphisms was obtained in a genome-wide association study of ECC in a multi-ethnic, community-based cohort of 6,144 preschool-age children in North Carolina. ECC was quantified and measured by calibrated examiners using ICDAS criteria and the dmfs index. Daily SSB consumption frequency was obtained via a parent questionnaire, whereas optimal (≥ 0.60 ppm) vs. sub-optimal (< 0.60 ppm) fluoride exposure was determined by home water samples measurement (EPA method 300.0). Genome-wide interactions were identified with 1- and 2-degree-of-freedom tests in linear mixed-models of dmfs adjusting for age, sex, race/ethnicity, population stratification, and a $P < 5 \times 10^{-8}$ statistical significance threshold.

Results: We identified 9 genome-wide significant loci, several of those with important and relevant functional roles, including variants in *SLC41A3* (*rs71327750*, $P = 3.2 \times 10^{-8}$) and *RNF157* (*rs117997344*, $P = 2.6 \times 10^{-8}$). *Rs650314* ($P = 3.2 \times 10^{-9}$) is 25Kb upstream of *PHOSPHO1*, a gene involved in bone mineralization and implicated in childhood hypophosphatasia, which presents with premature loss of primary teeth and defects of enamel and dentin. Eight additional significant polymorphisms were found in sugar-stratified analyses, including *rs144438881* ($P = 4.5 \times 10^{-8}$), ~20Kb downstream of the known bitter taste receptor genes *TAS2R3*, *TAS2R4*, and *TAS2R5*. Interestingly, one variant, *rs62168414*, was genome-wide significant for a SNP-sugar interaction effect (locus: AC016682.1, P -difference = 3.17×10^{-8}).

Conclusion: This study offers novel evidence for gene-environment interactions in ECC that upon validation in additional populations could be leveraged in risk assessment and precision dentistry applications.

Funding: NIH/NIDCR - U01DE025046

Abstract # - 41 Culture-based versus DNA-sequencing for Determining Mutans Streptococci Caries Association

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Objectives: Mutans streptococci (MS) have long been identified as primary etiologic agents for dental caries, but culture-independent studies have begun to challenge this central role. This study sought to examine the basis of this discrepancy by comparing traditional culture with genome sequencing of discrete biofilm samples.

Experimental Methods: Samples collected from occlusal surfaces of 46 permanent second molars of 13 12-year-olds were cultured on MS-selective Mitis-Salivarius-Bacitracin agar (MSB) and confirmed with Sanger sequencing. The MS isolates were further discriminated based on distinct colony morphologies on MSB and evaluated for their ability to form sucrose-dependent biofilms in a microtiter assay and to grow in pH5 TSB. To evaluate bacterial microbiome, samples were analyzed by 16S rRNA gene sequencing combined with the BLASTN-based search algorithm for species identification.

Results: Of the samples, 12 of 24 with active white spot lesions (AWSL) versus 6 of 22 from sound surfaces yielded MS on MSB. In contrast, all the samples had detectable MS based on 16S rRNA gene sequencing with abundance estimates that should have yielded identifiable isolates. Pt4's active caries indices were substantially higher (cavitated surfaces=13, AWSL=18) than the other patients (cavitated range=0-4; AWSL range=0-9). The colonies of four isolates from Pt4 were larger than other isolates. Pt4 teeth #2 and 15 isolates were distinguished by excessive polysaccharide production encasing the entire colony, but in contrast, they had the lowest scores (OD=0.18) of all isolates (OD=0.48+0.12) for sucrose-dependent binding. Pt4 isolates #15 and 18 grew uninhibited in pH5 TSB compared to significant inhibition of the other 16 isolates, including Pt4 #2 and 31.

Conclusions: The ability to grow on MSB with discrete colony morphologies may be a distinguishing trait of virulent MS. Traditional culture and isolates' phenotypic evaluation may still provide valuable insights complementing the greater detail provided by molecular approaches.

Funding: AAR was funded by the Science without Boarder Scholarship CAPE # 87729/13-1; Brazil

Abstract # - 42 Evaluating Speech of Dentofacial Disharmony Patients through Vowel Formant Analysis

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Objectives: Patients with Dentofacial Disharmony (DFD) present with abnormal orofacial proportions, impacting esthetics, mastication and speech. Speech disorders negatively affect patients' self-esteem, quality of life, peer and teacher perceptions, and long-term career performance. As a result, it is important to understand the effects of DFD on speech. Limited data are available on vowel articulation and formant analysis of DFD subjects. Our aim is to characterize vowel formants in DFD subjects with Class III, underbite malocclusions relative to Class I controls and correlate formant values with degree of malocclusion.

Experimental methods: To characterize vowel articulation, audio recordings and surgical records including occlusal (bite) and cephalometric x-ray measures were collected from DFD subjects (103 Class III) and 61 Class I controls. Participants were recorded speaking phrases containing the corner vowels /æ a u i/ in similar phonetic contexts. Audio recordings were analyzed by measuring the first two formants (F1 and F2) at the 25% time point of the vowels using PRAAT software. A linear mixed effects regression model (with the word and patient as random variables) was used to explore relationships between the formants of particular vowels and occlusal/skeletal cephalometric dimensions using R software.

Results: Preliminary data indicate that DFD subjects with underbites present with lower F1 and higher F2 formant values when compared to Class I controls. The vowel spaces of Class III patients are notably different than Class I controls, with changes in /æ a u/.

Conclusions: Formant analysis provides an objective, quantitative approach for evaluating vowels in DFD subjects. Data suggest that Class III patients demonstrate alterations in vowel formants compared to controls, based on a large Class III DFD cohort.

Funding: NIDCR K08 Grant 1K08DE030235-01A1

Abstract # - 43 Access and Dental Utilization Among Publicly Insured Pediatric Oncology Patients

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Objectives: Children with complex medical needs face difficulties in accessing dental care. The aim of this study was to investigate access and utilization of dental services among publicly insured children with a cancer diagnosis in North Carolina.

Experimental Methods: Cancer patients ages 0 to 21 were identified using ICD-10 diagnosis codes and CPT procedure codes in NC Medicaid claims data between 2016 and 2019. Dental claims were used to estimate two metrics: the percentage of patients who received any dental service (i.e., “access rate”) and among those, the percentage of patients who received preventive dental services (i.e., “prevention ratio”). These estimates among cancer patients were compared to those among the entire NC Medicaid population, as well as between age groups, regions of NC, and federal fiscal years.

Results: There were 5,635 NC Medicaid enrollees ages 0-21 who were identified as cancer patients between 2016-2019. Access rates and prevention ratios remained relatively stable during the study period, ranging between 52-54% and 89-90%, respectively. Cancer patients’ access rates were similar to the overall population (i.e., 51-52%) whereas their prevention were slightly lower than the overall population (i.e., 94%). Considerable variation in both dental access and prevention was found between age groups (e.g., utilization peaked among 6-9-year-olds) and state regions.

Conclusions: Dental utilization among Medicaid-enrolled cancer patients in NC is similar to the overall population. While a considerable proportion of oncologic patients receive preventive dental services, there appears to be room for improvement, overall and particularly among children under the age of 6.

Funding: None

Abstract # - 44 Prevalence of High-Risk Human Papillomavirus in Oral Squamous Cell Carcinoma

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Objective: This study aims to determine the prevalence of HR-HPV infection in OSCC by means of p16 IHC and HR-HPV ISH and to assess the utilization of p16 IHC as a surrogate marker for transcriptionally active HR-HPV in OSCC.

Methods: This study was approved by our Institutional Review Board. OSCC cases from 2018 to 2019 with p16 IHC and HR-HPV ISH studies diagnosed at the University of North Carolina at Chapel Hill Oral and Maxillofacial Pathology Laboratory were retrieved (n = 107). The hematoxylin and eosin, p16 IHC, and HR-HPV ISH slides were reviewed and scored by three board-certified oral and maxillofacial pathologists. Sixty-nine cases met the inclusion criteria for this study.

Results: There was 100% concordance between the pathologists. Sixty-four (92.8%) cases were non-reactive for both p16 IHC and HR-HPV ISH. Four (5.8 %) cases demonstrated only p16 immunoreactivity. One (1.4%) case, from the floor of the mouth, demonstrated both p16 and HR-HPV ISH reactivity.

Conclusion: In this cohort of OSCC, HR-HPV prevalence was low. These results support the more aggressive conventional treatment of OSCC. In view of the discordance in 5.8% of the cases, investigation of other potential HPV etiologic types is warranted.

Acknowledgements

Research Day Organizing Committee

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Paul Gardner

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