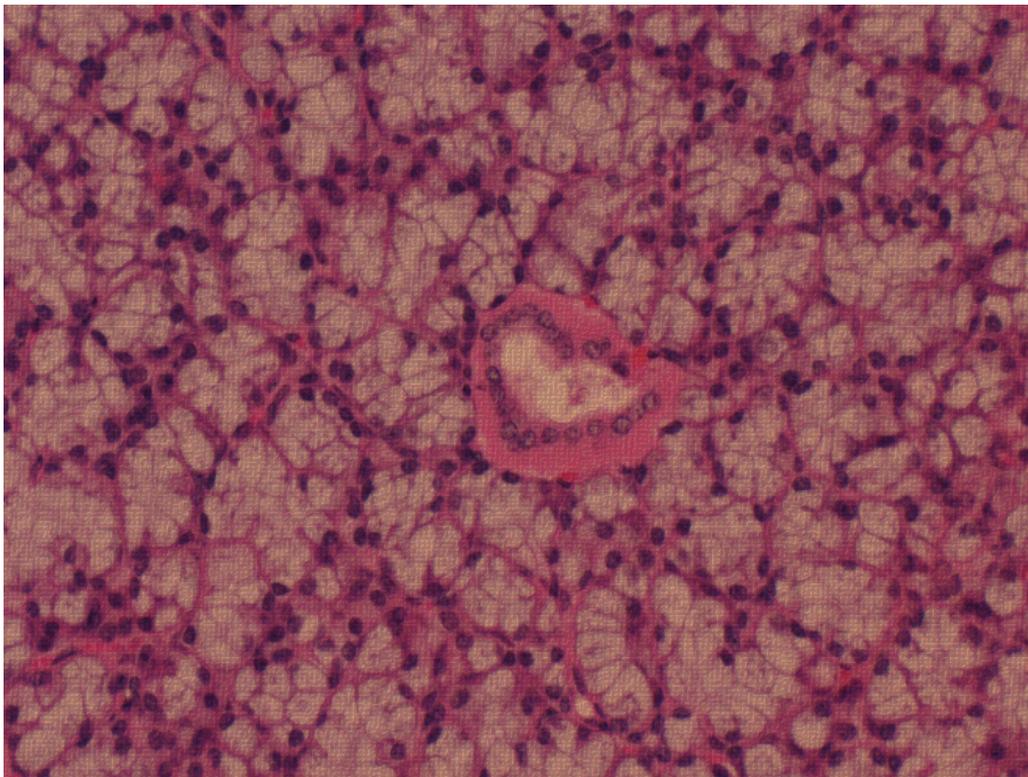




**ADAMS SCHOOL  
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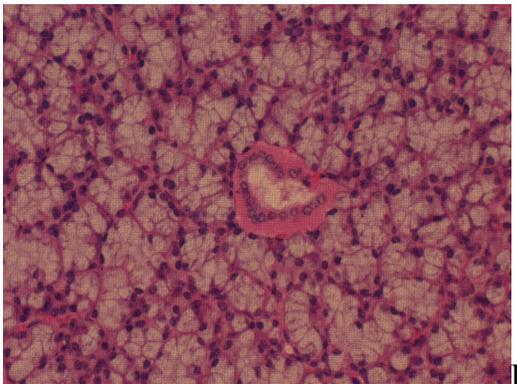
UNC-CH Adams School of Dentistry

**37<sup>th</sup> RESEARCH DAY**  
**March 17, 2021**



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**Cover image taken by:**

Adele Musicant, postdoctoral researcher, Adams School of Dentistry, University of North Carolina at Chapel Hill

Research mentor: Antonio Amelio

[“Heart-shaped salivary gland duct”](#).

## WELCOME LETTERS

Dear Colleagues,

We would like to welcome everyone to the 37th Annual Dental Research Day. This year we will have a hybrid meeting, with both virtual and selected in-person events. At the Adams School of Dentistry, we are committed to inspiring, creating and supporting all aspects of Discovery and Innovation. This is highlighted by the diverse, inspiring and high-quality accomplishments of our students, faculty, staff, research fellows and visiting scholars being shared at the Annual Dental Research Day.

It is clear from the array of work to be presented, that investigators within the School interact and collaborate with investigators on the UNC-CH campus, as well as with leading investigators and institutions elsewhere in the United States and abroad. Indeed, we are very excited to have 56-oral and poster presentations and keynote address by Dr. Rena D'Souza, DDS, MS, PhD, Director of the National Institute for Dental and Craniofacial Research, National Institutes of Health. She is a clinician-scientist that has been strongly committed to discovery and mentoring throughout her academic career.

In addition, there will be 5 virtual seminars and 2 in-person hands-on workshops. This year, the Research Day Executive Committee created the new Steven Offenbacher Excellence in Dental and Craniofacial Research Award. This research award offered by the ASOD recognizes Dr. Offenbacher's contributions to the field of dental and craniofacial research.

It is our hope that you enjoy the day's activities designed to promote the fellowship of Discovery and Innovation and crafted by the organizing committee which includes the North Carolina Section of the American Association of Dental Research and the local chapter of the Student Research Group.

We are excited to share in the day's experiences with each of you,



*Shannon Wallet*

Shannon Wallet, PhD, Associate  
Dean for Discovery and Innovation



*Julie Byerley*

Julie Byerley, MD, MPH, interim Dean of the  
Adams School of Dentistry

Dear Colleagues,

We are thrilled to welcome you to the UNC-Chapel Hill, Adams School of Dentistry 37th Annual Research Day. This year is especially exciting because it is the first time the event will be hosted in a hybrid format with virtual sessions and select in-person events. It is a day of celebration which enables students, trainees of all levels, faculty, staff, visiting scholars, alumni, and exhibitors to engage with one another and present their research accomplishments towards which they have worked so hard.

The North Carolina Section of the American Association for Dental Research (NCAADR) and the local chapter of the Student Research Group are excited to see how this historic event continues to grow every year and are eager to experience the opportunities provided by a hybrid format. Despite the setbacks and challenges everyone has faced due to COVID-19, we have 56 poster and oral presenters: 16 dental students, 25 masters and PhD students, 9 post-doctoral fellows and visiting scholars, 2 undergraduate students, 3 staff members, and 1 faculty member. The research presented covers a variety of fields including Biomaterials/Dental Materials, Craniofacial and Skeletal Biology, Cancer Biology, Education Research, Imaging/Therapeutic Modalities, Population and Epidemiology, Social Science, and Tissue Repair/Regeneration/Wound Healing. We are honored to welcome Dr. Rena D'Souza, D.D.S., M.S., Ph.D., who is currently serving as the director of NIH's National Institute of Dental and Craniofacial Research (NIDCR), as our keynote speaker. Her presentation on "How Science and Technology Advances will Shape the Future of Oral Health Research" supports our school's mission of becoming the global model for oral health education, in care and discovery. We would also like to thank all of our seminar and workshop leaders, presenters, attendees, and event sponsors for supporting our researchers and helping make this a day full of scientific exchange and collaboration.

We hope you all have a great day as you explore the achievements of our researchers and we look forward to another successful scientific event!



*Mustafa Girnary*

Mustafa Girnary, Second year DDS student  
President Student Research Group



*Julie Marchesan*

Julie Marchesan, DDS, PhD. Assistant  
Professor, President NC-AADR



Dr. Rena N. D'Souza

## RESEARCH DAY KEYNOTE PRESENTATION

12-1PM, Wednesday March 17, 2021

Virtual presentation

Please visit <https://dentistry.unc.edu/discovery/research-day/> (under event registration)

### **How Science and Technology Advances will Shape the Future of Oral Health Research**

**Rena N. D'Souza, DDS, MS, PhD**

Director, National Institute of Dental and Craniofacial Research

In this presentation, Dr. D'Souza will talk about the recent increase in knowledge of the genetic and molecular control of craniofacial and palatal morphogenesis. However, the interactions between signaling pathways that regulate the growth and fusion of palatal shelves are largely unknown. Since it is the interaction between molecules rather than the intrinsic functions of any individual gene product that is responsible for the orchestration of pattern formation, this is an important problem that is critical to resolve. For the first time, we show that the Wnt gene signaling pathway is important in palatogenesis. Our data also illustrate the importance of the role of ectodysplasin (Eda/r) signaling in the Pax9-mediated tooth agenesis and cleft palate formation we further delineate the roles of signaling pathways. Controlled in-utero delivery of small molecule Wnt and Eda agonist therapy consistently induces palatal shelf closure in Pax9 mutant mouse embryos. Collectively, these studies advance our understanding of how key signaling pathways interact during normal and abnormal palate formation. Such basic science knowledge will provide a strong biologic rationale for the development of safe therapies that can prevent or correct cleft defects in humans.

In the concluding segment of the talk, information will be shared on The National Institute of Dental and Craniofacial Research (NIDCR) which is the U.S. federal government's lead agency for scientific research on dental, oral, and craniofacial health and disease. NIDCR funds a dynamic portfolio of dental, oral, and craniofacial research spanning basic, translational, social and behavioral, and clinical research domains, and supports a strong research workforce through research training and career development awards.

Dr. D'Souza is the Director of the National Institute of Dental and Craniofacial Research, National Institutes of Health. She is deeply committed to the organization's mission — to improve dental, oral and craniofacial health — and believes the institute plays a key role in how oral health care is delivered.

Prior to becoming NIDCR's director, Dr. D'Souza served in the position of Associate Vice Provost for Research for the University of Utah and as Assistant Vice President for Academic Affairs and Education for the Health Sciences. She held the Ole and Marty Jensen endowed chair in the School of Dentistry where she served as inaugural dean. As a clinician-scientist, D'Souza has been strongly committed to discovery and mentoring throughout her academic career. She is a past president of the American Association for Dental Research (AADR) and the International Association for Dental Research (IADR).

She has authored over 150 publications and book chapters in the areas of craniofacial development, matrix biology and tissue regeneration for over 30 years. She is a Fellow of AAAS and also of AADR. Dr. D'Souza received the Presidential Award for Research Excellence from the Texas A&M Health Science Center in 2010 and was inducted into the German National Academy of Sciences in 2012. She was recognized as the Columbia University College of Dental Medicine's Birnberg Research Medal in 2016 and received the Irwin D. Mandel Distinguished National Mentoring Award in 2017.

Dr. D'Souza will maintain an active research laboratory in the National Institute of Child Health and Human Development (NICHD), NIH.

## SCHEDULE OF EVENTS

### March 17, 2021 (Wednesday)

Time	Activity
7:30-8:30am	Login set-up and vendor set-up
8:30am-4:30pm	Exhibition open
8:30-8:40am	Welcome and opening remarks Julie Byerley, MD, MPH. Interim Dean, UNC Adams School of Dentistry Julie Marchesan, DDS, PhD. President NC-AADR
8:45am-10:15am	Virtual Oral presentations (with award competitions*)
10:15am-11:45pm	Virtual poster presentations (with award competitions*)
12-1pm	Keynote Presentation (virtual presentation) “How science and technology advances will shape the future of oral health research” presented by Dr. Rena D’Souza
2:30-4:30pm	- Seminars and Workshops (by registration only) - Vendor exhibition (ASOD atrium and virtual)

### March 19, 2021 (Friday) – SAVE THE DATE!

Time	Activity
12-1pm	Award ceremony at the Adams School of Dentistry (in person, by registration only – Koury G405).

## ORAL PRESENTATIONS

To access the virtual presentations, please visit <https://dentistry.unc.edu/discovery/research-day/> (under event registration).

## SEMINARS

**Seminar 1:** How to conduct high quality clinical research at the ASOD

**Presenter**

Shannon Wallet, PhD

**Learning objectives:**

- 1) To increase your general knowledge about the logistics of conducting clinical research
- 2) To learn about the different types of clinical research and trials
- 3) To understand the opportunities for developing research at the UNC GoHealth Clinical Center
- 4) Learn about the types of services that the clinical center can offer to conduct a clinical project of the highest quality possible

**Seminar 2: Oral Cavity at the COVID-19 Crossroads: Infection, Transmission, and Prevention**

**Presenters**

**Jennifer Webster-Cyriaque DDS PhD**

Professor, Division of Craniofacial and Surgical Care, ASOD-UNC

Professor, Division of Oral and Craniofacial Sciences, ASOD-UNC Professor, Department of Microbiology and Immunology, School of Medicine-UNC

Director, Viral Oral Infections in Immunosuppression and Cancer (VOIICe)

PI and Director, Mechanisms of Translation Realizing Discovery and Understanding the Pipeline CTSA Post-Doctoral Program, UNC

**Kevin Byrd, DDS, PhD**

Research Assistant Professor in the Division of Oral & Craniofacial Health Sciences.

**Learning objectives:**

- 1) To understand the known viral epidemiology of the current pandemic
- 2) To understand the systemic and oral pathogenesis and transmission dynamics of SARS CoV2
- 3) To understand the diversity of human oral cell types that comprise the two distinct niches in adults
- 4) To discover how oral cell subpopulations are at-risk for infection broadly by viruses such as SARS-CoV-2
- 5) To learn how infection of the oral tissues sets up a silent transmission axis in COVID-19.

**Seminar 3: How to effectively manage your research program**

**Presenter**

**Susan Pusek, DRSc**

Director, Education Programs, NC TraCS Institute, University of North Carolina at Chapel Hill

**Learning objectives:**

- a) Understand the importance of project management for success
- b) Apply skills of project management to managing one's research project
- c) Run effective meetings
- d) Anatomy of NIH RFA

**Seminar 4: Presentation and Discussion of Oral and Maxillofacial Pathology Cases**

**Presenter**

**Ricardo Padilla, DDS**

Board Certified Oral and Maxillofacial Pathologist, Residency Director – UNC Oral and Maxillofacial Pathology

Kaneda Distinguished Associate Professor of Oral and Maxillofacial Pathology

Division of Diagnostic Sciences, Adams School of Dentistry, University of North Carolina at Chapel Hill

**Learning objectives:**

- 1) To understand the clinical, radiographic, microscopic, and laboratory findings of common and uncommon cases of oral and maxillofacial pathologic conditions
- 2) To learn how to progress through the diagnostic process and management of each of the cases presented.

**Seminar 5:** The future of radiology in dentistry: where are we now and where are we going?

**Presenter:**

**Donald A Tyndall DDS, MSPH, PhD, FICD**

Diplomate ABOMR

Professor, Department of Diagnostic Sciences

**Learning objectives:**

- 1) To increase your knowledge of future trends in dental radiology
- 2) Increase understanding of how they will be applied in the practice of dentistry

## WORKSHOPS

In person workshops have a limit capacity of 20-30 participants – by registration only

**Workshop 1:** The Use of Soft Tissue Substitutes for Ridge Preservation and Root Coverage Procedures

**Presenter**

Thiago Morelli, DDS, MS

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

**Room number:** ASOD Koury, 1405 and 1411 (SimLab)

**Learning objectives:**

- a) Understand how to select cases that require soft tissue augmentation
- b) Learn about the techniques and materials currently available - the scientific evidence to support it
- c) Hands-on experience practicing soft tissue grafting

**Workshop 2:** Guided surgery: now and the future

**Presenters**

**Matthew Mason, DDS, MS, PhD**

Assistant Professor - Periodontology

UNC Adams School of Dentistry

**Room number:** ASOD Koury, G508

**Marta Musskopf, DDS, MSD, PhD**

Postdoctoral Research Associate - Periodontology

Division of Comprehensive Oral Health

UNC Adams School of Dentistry

**Renata Camino Navarro, DDS, MS**

Assistant Professor - Prosthodontics

Division of Comprehensive Oral Health

UNC Adams School of Dentistry

**Learning objectives:**

- a) Learn about dynamics guiding of implant placement
- b) Understand how to introduce novel technologies into your treatment plan
- c) Understand the differences between static and dynamic guided surgery

## PRESENTATION SCHEDULE

To access the virtual presentations, please visit <https://dentistry.unc.edu/discovery/research-day/>

(under event registration).

<b>Oral Sessions (8:45-10am)</b>	<b>Time</b>	<b>Presenter</b>	<b>Title</b>
<b>Craniofacial and Skeletal Diseases</b>	8:45-9am	Thomas Brader	Improved Quality of Life in Post-condylectomy Patients: A Retrospective Analysis
	9-9:15am	Mary Morgan Bitler Keyser	Orthognathic Speech Pathology: Impacts of Anterior Open Bite on Speech
	9:15am-9:30am	Marta Musskopf	Minipig Intraoral Dental Implant Model - Meta-Analysis on Osseointegration
	9:30-9:45am	Miguel Simancaras-Pallares	Patterns of Fillings, Crowns, and Extractions in the Primary Dentition
<b>Regeneration and Biomaterials &amp; Dental Materials</b>	8:45-9am	Amanda Finger Stadler	Evaluation of a Novel Alloplastic Biomaterial
	9-9:15am	Mylan Young	Low-Intensity Pulsed Ultrasound (LIPUS) Effect on Murine Skeletal Muscle Regeneration

	9:15am-9:30am	Matthew Pham	Accuracy of Patient Specific Plates During Lefort I Osteotomy
	9:30-9:45am	Anastassia Dokova	Tooth Autotransplantation: Current Practices, Barriers to Adoption and Future Directions
<b>Social Science and Population &amp; Epidemiology</b>	8:45-9am	Katelyn Cass	Patient and Caregivers Perceptions on Animal Assisted Therapy in Orthodontics.
	9-9:15am	Daniel Lee	Identifying factors that impact general dentist referrals to orthodontists
	9:15am-9:30am	Jeffrey Goldsmith	NC Medicaid: Participation and perceptions among orthodontists. A 15-year update.
	9:30-9:45am	James Zhong	Traumatic Dental Injury Risk Appraisals by Orthodontists and Pediatric Dentists
	9:45-10am	Joshua Raisin	Barriers to oral health care for transgender and non-binary populations
<b>Therapeutics and Patient Care</b>	8:45-9am	Kshitij Parag-Sharma	Elucidating the Molecular Mechanisms Governing Drug Tolerance in Salivary-Gland Cancer
	9-9:15am	William Seaman	Lateral Flow Assays Detect Sars-CoV-2 N-antigen/anti-Sars-CoV-2 IgG/IgM in Patient Saliva
	9:15am-9:30am	Liesl Jeffers-Frances	Metal Nanoparticle As A Shield Against SARS-CoV-2
	9:30-9:45am	Tanner Anderson	The Reliability of Rugae Superimposition in Rapid Palatal Expansion Cases
	9:45-10am	Brittanie Almitra Height and Monique Duru	Creating a Medical-Dental Referral Pipeline for Patients with Diabetes.
<b>Poster sessions (10:15-11:45am)</b>			
<b>Poster Session 1 (10:15-10:45am)</b>	<b>Time</b>	<b>Presenter</b>	<b>Title</b>
<b>Craniofacial and Skeletal Diseases</b>	10:15-10:20am	Mustafa Girnary	Caspase-1-mediated Periodontal Bone Destruction is Sex-dependent
	10:20-10:25am	Vinicius de Paiva Gonçalves	Systemic Dietary Hesperidin Affects Osteoclastogenesis and Ligature-induced Alveolar Bone Loss

	10:25-10:30am	Trevor Oliverson	Extended Antibiotics After Orthognathic Surgery Do Not Lower Infection Rates
	10:30-10:35am	Ali Altitinch	The therapeutic role of CDDO-Me in modulating Nrf2 to control TLR-induced inflammation in human oral keratinocytes.
	10:35-10:40am	Anna Farrell	Dysbiosis During Experimental Periodontitis Development
	10:40-10:45am	Clare Blocklage	Orthodontic Loading Activates Cell-Specific Autophagy In A Force-Dependent Manner
<b>Biomaterials/Dental Materials and Regeneration</b>	10:15-10:20am	Zaid Badr	Strength and Survivability of Zirconia Crowns as a Function of Ytria Concentration.
	10:20-10:25am	Tariq Alsahafi	In-vitro wear of bulk-fill resin composites after thermo-mechanical loading
	10:25-10:30am	Ali Altak	Light-cure Irradiance, Energy and Tip Distance Through Resin-based CAD/CAM Materials <sup>[1][2]</sup> <sub>SEP</sub>
	10:30-10:35am	Coco Roening	Geographical variations in microbiota from immature teeth with necrotic pulp
	10:35-10:40am	Lauren Katz	Differential Mechanisms of Craniofacial Myogenesis Offer Insight into Regenerative Therapies
<b>Poster Session 2 (10:45-11:20)</b>			
<b>Population and Epidemiology</b>	10:45-10:50am	Zachary Burk	Clinical Patterns of Primary Dentition Developmental Defects of the Enamel
	10:50-10:55am	Meredith Davis	Adiposity and Oral Health in North Carolina Preschool-age Children
	10:55-11am	Anna Batorsky	Dental Utilization Differences in Older Adult U.S. Birth Cohorts
	11-11:05am	Amrita Temble	Sociodemographic Factors and Older Adults' Self-Rated Oral Health Status, 2008-2018
	11:05-11:10am	Emily Imes	Guardian-Reported Child Oral Health Correlates with Untreated Disease and Toothaches
	11:10-11:15am	Poojan Shrestha	Lower Caries Experience Among Children with Dental Homes

	11:15-11:20am	Breanne Smith	Examining Caregiver Oral Health Literacy and Children Oral Health Status
<b>Social Sciences/Clinical Studies</b>	10:45-10:50am	Hannah Archer	Oral Health Content Lacking on Non-Dental Safety Net Clinic Websites
	10:50-10:55am	Gabriella Gallo & Deborah Liu	Identifying COVID-19's Impact on Dentists' Workforce Confidence and Workflow Changes
	10:55-11am	Amanda Swanson	"No Wrong Door" to Hypertension Control: Interprofessional Service-Learning in Dentistry
	11-11:05am	Jason Tasoulas	A SEER Database Analysis of Adenoid Cystic Carcinoma Patient Survival
	11:05-11:10am	Caroline Meier	Hybrid Pain Management Strategy Limits Left-over Opioid Doses
	11:10-11:15am	Kevin Chan	Pseudoaneurysms After Lefort I Osteotomy
	11:15-11:20am	Elisa Hannah	Actively Growing Unilateral Condylar Hyperplasia in a Heterogenous Population
<b>Poster Session 3 (11:15-11:55am)</b>			
<b>Education</b>			
	11:15-11:20am	Kamaira Philips	Exploring A Career In Academic Dentistry
	11:20-11:25am	Kristen Cockrell	Evaluating Student Preparedness Towards Providing Oral Healthcare For Hemophilia Patients
	11:25-11:30am	Wai-Sum Leung	Implementing Environmental Sustainability Educational Intervention in Dental Hygiene Instruction
	11:30-11:35am	Hannah Cheung	Dental Hygiene Curricula: Treating Patients with Intellectual and Developmental Disabilities
	11:35-11:40am	Taylor Schmidt	Poverty Simulation and Extramural Rotations: Connecting the Dots?
	11:40-11:45am	Sarah Liebkemann	Web-based unfolding case study in an interprofessional online class
	11:45am-11:50am	Sarah Morgan	Learners as Leaders: Quality Improvement Methodology in Pre-Doctoral Dental Education

	11:50-11:55am	Ellen Stewart	Preclinical virtual removable partial denture survey and design
<b>Bioinformatics/Imaging and Therapeutic Modalities</b>			
	11:15-11:20am	Ryan Murphy	SYNGR3 Expression has Diagnostic Value in HPV16-associated HNSCC
	11:20-11:25am	Adam Hoxie	Micro-CT as Reference Standard for Early Carious Lesion Activity Assessment
	11:25-11:30am	Colin LaPrade	Doses Associated With Variable Collimator Distances During Bitewing Examinations
	11:30-11:35am	Margaret McGuire	Geographic Tongue as a Reaction-Diffusion System
	11:35-11:40am	Hudson Spangler	SculptorHD: A Web-Based Rendering Application for Communicating Dental Conditions
	11:40-11:45am	Samantha Jhingree	Validation of Spectral Moment Analysis to Characterize Speech Distortion Severity

## ABSTRACTS

### ORAL PRESENTATIONS

#### Craniofacial and Skeletal Diseases

##### **1) Improved Quality of Living Following Combined Condylectomy and Orthognathic Surgery: A Retrospective Analysis for Active Unilateral Condylar Hyperplasia**

Brader T<sup>1</sup>, Bhatt P<sup>1</sup>, Turvey TA<sup>1</sup>

<sup>1</sup>Department of Oral and Maxillofacial Surgery, School of Dentistry, University of North Carolina at Chapel Hill

**Objectives:** To assess quality of life in patients who underwent combined condylectomy and orthognathic surgery in conjunction with orthodontic treatment for active unilateral condylar (TMJ) hyperplasia. This pathologic process can lead to the development of esthetic and functional concerns. High condylectomy (7-10mm of bone removed from condylar process) is the treatment studied, but currently, there is no published literature that analyzes patient satisfaction. **Methods:** 61 patients who underwent simultaneous condylectomy and orthognathic surgery for active unilateral condylar hyperplasia at UNC hospitals between 2004-2017 (minimum 4 years postop) were mailed a questionnaire containing 21 questions to assess their quality of life after undergoing high treatment. All patients underwent orthodontic treatment. **Results:** 25 (41%) patients completed the questionnaire. 17 (68%) were female and 8 (32%) were male. 24 (96%) reported that that they are satisfied with their results. Even after fully realizing everything involved with treatment, these 24 respondents endorsed that they would do it again. Benefits of treatment included appearance change, improved mastication, reduction of discomfort and improvement of

jaw functioning etc. Indication for treatment differed for each patient but when polled on their greatest benefit derived from treatment, 13 (52%) reported appearance change, 19 (76%) reported improved mastication and 7 (28%) reported reduction of discomfort (ten respondents provided more than one “greatest benefit”). Overall, 9 (36%) patients endorsed TMJ pain prior to surgery and 6 (66%) of those individuals reported that they no longer suffer from TMJ arthralgia of any magnitude. Furthermore, 10 (40%) patients reported “clicking” prior to treatment, with 13 (52%) reporting “clicking” afterwards. Of the 25 surveyed patients, 9 (36%) reported frequent headaches prior to treatment. 100% of these individuals reported a decrease in frequency and intensity of headaches since treatment. Based on the preoperative clinical findings of the 25 patients, 13 (52%) patients were classified as Type I (Hemimandibular Elongation), 4 (20%) were Type II (Hemimandibular Hyperplasia) and 8 (32%) were Type III (combination of type I and type II), according to the Obwegeser and Makek classification of condylar hyperplasia. **Conclusion:** Overall, a significant majority of patients undergoing simultaneous condylectomy and orthognathic surgery combined with orthodontics benefited from treatment. This is important for healthcare providers when considering referral for condylar hyperplasia. Prior to this data, treatment was agreed upon between provider and patient based on the practical idea that surgical intervention will improve quality of life. Now, potential patients can be educated on tangible treatment outcomes when determining whether or not to pursue treatment, regardless of their presenting concern.

## **2) Orthognathic Speech Pathology: Impacts of Anterior Open Bite on Speech**

Keyser MMB<sup>1</sup>, Zajac D<sup>1</sup>, Bocklage C<sup>1</sup>, Oliver S<sup>1</sup>, Mielke J<sup>2</sup>, Jacox L<sup>1</sup>.

<sup>1</sup>Division of Craniofacial and Surgical Sciences, Orthodontics, Adams School of Dentistry, UNC-CH, <sup>2</sup>Department of English, Linguistics Program, North Carolina State University Raleigh, NC

**Objectives:** Speech-sound disorders (SSDs) are seen in 80% of dentofacial deformity (DFD) subjects compared with 5% of the general population, impacting communication and quality of life, but the causal link is unknown. We hypothesize there are both qualitative and quantitative differences in spectral properties of stop (/t/ or /k/), fricative (/s/ or /ʃ/), and affricate (/tʃ/) consonant sounds and that severity of anterior open bite (AOB) jaw disharmony correlates with degree of speech abnormality. **Methods:** To test our hypotheses, orthodontic records and audio recordings were collected from DFD patients (n=39 AOB, 62 controls). A speech pathologist evaluated subjects and recordings were analyzed using spectral moment analysis (SMA) to measure sound frequency distortions. **Results:** A significant (p<0.01) increase in the centroid frequency (M1) was seen in the /k/, /t/, and /tʃ/ phonemes of “all AOB” subjects compared to the controls. Stratifying the AOB sample by anterior-posterior, M1 differences were noted for additional phonemes in Class II and III subgroups, indicating possible interaction between the vertical and anterior-posterior (AP) dimensions. Using linear regression, correlations between AOB skeletal severity (assessed via cephalometric measurements) and articulation distortion were found for /k/ and /t/ phonemes. **Conclusions:** A higher prevalence of qualitative SSDs and significant quantitative spectral distortions in consonant phonemes were seen in AOB patients compared to controls. Additionally, severity of skeletal AOB is correlated with the degree of SSD for consonant phonemes. These findings provide insight into the interplay between craniofacial and vocal structures, and elucidate how the treatment of DFD may impact speech-sound disorders.

## **3) Minipig Intraoral Dental Implant Model - Meta-Analysis on Osseointegration**

Musskopf ML<sup>1</sup>, Finger Stadler A<sup>1</sup>, Wikesjö UM<sup>1</sup>, Susin C<sup>1</sup>.

<sup>1</sup>Laboratory for Applied Periodontal & Craniofacial Research Division of Comprehensive Oral Health, Periodontology, Adams School of Dentistry, University of North Carolina at Chapel Hill

**Objectives:** Minipig models are increasingly used to evaluate dental implant technologies, however, no systematic evaluation of their utility has been reported to date. The aim of this meta-analysis was to estimate osseointegration patterns in the Minipig Intraoral Dental Implant Model and explore factors that may affect osseointegration. **Methods:** A systematic review including PubMed and EMBASE databases through 2020 was conducted. Two independent examiners screened titles/abstracts and selected full-text articles (published in English, Spanish or Portuguese) reviewed by one examiner for eligibility. Studies were included when titanium implants had been placed into native alveolar bone, and mean±SD was reported or could be estimated. Assessment of risk for bias was performed to ascertain treatment allocation, examiner masking, and calibration. Random-effects meta-analyses and meta-regressions were done using bone-implant contact (BIC) as the main outcome. **Results:** The search yielded 249 titles of which 198 abstracts and 124 full-text articles were reviewed. 47 original studies qualified for the quantitative analysis. Randomization, masking, and calibration were reported in 51% (n=24), 25% (n=12) and 8% (n=4) of studies, respectively. Overall, BIC mean was 61.6% (95%CI: 59%-64.28%). BIC increased significantly over time (p<0.001): 43.6% (95%CI: 36.2-51) at 2 weeks, 58.4% (95%CI: 53.9-63) at 4 weeks, and 68% (95%CI: 65.1-71) after 4 weeks. Immediate implants exhibited significantly lower BIC than implants that were placed into healed ridges (coef: 20.18±4.5, p<0.0001). Non-loaded implants featured significantly lower BIC than loaded implants (coef: 10.1±4.7, p=0.03). No significant differences were observed for animal characteristics (strain or age), post-extraction healing time, and arch. **Conclusions:** The Minipig Intraoral Dental Implant Model appears to demonstrate osseointegration patterns similar to that observed in humans. This conclusion should be interpreted with caution however due to the limited number of studies evaluating osseointegration histologically in humans. **Funding Source:** Nobel Biocare

#### **4) Patterns of Fillings, Crowns, and Extractions in the Primary Dentition**

Simancas-Pallares M<sup>1</sup>, Spangler H<sup>1</sup>, Ginnis J<sup>1</sup>, Vann Jr WF<sup>1</sup>, Wright T<sup>1</sup>, Ribeiro A<sup>2</sup>, Divaris K<sup>1</sup>.

<sup>1</sup>Division of Pediatric and Public Health, Adams School of Dentistry, UNC-CH; <sup>2</sup>Division of Diagnostic Sciences, Adams School of Dentistry, UNC-CH.

**Objective:** Early childhood caries (ECC) is a broad disease definition that includes restored and unrestored disease as well as varying levels of severity. Caries lesions are distributed according to clinically recognizable patterns (e.g., smooth surfaces *versus* pits and fissures) but little is known about patterns of restorative and surgical ECC management (i.e. fillings, crowns and extractions). In this investigation our aim was to identify patterns of fillings, crowns, and extractions in a large sample of preschool-age children. **Methods:** We relied upon clinical surface and tooth-level information on restorations and extractions from a community-based sample of children ages 3-5 [N=6,404 of which 30% (n=1,940) from an epidemiologic study of early childhood oral health in North Carolina who had at least one restoration or extraction due to caries. To identify patterns (i.e., latent classes) of fillings, crowns and extractions in the primary dentition, teeth and individual surfaces were treated as binary latent class indicators of treatment and were entered in latent class analysis (LCA). The optimal number of classes was determined using model-fit criteria and clinical relevance. Analyses were undertaken using Mplus v.8.5 (Muthén & Muthén, Los Angeles, USA). **Results:** We identified 3 patterns of fillings, 5 patterns of crowns, and 3 patterns of extractions. The prevalence of patterns within each group ranged from 8-60%. The identified latent classes resembled recognizable patterns of surface- and tooth-specific carious lesion distribution

(e.g., molars, maxillary incisors, and combinations) and exhibited a high degree of ipsilateral symmetry. **Conclusions:** The identified patterns of restorations and extractions in the primary dentition resemble recognizable patterns of ECC experience. Upon replication and validation in future studies, these clinical patterns may prove informative for children's oral health trajectories in the mixed and permanent dentitions. **Funding source:** NIH/NIDCR - U01DE025046.

### **Biomaterials/Dental Materials and Regeneration**

#### **5) Evaluation of a Novel Alloplastic Biomaterial**

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**Objectives:** To evaluate the bone regenerative potential of two novel alloplastic biomaterials using a critical-size rat calvarial defect model. **Methods:** Fifty-six, adult, male, Sprague-Dawley rats, 11-12 weeks old, weighing 310-510g were randomized into 8 groups of 7 animals. An 8-mm critical-size calvaria defect was created, and each group received one of the following treatments: sham surgery (negative control), deproteinized bovine bone mineral (DBBM) + collagen membrane (CM, positive control), poly-(lactic-co-glycolic-acid) (PLGA) coated pure phase  $\beta$ -tricalcium phosphate (TCP), or PLGA coated 60% hydroxyapatite (HA) + 40%  $\beta$ -TCP composite. The groups were divided into 2- and 6-week healing intervals. uCT was used to evaluate mineralized tissue inside the defect and biomaterial displacement. **Results:** Significantly greater mineralized tissue volume was observed in the biomaterial groups when compared to the sham controls at both time points; no significant differences were observed among biomaterials. There was a significant increase in mineralized tissue from 2 to 6 weeks. Biomaterial vertical displacement was greatest at 2 weeks and decreased by 6 weeks. Vertical displacement could largely be explained by hematoma formation under the biomaterial. Lateral displacement was minimal for the candidate biomaterials, but significantly greater for the DBBM group, despite the use of a collagen membrane for biomaterial containment. **Conclusions:** Within the limits of this study, PLGA coated  $\beta$ -TCP and PLGA coated HA/ $\beta$ -TCP showed comparable mineralized tissue formation to DBBM + CM. These biomaterials demonstrated less lateral displacement than the DBBM + CM group and were able to maintain their overall geometry throughout the duration of the study. Histological analysis is needed to qualify the nature of the mineralized tissue observed.

#### **6) Low-Intensity Pulsed Ultrasound (LIPUS) Effect on Murine Skeletal Muscle Regeneration**

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**Objectives:** Low-intensity pulsed ultrasound (LIPUS) is an FDA-approved method for healing of bone fractures. It is also used for deep muscle tissue injuries; however, little evidence exists on the effect of LIPUS on skeletal muscle regeneration for tissue engineering purposes. This pilot study aimed to (1) modify tissue culture bioreactors for the application of LIPUS, and; (2) investigate the effects of LIPUS on murine skeletal muscle cell proliferation and differentiation, and muscle fiber hypertrophy. **Methods:** Custom-made tissue culture bioreactors were modified to provide 1.7MHz LIPUS. C2C12 murine skeletal muscle cells and multinucleated muscle fibers were

subjected to 20 minutes of LIPUS every 24 hours over a 5-day period. Negative controls were grown under the same conditions and not subjected to LIPUS. At days 1, 3, and 5, samples were stored in TRIzol™, frozen at -20°C, or fixed with 2% paraformaldehyde for later analysis using RT-PCR, CyQUANT assay, and immunocytochemistry respectively. Cell proliferation was determined using the CyQUANT assay and direct cell counting. Cell differentiation was determined by gene expression of the muscle regulatory factors, MyoD1 and myogenin, and quantification of the fusion index. Fiber hypertrophy was determined using ImageJ (NIH) software. **Results:** Bioreactors were successfully modified to provide consistent LIPUS at 1.7MHz. Cell proliferation at day 1 was greater for the LIPUS-negative cells. However, by day 5, there was a greater number of LIPUS-positive cells (non-significant). Cell differentiation and fiber hypertrophy were present in both groups – once again, this was not statistically significant. **Conclusion:** LIPUS exposure is not detrimental to murine skeletal muscle cells and multinucleated fibers. Future work will focus on studying the LIPUS parameters of intensity and time to identify the optimal parameters for accelerated skeletal muscle regeneration.

## 7) Accuracy of Patient Specific Plates During Lefort I Osteotomy

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**Objectives:** Compare actual versus predicted vertical and horizontal maxillary movements after Lefort I osteotomy when utilizing patient-specific plates. **Methods:** The study was a retrospective chart review. Inclusion criteria were patients whose surgeries were planned virtually, underwent Lefort I osteotomy, and were fixated with patient-specific implants. Movements were measured using pre-and post-operative lateral cephalograms. Patients without adequate imaging or a diagnosis of a craniofacial syndrome were excluded. The primary outcome variable was the difference between the predicted and actual movements. Explanatory variables were large movements (greater than 9 millimeters (mm)) and single jaw versus bimaxillary surgery. **Results:** Twenty patients were included. Four underwent Lefort alone while 16 had bimaxillary surgery. Eight patients had no planned large movements. The 12 who did have large planned movements were all in the anterior-posterior (AP) direction. The median planned vertical and horizontal movements were 1.20mm (IQR-0.45,3.05) and 7.80mm (IQR-5.05, 10.05) respectively. The median difference between planned and actual vertical movements was 1.25mm (IQR-0.50,2.55) with a 95% confidence interval of 0.10-2.80 overall for the 20 patients. For the subgroups, the average difference for patients with movements less than 9mm was 1.35 (IQR-0.75,2.45) and 1.20mm (IQR-0.40,2.70) in patients with movements greater than 9mm, 0.7mm (IQR: 0.40,1.30) in patients who underwent Lefort only and 1.7mm (IQR: 0.55,2.65) in patients who underwent bimaxillary surgery. The median difference between planned and actual horizontal movements was 1.70 (IQR-0.70,3.10) with a 95% confidence interval of 0.35-4.35 overall for the 20 patients. The median difference was 2.20mm (IQR-0.65,3.80) in patients with movements less than 9mm, 1.50mm (IQR-0.70,3.05) in patients with movements greater than 9mm, 2.1mm (IQR-1.50,2.60) in patients who underwent Lefort only and 1.3mm (IQR-0.65,3.35) in patients who underwent bimaxillary surgery. **Conclusions:** Patient-specific implants provide an accurate means of obtaining planned vertical and horizontal movements of the maxilla during Lefort osteotomy.

## **8) Tooth Autotransplantation: Current Practices, Barriers to Adoption and Future Directions**

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**Objectives:** Tooth autotransplantation (AT) is a viable treatment option for children with missing teeth—while popular in other parts of the world, it is seldom practiced in North America. To understand AT adoption-related perceptions, experiences, and influences we carried out a two-part, sequential survey and interview study among specialists who primarily care for children with missing teeth in North Carolina. **Methods:** A convenience sample of orthodontists (n=50) and pediatric dentists (n=46) recruited from CE meetings completed an 18-item survey. Maximum variation sampling was used to select participants for a follow-up semi-structured interview until theoretical saturation occurred (n=20). Interviews were digitally recorded, transcribed verbatim, and thematically analyzed using Atlas.ti software. Reporting was based on a priori codes, emerging themes, and insightful quotes. **Results:** Virtually all participants had heard of AT and most (95%) reported being familiar with it; yet only 8% had been involved in the treatment of a patient with AT. Patient selection and acceptance, peer network collaboration, and level of experience emerged as major factors affecting adoption behaviors among providers. Respondents' practice philosophy was influenced by the availability of evidence in the literature, the "implant culture", and preference for simple and esthetic solutions. "Adopters" viewed AT as an alternative standard-of-care, whereas "skeptics" questioned esthetics in the short-term and success in the long-term. **Conclusions:** There is interest and appreciation for AT as a biological solution for managing missing teeth. Establishment of referral centers and promotion from local practice influencers or key opinion leaders emerged as promising avenues for popularizing AT. **Funding source:** Division of Pediatric and Public Health (Department of Pediatric Dentistry).

## **Social Science and Population and Epidemiology**

### **9) Patient and Caregivers Perceptions on Animal Assisted Therapy in Orthodontics**

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**Objectives:** Dental anxiety affects 6-22% of children leading to lifelong dental and orthodontic avoidance. Animal Assisted Therapy (AAT) is used to reduce anxiety and perception of pain in other healthcare settings. **Methods:** To evaluate perceptions of canine AAT in orthodontics, a cross-sectional survey (n=600 total) was conducted of orthodontic patients (n= 400) and caregivers (n=200), half randomized to have a therapy dog present. The Qualtrics survey consisted of validated and pre-tested questions. **Results:** An overwhelming majority of patients and caregivers expressed little to no concern regarding cleanliness (82.9%), allergies (79.8%) and safety (89.3%) with a therapy animal in a dental setting. All groups believe therapy animals make experiences in dental offices more enjoyable (77.5%, p<0.05), and half would preferentially select an office

offering AAT. **Conclusion:** Across all cohorts, responses strongly support use of AAT in orthodontic settings and suggest it could be a practice builder and anxiety-management tool.

### **10) Identifying factors that impact general dentist referrals to orthodontists**

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**Objectives:** Referrals from general dentists are a major source of orthodontic patients, but our knowledge of factors guiding referral decisions is limited. Published reports on referral preferences are dated, despite rapid change in orthodontics, so we aim to conduct a nationwide qualitative and quantitative study to assess interprofessional values and communication methods. Through qualitative interviews and a nationwide survey on inter-doctor referrals and communication, we will understand experiences and identify factors that are important to general dentists in different age brackets when choosing to refer to an orthodontist. We will also assess preferred communication methods between orthodontists and generalists and explore how general dentists evaluate orthodontic outcomes. **Methods:** In the qualitative phase, 23 privately practicing general dentists participated in one-on-one, semi-structured qualitative interviews following a topic guide. A survey was developed based on qualitative findings and distributed nationally to American Dental Association members (n=269). Data were evaluated with descriptive and bivariate statistics. **Results:** Referring general dentists refer to specific orthodontists due to the orthodontist's perceived skill (55%) and proximity to the patient (29%), though 63% of general dentists report "less than ideal" or "severely lacking" orthodontic training. The two most popular communication methods for general dentists are phone calls (58%) and emails (49%). Canine guidance (43%) and overbite & overjet (40%) were the most important occlusal aspects of an orthodontic finish, as judged by generalists. Finally, patient satisfaction (58%) was critical for good working relationships with orthodontists. **Conclusion:** Excellent orthodontic care remains a primary motivator for referrals from generalists to orthodontists. Patient satisfaction and good communication is critical for successful relationships between providers and for maintaining referral streams. **Funding source:** American Association of Orthodontists Foundation.

### **11) NC Medicaid: Participation and perceptions among orthodontists. A 15-year update.**

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**Objectives:** Our objective was to update a study published in 2004 that investigated the participation and perception of licensed, active orthodontists in the North Carolina Medicaid program. Since that time, significant political, health policy, and practice changes have occurred that may have affected acceptance of Medicaid for orthodontic care. Discovering current patterns of Medicaid acceptance in the new practice environment may help guide educational and health policy actions to improve Medicaid utilization. **Methods:** After obtaining permission the survey tool from 2004 was used for direct comparison of data to provide a 15-year update. The survey consisted of 28 Likert-scale questions and was divided into four domains: patient population,

practitioner demographics, practice characteristics, and Medicaid issues. Licensed orthodontists in NC were sent an electronic survey using Qualtrics survey software. Respondents' acceptance of Medicaid was assessed as well as perception of actual and potential barriers to Medicaid acceptance. **Results:** The survey response rate was 43% (n=117), and 64 respondents completed the survey in full (23%). In 2019, 37.5% (n=24) of respondents reported that they currently accept new Medicaid patients, a 56% increase from 2004. In 2019, 37.5% reported a net profit from these cases in contrast to 12.5% of respondents in 2004. For all ten commonly cited barriers to acceptance of Medicaid, providers who never accepted Medicaid reported the problem to be significant more often than current Medicaid providers. All three groups perceived low fee reimbursement to be a significant barrier for participation (P=.0070). No association was found across any demographic or practice characteristics and Medicaid acceptance. **Conclusion:** From 2004 to 2019, there was a notable increase in orthodontic providers who accept Medicaid coverage in NC. More providers reported generating net profit from Medicaid cases in 2019 compared to 2004. Low reimbursement continues to be a significant barrier to Medicaid acceptance.

## 12) Traumatic Dental Injury Risk Appraisals by Orthodontists and Pediatric Dentists

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**Objective:** Traumatic dental injuries (TDI) are common among children and adolescents, and pose clinical challenges requiring interdisciplinary care. Orthodontists and pediatric dentists are engaged in the risk appraisal and management of TDI. This study sought to investigate how orthodontists and pediatric dentists assess TDI risk and its influence on orthodontic treatment recommendations. **Methods:** An online questionnaire was sent to a random sample of 2,101 active members of the American Association of Orthodontists and all 5,906 members of the American Academy of Pediatric Dentistry. The questionnaire collected information about participants' practice characteristics associated with TDI management including practitioner confidence, assessment of TDI risk, and preventive intervention. Analyses relied on descriptive statistics and bivariate testing methods using conventional P<0.05 statistical significance criterion. **Results:** Complete responses were obtained from 394 clinicians from all US states, including 60 orthodontists (3% response) and 334 pediatric dentists (6% response). Respondents were mostly in solo private practice (69%) and had been practicing for an average 16 years. Orthodontists were less comfortable than pediatric dentists in TDI management (28% of orthodontists responded 'very comfortable' vs. 72% of pediatric dentists, P<0.0005). In terms of TDI risk factors, orthodontists and pediatric dentists were remarkably consistent in their rankings: incisor protrusion, increased overjet, previous trauma history, inadequate lip coverage, and team sports participation as the most important. Pediatric dentists considered TDI risk being more important for needing phase I treatment than orthodontists (extremely/very important: 58% vs. 32%, P=0.001). **Conclusions:** While orthodontists and pediatric dentists are consistent in their ranking of TDI risk factors, they differ in their comfort in managing TDIs, as well as their assessments of phase I treatment need due to TDI risk.

## 13) Barriers to oral health care for transgender and non-binary populations

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**Objective:** Despite health disparities and barriers to medical care being well documented in the literature, the oral health status and barriers to dental care for transgender and gender non-binary individuals remain understudied. To address this knowledge gap, this study seeks to examine transgender and non-binary individuals' perceived oral health, as well as their perceptions, experiences, and postulated gender identity-related factors influencing their acceptance or avoidance of dental care. **Methods:** Eligible participants are individuals who self-identify as transgender or non-binary and are at least 12 years of age. Recruitment is done via online postings, listservs, and word of mouth. Information on gender identity, self-reported oral health, perceptions, and experiences related to receiving oral health care services is collected via a 32-item questionnaire designed for this study. The current data analysis relied on descriptive methods including the generation of frequencies, proportions, and ranks. **Results:** To date, 101 transgender and non-binary individuals ages 12-70 (mean age: 33 years) have participated in the study. Almost half of respondents (46%) have not had a dental visit during the last 12 months, and 39% stated their oral health as fair or poor. About a third of participants reported being misgendered very or fairly often, and a similar proportion reported avoiding the dentist very or fairly often because of their gender identity. Virtually all respondents suggested that being addressed by their correct pronouns and their actual (versus their birth) names were important to them when receiving oral health care. **Conclusions:** The preliminary results of the study provide important insights into transgender and non-binary individuals' perceived oral health, experiences and preferences in the dental environment. While these results will need to be verified in larger and more diverse samples, they provide alarming and actionable information regarding this population's oral health and care.

### **Therapeutics and patient care**

#### **14) Elucidating the Molecular Mechanisms that Govern Drug Tolerance in Salivary Gland Cancer**

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**Objectives:** Mucoepidermoid carcinoma (MEC) is the most common salivary gland cancer. Low grade tumors are indolent and effectively treated by surgical resection, but patients with high grade tumors have an abysmal ~35% 5-year survival due to frequent recurrence and metastasis. While tumor growth and progression is driven in part by aberrant EGFR signaling, recent clinical trials have failed to demonstrate therapeutic efficacy of EGFR monotherapies to treat MEC. In this study we sought to elucidate the mechanisms responsible for this apparent resistance to drugs targeting EGFR. **Methods:** Effects of EGFR inhibition was evaluated against 5 MEC cell lines in cell proliferation, apoptosis, cell cycle, 2D colony formation, 3D sphere formation, and cancer stem cell assays. RNA-seq was performed to elucidate the transcriptional pathways and molecular mechanisms driving drug tolerance. **Results:** EGFR inhibitor (EGFRi) monotherapy strongly inhibits MEC cell proliferation ( $IC_{50} = \sim 200$  nM) and causes cell cycle arrest in a dose-dependent fashion. Further, Erlotinib treatment reduced MEC cell 2D colony and 3D tumorsphere formation in a dose-dependent manner. However, no cell death was observed, even *supra*-therapeutic doses of Erlotinib (25  $\mu$ M;  $\sim 80 \times IC_{50}$ ) failed to induce apoptosis. Notably, sustained EGFRi treatment (31 days) did not cause cell death or result in emergence of drug resistance clones but maintained cells in a quiescent state. Bioinformatic analysis of RNA-seq data from EGFRi-induced quiescent cells identified the emergence of an embryonically conserved transcriptional reprogram. **Conclusion:** Salivary MEC cells enter quiescent, drug-tolerant state upon EGFR inhibition. Pharmacologic and genetic inhibition confirmed that this state of suspended animation is not driven by autophagy- or YAP-mediated survival mechanisms. On-going investigations are focused on understating the role of metabolic re-wiring, and towards the development of novel combinatorial therapeutics to overcome this unexpected drug tolerant state.

**Funding Sources:** UNC Cancer Research Funds and NIH/NCATS TraCS Translational Team Science Award (ALA).

### 15) Detection of Sars-CoV-2 N-antigen and anti-Sars-CoV-2 IgG/IgM in Symptomatic Patient Saliva Using Lateral Flow Assays.

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**Objectives:** Rapid detection of Sars-CoV-2 antigens and immunoglobulin (Ig) responses are essential to control virus spread and related global morbidity/mortality. RT-qPCR of nasopharyngeal swabs are in standard use for Sars-CoV-2 detection. We hypothesize that oral fluids provide a readily available sample for the rapid detection of both Sars-CoV-2 and host responses. The study objective was to use lateral flow assays (LFA) to monitor longitudinal viral N-antigen and anti-Sars-CoV-2-specific antibody detection in oral samples from symptomatic Covid-19 patients. **Methods:** LFA was used to detect Sars-CoV-2 N-antigen and Sars-CoV-2-specific anti-S protein RBD. Longitudinally-collected saliva/throat wash (TW) from subjects that were nasopharyngeal RT-qPCR+ were assayed. SARS COV2 RT-qPCR was performed in parallel and N antigen was detected by immunoblot. Archived, pre-Covid-19 saliva/TW served as negative

controls. Antigen and antibody signals were normalized and quantitated using ImageJ. **Results:** In this cohort (n=16) the mean age was 40, 7 participants identified as female, 66% were white, 6% Black, 6% Asian, and 20% were of Hispanic ethnicity. At baseline N-antigen was detected in 56% of saliva samples, in 82% of TW, and only 2/16 were qPCR+ in saliva/TW. Persistent N-antigen was detected in 60% of saliva samples and 83% of TW samples at 4 weeks. At entry, 94%/100% of saliva/TW were Sars-CoV-2 IgG+ and 75%/63% were IgM+. At 4 weeks Sars-CoV-2-IgG (100%/83%) and IgM (80%/67%) persisted in saliva/TW. Oral IgG detection was associated with age (p=0.019). Cough, fatigue, nausea, and composite upper respiratory symptoms were negatively associated with oral IgM levels (p=0.0008, p=0.02, and p=0.004 respectively). **Conclusion:** Important to patient assessment, oral fluids are easily accessible for Sars-CoV-2 N-antigen and Ig detection and both can be rapidly monitored by LFA. Important to both transmission and disease course, we demonstrate viral persistence in oral fluids and show clear relationships between select symptoms and early Ig responses.

### 16) Metal Nanoparticle As A Shield Against SARS-CoV-2

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**Objectives:** The recent emergence of the novel, pathogenic SARS-coronavirus 2 (SARS-CoV-2) and its rapid national and international spread pose a global health emergency. Coronavirus infection requires binding of the viral spike (S) proteins to cellular receptors on the surface of the target cells. Of utmost importance is the ability to create an antiviral that can block viral entry into host cells. Metallic nanoparticles (silver (AgNP), copper (CuNP), aluminum (AlNP) and ions have emerged as novel antiviral agents against numerous viruses, but their antiviral activity against coronaviruses have not been investigated. We hypothesize that metallic nanoparticles can bind to and inhibit the spike proteins of coronaviruses from interacting with the cellular receptor on host cells. **Materials and Methods:** We (1) used computational modeling to determine the optimal metallic nanoparticle (Ag, Al, Cu) that binds to spike coronavirus protein, (2) verified the computational model by creating a coronavirus-like particle that could be used to demonstrate binding of spike with the metallic nanoparticle in-vitro and (3) determined the toxicity of the antiviral metallic nanoparticle on human salivary gland and oral keratinocyte cells. **Results:** The modelling results demonstrated that copper nanoparticle binds to nucleocapsid residues LYS199-ASN202, silver nanoparticle binds to the nucleocapsid residues GLU34 and ARG37 and the main protease glycine heavy region (GLY1, 214, 282). Aluminum nanoparticle binds to the nucleocapsid residues GLN38 and ARG37. In-vitro, copper nanoparticles decrease metabolic activity of human oral cells in a dose dependent manner. Ongoing studies are testing the impact of CuNP on SARSCoV2 nucleocapsid protein self-assembly. **Conclusions** It appears that copper nanoparticles may be useful as an antiviral by binding to the nucleocapsid protein. This may be useful as a protective shield when incorporated into fabric or surfaces in the built environment to prevent viral infection. **Funding Source:** North Carolina Policy Collaboratory

### 17) The Reliability of Rugae Superimposition in Rapid Palatal Expansion Cases

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**Objectives:** The objective of this study was to compare the reliability of palatal rugae landmarks versus maxillary skeletal landmarks for superimposition in orthodontic patients treated with palatal expansion. **Methods:** T<sub>1</sub> and T<sub>2</sub> intraoral scans and Cone Beam Computed Tomography (CBCT) scans were obtained in 15 patients (ages 11-40 years) treated with Rapid Palatal Expansion (RPE). T<sub>1</sub>(Pre-treatment) CBCTs were oriented to a standardized coordinate system, and T<sub>2</sub> (Post-treatment) CBCTs were registered and superimposed to T<sub>1</sub> using Björk skeletal landmarks. Surface models for the registered T<sub>1</sub> and T<sub>2</sub> CBCTs were constructed. Intra-oral scans of the dentition at T<sub>1</sub> and T<sub>2</sub> were overlaid onto the registered CBCT surface models. A second superimposition of the T<sub>2</sub> to T<sub>1</sub> intraoral scans was performed using the palatal rugae landmarks. Concordance between the two methods of superimposition were compared using Lin's concordance correlation coefficient, and the extension of agreement will be illustrated in Bland-Altman plots. **Results:** The mean difference in Euclidean distance changes for incisors, canines, and molars were 0.2mm, 0.2mm, and 0.0mm, respectively. The transverse dimension displayed the highest degree of concordance (0.91 – 0.99 ρ<sup>Ⓢ</sup>) between the two methods. Anteroposterior and Euclidean measurements were moderate (0.68 – 0.92, and 0.82 – 0.94 ρ<sup>Ⓢ</sup>, respectively), and the vertical dimension displayed the poorest overall concordance (0.68 – 0.95 ρ<sup>Ⓢ</sup>). **Conclusion:** The palatal rugae superimposition method produced different dentoalveolar movement when compared against the maxillary skeletal superimposition method.

### **Creating a Medical-Dental Referral Pipeline for Patients with Diabetes.**

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**Objective:** It is well-demonstrated that patients with type 2 diabetes mellitus (T2DM) are at increased risk for periodontal disease (periodontitis). Conversely, people with periodontitis and diabetes have poorer glycemic control. Objectives: This Schweitzer Fellows project aimed to: 1) assess the oral health screening practices at East Carolina Family Medicine Center (ECFMC); 2) measure the oral health-related quality of life and self-reported periodontal disease among patients with T2DM and managed by physicians and diabetes educators ECFMC; 3) counsel and educate patients with T2DM on oral disease prevention and nutrition; 4) formulate an oral health counseling best practice (intervention) in collaboration with physicians (PCPs), residents and diabetes educators; and 5) create a sustainable medical-dental referral pipeline for the co-management of patients with T2DM. **Methods:** Patients with T2DM were recruited for this project along with PCPs, residents and diabetes educators. This report focuses on patient demographics, acceptance of the patient education intervention and preliminary findings on the effect on glycemic control. **Results:** 27 patients were recruited from ECFMC and referred to ECU SoDM for a “dental home.” The majority of the patients identified as female (76.9%) versus male (23.1%). 84.6% identified as Black, 11.5% as White, and 3.8% as multiracial. The age of participants ranged from 22-81 years (mean, 56 years). The majority of the participants were single or never married. Approximately one-third of patients reported monitoring blood sugar daily. Fifteen PCPs, residents and diabetes educators received oral health training. Overall project recruitment outcomes were met despite the COVID-19 pandemic and clinic closures. Preliminary data on

changes in hemoglobin A1c indicated no clear trend in altering glycemic control with the educational intervention alone. **Conclusions:** Overall, this project demonstrates the feasibility of establishing a referral pipeline for patients with T2DM between ECFMC and SoDM for improved oral and overall health.

## **POSTER PRESENTATIONS**

### **Craniofacial and Skeletal Diseases**

#### **18) Caspase-1-mediated periodontal bone destruction is sex-dependent**

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**Objectives:** Men have a higher prevalence of periodontal disease than women. Mechanisms underlying this sexual dimorphism are unclear. The main aim of the study was to determine the impact of sex in the periodontal inflammatory response. **Methods:** Gingival crevicular fluid (GCF)-IL-1 $\beta$  levels from 6,182 individuals were evaluated by ELISA and compared for sex-related differences. Experimental periodontitis progression in male and female mice was evaluated in a time-dependent manner (0, 3, and 9-days). Gingival IL-1 $\beta$  expression was measured by quantitative real-time PCR (qRT-PCR) and bone levels by micro-computed-tomography ( $\mu$ CT). Peritoneal macrophages plated at  $2.5 \times 10^5$  cells/well were stimulated with AIM2 (poly:dA/dT) and NLRP3 (nigericin) agonists. Supernatants were analyzed for IL-1 $\beta$  levels by ELISA. To evaluate the impact of IL-1 $\beta$  in experimental periodontitis, we administered caspase-1 inhibitor VX-765 (which cleaves IL-1 $\beta$  into its active form) to female/male/ovariectomized female mice. Alveolar bone loss was analyzed by  $\mu$ CT. **Results:** Men had significantly higher GCF-IL-1 $\beta$  levels than women ( $155.07 \pm 5.63$  vs.  $134.3 \pm 3.4$  [mean $\pm$ SE] ng/mL). In the experimental periodontitis model, male mice exhibited a 10-fold increase in gingival-IL-1 $\beta$  expression compared to 3-fold in females ( $p \leq 0.007$ ) 3-days post-ligature. Inflammasome activation was evaluated in peritoneal macrophages, and cells derived from male mice had  $\sim 5$  times higher IL-1 $\beta$  levels when stimulated with AIM2 and NLRP3 inflammasome agonists. When treated with a caspase-1 inhibitor (VX-765) upon induction of periodontitis, a  $\sim 50\%$  decrease in alveolar bone-loss was observed in male mice at 9-days ( $p = 0.03$ ) and the mRNA IL-1 $\beta$  expression decreased only in male mice ( $p = 0.02$ ) at 3-days. No effect in bone-loss was observed for female mice (unmodified and ovariectomized) that received the drug, suggesting that the sexual differences are unlikely to be mediated by the presence of female hormones. **Conclusion:** The understanding that males have a more robust and dominant IL-1 $\beta$  response provides novel information on the potential for caspase inhibition as a treatment for periodontal diseases. **Funding source:** This study was funded by the National Institutes of Health KL2TR002490 (K.V.S), K08DE026537 (K.M.B.), K01DE027087 (J.T.M.),

the American Association for Dental Research Anne D. Haffajee Award (J.T.M), and the DDS Short-Term Research Fellowship Grover C. Hunter Award (M.S.G.).

### **19) Systemic Dietary Hesperidin Affects Osteoclastogenesis and Ligature-induced Alveolar Bone Loss**

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**Objectives:** Within the context of host modulation, the aim of this study was to evaluate the effect of systemic administration of hesperidin (HE) in a ligature-induced model of periodontal inflammation in mice. **Methods:** Forty C57BL/6 mice (8 weeks of age) were distributed into 4 groups (n=10): 1- ligature, 2- ligature + Hesperidin (HE) 125mg/kg, 3- ligature + HE 250mg/kg, 4- ligature + HE 500mg/kg. The animals received HE once a day by oral gavage starting 4 weeks before ligature insertion and until sacrifice. A silk ligature was placed between M1 and M2 right maxillary molars for 10 days. The left hemimaxilla with no ligature was set as control. The maxillae were subjected to computerized microtomography ( $\mu$ CT), histopathological evaluation (H&E) and osteoclast quantification by TRAP method. ANOVA followed by Tukey post hoc test were used for statistical analysis using GraphPad Prism 8. **Results:** Ligature promoted a marked alveolar bone resorption observed by the significant reduction in bone volume in all animals. Dietary HE 500mg/Kg increased the alveolar bone resorption ( $p<0.05$ ). The number of TRAP+ cells was statistically higher in bone associated with ligature alone and ligature+HE. Interestingly, there was an increase in osteoclasts in animal controls subjected to 500mg/kg of daily HE (no ligature) ( $p>0.05$ ). **Conclusions:** Oral administration of high concentration of dietary HE can promote increased osteoclast numbers and potentiate insult-induced alveolar bone loss. Further evaluations are underway to identify the mechanistic aspect of HE-mediated bone turnover. **Funding source:** NIH/NIDCR R03DE028035-01A1, FAPESP/Brazil - 2018/14536-3.

### **20) Extended Antibiotics After Orthognathic Surgery Do Not Lower Infection Rates or Adverse Drug Reactions**

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**Objective:** To determine if extended post-surgery antibiotics following orthognathic surgery is associated with lower wound infections or adverse drug reactions. **Methods:** This UNC IRB and HIPPA exempt study included one hundred patients who underwent Le Fort I osteotomy, bilateral sagittal split osteotomy, or both by the same attending surgeon between July 2017 and June 2019. All received “short term” IV AB for 24 hours peri-operatively. Patients treated from July 2017 to June 2018 received extended PO AB at discharge for one added week. Those treated from July 2018 to June 2019 did not. Exclusion criteria were patients who were active smokers or had insulin dependent diabetes mellitus. The primary outcome variables were wound infection or not, or

adverse reaction to antibiotics. The primary predictor variable was extended AB at discharge or not. Secondary predictor variables were demographics, length of surgery, and estimated blood loss. All outcome data were obtained from patient records in 2020. **Results:** In a two-year timeframe 50 patients were in the extended antibiotic group (AG) and 50 in the “short term” antibiotic group (NG). The characteristics were similar: Surgery AG 17 LF, 19 LF+BSSO, 14 BSSO and NG 15 LF, 19 LF+BSSO, 16 BSSO, Mean age AG 25.2y (SD 11.0), NG 24.8y (SD 9y). AG were 30 females, NG 31 females. Mean AG surgery length 151min (SD 55min), NG 161min (SD 54min). Mean estimated AG blood loss 148 mL (SD 75mL), NG 153mL (SD 85mL). AG one PO infection; NG three PO infections. Four adverse AB drug reactions occurred in AG, none in NG. Of the four adverse reactions one was severe diarrhea, and three were rash. Infection rates or adverse drug reactions to AB were not significant between the AG and NG groups (P=0.61). **Conclusion:** Extended use of AB after orthognathic surgery was not associated with lower rates of wound infections nor adverse antibiotic drug reactions. **Funding:** This study was supported by departmental research funds in the Dental Foundation of North Carolina.

## **21) The therapeutic role of CDDO-Me in modulating Nrf2 to control TLR-induced inflammation in human oral keratinocytes.**

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**Objectives:** Oral epithelial cells regulate the delicate balance between tolerance and inflammation using innate immune receptors, including toll-like receptors (TLRs). Induction of immune homeostasis at the cellular level is restored in part by the transcription factor Nuclear Factor-Erythroid-2-Related Factor (NRF2). Indeed, several studies have documented the downregulation of NRF2 in the inflammatory condition of chronic periodontitis. The purpose of this study was to quantify the effect of the NRF2-agonist Bardoxolone methyl (CDDO-Me) on human oral keratinocytes’ (HOK) innate immune functions. **Methods:** Human oral keratinocytes were stimulated with TLR1/2 (1 µg/mL) and TLR5 (100 ng/mL) agonists, in the absence and presence of CDDO-Me (100nM, 500 nM, 1000 nM). Supernatants and mRNA were collected at 0, 6 and 24-hours post TLR-stimulation. The expression of Nrf2 mRNA was detected using quantitative reverse transcription-polymerase chain reaction (qRT-PCR). Immune profiling was performed using NanoString and nSolver analysis platforms. **Results:** RT-qPCR analysis revealed constitutive expression of Nrf2 mRNA in unstimulated HOK. Both TLR1/2 and TLR5 ligands were found to significantly downregulate Nrf2 mRNA gene expression at 6 and 24 hours. When treated with CDDO-Me, Nrf2 mRNA gene expression was only significantly upregulated in cells stimulated with TLR5 ligands (P < 0.05). NanoString immune profiling demonstrated several immune and metabolic genes which were regulated by CDDO-Me in both TLR1/2 and TLR5-stimulated HOK. **Conclusions:** Results of this study suggests that CDDO-Me may boost the TLR-induced reduction of NRF2 in HOK. These findings warrant performing pre-clinical studies to determine whether administration of CDDO-Me will help in reducing epithelial cell mediated inflammation such as those observed in periodontal disease. **Funding source:** NIH

## **22) Dysbiosis During Experimental Periodontitis Development**

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**Objectives:** Periodontitis is associated with a dysbiotic microbiota and an exaggerated immune response that can lead to tooth loss. This study aims to examine the development of pathogenic polymicrobial communities during the development of murine gingivitis and periodontitis.

**Methods:** Experimental periodontitis was induced in C57BL/6 mice using the ligature-induced periodontitis model. Ligatures were collected in a time-dependent manner at 0, 3, 6, 9, 12, 15, and 18 days post-ligature placement. Ligature samples were collected and evaluated by 16S rRNA sequencing (MiSeq, Illumina) and QIIME. Relative abundance calculations were used to determine differences among health, gingivitis, and periodontitis (ANOVA, Bonferroni-adjusted). **Results:** An evident microbial shift was observed in 25 genera during the development of gingivitis and periodontitis. From day 0-18, there was a dramatic shift in *Streptococcus* which experienced an overall decrease (54.04-0.02%) as well as in *Enterococcus* which experienced an overall increase (23.7-73.1%) when periodontitis was developing. Over the course of the 18 days of disease progression there was an increase in the facultative and strictly anaerobic bacteria. A total of 8 species were significantly different during disease progression (FDR correction,  $p < 0.05$ ), most of which identified as gram-positive bacteria. **Conclusion:** Bacterial microbiome shifts were identified during the development of experimental periodontitis, marked by an increase of anaerobes and a selection for gram-positive genera including *Streptococcus* and *Lactobacillus*. These findings further support the utilization of the ligature model for microbial shift analysis under different experimental conditions. **Funding Source:** This study was supported by T90DE021986 and F32DE026688 (YZJ), IBM Junior Faculty Development Award from the University of North Carolina at Chapel Hill and K01DE027087 (JTM).

### 23) Orthodontic Loading Activates Cell-Specific Autophagy in a Force-Dependent Manner

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**Objectives:** Orthodontic tooth movement (OTM) relies on bone remodeling and controlled aseptic inflammation. Autophagy, a conserved homeostatic pathway, has been shown to play a role in bone turnover. We hypothesize that autophagy participates in regulating bone remodeling during OTM in a force-dependent and cell-type specific manner. **Methods:** A split mouth design was

used to load molars with one of three force levels (15g, 30g, or 45g) in mice carrying a GFP-LC3 transgene to detect cellular autophagy. Fluorescent microscopy and qPCR analyses were used to evaluate autophagy activation and how it correlates with force level. Cell type-specific antibodies were utilized to identify cells with GFP positive puncta (autophagosomes) in periodontal tissues. **Results:** Autophagic activity increased shortly after loading with moderate force and was associated with expression of bone turnover, inflammatory and autophagy markers. Different load levels resulted in altered degrees of autophagic activation, gene expression and osteoclast recruitment. Autophagy was specifically induced by loading in macrophages and osteoclasts found in the periodontal ligament and alveolar bone. Data suggest autophagy participates in regulating bone turnover during OTM. **Conclusions:** Autophagy is induced in macrophage-lineage cells by orthodontic loading in a force-dependent manner and plays a role during OTM, possibly through modulation of osteoclast bone resorption. Exploring roles of autophagy in OTM is medically relevant given that autophagy is associated with oral and systemic inflammatory conditions. **Funding source:** American Association of Orthodontics Foundation Postdoctoral Research Award AAOF

### **Biomaterials/Dental Materials and Regeneration**

#### **24) Strength and Survivability of Zirconia Crowns as a Function of Yttria Concentration.**

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**Objectives:** To compare four different types (based on yttria concentration) of full coverage zirconia restorations in terms of survival rate and fracture resistance after thermocyclic aging and/or thermo-mechanical loading in a chewing simulator. **Methods:** Partially-Stabilized-Zirconia (PSZ) crowns with fiber-reinforced resin die assemblies (n=80) were fabricated using 4 different types of zirconia based on their yttria concentration: multilayer 3Y-PSZ/5Y-PSZ (occlusal third), multilayer 4Y-PSZ/5Y-PSZ (occlusal third), monolithic 4Y-PSZ and monolithic 3Y-PSZ to serve as controls (n = 20). Within each group, ten samples were subjected to thermo-mechanical loading under 110 N at a frequency of 1.4 Hz for 1.2 million cycles with simultaneous thermocycling (10,000 cycles, 5-55°C). The other ten samples were subjected to thermocycling alone (10,000 cycles, 5-55 °C). The samples were loaded to failure to measure its fracture resistance. The data were analyzed for statistical significance by two-way ANOVA and Tukey's HSD post-hoc test ( $\alpha = 0.05$ ). **Results:** All specimens survived the two aging protocols. The yttria content had a statistically significant effect on the mean fracture resistance of the crowns ( $p < 0.0001$ ). The mean fracture resistance load, from the highest to the lowest: monolithic 3Y-PSZ, monolithic 4Y-PSZ, followed by the two multilayer systems 3Y-PSZ/5Y-PSZ, 4Y-PSZ/5Y-PSZ. The fracture resistance loads between the two multilayer systems 3Y-PSZ/5Y-PSZ, 4Y-PSZ/5Y-PSZ were not statistically significant ( $p=0.98$ ). These findings indicated that final fracture of the crowns was originated from the occlusal surface. In addition, the mechanical loading protocol did not affect the mean fracture resistance within each group ( $p = 0.18$ ). **Conclusions:** Increasing the yttria concentration at the occlusal third of the crown decreased its fracture resistance. The mechanical loading protocol did not affect the fracture resistance of zirconia.

## 25) In-vitro wear of bulk-fill resin composites after thermo-mechanical loading

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**Objectives:** The purpose of this study was to compare the amount of volumetric wear of bulk-fill resin composites to a conventional composite and human enamel after thermo-mechanical loading. **Methods:** Five resin composites (n=10) were tested: four bulk-fill resin composites (Filtek One [3M], Tetric Evoceram Bulk-fill [Ivoclar], Tetric Power Fill [Ivoclar], Sonic Fill3 [Kerr]) and one conventional composite (Filtek Supreme Ultra [3M]). Specimens were subjected to a 2-body volumetric wear evaluation using a chewing simulator. Recently extracted teeth were used as a control. Disc-shaped specimens (3×10mm) received 500,000 load cycles against steatite antagonists and were also simultaneously thermocycled (5,000 cycles 5-55°C). Volumetric wear (mm<sup>3</sup>) was measured using the Geomagic Control X software (3D Systems) based on before and after Trios 3D digital scanner images of the specimens. Volumetric wear was statically analyzed using the one-way ANOVA and Tukey's post-hoc test ( $\alpha=0.05$ ). **Results:** All tested resin composites wore at rates significantly higher than enamel ( $P<0.05$ ). The mean volumetric wear of the resin composites ranged between 1.013-1.482 mm<sup>3</sup>, while enamel had a mean volumetric wear of 0.246 mm<sup>3</sup>. Bulk-fill resin composites showed higher wear resistance than the conventional composite. **Conclusions:** Under the study parameters, enamel was more resistant to wear than all resin composites tested. Bulk-fill resin composites presented higher wear resistance than the conventional resin composite.

## 26) Light-cure Irradiance, Energy and Tip Distance Through Resin-based CAD/CAM Materials

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**Objectives:** To measure the effect of resin-based CAD/CAM materials on light irradiance and energy transmittance, and to measure the effect of light-cure tip distance from the materials on light irradiance and energy transmittance. **Methods:** Square-shaped specimens (10×10×1.5mm) of a composite-resin (Lava Ultimate, 3M), ceramic-resin (Enamic, VITA) and bis-acrylic resin (Vita CAD temp, VITA) materials were prepared. A spectroradiometer (MARC resin calibrator, BlueLight Analytics) was used to measure light irradiance and energy transmittance through each material with the light-curing tip (DeepCure S, 3M) placed at 0, 2, and 4 mm distance from the material at 20 seconds curing-time. Data was analyzed using two-way ANOVA at ( $P<0.05$ ) significance. **Results:** Composite-resin transmitted the highest irradiance and energy compared to the other two materials regardless of the light-cure tip distance ( $P<0.05$ ) (Table 1,2). The light-cure tip distance had a significant effect on light-cure irradiance and energy transmittance regardless of the material type ( $P<0.05$ ) (Table 1,2). **Conclusions:** Light-cure irradiance and energy transmittance is material dependent. Composite-resin allowed more transmittance than ceramic-resin and bis-acryl resin. Distance of light-cure tip from the materials had an adverse effect on light-cure irradiance and energy transmittance.

## 27) Geographical variations in microbiota from immature teeth with necrotic pulp

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**Objectives:** Endodontic infections contain diverse microbiota that may be influenced by geographical location. The purpose of this study was to analyze the microbiota in immature teeth with necrotic pulp from four dental schools that participated in a nationally funded randomized clinical trial on pulp regeneration. **Methods:** 116 patients with necrotic pulp in immature teeth were included from Loma Linda University (LLU), University of Texas (UT), University of North Carolina (UNC), and University of Maryland (UM). Patients were randomized into three treatment protocols: Regeneration (1.25% hypochlorite with 17% EDTA irrigation, and 0.1 mg/mL of triple antibiotic paste (TAP)), Revascularization (5% hypochlorite in the first appointment, and 1 g/mL of TAP), and Apexification (5% hypochlorite at two appointments and Ca(OH)<sub>2</sub>). Samples were collected preoperatively (S0), after irrigation at the first appointment (S1), and after 1-3 weeks of medications (S2). Samples were sequenced at Forsyth Institute (HOMINGS platform) (n=46) and at UNC Microbiome Core Facility (n=51).

**Results:** The most abundant genera were:

	UNC	UM	UT	LLU
<b>S0</b>	<i>Fusobacterium</i>	<i>Fusobacterium</i>	<i>Fusobacterium</i>	<i>Sphingomonas</i>
	<i>Bacteroidaceae [G-1]</i>	<i>Porphyromonas</i>	<i>Tannerella</i>	<i>Fusobacterium</i>
	<i>Selenomonas</i>	<i>Prevotella</i>	<i>Peptostreptococcaceae [XI][G-7]</i>	<i>Pseudomonas</i>
<b>S1</b>	<i>Acinetobacter</i>	<i>Enterococcus</i>	<i>Acinetobacter</i>	<i>Enterococcus</i>
	<i>Bacteroidaceae [G-1]</i>	<i>Fusobacterium</i>	<i>Sphingomonas</i>	<i>Pseudomonas</i>
	<i>Fusobacterium</i>	<i>Klebsiella</i>	<i>Pseudomonas</i>	<i>Sphingomonas</i>
<b>S2</b>	f-Enterobacteriaceae	<i>Enterococcus</i>	<i>Sphingomonas</i>	<i>Sphingomonas</i>
	<i>Acinetobacter</i>	<i>Klebsiella</i>	<i>Acinetobacter</i>	f-Enterobacteriaceae
	<i>Stenotrophomonas</i>	o-Rhizobiales	<i>Pseudomonas</i>	<i>Enterococcus</i>

There were significant differences among all sites in alpha diversity except for UT vs. LLU (p<0.05). At the different time points, S0 had no significant differences among the sites; S1 had significant difference between UM vs. LLU and UNC; and S2 had significant differences between LLU vs. UNC and UM, and between UNC vs. UM and UT (p<0.05).

**Conclusion:** Site differences existed among the four sites in pre-operative and intra-treatment most abundant microbial taxa and diversity. However, the overall trend was the decrease in abundance of typical endodontic taxa and an increase in resistant taxa following treatment procedures.

**Funding source:** Funded by the Foundation for Endodontics.

## 28) Differential Mechanisms of Craniofacial Myogenesis Offer Insight into Regenerative Therapies

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**Objectives:** Limited therapeutic options exist to rebuild functional craniofacial skeletal muscle in individuals suffering from orofacial muscle diseases, trauma, and oncologic surgical defects.

Knowledge on craniofacial muscle regeneration is currently lacking as most studies on muscle regeneration are limited to limb muscles, which have distinct embryological origins compared to craniofacial muscles. The objective of this study is to characterize the molecular mechanisms surrounding the regenerative program of craniofacial skeletal muscle and its resident stem cells, satellite cells (SCs), to identify therapeutic targets for craniofacial muscle regeneration. **Methods:** Regenerative capacity was assessed *in vivo* by measuring embryonic myosin heavy chain (eMHC), a marker for early muscle regeneration, and cross-sectional area of regenerated masseter (craniofacial) and tibialis anterior (TA) (limb) muscles following injury. To determine SC function *in vitro*, SCs were isolated from masseter and TA using fluorescence-activated cell sorting (FACS) and proliferation and differentiation were measured by EdU incorporation and fusion index, respectively. Single-cell RNA sequencing (scRNA-seq) was used to identify differentially expressed genes in craniofacial SCs throughout a timecourse of regeneration. Viral-mediated gene manipulation was used to elucidate the roles of identified genes in craniofacial myogenesis. **Results:** Regenerating craniofacial muscle expressed eMHC earlier and demonstrated a faster return to basal muscle fiber size following injury compared to limb. Craniofacial SCs had higher rates of proliferation and differentiation *in vitro*. scRNA-seq identified *Ebfl* as significantly upregulated in craniofacial SCs compared to limb SCs during myogenesis. Lentiviral-mediated knockdown of *Ebfl* in craniofacial SC resulted in increased differentiation and fusion into myofibers. **Conclusions:** Our results demonstrate that craniofacial muscle and its satellite cell population have an enhanced regenerative program compared to limb. The identification of *Ebfl* as a differentially expressed gene in craniofacial satellite cells could present a potential target for craniofacial muscle regenerative therapies. **Funding source:** UNC Adams School of Dentistry, Division of Oral and Craniofacial Health Sciences

## **Population and Epidemiology**

### **29) Clinical Patterns of Primary Dentition Developmental Defects of the Enamel**

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**Objective:** Developmental defects of the enamel (DDE) are a heterogeneous group of clinically manifest disturbances of amelogenesis. Despite their considerable prevalence and reported association with caries risk, DDE remain understudied, especially in the primary dentition. In this study, we sought to identify patterns of DDE intraoral distribution in the primary dentition and assess their association with early childhood caries experience. **Methods:** We used tooth-level DDE data from an epidemiologic study of early childhood oral health in North Carolina. Diffuse opacities, demarcated opacities, and hypoplastic defects were recorded on the facial/buccal surfaces of all primary teeth using Clarkson and O'Mullane's modified epidemiologic index criteria. We used Latent Class Analysis to identify patterns of DDE for each DDE type among 2,965 participants ages 3-5 without any prior restorative treatment experience. We used bivariate methods to examine differences in caries experience by DDE subtype. Analyses were done with Mplus v.8.5 (Muthén & Muthén, CA) and Stata 16.1 (StataCorp LP, College Station, TX). **Results:** The identified DDE patterns were characterized by affection of different sets of teeth (i.e., mandibular canines, first or second primary molars, maxillary incisors), bilateral symmetry, and significantly different caries experience. Generally, there were 4 clinical patterns

for each DDE type, with the least prevalent ones being those with the most affected teeth. Among those with hypoplastic defects, 46% clustered in a group wherein lower canines were predominantly affected, whereas maxillary canines (41%) and maxillary anteriors (10%) formed their own, less prevalent clusters. **Conclusions:** We have identified distinct patterns of DDE, manifesting symmetrically on different sets of teeth. These DDE patterns differ with respect to their associations with caries experience and are likely due to different etiologic mechanisms or individual susceptibilities. Understanding genetic susceptibility and oral microbiome differences between these clinical patterns can help shed light onto their etiology and quantify their contribution to ECC. **Funding source:** AADR Student Research Fellowship, NIH/NIDCR #U01-DE025046.

### **30) Adiposity and Oral Health in North Carolina Preschool-age Children**

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**Objectives:** The association between childhood obesity and early childhood caries (ECC) remains unclear. This study examined the prevalence of obesity and its association with ECC and postulated common risk factors in a community-based sample of preschool-age children. **Methods:** Clinical and questionnaire data were obtained from an oral epidemiologic study among children ages 3-5 attending public preschools in North Carolina. Anthropometric classifications were based on age- and sex-specific body mass index (BMI) Z-scores. ECC was defined at the established caries lesion (ICDAS $\geq$ 3) threshold. Bivariate testing methods accounting for clustered data were used to examine associations between measures of BMI and ECC, as well as their respective associations with postulated common risk factors. Geographic Information System (GIS)-based methods were used to examine geographical distribution of adiposity and ECC across the state and spatial “hotspot” analyses relied upon the Getis-Ord  $G_i^*$  and the Local Moran’s I statistics. **Results:** Among 6,357 children with complete dental and anthropometric information, 9% were obese, 14% were overweight, 68% were normal weight, and 9% were underweight. Approximately half (54%) of children had ECC. There was no association between measures of adiposity and ECC, except for a statistically significant yet small-in-magnitude inverse association between untreated disease and BMI. Frequent consumption of sugar-containing snacks and beverages was strongly associated with ECC but not with obesity. Hispanic ethnicity, low parental education, and history of a child having been put to bed with a bottle containing something other than water were significantly associated both with obesity and ECC. Hotspots of pediatric underweight and ECC were identified in counties with high poverty, food insecurity, and low access to dental care. **Conclusion:** No material association between obesity and ECC was found among this community-based sample of preschool-age children. The findings of common social, demographic, and behavioral factors underlying both warrant further investigation. **Funding source:** NIH/NIDCR U01-DE025046

### **31) Dental Utilization Differences in Older Adult U.S. Birth Cohorts**

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**Objective:** This study examines complex sample survey data collected longitudinally on Americans age 51+ from the national Health and Retirement Study (HRS). Because of historical

differences in public policy, social services, and societal norms, we hypothesize there may be distinct and relevant differences in dental utilization over time between groups defined by birth cohort. **Methods:** We use longitudinal survey logistic regression to evaluate dental utilization in the past two years of four birth cohorts born between 1924-1953, from 2008 (n=13819) to 2018, in an unadjusted model and models adjusting for sociodemographic, behavioral and health variables. Time-varying variables include edentulism, dental insurance and retirement status. **Results:** Dental utilization across all birth cohorts in dentate individuals ranged between 70-76% between 2008-2018, whereas in edentulous individuals, utilization ranged between 15-25%. An unadjusted model supports the hypothesis that birth cohorts differentially utilize dental visits over time in dentate individuals (p=0.048). In adjusted models, the differences in dental utilization over time among birth cohorts become more pronounced in dentate individuals (p=0.0025). In dentate individuals, the two younger birth cohorts did not have a statistically significant change in dental utilization over time (p=0.31, 0.61), yet the two older birth cohorts had statistically significant declines in dental utilization over time (p=0.0014, 0.0019). The pattern of dental utilization over time is different in edentulous individuals compared to dentate. In an adjusted model including both time-varying retirement status and dental insurance, retirement status is not significant (p=0.065), but becomes highly significant once dental insurance is not included in the model (p=0.0025). **Conclusion:** Patterns of dental utilization over time are different among the four birth cohorts, and among edentulous and dentate individuals. Analyses helped evaluate the differences between age and the historical contextual differences between birth cohorts. Future work could examine associations between dental insurance and retirement status over time.

### **32) Sociodemographic Factors and Older Adults' Self-Rated Oral Health Status, 2008-2018**

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**Objective:** This study examines the effects of sociodemographic and other factors on self-rated oral health status of older adults in the United States at two time points, 2008 and 2018. **Method:** Data were from the University of Michigan's Health and Retirement Study (HRS), a nationally representative longitudinal survey of Americans aged 51 and older. Responses from participants who completed the Core HRS survey and Dental Module (DM) in 2008 (n=1310), 2018 (n=1378), and both timepoints (n=559) were analyzed. Our outcome measure was Self-Rated Oral Health Status (SROHS) (positive vs negative). Potential explanatory variables included employment/retirement status, education, urban/rural area of residence, Medicaid enrollment status, demographic factors (age, gender, race/ethnicity, marital status), edentulism status, dental insurance, and dental utilization. Using survey logistic regression analysis, we estimated the association between sociodemographic factors and SROHS during 2008 and 2018. **Results:** In 2008 and 2018, positive SROHS was reported by 71.4%, and 68.4%, respectively. Among the common DM respondents positive SROHS was reported by 73.8% and 73.5%, in 2008 and 2018, respectively. During 2008, respondents who were more likely to report positive SROHS were: married- OR=1.65(CI:1.15,2.35), female- OR=1.56(CI: 1.10, 2.23), college educated- OR=3.79 (CI:2.20,6.51), edentulous-OR=3.51(CI: 1.91,6.48), who visited the dentist in the previous two years- OR= 1.58(CI:1.02, 2.44). Similar results were obtained for the 2018 DM respondents where female, college educated, married, edentulous, and who visited the dentist in the previous two years were more likely to report positive SROHS. **Conclusion:** The majority of American older

adults reported to have positive SROHS. The proportion was similar at both time points. Sociodemographic factors influence the oral health of the older population. Having a prior dental visit was a primary modifiable factor. Interventions should be further developed to improve the access to oral healthcare among elderly that will contribute to the decrease in oral health disparities.

### **33) Guardian-Reported Child Oral Health Correlates with Untreated Disease and Toothaches**

Imes EP,<sup>1</sup> Ginnis J,<sup>2</sup> Simancas-Pallares MA,<sup>2</sup> Shrestha P,<sup>2,3</sup> Divaris K.<sup>2,3</sup>

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**Objectives:** Parents'/guardians' perceptions of their children's oral health are useful proxies of their clinically determined dental needs and are known to influence dental care-seeking. In this study we sought to examine 1) the social and behavioral correlates of fair/poor guardian-reported child oral health, and 2) quantify the association of these reports with the prevalence of untreated early childhood caries (ECC) and reported toothaches. **Methods:** We used guardian-reported child oral health information (dichotomized as fair/poor versus excellent/very good/good) obtained via a parent questionnaire that was completed for 7,965 participants (mean age=52 months; range=36-71 months) of a community-based epidemiologic study of early childhood oral health in North Carolina. Social, demographic, oral health-related behavioral data, and reports on children's history of toothaches (excluding teething) were collected in the same questionnaire. Untreated ECC was measured via clinical examinations in a subset of 6,328 children and was defined as the presence of one or more tooth surfaces with an ICDAS $\geq$ 3 caries lesion. Analyses relied on descriptive and bivariate methods, and multivariate log-binomial model, accounting for the clustered nature of the data. **Results:** The prevalence of fair/poor oral health in this sample was 15%--it increased monotonically with children's age, was inversely associated with parents' educational attainment, and was higher among Hispanics (21%) and African Americans (15%) compared to non-Hispanic whites (11%). Brushing less than twice a day, not having a dental home, and frequently consuming sugar-containing snacks and beverages were significantly associated with worse reports ( $P<0.0005$ ). Children with fair/poor reported oral health were twice as likely to have untreated disease [prevalence ratio (PR)=2.0; 95% confidence interval (CI)=1.8-2.1] and 3.5 times as likely to have experienced toothaches [PR=3.5; 95% CI=3.1-3.9] compared to those with better reported oral health. **Conclusions:** Guardian reports of their children's oral health are valuable predictors of clinical and public health-important child oral health outcomes.

### **34) Lower Caries Experience Among Children with Dental Homes**

Shrestha P,<sup>1,2</sup> Ginnis J,<sup>1</sup> Simancas-Pallares MA,<sup>1</sup> Slade GD,<sup>1</sup> Divaris K<sup>1,2</sup>

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**Objectives:** The dental home concept is an important component of early childhood oral health care; however, evidence supporting its utility in preventing early childhood caries (ECC) is scant.

To address this knowledge gap, we sought to quantify the association between dental home and ECC experience among two large samples of preschool-age children. **Methods:** We used data from 6,259 participants (age range 36-71 months) enrolled in a cross-sectional community-based study of ECC among public preschools in North Carolina (ZOE 2.0), a low-income, high caries risk population. Analyses were repeated in a similarly aged nationally representative sample of 3,963 community-dwelling children from the National Health and Nutrition Examination Survey (NHANES). Dental home was defined as the child usually visiting the dentist for checkups (not problems) according to parent/guardian. The primary outcome measure was the sum of decayed, missing, and filled surfaces (dmfs); a secondary outcome was untreated defined as the sum of established/severe (ICDAS $\geq$ 3) caries lesions. Analyses relied on bivariate methods and multivariable Poisson regression modeling, accounting for the complex study designs. **Results:** Dental home was predominant in the studied samples, 84% in ZOE 2.0 and 63% in NHANES, and the prevalence of ECC was 54% (dmfs mean=8.5) and 29% (dmfs mean=3.3), respectively. Children in ZOE 2.0 without dental homes were more likely to have ECC [adjusted prevalence ratio=1.1; 95% confidence interval (CI)=1.0-1.2], had more caries-affected surfaces (mean ratio=1.2; 95% CI=1.0-1.3) and more unrestored caries lesions (mean ratio=2.0; 95% CI=1.7-2.3; mean difference=1.7; 95% CI=1.3-2.1) compared to those with dental homes. Relative measures of caries experience associated with dental home were similar in the nationally representative sample. **Conclusions:** This cross-sectional study provides evidence in support of better oral health outcomes among children with dental homes; future, prospective investigations may provide additional evidence regarding possible long-term benefits associated with dental homes. **Funding Source:** NIH/NIDCR #U01-DE025046

### 35) Examining Caregiver Oral Health Literacy and Children Oral Health Status

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**Objectives:** Oral health literacy (OHL) is the measure of how well an individual collects and comprehends oral health information, as well as his or her ability to subsequently make advisable oral health care decisions. Measures for OHL include a number of validated instruments from the literature, such as the Rapid Estimate of Adult Literacy in Medicine and Dentistry (REALMD). Oral health status (OHS) is the measure of one's current state of oral health, based upon clinical examination, evaluation of dental, medical and social histories, including results from and stability of previous treatment. In this rapid review, we examined literature in PubMed® to determine whether there is credible evidence of an association between caregiver oral health literacy and children oral health status. **Methods:** We searched using applicable MeSH subject heading and keyword terms, and no filters were applied. Two blinded reviewers screened 85 articles. Only peer-reviewed articles were included. Additionally, we only examined literature pertaining to children through 11 years old, that was published within the last 15 years. Ultimately, 6 articles met the inclusion criteria, which were established a priori. The credibility of the evidence of the included articles was determined using the appropriate Joanna Briggs Critical Appraisal Checklists. **Results:** Associations between caregiver OHL and children OHS were demonstrated across 83% of articles. **Conclusions:** There is credible evidence that caregiver OHL is associated with children OHS. This review supports that a caregiver's limited OHL may affect a child's OHS negatively. Language, socioeconomic status, education, occupation and other factors can all influence both OHL and OHS of caregivers and children.

## **Social Sciences/Clinical Studies**

### **36) Oral Health Content Lacking on Non-Dental Safety Net Clinic Websites**

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**Objectives:** In North Carolina (NC) 98/100 counties are classified as Dental Health Professional Shortage Areas. Safety Net Clinics (SNC) are a type of health service center that delivers healthcare to uninsured, Medicaid, and other vulnerable populations. SNC websites are an important source of information for both patients and healthcare providers. Our goals in the first phase of a multi-phase project was to 1) assess the presence and type of oral health information on the websites of non-dental SNC websites in NC and 2) identify the characteristics of the counties where the sites were located. **Methods:** Of the 320 SNCs, a list of the 92 that do not provide dental services was provided by the North Carolina Oral Health Collaborative. Their websites were viewed to determine any presence of oral health education and any information about the county's available dental services such as dental practices accepting Medicaid patients or other SNCs providing dental services. Each website's search function was used with lay dental terms (e.g., oral health, dental, oral hygiene, fluoride, teeth, mouth, decay). **Results:** Of the 92 non-dental NC SNCs in 65 counties, 100% of the websites lacked consumer educational information about oral health. Only 15% had information about the closest dental provider. Compared to the state overall, of the counties with non-dental SNCs, 77% had a worse dentist:population ratio; 80% were more rural, 66% met or exceeded the state average for poor health outcomes. **Conclusion:** The availability of oral health education and nearby dental providers on non-dental SNC websites was limited. Our findings suggest an opportunity exists to add this information to increase knowledge and availability of oral health resources in these underserved areas. A future goal is to provide SNCs resources to enhance the oral health content of their websites.

### **37) Identifying COVID-19's Impact on Dentists' Workforce Confidence and Workflow Changes**

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**Objective:** The COVID-19 crisis has changed the attitude, security, vitality and hopes of the U.S. workforce. Small businesses, in particular, are in precarious financial situations as they were drastically affected by the pandemic. In this troubled economic environment, LinkedIn created a biweekly US Workforce Confidence Index summarizing individuals' feelings towards job security, financial confidence, and prospects of career advancement. To extend these timely investigations to dentistry, where little is known about workers' perspectives. **Methods:** We adapted the LinkedIn survey to investigate workforce sentiment among practicing dentists. Using this survey, we aim to (1) gauge how dentists' workforce confidence compares to the U.S. healthcare industry and U.S. workforce as a whole, and (2) assess how dentists' feelings about

their financial future, prospects for career advancement, and modifications to workflow have changed in response to COVID-19. Online surveys were nationally distributed to the American Dental Association membership (ADA, N=9,000). Data were evaluated using descriptive and bivariate statistics. **Results:** Preliminary data include 251 responses. Private practicing dentists report experiencing personal financial repercussions during COVID-19 with 52% saying their personal spending will decrease over the next 6 months. When looking beyond the pandemic, 55% of respondents think their practice's gross revenue will increase and 75% expect their take home income to remain the same or increase. Nearly all surveyed dentists have incorporated new personal protective equipment, safety products, and/or workflow changes since the start of COVID-19. Many show a willingness to make further additions if a product is shown to be effective against the virus that causes COVID-19. **Conclusions:** As one of the first surveys to explore these topics on a national level, our data will provide insight into how the COVID-19 pandemic has impacted dentists' professional and financial outlooks.

### **38) “No Wrong Door” to Hypertension Control: Interprofessional Service-Learning in Dentistry**

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**Objectives:** Many patients at the University of North Carolina Adams School of Dentistry present with complex and often undiagnosed medical needs. Twenty-two percent report not visiting a primary care provider within two years and 55% present with high blood pressure. Uncontrolled hypertension can create significant barriers to dental care, increasing the risk of poor oral-systemic health. We aim to explore the viability of an interprofessional health intervention in dentistry by establishing a pilot program for at-home hypertension management among dental patients.

**Methods:** Patients diagnosed with hypertension or having multiple recent elevated blood pressure readings were identified from the Admissions Clinic and through referrals from an on-site social worker and dental hygiene students. Eligible participants were invited to enroll in an 8-week program including four virtual meetings and daily blood pressure tracking. Monitors were provided. Meetings were conducted via Zoom by an interprofessional team (one dental student, one medical student) and included a verbal 10-question survey assessing health behaviors, perceived health status, and barriers to care, followed by hypertension education and lifestyle counseling. Community referrals were provided to those lacking medical care. A follow-up survey was sent four weeks after program completion. **Results:** Sixteen patients are currently enrolled; 46 virtual patient encounters have been completed. Preliminary feedback has been positive with high engagement and compliance. Participants who finished the program most frequently cited improved awareness of disease status, greater motivation to make healthier choices, and increased medication adherence as benefits from participation. Subsequent enrollment and data collection are ongoing. **Conclusions:** The dental setting provides a unique opportunity to identify at-risk patients and facilitate engagement with the healthcare system through interprofessional

collaboration. Providing educational counseling with virtual follow-up support is a strategy to improve patient-reported outcomes and self-efficacy; this presents a rich service-learning environment for interprofessional student education. **Funding:** North Carolina Albert Schweitzer Fellowship; UNC Health Foundation; UNC Office of Interprofessional Education and Practice.

### **39) A Retrospective SEER Database Analysis of Adenoid Cystic Carcinoma Patient Survival**

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**Objectives:** Adenoid cystic carcinoma (ACC) is a rare salivary gland tumor, comprising less than 1% of head and neck neoplasms. ACC displays aggressive behavior with frequent recurrence and metastasis. It can affect several sites in the head and neck region, but the potential role of tumor site on survival and treatment response remains unclear, and little information exists regarding the impact of clinicopathological parameters and adjuvant radiotherapy (aRT) on ACC disease specific (DSS) and overall survival (OS). **Methods:** We extracted demographic, treatment, and survival information of 1439 patients with major or minor intraoral salivary gland ACC from the Surveillance, Epidemiology, and End Results (SEER) database. The associations between tumor characteristics and aRT with OS and DSS were estimated using hazard ratios (HR) and 95% confidence intervals (CI). **Results:** Submandibular gland ACCs had the worst prognosis (adjusted DSS HR = 1.48; 95% CI = 0.99–2.20, compared to parotid), and this difference was more pronounced among patients with advanced-stage tumors (adjusted DSS HR = 1.93; 95% CI = 1.13–3.30). aRT was associated with increased overall survival only among stage III submandibular ACC patients (HR = 0.64; 95% CI = 0.42–0.98) and had no benefit in any other group. **Conclusion:** Submandibular gland ACC carries a worse prognosis than other gland subsites and may benefit from aRT. These results underscore the role of tumor site on treatment response and survival of patients with head and neck ACC. The different outcomes between submandibular gland and other major or minor gland ACCs warrant further mechanistic investigation. **Funding source:** Academy of Athens PhD Scholar in Medicine Award (JT) and UNC Lineberger Tier 3 Developmental Award funds and the University Cancer Research Fund (ALA).

### **40) Hybrid Pain Management Strategy Limits Left-over Opioid Doses**

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**Objectives:** Clinicians treating post-procedure acute pain face a two-fold challenge: moderate pain levels while simultaneously limiting left-over opioid doses. Strategies for achieving the dual goals include; the traditional “letting the patient decide” prescribing opioid doses for all, or proposed “let clinician” decide prescribing only for those predicted to have elevated pain. A hybrid strategy relies on joint decision making between the patient and clinician. The hypothesis for this IRB approved prospective study was that a hybrid-strategy would result in fewer left-over opioid doses as compared with the historic strategy. **Methods:** This IRB approved study included patients aged 19-26 years who had at least two mandibular third molars removed under IV sedation. Patients were treated with intraoperative IV preventive antibiotics, dexamethasone, ketorolac, ondansetron, local anesthetics including liposomal bupivacaine and post-operative cold therapy and scheduled ibuprofen. Patients were given two prescriptions (Rx), each for 4 doses of Hydrocodone/APAP 5/325, to be taken as needed for pain; one Rx could be filled on the day of surgery, the second on any subsequent day. Opioid Rx data were retrieved from patient records and the North Carolina RxSentry Prescription Drug Monitoring Program. Descriptive statistics were used for analyses. **Results:** Data were analyzed from 78 patients treated consecutively in 2018. Sixteen patients (21%) filled one opioid Rx, sixteen patients (21%) filled two opioid Rx. The patients who filled one Rx had 46 left-over doses, 72% of possible doses, and the patients who filled two Rx had 42 left-over doses, 32% of possible doses. **Conclusions:** The Hybrid-strategy achieved reduction in left-over opioid doses as compared to traditional practice, all patients with a single multiple-dose opioid Rx. Decreasing the number of left-over opioid doses is an important step addressing opioid addiction and overdose. The question remains: was acute pain moderated effectively with a hybrid-strategy?

#### 41) Pseudoaneurysms After Lefort I Osteotomy

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**Objective:** The Lefort I maxillary osteotomy remains a workhorse surgical technique for addressing dentofacial deformities, however, significant complications can arise. One of the most serious complications is a pseudoaneurysm that results from trauma to an artery. The bleeding episodes normally develop 10 days to four weeks post hospital discharge. Typically, these are minor sentinel bleeding preceding a hemorrhagic episode that results in an emergency room visit. While rare, significant morbidity has been reported and bleeding can be rapid and life-threatening. While definitive treatment of pseudoaneurysms via embolization has proven successful, significant post-operative risks to patients exists due to the delay in symptom presentation and identification as well as embolism morbidities. The purpose of our investigation is to determine the incidence of pseudoaneurysms after Lefort I osteotomy at a single, high surgical volume institution and to report treatment options and outcomes of patients who experienced this problem. **Methods:** The billing directory for CPT codes corresponding to single, two- and three-piece Lefort I osteotomies was searched from January of 1998 to December of 2020. All cases of pseudoaneurysm arising post surgically performed over this 22-year period were identified. **Results:** Out of 1,900 Lefort I osteotomies performed, four cases of pseudoaneurysm

were identified. The calculated incidence rate of this complication was 0.2%. All four patients elected for embolization in which embolization was successful and of no consequence. Three of the four patients were male. In all cases the major bleed was preceded by several smaller bleeds. **Discussion and Conclusion:** Although rare, vascular pseudoaneurysms can be life threatening. Early detection of prodromal symptoms is vital to proper identification and definitive treatment.

## 42) Actively Growing Unilateral Condylar Hyperplasia in a Heterogenous Population

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**Objective:** To report and review the demographic data and treatment of a cohort surgically treated with actively growing unilateral condylar hyperplasia (CH) in a representative United States (US) population. The patients were categorized by clinical and radiographic appearance into hemimandibular elongation (HE), hemimandibular hyperplasia (HH), and hybrid (HH-HE) forms. **Methods:** 80 patients diagnosed with actively growing CH were surgically and orthodontically treated. Demographic and clinical presentation data of these developmental conditions were assessed. Surgical treatment was also reviewed. **Results:** Women were affected more frequently than men (W-52; 65%;  $p < 0.05$ ). HE (49; 61%;  $p < 0.05$ ) occurred more frequently than HH (24; 30%) and HH-HE (7; 9%). Difficulty eating and chewing were the most commonly reported chief complaints, followed by appearance concerns and pain. There was no difference in chief complaint between HH and HE ( $p > 0.05$ ). Right side was affected more than left (R-49; 61%;  $p < 0.05$ ) overall, and when stratified. All racial groups were represented. 87% of patients were treated with bimaxillary surgery combined with condylectomy. **Conclusions:** Both HH and HE are diagnosed through clinical and radiographic examination. Our results showed that HE occurs more frequently, all deformity subclassifications occur more frequently in females, the majority present in adolescence and all racial and ethnic groups are affected. The majority of patients required bimaxillary osteotomy with simultaneous condylectomy and genioplasty.

## Educational Research

### 43) Exploring A Career In Academic Dentistry

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**Objective:** As a 2020-2021 ADEA ADCFP fellow (Academic Dental Careers Fellowship Program) I explored rewarding and challenging experiences related to academic dental careers, with a special focus on being female in a historically male-dominated role. The goals are: 1) Discover how an academic career could fulfill my goals; 2) Participate in the development of a novel Cariology curriculum; 3) Explore the meaning of dental education during the COVID-19 Pandemic and beyond. **Methods:** To investigate Goal 1, I planned to conduct twenty one-on-one interviews with faculty, especially females from different ethnic groups in diverse stages of their careers. I reflected over the course of the fellowship using a virtual vision board. To explore Goal 2, I contributed to course design and was a teaching assistant for Dent 111 (Introduction to Cariology). To fulfill Goal 3, I was a teaching assistant for Dent 100 (Social and Ethical Issues in

Dental Practice) during the height of the pandemic in Fall 2020. **Results:** To date, I have conducted seven one-on-one faculty interviews, learning how academia can meet some of my goals, such as my desire to work and grow in teams, benefit from mentorship, and conduct research as well as clinical endeavors. However, challenges are bureaucracy, compensation disparities, and being female. I am mentoring small groups of students in Dent 111 to complete lab and course-related activities. Finally, I created resources to help navigate challenges with online learning for Dent 100 as well as provided guidance to students creating dental ethics videos. **Conclusions:** In conclusion, I have enjoyed my experience interacting with faculty and students and learned much about how faculty overcome challenges. I have grown both personally and professionally in this project and will continue investigating what it means to be an academician to determine how this role will fit into my future. **Funding source:** This work was supported by the 2020-2021 ADEA ADCFP Fellowship (Academic Dental Careers Fellowship Program).

#### **44) Evaluating student preparedness towards providing oral healthcare for hemophilia patients**

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**Objective:** Hemophilia patients experience significant barriers to receiving dental care, particularly with locating knowledgeable and comfortable oral healthcare providers. This mixed-methods study aimed to assess dental (DDS) and dental hygiene (DH) students' knowledge, confidence, and willingness to provide oral healthcare services to hemophilia patients. **Methods:** A survey was emailed to second-year DH and third-year DDS students at the University of North Carolina at Chapel Hill Adams School of Dentistry. Data was collected using a Likert-scale to measure students' knowledge, confidence, and willingness towards providing oral health screenings, counseling, dental treatment, dental referrals, and hematologic consultations towards patients with hemophilia. Open-ended items gathered feedback regarding perceived educational and clinical learning experiences. Associations between constructs of knowledge, confidence, and willingness were compared within both groups using Pearson correlation coefficients. Content received during training was compared between both groups using Cochran-Mantel Haenszel statistics. **Results:** One hundred nineteen matched surveys were returned (85 DDS, 34 DH) with a 100% response rate for DDS and 97% for DH students. DDS participants reported being more willing than they were knowledgeable ( $p=0.0004$ ) or confident ( $p<0.0001$ ) in providing oral health services. DH participants reported possessing greater knowledge than confidence ( $p=0.0008$ ) and were more willing than knowledgeable ( $p=0.0016$ ). Among clinical and educational experiences, 5% (N=4) DDS and 3% (N=1) DH participants reported receiving content on hemophilia and oral health in all categories (didactic knowledge, clinical interactions, and case-studies). Among both groups, 5% (N=6) reported clinical learning experiences. **Conclusion:** Enhanced education is needed to expand access to patients with hemophilia. Oral healthcare learners must have adequate opportunities to acquire the knowledge, confidence, and willingness to provide oral healthcare services to this population. Participants in this study expressed willingness but reported a lack of

confidence associated with managing patients with hemophilia. Clinical application of knowledge should be considered vital for student learning experiences.

#### **45) Implementing Environmental Sustainability Educational Intervention in Dental Hygiene Instruction**

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**Objectives:** The planet is facing a global climate crisis that poses a threat to public health on global and local scales. As the healthcare industry, including dentistry, contributes to a large portion of national waste output, steps should be taken to minimize dentistry's contribution to waste. The purpose of this study was to implement an educational intervention and assess its impact on Dental Hygiene (DHYG) students' perceptions on environmentally sustainable practices in dentistry.

**Methods:** Thirty-five second-year DHYG students at the UNC-CH Adams School of Dentistry (ASoD) were recruited for this mixed-methods pilot study. This study consisted of a pre- and post-survey component, an online educational module, and a final assignment followed by another post-survey. Pre- and post-module survey scores were compared with paired t-tests. Univariate and qualitative analyses were conducted on the post-assignment component.

**Results:** Twenty-four students had qualifying responses for the pre- and post-module survey (Response Rate: 68.57%). Twenty-two participated in the post-assignment survey component (RR: 62.86%). Participants scored higher on knowledge/attitude-based questions after module completion and were more favorable towards environmentally sustainable practices within dentistry. Majority of responses (>90%) indicated that the follow-up assignment strengthened their learning experience. Qualitative analysis revealed that the reflective assignment helped students apply module concepts in the real world and adopt behavioral changes to be less wasteful in clinic. **Conclusion:** Instructional interventions on environmentally sustainable dentistry in DHYG education may improve student's knowledge of environmentally sustainable dentistry and encourage behavioral changes to be more waste conscious. Dental hygiene educators that wish to minimize dental waste output and promote public health should consider incorporating environmentally sustainable dentistry into the dental hygiene curriculum. Findings from this study can be used as a model to build an evaluation system for the introduction of a new environmental sustainability component to dental hygiene educational curriculum.

#### **46) Dental Hygiene Curricula: Treating Patients with Intellectual and Developmental Disabilities**

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**Objective:** In 2019, the Commission on Dental Accreditation (CODA) changed its standard to require “providing dental hygiene care” for dental hygiene students to obtain competency in the treatment of patients with special needs. The purpose of this research project was to evaluate the current accredited United States dental hygiene programs’ curriculum to prepare dental hygienists to treat patients with intellectual and developmental disabilities (I/DD). **Methods:** A 25-question Qualtrics® survey was sent through a listserv to 325 dental hygiene directors of accredited programs. Survey topics about treatment of patients with I/DD included: curriculum content and structure, curriculum changes in response to new CODA standards, timing, setting and extent of clinical experiences, assessment of competency and educational barriers. Descriptive statistics were calculated. **Results:** The response rate was 29.5% (n=89/301 delivered surveys). Almost all respondents (98.9%) reported that their students received education on treating patients with I/DD. Over half (59.5%) reported no changes had been made to their curriculum in response to new CODA changes. Most directors, 69.7%, reported that the students are required to provide clinical care for patients with I/DD. Of the 73.7% who reported that each student provided care for  $\geq 1$  patient with I/DD, 80.4% indicated that their students have 1-5 such experiences. Program directors reported  $\leq 10$  hours teaching students how to care for patients with I/DD in classroom (64.9%), internal clinic (56.1%), and external clinic (64.2%) settings. “Lack of patients available in clinics” was identified as the biggest barrier to the students’ education on treating patients with I/DD. **Conclusion:** CODA’s updated accreditation standards changed from competence in *assessing* to “require students to be competent in *providing* dental hygiene care for patients with special needs.” Based on the data gathered from program directors’, recommendations can be made to increase the capacity of educational experiences of treating patients with I/DD.

#### **47) Poverty Simulation and Extramural Rotations: Connecting the Dots?**

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**Objective:** Increasing dental students’ awareness of the impacts of social determinants on oral health and oral health disparities is an important goal that can affect students’ subsequent clinical decision-making and patient interactions. The objective of this study is to evaluate the potential impacts and limitations of poverty simulations on students’ perceptions and understandings during their extramural rotations when they engage with patients from low socio-economic backgrounds. **Methods:** In spring 2017, 2018 and 2019, UNC dental students participated in poverty simulations prior to their summer extramural rotations. The following fall, they completed reflection essays about critical incidents during their rotation experiences. Qualitative analysis was used to analyze the 32 written reflections that specifically referenced the poverty simulation to gauge lasting impact. Initial inductive content analysis was used to identify, code and analyze themes present in students’ reflections. Individual reflections were then weighted using these themes and subsequent categories. **Results:** Nine themes relative to the students’ perceptions of patients’ circumstances were identified and collapsed into three broader categories: (1) deficit-based perspectives (n=9 weighted student reflections) included students’ essentializing socioeconomic status, attributing oral health disparities to individual choices, and assigning solutions to oral health disparities to individual dental healthcare providers; (2) sympathetic perspectives (n=16) included students’ recognition of the complexity of their patients’ lives as well as a sense of sympathy/empathy for their patients’ circumstances; and (3) critical perspectives (n=1) included, for instance, students questioning structural barriers to equitable oral health outcomes. **Conclusion:** The simulation and

the extramural rotations generated awareness of the complexity of factors that impact oral health as well as sympathy toward patients' experiencing adverse oral health outcomes. However, deficit-based perspectives remained alongside limited attention to the sociopolitical contributors to oral health disparities. Additional educational strategies are needed to generate in students commitments to social justice in addressing oral health disparities.

#### **48) Web-based unfolding case study in an interprofessional online class**

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**Objectives:** Investigate the impact of a web-based unfolding case study on the knowledge, skills, and attitudes (KSAs) of students in an online, interprofessional class. Secondary aims include assessment of the impact that COVID-19 had on learner perspectives and exploration of opportunities for further development and utilization of the web-based unfolding case study.

**Methods:** Interprofessional teams of four to five students enrolled in an online Population Health Course completed a series of modular activities relating to a web-based unfolding case study. The case utilized prototypical virtual reality to create an interactive video experience relating to a patient encounter. A total of 309 students from nursing, dentistry, PA, medicine, and pharmacy completed all activities related to the unfolding case study. Primary data was collected using a five-item open-ended Qualtrics survey and a focus group, and reflection papers yielded secondary data. The focus group was digitally recorded using Zoom and transcribed. Atlas.ti software and interpretative descriptive coding was used to analyze qualitative responses in order to identify themes. **Results:** A total of six students participated in the focus group, 32 submitted survey responses, and 13 submitted reflection paper responses. A preliminary review of the data through the lens of Kirkpatrick's model reflects major themes relating to (1) student reactions to the format, content, and delivery of the unfolding case, (2) impact of the activity on knowledge, skills, and attitudes and (3) Interprofessional teamwork regarding communication, coordination, and collaboration. **Conclusions:** The findings of this report indicate student-reported increase in knowledge, skills, and attitudes related to needs assessment, health disparities, engagement/motivational interviewing, and care collaboration. Data indicates recommendations for further development of unfolding case study to include expanded interactive virtual reality features, examples of successful patient encounters, and a desire for more activities to build interprofessional skills through engagement with peers.

#### **49) Learners as Leaders: Quality Improvement Methodology in Pre-Doctoral Dental Education**

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**Objectives:** To pilot a student-led Quality Improvement (QI) project and explore effectiveness of such project in improving the prenatal oral health patient care process. **Methods:** This pilot study (IRB #19-0860) was conducted at the UNC Adams School of Dentistry (ASOD) between September 2019 and March 2020. Two student researchers utilized Plan-Do-Study-Act (PDSA) cycles to design and implement a QI project within the school. Researchers interviewed key players in prenatal oral health program (pOHP) rotations and diagrammed rotation flow using methodology of the Institute of Healthcare Improvement. They utilized input from faculty and peers to select two problems within the rotation and an intervention. Researchers split third-year dental students evenly into experimental and control groups based on date of rotation. Pre- and post-surveys were emailed to students before and after rotation completion, containing questions on Likert scale addressing selected problems. Descriptive analysis was used to determine effectiveness of intervention. **Results:** Researchers selected lack of student preparation and failure to turn in necessary forms upon rotation completion as their problems of focus. As their intervention, researchers manually sent text message reminders one week prior to and one day after the rotation. Pre-survey responses (N= 79, 96%) showed preference for reminders, with sixty-eight (86%) and sixty-seven (85%) students indicating favor towards text reminders before and after their rotation, respectively. Secondary to COVID-19, experimental group post-survey response rate (N=14, 38%) left researchers with low power for statistical comparisons. However, descriptive analysis indicated preference for text reminders. Researchers reported the process improved their confidence in using QI methodology in their future careers. **Conclusion:** This study illustrated the utility of QI study design and implementation as an educational tool for learners. Despite limited data secondary to COVID-19, this pilot illuminated preliminary positive outcomes of text message reminders on rotation performance at the ASOD.

### **50) Preclinical Virtual Removable Partial Denture Survey and Design**

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**Objectives:** To explore student perspectives learning fundamental concepts of removable partial denture (RPD) survey and design using computer-assisted design (CAD) software. **Materials/methods:** Students learned RPD concepts remotely for the preclinical RPD course on digital casts using a software developed by 3PointX. Student feedback on this educational method was gathered using a 13-question Qualtrics survey sent out to the UNC Adams School of Dentistry Class of 2022. The data was statistically analyzed using Microsoft Excel and assessed using descriptive statistics. **Results:** 87 students participated in the course and designed RPDs on 14 pre-selected and digitized casts. The learning curve varied widely among students but the asynchronous nature of the activity allowed for self-paced progress. 3D modeling appeared to improve comprehension based on previous classes. Of the 41 responses, 71% of students indicated they “strongly” or “somewhat” agreed that their education was positively impacted by learning RPD survey and design virtually. 17% felt neutral about the impact on their education. Commonly noted strengths of virtual design included the ability to quickly alter a design, precision of undercuts and other values, and speed of the workflow. The most common drawbacks cited by participants included the desire to manipulate the cast in their hands, concerns with translating this to the UNC ASOD’s clinic workflow, and the learning curve or “glitches” with software. 13 students (43.3%) responded that they anticipate using a digital design process for RPDs, while 6 (20.0%) would use a conventional process, and 11 (36.6%) indicated they would employ both.

When asked if they would digitally design and survey a cast themselves post-graduation or send to a lab, 19 (57.6%) responded they would digitally survey and design themselves, 8 (24.2%) would defer to a lab, and 6 (18.2%) would do both. 4 (12.1%) students responded that they would recommend future RPD courses be taught in a strictly digital format, 4 (12.1%) suggested strictly conventional, and the vast majority (75.8%) recommended a combination of both digital and conventional survey and design formats. **Conclusions:** The COVID-19 pandemic necessitated a novel way to teach RPD survey and design virtually. Utilizing a CAD software program proved to be a successful solution. The majority of student feedback was positive for learning in the digital format. Moving forward, the software can be integrated alongside conventional methods regardless of remote learning requirements to enhance student learning and foster interest in digital workflows.

### **Bioinformatics/Imaging and Therapeutic Modalities**

#### **51) SYNGR3 Expression within Immune Cells of the Tumor Stroma has Diagnostic Value in HPV16-associated Head and Neck Squamous Cell Carcinoma**

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**Objectives:** Nearly 60% of oropharyngeal head and neck squamous cell carcinomas (HNSCCs) are positive for the human papillomavirus-16 (HPV16). While HPV is a prognostic factor of these cancers, interpretation of available HPV detection assays remains challenging. Both p16 IHC and

HPV16 ISH are currently used detection methods but suffer from sub-optimal specificity and sensitivity, respectively. We employed an immunogenomics approach to identify and validate a complementary method of establishing HPV status in HNSCCs. **Methods:** To assess tumor-immune interactions, we surveyed available TCGA data and identified genes differentially expressed (DEGs) in immune cells between HPV(+) and HPV(-) HNSCCs. Candidate genes were tested in clinical specimens using both quantitative RT-PCR and immunohistochemistry (IHC), and then validated by IHC of a tissue microarray (TMA) of HNSCC cases. Multiplex immunofluorescent staining of the same TMA was then performed with immune cell markers to confirm expression in the immune compartment of the tumor. Lastly, Receiver Operating Characteristic (ROC) curve analysis was performed to assess the sensitivity and specificity relative to existing HPV detection assays. **Results:** HPV(+) HNSCCs have a unique immunogenomic signature that includes robust expression of Synaptogyrin-3 (SYNGR3) in Th1 cells within the tumor stroma. SYNGR3 mRNA and protein are significantly higher in primary HPV(+) HNSCC patient tumors relative to their HPV(-) counterpart, and pan-CD3/SYNGR3/pan-Cytokeratin multiplex staining successfully confirmed that SYNGR3 is enriched in T cells of these tumors. ROC curve analyses revealed that co-detection of SYNGR3 and p16 provides more sensitivity and specificity for HPV detection when compared to p16 IHC alone. **Conclusion:** HPV(+) HNSCCs harbor T cells that exhibit robust SYNGR3 expression supporting its use as a novel biomarker of HPV positivity. These data indicate that co-detection of SYNGR3 and p16 by IHC can more reliably predict HPV status in HNSCCs, and therefore has diagnostic and prognostic value in the clinic. **Funding source:** NIH/NIDCR Ruth L. Kirschstein National Research Service Award (NRSA) F31 Fellowship (RMM), NIH/NCI T32-CA211056 (to MBC), University Cancer Research Fund (UCRF) and UNC Lineberger Tier 3 Developmental Award (ALA).

## 52) Micro-CT as Reference Standard for Early Carious Lesion Activity Assessment

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**Objectives:** This study aims to identify thresholds in microtomographic (micro-CT) mineral density profiles of the enamel smooth surface layer among demineralized, remineralized lesions, and sound surfaces in an effort to use this analytical tool as a potential reference standard for future *ex vivo* caries activity assessment validation studies. **Methods:** Sound and non-cavitated (ICDAS 1-3) smooth surfaces (n=59) were selected via visual-tactile examination for caries activity using the ICCMS criteria. Two calibrated examiners evaluated the teeth independently for caries activity status (active, inactive, sound), with a second exam each conducted one week later. The teeth were then scanned via micro-CT. The sagittal slice showing the deepest part of the lesion was selected from the reconstructed three-dimensional images. Line plot analysis was used to create plots of mineral density against lesion depth, and the AUC was calculated for each plot. AUC thresholds were established using discriminate analysis to classify

sound, remineralized, and demineralized surfaces against the gold standard examiner's ICCMS assessment. **Results:** Intra-examiner ICCMS activity agreement ranged from 0.72-0.75 kappa coefficient ( $k$ ), while inter-examiner agreement was  $k = 0.64$ . Significant differences in mineral density were observed among sound, demineralized and remineralized lesions (Kruskal-Wallis,  $p < 0.01$ ) when comparing their respective AUC plot analyses. Diagnostic thresholds were associated with caries ICCMS activity classification using AUC mineral density values of the most external 96  $\mu\text{m}$  enamel surface (Sound  $\geq 216\text{gHA/cm}^3$ ; Remineralized  $\geq 203\text{gHA/cm}^3$ ; Demineralized  $< 203\text{gHA/cm}^3$ ). The established thresholds demonstrated 76.3% agreement with the ICCMS assessment in identifying demineralized lesions ( $k = 0.45$ ), with sensitivity of 0.73 and specificity of 0.77. **Conclusion:** This study demonstrates quantifiable differences between demineralized, remineralized lesions, and sound surfaces, which may be used for *ex vivo* classification of caries activity. This study further indicates the difficulty in diagnosing caries activity for initial lesions using visual-tactile clinical exams, even for experienced examiners. **Funding Source:** This work was supported by the University of North Carolina Adams School of Dentistry and Dental Foundation of North Carolina.

### **53) Doses Associated With Variable Collimator Distances During Adult/Child Bitewing Examinations**

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**Objectives:** The National Commission on Radiation Protection has strongly reinforced recommendations for the use of rectangular collimation (RC) for intraoral radiography (IR) in the most recent Report No.177. In response to continued concerns for risks associated with dental diagnostic imaging, adoption of the ALARA concept (As-Low-As-Reasonably-Achievable) has inspired the use of well proven dose reduction strategies, such as tighter collimation and beam-alignment devices for IR. Despite the assistive benefit of beam-alignment systems, variations in operator implementation can occur. Substantial evidence exists for a cumulative dose-related response to ionizing radiation in the form of cancer developing years after initial exposure. Therefore, the purpose of this study was to measure equivalent doses and calculate E from adult and child bitewing (BW) examinations using a conventional wall-mounted source with both RC and circular techniques. **Methods:** Anthropomorphic adult/child phantoms and optically stimulated luminescent dosimeters were used to measure dose from simulated BW examinations with flush vs. retracted beam-alignment ring (adult  $n=4$  / child  $n=2$ ) at 24 head/neck tissue/organ sites. Exposure parameters were 70 kV/7mA (3.5mAs & 8.96mAs) respectively for RC and circular. ANOVA and Tukey HSD statistics were used. **Results:** Adult BW examination E(uSv) was RC(8.0/8.2), Circular(14.7/13.3) for flush vs. retracted positioning. Child E was RC(5.9/5.4), Circular(8.9/8.8), respectively. Both RC conditions produced significantly lower E than Circular for adult and child phantoms ( $p=0.0001$ ). Flush vs. retracted E differences were not significant within all phantom conditions. Despite increased dose to specific tissues with retracted exposures, E generally decreased slightly with the exception of a negligible increase with adult RC. **Conclusion:** E is the preferred way to estimate and compare potential risks from ionizing radiation exposure. However, whole-body-E values alone can shroud the exposure burden to specific dentomaxillofacial tissues. In some cases, increasing source-to-patient distance may increase dose to specific tissues, without significantly increasing E.

#### 54) Geographic Tongue as a Reaction-Diffusion System

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**Objectives:** Geographic tongue (GT) or benign migratory glossitis is a condition of an unknown cause characterized by chronic lesions that slowly migrate across the surface of the tongue. The condition's characteristic wavefronts suggest that it can be modeled as a reaction-diffusion system. Here, we present a model for geographic tongue pattern evolution using reaction-diffusion equations applied to portions of spheroids and paraboloids that approximate a tongue shape. **Methods:** We selected the Barkley model for our reaction-diffusion equations because the Barkley model captures key GT phenomenology and is designed to be fast to numerically integrate. We modified the reaction-diffusion system to account for surface curvature using the Laplace-Beltrami Operator and then numerically integrated the model over spheroids using the Finite Element Method on desktop computers. **Results:** We report images of simulations where wavefronts of excitation are initiated under different conditions on spheroids and paraboloids resembling the tongue. We show the propagation of these wave fronts and spirals and compare them to clinical images of geographic tongue. **Conclusions:** Geographic tongue, like many other spatiotemporal patterns in biology, can be modeled as a reaction-diffusion system. Finite-element decomposition of the differential equations on spheroids and paraboloids easily generated spiral and elliptical wave fronts similar to those observed clinically. The qualitative similarity between our simulations and patient data can be achieved without assuming anisotropic diffusion on the tongue's surface. In our next steps, we will use experimental time-series to measure real GT propagation speeds and determine diffusion constants to reproduce particular subjects' GT behavior as well as investigate the effects of inert obstacles like fungiform papillae or fissures in the tongue on GT evolution. **Funding source:** The Sherman Fairchild Foundation, The College of Wooster.

#### 55) SculptorHD: A Web-Based Rendering Application for Communicating Dental Conditions

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**Objective:** The importance of using visual aids for communicating clinical examination findings or proposed treatments in dentistry cannot be overemphasized. Similarly, communicating dental research results with tooth-surface level precision is impractical unless visual representations are used. To this end, we have developed a data visualization informatics pipeline that converts primary tooth- or tooth surface-level information to colorized, three-dimensional renderings of the primary dentition. Here, we present the development, deployment, and two real-life applications of a web-based implementation of the tool for clinical and research purposes. **Methods:** The core of the informatics pipeline revolves around texture (UV) mapping of a three-dimensional model of the primary dentition. The 88 individually segmented tooth surfaces receive independent inputs from Python scripts that dynamically update their colors and textures according to customizable user specifications. The web implementation is done via Google Cloud. **Results:** The deployed web tool (SculptorHD) can accommodate manually entered or spreadsheet formatted tooth surface

data and allows the customization of color palettes and thresholds, as well as surface textures (e.g., condition-free, caries lesions, stainless, or ceramic steel crowns). Its current implementation was successfully used by UNC-affiliated and international collaborators studying early childhood caries (ECC)—the tool enabled the visualization and interpretation of clinical subtypes of ECC using tooth surface caries experience summary data. As a demonstration of its potential clinical utility, the tool was also used to simulate the restorative treatment presentation of a severe ECC case, including the use of stainless steel and ceramic crowns. **Conclusions:** We expect that this publicly available web-based tool can aid clinicians and investigators deliver precise, visual presentations of dental conditions and proposed treatments. The creation of rapidly adjustable “lifelike” dental models which are integrated to existing electronic health records and respond to new clinical findings or planned work, is likely to boost two-way communication between clinicians and their patients. **Funding source:** Viviana R. Duce Research Fellowship in Pediatric Dentistry; Grover C. Hunter Research Fellowship; NIH/NIDCR #U01-DE025046.

### **56) Validation of Spectral Moment Analysis to Characterize Speech Distortion Severity.**

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**Objectives:** At UNC, 25% of the dentofacial disharmonies (DFD) patients who pursue jaw surgery have a chief concern related to speech. However, there is little known about the correlation between jaw deformities and speech distortion and whether or not surgical correction yields lasting improvement for speech. Previously published data are primarily qualitative and based on subjective perceptual analysis by speech language pathologists (SLPs). To quantify the relationship between DFD and speech distortion, the Jacox Lab has employed spectral moment analysis (SMA) using Time-Frequency analysis software for 32-bit Windows (TF32). Preliminary findings show SMA reveals significant differences between DFD patients and controls, with higher spectral frequencies for DFD patients. It is not known, however, if there is a direct relationship between quantitative SMA and perceived distortion of speech. **Methods:** To address this question, lay listeners (n=100) were asked to rate the speech sounds /t/, /k/, /s/, and /sh/ on a visual analog scale as “completely clear” versus “severely distorted” in an online cross-sectional, quantitative survey. The speech sounds utilized in the survey have different spectral characteristics between DFD and control populations. We hypothesize that there is a direct relationship between perceived degree of speech distortion and shifts in SMA values. **Results:** Preliminary analysis suggest lay listeners are able to distinguish a clear production from a distorted production as judged by SMA quantification, supporting the hypothesis. **Conclusions.** Preliminary results indicate SMA quantification is validated by and consistent with lay listeners perceptions of distortions. **Funding source:** NC TraCS \$5K - \$50K Translational Research Matched Pilot Grant Program; AAOMS Foundation Research Award

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