38th Annual Research Day

Wednesday, March 2, 2022

https://dentistry.unc.edu/discovery/research-day/
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Front cover images taken by:

Christina Graves, PhD, Post-doctoral fellow, Adams School of Dentistry
Darius Thompson, undergraduate researcher
Erik Norloff, undergraduate researcher

Pictured are the neural projections of the zebrafish enteric nervous system using tissue clearing (iDISCO) and whole-organ confocal imaging. We are interested in understanding the effects of environmental stress on neuroimmune processes across the gum-to-gut axis (zebrafish have teeth, too!)

Wenjun Li, Pre-doctoral Candidate, Oral Craniofacial Biomedicine (OCBM)
Bijan Mahboubi, 1st year dental student, Adams School of Dentistry

Mouse salivary glands were visualized by Hematoxylin and Eosin (H&E) staining showing the unique border between sublingual (left) and submandibular (right) glands. This animal model is used to study oral health diseases, such as Sjögren's syndrome, an autoimmune disorder that can target the salivary glands resulting in chronic dry mouth.
Dear Colleagues,

We would like to welcome everyone to the Adams School of Dentistry’s 38th Annual Dental Research in Review Day. It has been quite the year for research, discovery, and innovation as well as for our personal and professional lives. We are excited that we are able to hold our event in-person albeit with mitigation strategies still in effect. Thank you for joining us in celebrating the accomplishments of our students, faculty, staff, research fellows and colleagues from around the University and the State.

Here at the Adams School of Dentistry, we are committed to inspiring, creating and supporting all aspects of Research, Discovery, and Innovation. It is clear from the array of work to be presented, that investigators within the Adams School of Dentistry interact and collaborate with investigators on the UNC-CH campus, as well as with leading investigators and institutions across the nation and abroad.

In addition to 56 oral and poster presentations, the day’s events will include a keynote address by Roger Fillingim, PhD, Distinguished Professor, Director of the UF Pain Research & Intervention Center for Excellence, University of Florida. In addition, there will be four Hands on Workshops in which attendees can participate, whereby the topics are as diverse as the interests and expertise of our attendees. Finally, we have received significant sponsorship of many of our activities from our corporate partners, the office of sponsored research (OSR), the UNC Center for Excellence, and our partners in Diversity Equity and Inclusion (DEI).

It is our hope that you enjoy the day’s activities designed to promote the fellowship of Research, Discovery, and Innovation. The day was crafted by the organizing committee which includes members from the Research Advisory Committee, 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, PhD
Associate Dean for Research, Discovery, and Innovation

Ed Swift, DMD, MS
Interim Dean and Professor, Adams School of Dentistry
Dear Friends and Colleagues,

On behalf of the North Carolina Section of the American Association for Dental, Oral and Craniofacial Research (NC AADOCR) and the UNC Student Research Group (UNC SRG), it is our great pleasure to welcome you to the 38th UNC Adams School of Dentistry Research Day.

We are excited to be back to an in-person meeting, with an excellent scientific program that includes Dr. Roger B. Fillingim, Distinguished Professor and Director of the University of Florida Pain Research and Intervention Center of Excellence as the Keynote Speaker. The scientific program also includes hands-on courses, posters, and oral presentations, which definitely harness the excitement generated within the long history of the UNC Adams School of Dentistry Research Day!

The meeting will bring together the scientific community of UNC Adams School of Dentistry’s students, faculty, staff, research fellows and visiting scholars and many segments of the Dental, Oral and Craniofacial Research, to provide a unique opportunity for sharing the latest discoveries and ideas. We would like to especially thank all of our 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 look forward to an exciting meeting on March 2nd, which promises great scientific debate and enjoyable (and safe) social interaction. We hope you enjoy your day here at UNC Adams School of Dentistry celebrating the hard work of all of our researchers!

With best regards,

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

UNC Student Research Group Executive Board
L to R: Mylan Young (Advocacy Chair), Amanda Swanson (Secretary), Mustafa Girnary (President), Skylar McGaughey (Treasurer), Angeliz-Concepcion (Historian)
38th Research Day Keynote Presentation

Kirkland Auditorium, Koury Oral Health Sciences Building
UNC Adams School of Dentistry
12 pm – 1 pm, Wednesday, March 2, 2022

Let’s Get Personal: How Understanding Individual Differences Can Enhance Pain Treatment

Roger Fillingim, PhD
Distinguished Professor, Director of the UF Pain Research & Intervention Center for Excellence
University of Florida

Roger B. Fillingim, PhD is a Distinguished Professor in the University of Florida (UF) College of Dentistry and Director of the UF Pain Research & Intervention Center of Excellence. His research investigates biological and psychosocial contributions to individual differences in pain, including the influences of sex/gender, race/ethnicity and aging on the experience of pain. Dr. Fillingim’s research has been continuously funded by the NIH since 1994, including a current MERIT award from the National Institute on Aging. He has published more than 400 peer-reviewed papers and has delivered plenary and keynote addresses at numerous international conferences. Dr. Fillingim has also provided national leadership, serving as the President of the American Pain Society from 2012-2014, and serving on the US Department of Health and Human Service Interagency Pain Research Coordinating Committee. Dr. Fillingim has received numerous honors and awards, including the Wilbert E. Fordyce Clinical Investigator Award and the Public Service Award (both from the American Pain Society), and UF Foundation Preeminence Term Professorship (2019).

(In case you cannot make it in person)
https://unc.zoom.us/j/92207937504?pwd=dmZwVHJ4VHJnYXBkVVZOTEQzWGdBUT09
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity and Location</th>
</tr>
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<tbody>
<tr>
<td>7:00 am - 8:00 am</td>
<td><strong>Poster and Vendor Set-up</strong>&lt;br&gt;Main Street and Atrium, Koury Oral Health Science Building, Ground floor</td>
</tr>
<tr>
<td>8:00 am - 9:00 am</td>
<td><strong>Welcome Breakfast</strong> <em>(registration required)</em>&lt;br&gt;West Lobby, Koury Oral Health Science Building, First floor</td>
</tr>
<tr>
<td>8:00 am - 4:30 pm</td>
<td><strong>Posters and Vendor Exhibitions Open</strong></td>
</tr>
<tr>
<td>8:00 am - 8:30 am</td>
<td><strong>Welcome and Opening Remarks</strong></td>
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<td></td>
<td>West Lobby, Koury Oral Health Science Building, First floor</td>
</tr>
<tr>
<td>8:30 am - 10:00 am</td>
<td><strong>Poster Presentations</strong>&lt;br&gt;Main Street, Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>10:15 am - 11:45 am</td>
<td><strong>Oral Presentations Session #1A</strong>&lt;br&gt;G405, Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>10:15 am - 11:45 am</td>
<td><strong>Oral Presentations Session #1B</strong>&lt;br&gt;G411, Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>11:30 am - 12:00 pm</td>
<td><strong>Boxed Lunch Pickup</strong> <em>(registration required)</em>&lt;br&gt;West lobby, Koury Oral Health Science Building, First floor</td>
</tr>
<tr>
<td>12:00 pm - 1:00 pm</td>
<td><strong>Keynote address: Roger B. Fillingim, PhD</strong>&lt;br&gt;Distinguished Professor, Director of the UF Pain Research and Intervention Center of Excellence&lt;br&gt;<strong>Let’s Get Personal: How Understanding Individual Differences Can Enhance Pain Treatment</strong>&lt;br&gt;Kirkland Auditorium, Koury Oral Health Sciences Building, First floor</td>
</tr>
<tr>
<td>1:15 pm - 2:45 pm</td>
<td><strong>Oral Presentations Session #2A</strong>&lt;br&gt;G405, Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>1:15 pm - 2:45 pm</td>
<td><strong>Oral Presentations Session #2B</strong>&lt;br&gt;G411, Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>3:00 pm - 5:00 pm</td>
<td><strong>Hands-on Workshops</strong> <em>(registration required)</em>&lt;br&gt;Koury Oral Health Sciences Building, Ground floor</td>
</tr>
<tr>
<td>5:00 pm - 6:30 pm</td>
<td><strong>Awards Reception</strong> <em>(registration required)</em>&lt;br&gt;West Lobby, Koury Oral Health Science Building, First floor</td>
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</table>
## Poster Presentations

**08:30 am – 10:00 am**

<table>
<thead>
<tr>
<th>Abstract Number</th>
<th>Time</th>
<th>Presenter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>830 am</td>
<td>John Kwiatkowski</td>
<td>Are dentists in agreement with antibiotic guidelines for odontogenic infections?</td>
</tr>
<tr>
<td>3</td>
<td>915 am</td>
<td>Deborah Liu and Gabriella Gallo</td>
<td>COVID-19’s Impact on Dentists’ Workforce Confidence and Workflow</td>
</tr>
<tr>
<td>4</td>
<td>830 am</td>
<td>Angeliz Rivera-Concepcion</td>
<td>Effect Of Dietary Hesperidin Rat vs. Mice Long Bone Homeostasis</td>
</tr>
<tr>
<td>5</td>
<td>915 am</td>
<td>Skylar McGaughey</td>
<td>Influence of hesperidin on bone healing of rat mandible defect</td>
</tr>
<tr>
<td>6</td>
<td>830 am</td>
<td>Joshua Raisin</td>
<td>Oral Healthcare Barriers for Transgender and Gender Nonbinary Populations</td>
</tr>
<tr>
<td>7</td>
<td>915 am</td>
<td>Caroline Meier</td>
<td>Hybrid Pain Management Strategy Limits Left-over Opioid Doses</td>
</tr>
<tr>
<td>8</td>
<td>830 am</td>
<td>Wenjun Li</td>
<td>Adeno associated virus mediated PDL1 therapy in immune modulation</td>
</tr>
<tr>
<td>9</td>
<td>915 am</td>
<td>Erik Norloff</td>
<td>Chronic stress alters gut motility in young zebrafish</td>
</tr>
<tr>
<td>10</td>
<td>830 am</td>
<td>Christina Graves</td>
<td>Early Life Stress Rewires The Gut</td>
</tr>
<tr>
<td>14</td>
<td>915 am</td>
<td>Steven Oliver</td>
<td>Orthognathic Speech Pathology: Impacts of Class II Malocclusion on Speech</td>
</tr>
<tr>
<td>15*</td>
<td>915 am</td>
<td>Samantha Glover and Devon Collins</td>
<td>Feasibility of measuring fluoride in fingernail clippings of preschool children</td>
</tr>
<tr>
<td>16*</td>
<td>830 am</td>
<td>Colin LaPrade</td>
<td>Collimator-to-Patient Distance: Effects on Dose for Bitewing Radiography</td>
</tr>
<tr>
<td>17</td>
<td>915 am</td>
<td>Taneisha Livingston</td>
<td>Shifts in oral biofilm: microbiome and transcriptome investigation.</td>
</tr>
<tr>
<td>18</td>
<td>830 am</td>
<td>Neal Quinn</td>
<td>Mechanical Strength Evaluation of 3D-Printed Resin Crowns</td>
</tr>
<tr>
<td>19*</td>
<td>915 am</td>
<td>Kaitlin Jones</td>
<td>Guardians’ Self-Reported Oral Health is Associated with their Children’s ECC</td>
</tr>
<tr>
<td>20</td>
<td>830 am</td>
<td>Darius Thompson</td>
<td>The Impact of Early-Life Stress on the Developing Oral Cavity</td>
</tr>
<tr>
<td>24</td>
<td>915 am</td>
<td>Katherine Grant</td>
<td>Evaluation of Margin Designs for 3D-Printed Crown Patterns</td>
</tr>
<tr>
<td>25</td>
<td>830 am</td>
<td>Fernando Astorga</td>
<td>Efficacy of Tablets as a Learning Tool for Dental Students</td>
</tr>
<tr>
<td></td>
<td>Time</td>
<td>Speaker</td>
<td>Title</td>
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<tr>
<td>26</td>
<td>915 am</td>
<td>Allison Carron</td>
<td>2017 Periodontal Disease Classification System Use Among Dental Hygiene Faculty</td>
</tr>
<tr>
<td>29</td>
<td>915 am</td>
<td>Silvana Pasetto</td>
<td>Anadenanthera colubrina Modulates Virulence-Factors of Candida albicans and Inflammatory Response</td>
</tr>
<tr>
<td>32</td>
<td>830 am</td>
<td>Mustafa Girnary</td>
<td>Print Quality of Resin Patterns on Different 3D Printers</td>
</tr>
<tr>
<td>33</td>
<td>915 am</td>
<td>Thamiris Cirelli</td>
<td>PPARG variants associated with Periodontitis and Type 2 Diabetes Mellitus</td>
</tr>
<tr>
<td>35</td>
<td>915 am</td>
<td>Jennifer Judd</td>
<td>Women in Science and Healthcare Research (WISHR) Peer Support Initiative</td>
</tr>
<tr>
<td>36*</td>
<td>830 am</td>
<td>Meng Deng</td>
<td>AIF inhibits NLRP3 inflammasome dependent IL-1β induction by sequestering NEK7</td>
</tr>
<tr>
<td>37</td>
<td>915 am</td>
<td>Amanda Swanson</td>
<td>Transitional Digital Restorations for Developmental Dental Defects in Young Patients</td>
</tr>
<tr>
<td>40*</td>
<td>830 am</td>
<td>Ryan Gross</td>
<td>YouTube: An Innovative Platform in Dental Education</td>
</tr>
<tr>
<td>42</td>
<td>915 am</td>
<td>Triny Gutierrez</td>
<td>Identifying Factors Influencing Orthodontic Program Selection</td>
</tr>
<tr>
<td>43</td>
<td>830 am</td>
<td>Carolyn Collins</td>
<td>Antimicrobial efficacy of silver nanoparticles</td>
</tr>
<tr>
<td>45*</td>
<td>915 am</td>
<td>Surya Tripathi</td>
<td>Molecular Mechanisms Governing Long-Term Drug Tolerance in Salivary Gland Cancer</td>
</tr>
<tr>
<td>46</td>
<td>830 am</td>
<td>Reuel Kim</td>
<td>Physical and Functional Limitations in Dental Hygiene and Dental Students</td>
</tr>
<tr>
<td>48</td>
<td>915 am</td>
<td>Mallory Kocher</td>
<td>Correlation of Body mass Index and Craniofacial Morphology</td>
</tr>
<tr>
<td>50</td>
<td>830 am</td>
<td>Allen Rapolla</td>
<td>Novel Software-based Observational Coding Protocol for Evaluating Pediatric Dental Anxiety</td>
</tr>
<tr>
<td>51*</td>
<td>915 am</td>
<td>Joy Gerasco</td>
<td>Commensal Gut Microbiota: A Novel Regulator of Craniofacial Skeletal Development</td>
</tr>
<tr>
<td>52*</td>
<td>830 am</td>
<td>Matthew Manley</td>
<td>Comparison of PortrayTM Stationary Intraoral Tomosynthesis (SIT) and Conventional Bitewing Images</td>
</tr>
<tr>
<td>54*</td>
<td>915 am</td>
<td>Jared Sobo</td>
<td>New Aged Tricalcium Silicates Discoloration of Dentin</td>
</tr>
</tbody>
</table>

*Turner Award Finalists*
### Oral Presentations Session #1

10:15 am – 11:45 am

**Oral Presentations Session #1A**
G405, Koury Oral Health Sciences Building, Ground floor
[https://unc.zoom.us/j/97924508486?pwd=MXczN1hQR21YUXV1dWN4czlBS3NZQT09](https://unc.zoom.us/j/97924508486?pwd=MXczN1hQR21YUXV1dWN4czlBS3NZQT09)

<table>
<thead>
<tr>
<th>Abstract Number</th>
<th>Time</th>
<th>Presenter</th>
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</tr>
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<tbody>
<tr>
<td>11*</td>
<td>10:15</td>
<td>Feifei Huang</td>
<td>Accuracy of Artificial Intelligence in Identifying Radiolucencies in Panoramic Radiographs</td>
</tr>
<tr>
<td>21*</td>
<td>10:30</td>
<td>Anne Dorsey</td>
<td>Comparing Child and Adult Dose from Contemporary Extraoral Bitewing Radiography</td>
</tr>
<tr>
<td>23*</td>
<td>10:45</td>
<td>Iryna Hryvenko Daline</td>
<td>Diagnostic accuracy of TMD Screener in patients with endodontic pain</td>
</tr>
<tr>
<td>39*</td>
<td>11:00</td>
<td>Elizabeth Kay</td>
<td>3D Intraoral Tomosynthesis: Adult and Child Bitewing Radiography Dosimetry</td>
</tr>
</tbody>
</table>

11:15 – 11:45
Oral Session 1A Discussion

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**Oral Presentations Session #1B**
G411, Koury Oral Health Sciences Building, Ground floor
[https://unc.zoom.us/j/99714082501?pwd=dkY4SStaQ3pCN2RvWIUrV0pnM2R4dz09](https://unc.zoom.us/j/99714082501?pwd=dkY4SStaQ3pCN2RvWIUrV0pnM2R4dz09)

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<tr>
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</tr>
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<tbody>
<tr>
<td>13*</td>
<td>10:15</td>
<td>Emily Imes</td>
<td>“Against the Current” of Early Childhood Caries: Positive Outliers</td>
</tr>
<tr>
<td>22*</td>
<td>10:30</td>
<td>Marta Musskopf</td>
<td>A novel dental implant system with a simplified site preparation</td>
</tr>
<tr>
<td>27*</td>
<td>10:45</td>
<td>Brittany Booth</td>
<td>Entrustable Professional Activities in Dental Hygiene Education</td>
</tr>
<tr>
<td>44*</td>
<td>11:00</td>
<td>Ryan Kearney</td>
<td>Investigation into Long-Term Stability of Anterior Openbite Correction with Aligners</td>
</tr>
<tr>
<td>47*</td>
<td>11:15</td>
<td>Sara Albastoni</td>
<td>Prevalence of High-Risk Human Papillomavirus in Oral Squamous Cell Carcinoma</td>
</tr>
</tbody>
</table>

11:30 -11:45
Oral Session 1B Discussion

*Turner Award Finalists*
## Oral Presentations Session #2

### Oral Presentations Session #2A

G405, Koury Oral Health Sciences Building, Ground floor

https://unc.zoom.us/j/97924508486?pwd=MXczN1hQR21YUXV1dWN4czI8S3NZQT09

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<th>Abstract Number</th>
<th>Time</th>
<th>Presenter</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>1:15</td>
<td>Elnaz Gharah Bash</td>
<td>Exploring Synthetic Low Molecular Weight Heparins for Treatment of Periodontitis</td>
</tr>
<tr>
<td>38*</td>
<td>1:30</td>
<td>Bijan Mahboubi</td>
<td>Optimization of Adeno-Associated Virus Vector-Mediated Gene Transfer to Salivary Glands</td>
</tr>
<tr>
<td>49</td>
<td>1:45</td>
<td>Angela Chen</td>
<td>Identifying Biomolecular Pathways Which Change Gingivitis Response Under Stress</td>
</tr>
<tr>
<td>55*</td>
<td>2:00</td>
<td>Zachary Burk</td>
<td>Genome-wide Association Study of Primary Dentition Enamel Diffuse Opacities</td>
</tr>
<tr>
<td>56</td>
<td>2:15</td>
<td>Anna Farrell</td>
<td>Streptococcus oligofermentans inhibits Streptococcus mutans metabolic activity and aciduric properties</td>
</tr>
</tbody>
</table>

2:30 – 2:45

Oral Session 2A Discussion

## Oral Presentations Session #2B

G411, Koury Oral Health Sciences Building, Ground floor

https://unc.zoom.us/j/99714082501?pwd=dkY4SSstaQ3pCN2RvWIUrV0pnM2R4dz09

<table>
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<tr>
<th>Abstract Number</th>
<th>Time</th>
<th>Presenter</th>
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<tbody>
<tr>
<td>2*</td>
<td>1:15</td>
<td>Miguel Simancas-Pallares</td>
<td>Supragingival Biofilm Multi-Omics Differ Between Early Childhood Caries Clinical Subtypes</td>
</tr>
<tr>
<td>31*</td>
<td>1:30</td>
<td>Caroline Allbert</td>
<td>Spectral Characteristics of Speech in Children with Repaired Cleft Palate</td>
</tr>
<tr>
<td>41*</td>
<td>1:45</td>
<td>Nishma Vias</td>
<td>Distinct Biomarker Signatures Define Periodontal Disease Subtypes</td>
</tr>
<tr>
<td>53*</td>
<td>2:00</td>
<td>Kamaira Philips</td>
<td>Precision Periodontal Disease Subtypes are Associated with Pre-Term Birth</td>
</tr>
</tbody>
</table>

2:15 – 2:45

Oral Session 2B Discussion

*Turner Award Finalists*
# Hands on Workshops

3:00 pm – 5:00 pm *(registration required)*

<table>
<thead>
<tr>
<th>Room</th>
<th>Activity and Presenters</th>
</tr>
</thead>
</table>
| Koury G405 | **Biomimetic Restoration of Structurally Compromised Teeth**  
Bert Vasconcellos, DDS, MS, PhD, and Luis Schlichting, DDS, MS, PhD, Adams School of Dentistry             |
| Koury G411 | **Beyond Think Pair Share: Educational Techniques and Scholarship**  
Doug James, PhD, UNC Center for Faculty Excellence                                                      |
| Koury G502 | **Making Research Beautiful: Figure Making with BioRender**  
Jacqueline McCoskey, BioRender, and Cristiana Graves, PhD, Adams School of Dentistry                  |
| Koury G508 | **How to Navigate Research and Resources at UNC-CH:**  
*NCTraCs, Scientific Review Committee, LabArchives Electronic Notebooks*  
Andrea Carnegie, PhD, Chief Operating Officer, NCTRACS, Eric Everett, PhD, SRC, and Hannah Clark, LabArchives |
Abstract # - 01 Are dentists in agreement with antibiotic guidelines for odontogenic infections?

1Nelson, Derrick C; 2Blakey, George H; 3Shim, Christopher W; 4Duran, Celin E; 5Kwiatkowski, John; 6Phillips, Ceib; 7White, Ray P.

1Division of Craniofacial and Surgical Care, Department of Oral & Maxillofacial Surgery, UNC Adams School of Dentistry; 2Division of Craniofacial and Surgical Care, Department of Oral & Maxillofacial Surgery, UNC Adams School of Dentistry; 3Division of Craniofacial and Surgical Care, Department of Oral & Maxillofacial Surgery, UNC Adams School of Dentistry; 4UNC Adams School of Dentistry; 5UNC Adams School of Dentistry; 6Department of Oral & Craniofacial Biomedicine, UNC Adams School of Dentistry; 7Division of Craniofacial and Surgical Care, Department of Oral & Maxillofacial Surgery, UNC Adams School of Dentistry.

Objectives/Problem: Excessive use of antibiotics (Abx) in Agriculture and Health Care has led to negative impacts in both fields. Materials and Methods: To mitigate the problem the American Dental Association (ADA) (Lockart et al.2019) provided guidelines for Abx in odontogenic infections. To assess compliance of clinicians in North Carolina an IRB approved (UNC IRB# 20-3540) anonymous Qualtrics survey was emailed to all active dentists, 6041. Three clinical scenarios were designed to assess the likelihood of the clinician to prescribe antibiotics. Based on the guidelines Scenarios 1 and 3 suggested antibiotic use; Scenario 2 against. Options for response were “unsure, more likely, or least likely” to prescribe antibiotics. The final survey question asked if respondents were aware of the ADA guidelines. The survey also asked demographic information; scope/years of practice. Our hypothesis was that NC clinicians generally currently practiced within the ADA guidelines. Results: 784/6041 (13%) NC clinicians responded, a convenience sample. Two-thirds practiced greater than 10 years. Most were General Dentists 73%. In responses to scenario 1, 75%, and scenario 3, 82%, prescribed Abx, and to scenario 2, 96%, did not. Furthermore, for scenario 2, 88% of those less than 10 years did not prescribe compared to 81% in those greater than 10, (p= 0.0421). Conclusions: Based on this convenience sample most dentists responded in accordance with recently published ADA guidelines though not all responded being aware of them. Less experienced dentists were more conservative when abx were not indicated.

Abstract # - 02 Supragingival Biofilm Multi-Omics Differ Between Early Childhood Caries Clinical Subtypes

Simancas-Pallares, Miguel; 1 Cho, Hunyong; 2 Lin, Bridget M; 3 Roach, Jeff; 3 Ginnis, Jeannie; 1 Vann, William F Jr; 1 Ribeiro, Apoena; 4 Wu, Di; 5, 6 Divaris, Kimon

1Division of Pediatric and Public Health, Adams School of Dentistry, University of North Carolina at Chapel Hill, United States; 2Department of Biostatistics, Gillings School of Global Public Health, University of North Carolina at Chapel Hill, United States; 3Research Computing, University of North Carolina at Chapel Hill, United States; 4Division of Diagnostic Sciences, Adams School of
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**Objective:** Early childhood caries (ECC) manifests with a wide range of clinical presentations that may be reflective of its underlying etiologic and biological diversity. We sought to examine differences in taxonomic and functional features of the supragingival biofilm microbiome among children with different clinical subtypes of ECC. **Methods:** We used metagenomics (i.e., microbial DNA), metatranscriptomics (i.e., microbial RNA), and metabolomics (i.e., liquid chromatography with tandem mass spectrometry) data generated from supragingival plaque biofilms of 300 children ages 36-71 months, participants of the ZOE 2.0 study in North Carolina, US. Children were categorized in 5 ECC clinical subtypes generated via latent class analysis and based on the intra-oral distribution of surface-level caries experience (ICDAS≥1 threshold). To examine differences between ECC subtypes we compared measures of community composition (i.e., alpha and beta diversity indices), the relative abundance of key species (i.e., Streptococcus mutans) and metabolites between ECC subtypes, with the health-associated Class I as referent using t tests and a p<0.05 statistical significance criterion. **Results:** We found community diversity differences in all omics layers. Microbiome beta diversity was significantly lower in both metagenomics and metatranscriptomics data for two groups characterized by the presence of maxillary anterior caries lesions (ECC classes III and V, e.g., DNA-based beta diversity of class III vs. I, p=5.5x10^-8) indicating a high degree of similarity within these subtypes. Class III also had the lowest diversity in metabolomics. Streptococcus mutans abundance was highest among classes IV and V that were characterized by the highest burden of disease (e.g., Class V vs I, p=3.9x10^-2). **Conclusions:** Acknowledging the limitations imposed by the study’s cross-sectional design and modest sample size, these findings support the existence of possible biological differences reflected in the biofilm of distinct ECC clinical subtypes. **Funding:** NIH/NIDCR - U01DE025046 and R03DE028983

**Abstract # - 03 COVID-19’s Impact on Dentists’ Workforce Confidence and Workflow**

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**Objectives:** The COVID-19 pandemic has impacted the U.S. economy and workforce, with marked effects on small businesses. Studies have evaluated workers’ views of financial confidence and advancement, but there has been limited focus on the dental industry. To extend these timely investigations to dentistry, we adapted the LinkedIn Workforce Confidence Index survey to
investigate workforce sentiment among practicing dentists. Using this survey, we aim to assess how dentists’ feelings about their short- and long-term financial future have changed in response to COVID-19, along with modifications to practice workflow. **Methods:** Published scales and pretested questions were used to determine workforce confidence and workflow changes among dentists. Data were evaluated using descriptive and bivariate statistics. Surveys were distributed to the American Dental Association (ADA, N=9,000) and American Association of Orthodontics (AAO) membership (N=656). **Results:** Participants (N=656) were practicing general dentists (n=544) or specialists (n=112). Dentists’ top concern is increased cost of providing treatment (57.4% [Confidence Interval (CI): 53.5, 61.3]), associated with widely adopted workflow changes including reduced patient volumes (66.0% [CI: 62.4, 69.6]) and increased safety protocols and equipment (health screening, 75.5% [CI: 72.2, 78.8]), KN/N95 masks, 76.7% [CI: 73.5, 80.0]). However, the majority of respondents do not expect their personal or practice finances to be negatively affected after the pandemic, as only 18.5% ([CI: 15.4, 21.7]) predict their practice’s gross revenue to decrease. **Conclusions:** Dentists are optimistic in the wake of vaccinations and lifting restrictions. Most expect their finances and practice performance to remain the same or grow in the short-term and expect long-term improvements post-pandemic **Funding:** American Association of Orthodontics Foundation (AAOF) Martin ‘Bud’ Schulman Postdoctoral/Junior Faculty Fellowship and the Biomedical Research Award awarded to Dr. Laura Jacox.

**Abstract # - 04 Effect of Dietary Hesperidin Rat vs. Mice Long Bone Homeostasis**

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**Objectives:** The objective of this study was to investigate the bone-sparing effect of dietary hesperidin (HE), one flavonoid present in citrus fruits. **Methods:** In vitro, RAW cells were cultured with 1, 100, and 500 uM doses of HE for 5 days, and differentiation to osteoclasts was observed and quantified by TRAP staining. MC3T3-E1 pre-osteoblastic cells were cultured for 14, 21, and 28 days in the presence of the same concentrations of HE, and mineralization was assessed by alizarin red staining. In vivo, rodents were given dietary HE by daily oral gavage for 6 weeks (100mg/kg in Sprague-Dawley rats) and 6 and 12 weeks (500 mg/kg for C57B6 mice). Micro-computed tomography(microCT) analysis was performed. **Results:** HE led to a decrease in weight of all the animals over 6-week period that was reversed over time.microCT showed that rats and mice had an increase in bone volume, trabecular thickness, and trabecular and cortical density at 6 weeks. However, at least in mice, the positive effects in bone parameters present at 6weeks were not maintained at 12 weeks of oral gavage with daily HE. TRAP staining of RAW cells showed that HE had an anti-resorptive effect associated with higher doses however the effect on mineralization in vitro was positive at 1uM only. **Conclusions:** The results of this study show a protective effect of HE on in vivo bone loss in the early HE consumption process independent of dosage, but the effect may not last as metabolic demands change. The primary effect of HE on bone homeostasis could be mostly via modulation of the resorptive activities in bone cells
Abstract # - 05 Influence of hesperidin on bone healing of rat mandible defect

1McGaughey, Skylar; Gonçalves, 2Vinicius de Paiva; 2Musskopf, Marta; 1Rivera-Concepcion, Angeliz; 2Yu, Christina; 3Tuin, Stephen; 2Finger-Stadler, Amanda; 2Miguez, Patricia

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Objectives: At present, clinical use of bone morphogenetic protein 2 (BMP2) for bone regeneration presents some serious limitations including high quantity, costs, excessive inflammation, and ectopic ossification. Our group has previously shown that hesperidin (HE) locally delivered in a bone healing site will positively modulate BMP2-induced bone regeneration. This study aimed to evaluate the effect of dietary HE administered by oral gavage on BMP2-induced bone regeneration. Methods: HE was given by oral gavage (100 mg/Kg) to male Sprague-Dawley rats for 4 weeks prior and 2 weeks post-surgery. The BMP2 was delivered at 1 μg concentration in a collagenous scaffold within a 5mm critical sized defect in the rat mandible where it promotes an ectopic pattern of bone formation as compared to scaffold alone. The collagenous tissue was collected 7 days after surgery and processed for RT2 osteogenesis/inflammation arrays and other mandibles were harvested 2 weeks post-surgery and processed for microcomputed tomography and then demineralized for histological staining including picrosirius red (PSR). Results: Rats treated with BMP2 showed ectopic bone formation and incomplete bone defect filling as expected. Rats under dietary HE protocols showed almost complete bone filling of the 5mm critical sized defect without ectopic bone formation. There was a 15-fold reduction in NFkB signaling in the 7-day healing tissue under dietary HE supplementation. PSR staining showed a different pattern of bone collagen maturation for HE-treated compared to non-treated rats with indication of increase in osteocyte activity. Conclusions: Our findings show, for the first time, that HE as a dietary supplement has a modulatory role in BMP2 induced bone regeneration potentially via control of inflammation, effect on bone cell function, collagen maturation and can lead to a positive modulation of BMP-induced regeneration. Funding: NIH/NIDCR R03DE028035-01A1

Abstract # - 06 Oral Healthcare Barriers for Transgender and Gender Nonbinary Populations

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Purpose: Despite health disparities and barriers to medical care being documented in the literature, the oral health status, and barriers to dental care for transgender and gender non-binary (TGNB) individuals remain understudied. To address this knowledge gap, this study seeks to examine their perceived oral health, as well as their postulated gender identity-related factors influencing their acceptance or avoidance of dental care. Methods: Eligible participants were individuals who self-identify as TGNB and over the age of 12. Recruitment was done via online postings, listservs, and word of mouth between December 2020 and July 2021. Information on gender identity, self-reported oral health, expectations, and experiences related to receiving oral health care services was collected via a 32-item questionnaire designed for this study. Data analysis relied on descriptive methods and bivariate comparisons using a conventional p<0.05 statistical significance criterion. Results: One hundred eighteen transgender individuals ages 13-70 (median age: 30 years) participated in the study. Although over half of respondents had a dental visit in the last 12 months, participants’ avoidance due to gender identity was significantly associated with measures of self-reported sub-optimal oral health. While almost all respondents reported never being refused care, discrepancies were observed between participants’ expectations and their actual management in the dental setting. One-third reported being addressed by their incorrect name and pronouns and over half felt that their dental home was not equipped to provide gender appropriate care. Thematic analysis of our open-ended question revealed instances of (1) insensitivity, (2) awkward interactions, (3) avoidance and (4) lack of gender-affirming providers. Conclusions: The results of the study provide important insights into TGNB individuals’ oral health and management in the dental environment. While these results need to be verified in larger and diverse samples, they provide actionable information regarding this vulnerable population’s oral health and care.

Abstract # - 07 Hybrid Pain Management Strategy Limits Left-over Opioid Doses

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Objective: 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 “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? Funding: UNC OMFS departmental
funds

Abstract # - 08 Adeno associated virus mediated PDL1 therapy in immune modulation

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Objective: Protein-programmed death-ligand 1 (PDL1) as an important checkpoint protein, plays
a role in immune homeostasis and peripheral tolerance. It has been found associated with some
autoimmune diseases such as type I diabetes, but more mechanisms and medical applications
are to be discovered. We will deliver PDL1 via adeno associate virus (AAV), one of the most
popular viral vectors for gene therapy with low immunogenicity and persistent transgene
expression. We anticipate that the AAV-PDL1 gene therapy will achieve long-term remission in
autoimmune diseases via one-time injection. Methods: To enhance PDL1 expression level and
secretion, we modified wild type PDL1 into the secreted PDL1(sPDL1) by knocking out
transmembrane domain, then the plasmid was transfected in HEK-293 cell line. After 48h, the
sPDL1 protein was detected using western blot. The function was detected using T cell
proliferation assay. AAV5-sPDL1 was generated via triple transfection and purified by cesium
chloride density gradient. Collagen induced arthritis mice were used to as an autoimmune
disease model. Three groups were included: AAV5-sPDL1, PBS, and AAV5-luciferase. 5μl of AAV
(5e9vg) in each group(n=5) was injected in the left knee of mice. Joint size was measured each
week, at 6w, joint tissues were collected for histology. Results: sPDL1 was expressed in cell
supernatant and was around 7 time higher in total protein amount than wild type PDL1. T cell
proliferation was decreased in sPDL1(20.9 ± 2.8%), compared to negative control (32.9 ±3.9%).
In mice model, joint swelling decreased in PDL1 treated group compared to PBS and luciferase
group(p<0.05). Based on histology, the clinical score of joint inflammation, T cells and
macrophages infiltration were largely decreased in AAV5-sPDL1 treated group(p<0.05).
Conclusions: This work demonstrates a novel strategy to alleviate autoimmune diseases using
AAV-PDL1 gene therapy. Further work regarding the optimal dose of AAV-PDL1 will be
investigated. Funding: 5R01HL144661-03. Dr. Sun and Dr. Li
Abstract # - 09 Chronic stress alters gut motility in young zebrafish

**Norloff, Erik D**; **Wallet, Shannon M**; **Graves, Christina L**

**Objective:** Chronic stress has the potential to alter basic organismal functions, especially during critical development periods early in life. Chronic early life stress (ELS) is known to detrimentally impact gastrointestinal function later in life but the mechanisms underlying this association are incompletely understood. **Methods:** We first examined the ELS on gut motility in the digestive tract using a zebrafish model. Fish were stressed (strobe, turbulence, or chasing) twice per day at random intervals beginning at 6 dpf until 30 dpf. At the end of the stress period, we assessed transcription of key gut neuroimmune genes using a custom NanoString assay and gastrointestinal transit time using a custom built in-tank device. We observed an increase in caspase-3 expression which correlated with a delay in gastrointestinal transit time in stressed fish. We used fluorescent confocal imaging and 3D analysis of whole-mount gut tissue stained for the pan-neuronal marker HU+ which revealed significant neuron loss in the stressed group. **Results/Conclusions:** These data suggest that ELS induces intestinal gut motility as a result of caspase-dependent neuronal loss. Future experiments will determine if specific subtypes of neurons are impacted by ELS. **Funding:** T32-AI007273-35 (C. Graves)

Abstract # - 10 Early Life Stress Rewires the Gut

**Graves, Christina L**; **Norloff, Erik N**; **Chen, Angela**; **Thompson, Darius D**; **Wallet, Shannon M**

**Objective:** Early life stress (ELS) – chronic or extreme stress experienced during childhood development – is known to be an important epidemiological factor that significantly impacts gut pathophysiology later in life, but the cellular mechanisms by which this occurs remains unknown. In this study, we leverage the strengths of the zebrafish model system and introduce innovative models in order to explore the mechanisms by which ELS might alter neuroimmune crosstalk in the gut and lead to a “rewiring” of the enteric nervous system. **Results:** Our preliminary data show that ELS is associated with a unique tissue-specific neuroimmune phenotype characterized by an early glial and mast cell expansion followed by long term enteric neuronal loss and disrupted gut motility. **Conclusions:** We hypothesize that gut MC serve as “first responders” in ELS-associated gut dysfunction through a CRH-dependent mechanism and induce enteric glial hypertrophy and production of pro-apoptotic factors that ultimately lead to a loss of enteric neurons and motility impairment. Ongoing work seeks to delineate the spatiotemporal dynamics of glial and mast cell engagement as ELS-associated rewiring of the enteric nervous system progresses. **Funding:** UNC Microbiology and Immunology T32 Training Award (T32-AI007273-35) and the NIH Clinical and Translational Science Award (CTSA) NC TraCS $2K Pilot Award (2KR1432103) to C. Graves.
Abstract # - 11 Accuracy of Artificial Intelligence in Identifying Radiolucencies in Panoramic Radiographs

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Objective: Artificial intelligence (AI) can be used in radiology to complement the practitioner’s evaluation in order to form a final decision. This study evaluated the efficacy of general dentists detecting apical radiolucencies on panoramic radiographs, unaided and aided by artificial intelligence. Methods: 100 consecutive panoramic radiographs were acquired from 2019-2020 from the UNC Adams School of Dentistry clinics. Ground truth was established by a consensus panel of three board certified Oral and Maxillofacial Radiologists. Images were uploaded to Denti.AI, an artificial intelligence platform. 10 general dentist readers annotated the presence of apical radiolucencies in panoramic radiographs first without the help of AI, and then with the help of AI. Standard metrics of ROC, ROC/AUC with CI, sensitivity, and specificity were generated for the readers. Results: AFROC AUC increased by 0.027 (4%) in total readers compared to unaided read with no statistical significance (p=0.063). ROC AUC increased by 0.30 (3.71%) with no statistical significance (p=0.067). Sensitivity by case increased by 0.061 (7.86%) with statistical significance (0.003). Specificity by case decreased by 0.04 with no statistical significance (p=0.061). Subgroup analysis revealed the highest increase in sensitivity for PAI 5 lesions (15.07%) and mandibular premolar teeth (36%). Conclusion: Using AI software can improve dentists’ ability to detect more cases and lesions without significantly affecting specificity. In particular, the ability to find more positive cases is statistically significant (p=0.003).

Abstract # - 13 “Against the Current” of Early Childhood Caries: Positive Outliers


Objectives: Early childhood caries (ECC) is known to be influenced by numerous multi-level factors including social determinants, oral health-related behaviors and practices, and individual susceptibility. Disentangling these frequently intersecting influences and identifying key drivers of health remains challenging in dental public health and clinical practice. To add to the knowledge base of ECC determinants, we sought to identify and describe characteristics of positive ECC spatial outliers among a large, community-based sample of preschool-age children in North Carolina (NC). Methods: We used tooth surface-level clinical data of caries experience...
(i.e., dmfs index, defined at the ICDAS≥1 threshold) from 6,310 preschool-age children (mean age=52 months; range=36-71 months) who were participants of the ZOE 2.0 study in NC, United States and were successfully geocoded via a geographic information systems (GIS) application (ArcGIS Pro). We identified positive outliers (participants with low ECC experience in a high ECC experience area, LH) and their corresponding clusters of neighboring participants with high ECC experience (i.e., a “hotspot” or high ECC experience area, HH) using a Local Moran’s I p<10-3 criterion. We used bivariate methods to compare demographic characteristics, oral health behaviors, and practices between LH and HH participants using a p<0.05 statistical significance criterion. **Results:** There were 153 LH participants (dmfs median=7; range=0-14) and 161 HH (dmfs median=34; range=15-84) participants. More parent/guardian respondents were Spanish-speakers among the HH versus the LH group (27% versus 18%, p=0.04) and had less than high school education (36% versus 20%, p=0.01). We found no important differences in common oral health behaviors (e.g., tooth brushing frequency) or report of a dental home. **Conclusions:** Family demographics differed between ECC positive outliers and their high-ECC experience neighbors, within a community-based sample of children in high disease prevalence areas of NC. Future studies can further elucidate underlying mechanisms at-play using qualitative methods and biological data. **Funding:** NIH/NIDCR: U01DE025046

**Abstract # - 14 Orthognathic Speech Pathology: Impacts of Class II Malocclusion on Speech**

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**Introduction:** Articulation problems have a profound impact on communication, development and quality of life, and are diagnosed in 73-87% of patients with Class II dentofacial disharmony (DFD). We hypothesize that there are perceptual differences and quantitative differences in spectral properties of stop (/t/ or /k/), fricative (/s/ or /ʃ/), and affricate (/tʃ/) consonant sounds, and that severity of Class II jaw disharmony correlates with degree of speech abnormality. **Methods:** Orthodontic records and audio recordings were collected from DFD patients (n=53 Class II, 70 controls). A speech pathologist evaluated subjects and recordings were analyzed using spectral moment analysis (SMA) to measure sound frequency distortions. **Results:** The centroid frequency (M1) and spectral spread (M2) were significantly increased for the /k/, and /tʃ/ sounds of “all Class II” subjects compared to controls, with the greatest change seen in the “Class II open bite” subgroup. Using linear regression, correlations between Class II skeletal severity (based on cephalometric measurements) and articulation distortion were found for the /k/, /tʃ/, /s/ and /tʃ/ sounds. **Conclusions:** Class II patients present with a higher prevalence of qualitative distortions and significant spectral changes in consonant sounds compared to controls, but Class II spectral shifts are smaller than in the Class III and open bite cohorts, possibly related to Class II subjects’ ability to posture into a Class I position. The linear relationships between anterior-posterior discrepancy and spectral change suggest causation and that surgical treatment may improve
articular problems. **Funding:** TR/NCATS NIH HHS/United States UL1TR002489/NH/NIH HHS/United States 1K08DE030235-01A1/National Institutes of Dental and Craniofacial Research

**Abstract # - 15 Feasibility of measuring fluoride in fingernail clippings of preschool children**

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**Objective:** In preparation for a randomized controlled trial of fluoridated bottled water for prevention of dental caries, we assessed feasibility of measuring fluoride content of fingernail clippings from young children. The measurements will be important in the trial to provide biomarker evidence of fluoridated water’s contribution to children’s total fluoride intake. **Methods:** A convenience sample of children aged 2-4 years was recruited from Orange County, NC, and adjacent counties. The goal was to recruit 11 children who drank tap water containing fluoride according to CDC’s Water Fluoridation Reporting System (WFRS) and 11 children who drank either non-fluoridated public water or well water. Parents clipped children’s fingernails twice over 10 days and collected a tap water sample. Fluoride was extracted from clippings using hexamethyldisiloxane (HMDS) facilitated diffusion and measured using a fluoride ion-specific electrode. **Results:** The 22 children were aged 2-4 years, 45% were girls, 9% Hispanic and 45% non-White. Fluoride was measured successfully for all 22 samples of nail clippings, with notably lower concentrations in 2-year olds (median=3.7 mg/kg, interquartile range=2.8-4.2, n=11) compared to 3-4-year olds (4.9, 4.6-6.3, 11). While recovery rates for the HMDS method were acceptable (97%-110%), there was insufficient nail material to evaluate replication-reliability. Unexpectedly, 4/15 tap water samples from systems reported as fluoridated contained <0.1 mg/L F. Inquiries with the City of Durham revealed that fluoridation was stopped from 2020-2021 during engineering maintenance, explaining the discrepancy with WFRS reporting. Conversely, 2/6 well water samples contained >0.5 mg/L **Conclusions:** The HMDS method successfully measured fluoride content of fingernails in children as young 2 years. Additional toenail clippings will be collected in the trial for assessment of replicate-sample reliability. The observed likelihood of fluoride in well water emphasizes the importance of testing its fluoride concentration prior to prescribing fluoride supplements. **Funding:** NIH/NIDCR UG3DE029169.

**Abstract # - 16 Collimator-to-Patient Distance: Effects on Dose for Bitewing Radiography**

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**Objectives:** The purpose of this study was to measure effective (E) and equivalent doses from adult and child posterior bitewing (PBW) radiography examinations using varying intraoral
collimator-to-patient distances. **Methods:** Adult and child human tissue-equivalent phantoms and optically stimulated luminescent dosimeters were used to collect dose measurements for both adult-4 and child-2-projection PBW examinations with circular and rectangular collimation (RC) using the Focus Instrumentarium x-ray unit. Examination parameters were 70 kV, mAs: adult 8.96 and child 3.5. Using XCP-ORA beam-alignment systems, exposures were made with each collimator modality both flush and retracted to the length of the alignment ring bar from the phantom surface. **Results:** Normalized adult E (μSv) was rectangular: 9.7/8.1 and circular: 14.1/14.8 for flush/retracted conditions, respectively. Child E was rectangular: 5.3/5.2 and circular: 8.6/8.5 for flush/retracted, respectively. Increasing collimator-to-phantom distance did not yield significant differences in E for PBW examinations within rectangular or circular techniques (P=1.00). Normalized for distance, E from circular was 38% greater than E from rectangular and 66% greater without adjusting for distance. Compared with rectangular techniques, circular collimation increased average adult/child thyroid dose by 58 and 68%, respectively. Increasing collimator distance elevated thyroid dose by as much as 23 and 26% for adult circular and child rectangular PBW examinations, respectively. Although effects on E from increased collimator-to-patient distance were offset by small decreases in dose to the majority of dentoalveolar tissues, notable dose increases were seen in the thyroid, skin and eye lenses. **Conclusions:** Overall E was not affected by collimator distance. However, even with half the number of projections and reduced exposure parameters, the child thyroid received significantly higher dose compared to the adult from both circular and rectangular collimation. Increasing circular collimator-to-patient distance may result in significant adult thyroid dose increases. Similar distance may increase child thyroid dose regardless of collimator shape.

**Abstract # - 17 Shifts in oral biofilm: microbiome and transcriptome investigation.**

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**Objectives:** This study aimed to assess the changes in the microbiome and transcriptome of oral flora that result after introduction of fixed orthodontic appliances. **Methods:** Twenty-five patients were enrolled in a prospective, longitudinal study. Plaque and salivary samples were collected at four time points. DNA and RNA were extracted, sequenced, and compared to QUIMME to determine species; diversity was assessed via PD Whole Tree and Shannon indices and correlated to gingival changes over time. **Results:** The greatest change in relative abundance occurred between Weeks 0 and 1. Results showed 66% relative decrease in Actinobacteria, 32% relative increase in Veillonella, and 86% relative increase in Proteobacteria. Adverse gingival changes were noted for all patients over time relative to baseline measurements. **Conclusions:** Initial evidence suggests that a dysbiotic shift in both phylogenetic diversity and metatranscriptomic activity of supragingival oral biofilm occurs after the introduction of fixed
orthodontic appliances. **Funding:** NC TraCS $5K - $50K Translational Research Matched Pilot Grant (Carolina Translational and Clinical Sciences Institute)

**Abstract # - 18 Mechanical Strength Evaluation of 3D-Printed Resin Crowns**

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Commonly utilized current methods of full-coverage crown fabrication include conventional outsourced workflows (more cost effective, but longer treatment time) and in house milling (faster, but high initial equipment investment). The recent development of 3D printed final restorations aims to combine the advantages of each; limited evidence, however, has restricted their widespread implementation. In this study, we will compare fracture strength of a commercially available permanent crown resin, VarseoSmile Crown Plus (Bego) with lithium disilicate (emax, ivoclar vivadent), a commonly used CAD-CAM crown material. This will be determined through load-to-failure testing on a universal testing machine (Instron). Data will be analyzed using statistical software based on unpaired mutually exclusive groups to determine significance. If this study combined with further research validates the use of resin crowns in comparison to other commonly used materials, a significantly wider range of patients will be able to receive care from the perspectives of lower cost, reduced time spent at dental appointments, and increased number of practices with the technology due to ease of acquisition. **Funding:** Adams School of Dentistry DDS Short-Term Research Fellowship

**Abstract # - 19 Guardians’ Self-Reported Oral Health is Associated with their Children’s ECC**

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**Objective:** Guardians’ self-reported oral health is a promising proxy for children’s reported and clinically determined oral health; however, the magnitude of these associations in the community and whether they are influenced by families’ sociodemographic characteristics remains unknown. To address this knowledge gap, we sought to quantify the association between guardians’ self-reported oral health and their children’s oral health, and determine whether race/ethnicity and education level modify these associations. **Methods:** We used questionnaire (n=7,800) and clinical examination (n=6,243) data from a multi-ethnic, community-based study of early childhood oral health in North Carolina, United States. Participating children were ages 36-71 months. Guardians completed a 15-item questionnaire including NHANES-type
questions about their own and their children’s oral health status, i.e., including ratings of excellent/very good/good/fair/poor. Children’s clinical examinations were done at their preschools by trained and calibrated clinical examiners using ICDAS criteria (ECC was defined at the ICDAS≥3 threshold). We used bivariate and multivariable methods based on multi-level mixed-effects generalized linear models to examine the associations of guardians’ reported oral health with children’s reported and clinically determined oral health (i.e., ECC prevalence), among the entire sample and within strata of race/ethnicity and guardians’ education. **Results:** Guardians’ and children’s reported fair/poor oral health (FPOH) were 32% and 15%, respectively, whereas 54% of children had ECC. Guardian’s FPOH was strongly associated with children’s FPOH (OR=6.1; 95% CI=5.0-7.4), and this association was more pronounced among Hispanics and lower-educated guardians compared to their non-Hispanic and higher-educated counterparts (e.g., Hispanics: OR=10.0; 95% CI=6.7-14.9; non-Hispanics: OR=5.2; 95% CI=4.4-6.2). Similar trends but smaller-in-magnitude associations were found for guardians’ FPOH and children’s clinically determined ECC status (OR=1.5; 95% CI=1.3-1.7). **Conclusions:** The study’s findings support a strong association between guardians’ and their children’s reported and clinically-determined oral health, and implicated ethnicity and education as factors possibly modifying the magnitude of these associations. **Funding:** NIH/NIDCR - U01DE025046

**Abstract # - 20 The Impact of Early-Life Stress on the Developing Oral Cavity**

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Chronic and/or extreme stress in early life, often referred to as early adversity, childhood trauma, or early life stress (ELS) is associated with a wide range of adverse effects on development, including that of the oral cavity. In epidemiological studies, ELS has been associated with alterations in tooth development, enamel formation and premature tooth eruption and has also been shown to exacerbate periodontal disease resulting in tooth loss or decay as a consequence. In this study, we leveraged zebrafish to investigate the effects of chronic early life stress (ELS) stress on the developing oral cavity with the ultimate goal of interrogating the neuroimmune mechanisms underlying stress-associated enamel erosion and development. In order to test the hypothesis that ELS exposure results in earlier eruption of primary teeth and loss of enamel in a dose-dependent fashion, we established a novel model of chronic ELS by introducing unpredictable environmental stressors (chasing, altering tanks, and flashing lights) during the juvenile development period (5 - 30 days post fertilization). Following the completion of the stress period, we behaviorally assessed fish and found ELS-exposed fish exhibited stereotypical anxiety-like behaviors. We also developed microdissection and microscopy techniques in order to visualize the pharyngeal teeth ex vivo. Currently, we are working to determine the impact of ELS on tooth eruption, erosion, and enamel formation. In conclusion, we present data to support the use of zebrafish in interrogating the impact of ELS on the developing oral cavity and preliminary data in our quest to uncover key cellular targets. Results from these ongoing and future studies could provide important clues in understanding the ramifications of ELS on oral
health and tooth development and may ultimately lead to improvements in clinical care for pediatric patients with high exposures to adverse childhood events. **Funding:** UNC Microbiology and Immunology T32 Training Award (T32-AI007273-35) and the NIH Clinical and Translational Science Award (CTSA) NC TraCS $2K Pilot Award (2KR1432103) to C. Graves.

**Abstract # - 21 Comparing Child and Adult Dose from Contemporary Extraoral Bitewing Radiography**

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**Objective:** Effective dose of two EOBW modalities, Rayscan α+ and Sirona Orthophos SL, was evaluated. The results were compared to their respective panoramic modes and to one IOBW modality, Instrumentarium Focus, using rectangular and circular collimation. The effect of thyroid shielding on the thyroid gland was evaluated for both EOBW modalities. **Methods:** This preclinical experimental study, using anthropomorphic phantoms (average adult and 10-yr tissue equivalent) modified to accept optically stimulated luminescence dosimeters, evaluated effective dose (E) from two extraoral units (RayScan α+ (Ray Co. Ltd., Gyeonggi-do, South Korea), Sirona Orthophos SL (Dentsply Sirona, Charlotte, NC)) and one conventional IO unit using circular and rectangular collimation (Instrumentarium Focus (Kavo Kerr, Brea, CA)). Phantom sequences were triplicated for all modality combinations and average E was calculated. EOBW Parameters: Sirona Orthophos SL - 85kV, 7-10mA, 5.1s; Rayscan α+ - 80kV, 12-13mA, 7.2s. PAN Parameters: Sirona Orthophos SL – 63-69 kV, 6-12 mA, 14.1s; Rayscan α+ - 80kV, 12-14mA, 11.3-13.9 s. IOBW Parameters: Focus Instrumentarium - 70kV, 7mA, 0.5-1.28s. **Results:** Adult E for IOBW using rectangular collimation was significantly lower than E from all EOBW examinations. (p=0.00). Child E for IOBW using rectangular collimation was significantly lower than E for Rayscan α+ EOBW (p= 0.00), but not for Sirona Orthophos SL (p>0.05). Adult and child E for EOBW was significantly lower than the E from the PAN for Sirona Orthophos SL (p=0.00), but not for Rayscan α+ (p>0.05). IOBW E with circular collimation was significantly lower than IOBW E with circular collimation (p=0.00). **Conclusion:** Sirona Orthophos SL EOBW provides a child E comparable to IOBW, whereas the adult E is larger than for IOBW. Rayscan α+ EOBW provides a higher E compared to IOBW. Thyroid shielding can reduce adult thyroid equivalent dose with Rayscan α+. Rectangular collimation reduces IOBW E compared to circular collimation.

**Abstract # - 22 A novel dental implant system with a simplified site preparation**

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An ideal implant system should use a simplified site preparation and implant placement, achieve good primary stability and rapid osseointegration, and maintain long-term crestal bone stability. **Objectives:** to radiographically evaluate a new implant system using the minipig intraoral dental implant model. **Methods:** Eight Yucatan minipigs, 19-23-month-old, 62-72 kg were included. Third and fourth premolars and first molars were extracted, and tissues were allowed to heal for 12 weeks. Two Nobel Active TiUltra Ø3.5x10mm (control) and two Nobel Biocare N1 TiUltra Ø3.5x11mm (test) were randomly placed on each hemimandible and allowed to heal transmucosal for 13 weeks. Intraoral radiographs were taken at implant placement, 5 and 10 weeks of follow up, and after euthanasia. Each implant site was scanned using an ex-vivo μCT scanner. Parameters of osseointegration and bone remodeling were compared using parametric or nonparametric tests. The significance level was set at 5%. **Results:** Thirty-two implants were placed. Healing was uneventful for both experimental groups. One implant was lost for the control group at 5 weeks and one healing cap was lost for the test group at 13 weeks. A reduction on the radiographic bone level consistent with bone remodeling was observed at 5 weeks. At 10 weeks, a rebound was observed and the radiographic bone level reached approximately 0.2 mm below the platform at 13 weeks. Peri-implant bone parameters assessed using μCT showed no statistically significant differences between groups for bone-to-implant contact, first bone-to-implant contact, bone density, trabecular thickness, and trabecular spacing around the implants. **Conclusions:** the novel dental implant system using a simplified site preparation protocol and implant placement showed comparable clinical and radiographic performance to a predicate device using a standard site preparation protocol and implant placement.

**Abstract # - 23** Diagnostic accuracy of TMD Screener in patients with endodontic pain

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**Objectives:** While temporomandibular myalgia and arthralgia (TMD) are known to mimic endodontic pain, it is not feasible to apply the full Diagnostic Criteria for TMD (DC/TMD) in routine endodontic practice. This prospective study aimed to determine prevalence of painful TMD and assess the accuracy of a 6-item TMD pain screening questionnaire (Gonzalez et al, JADA 2011;142(10):1183–91) in patients with endodontic pain. **Methods:** One hundred consecutive patients referred for non-surgical root canal treatment with a history of tooth pain in the preceding 30 days were enrolled at the University of North Carolina. Before treatment, patients completed the TMD pain screening questionnaire, after which a board-certified orofacial pain
specialist/endodontic resident conducted both DC/TMD and endodontic examinations. Contingency tables were analyzed to compute screening sensitivity and specificity against the DC/TMD gold standard and logistic regression was used to calculate area under the receiver operator characteristic curve (AUROC). **Results:** The 100 patients were aged 18-74 years, 63% were female, 14% were Hispanic, and 54% were non-White. Pulp necrosis (34%) and symptomatic apical periodontitis (65%) were the most common endodontic diagnoses. 54% of patients had examiner-verified painful TMD. The screening questionnaire's AUROC was 0.77 (95%CL=0.69, 0.87), while at the screening-positivity threshold of ≥3, sensitivity was 0.85 (95%CL=0.76, 0.95) and specificity was 0.52 (95%CL=0.38, 0.67). The corresponding positive predicting value was 0.68 (95%CL=0.57, 0.79) and the negative predictive value was 0.75 (95%CL=0.60, 0.90). **Conclusions:** Over a half of patients presenting for endodontic treatment of a painful tooth had painful TMD. The TMD pain screening questionnaire was highly sensitive with useful overall accuracy in detecting painful TMD. **Funding:** IADR INFORM Early Career Researcher Small Grant, AAE Foundation Competitive Research Grant, AAOP Research Grant, Dr. Shizuko Yamauchi Endodontics Graduate Student Award

**Abstract # - 24 Evaluation of Margin Designs for 3D-Printed Crown Patterns**

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The specific aim of this project is to evaluate and compare the marginal fit of 3D printed crown patterns with varying marginal designs to determine if specific preparation designs are better suited when working with 3D printed patterns. Three prefabricated teeth were prepared each with a different marginal design (light chamfer, heavy chamfer, and shoulder), and digitally scanned using an intraoral scanner (Trios 3). Preparations were completed on mandibular first molars, following standard guidelines for total occlusal convergence, reduction, and external form. The resulting 3D preparation was used to digitally design each crown patterns (with identifiable landmarks) using a dental design software (3Shape). The resulting designs were printed using a 3D printer (Carbon M2). The printed patterns will be scanned, both seated and unseated on the prepared tooth, to allow measurement of fit and marginal gap (from a clinically acceptable threshold [<50μm gap] via quantitative measurements). Using Geomagic software, quantitative volumetric analyses will be conducted on the fit of the various patterns on the prepared teeth. Accuracy of the printed crown resin patterns compared to the digital design will be analyzed by superimposing the final scans over the initial design and measuring volumetric differences. Additionally, fit of each resin pattern will be examined using a micro-CT and crown fit will be quantified by superimposing the scans of printed crown patterns on the prepared tooth. The data will be interpreted via statistical differences between experimental groups and will be analyzed by ANOVA. Outcomes of the study may aid in establishing preparation guidelines for workflows involving 3D printing, based on the results of marginal gap. Results and conclusions
Abstract # - 25 Efficacy of Tablets as a Learning Tool for Dental Students

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INTRODUCTION The purpose of this study is to evaluate the usage of tablets among the first-year dental students at the University of Colorado School of Dental Medicine (CUSDM). The Class of 2022 at the CUSDM were issued iPads as part of a pilot program. We use quantitative data from exam scores of individual dental courses within the curriculum; Dental Anatomy and Occlusion.

MATERIALS AND METHODS Eighty questionnaires were distributed among first year dental students at the University of Colorado School of Dental. The survey was carried out using questionnaire-based methodology. The questionnaire contained 10 questions organized in 9 closed ended and 1 open ended question. All information was provided voluntarily and was evaluated anonymously.

RESULTS The response rate was 95%. 76 first-year dental students between the ages of 18-44 participated in the survey. A majority of participants (57.89%) fell into the age range of 25-34. 81.58% of the students entered dental school following completion of a bachelor’s degree. 69.74% of survey participants found the iPad™ as a useful learning tool during their first year. Many participants (84.21%) used their devices multiple times a day. Further, 56.58% of participants thought that the use of an iPad™ would prepare them for their future dental careers. Interestingly, 76.32% of the students did not prefer the iPad™ as an independent study tool but instead were partial to the use of an iPad™ in combination with a laptop computer.

CONCLUSION A majority of students gave positive feedback regarding organization and ease of notetaking with the iPad™, although a few individuals preferred to continue to take notes traditionally on paper. The tablet allows for personalized learning and serves as a tool for pre-clinical courses. Overall, the iPad™ was beneficial and aided in effective studying, however, more data needs to be collected to determine quantitative efficacy. Funding: National Center for Dental Hygiene Research & Practice, Inc., and Crest and Oral-B

Abstract # - 26 2017 Periodontal Disease Classification System Use Among Dental Hygiene Faculty

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Objectives: In 2017 the American Academy of Periodontology (AAP) introduced a new classification system of periodontal and peri-implant diseases and conditions. Dental hygiene
educators must learn, adapt to, and educate their students in applying this system. This research investigated the amount and type of training faculty have received regarding this system. Additionally, the perceived confidence in its understanding, accuracy of classification, and application with dental hygiene students. **Methods:** A cross-sectional convenience sample of 336 dental hygiene program directors and an unspecified number of full-time clinical dental hygiene faculty were invited to participate. The survey consisted of 24 multiple choice and open-ended questions addressing demographic, training, and confidence domains. The survey was administered via Qualtrics. Data underwent statistical analysis using descriptive statistics with confidence intervals and bivariate analysis, including Chi Square tests. **Results:** A total of 186 individuals voluntarily participated. 98.33% reported earning a 4+ year degree. Moreover, 46.38% reported 1-10 years of experience teaching undergraduate dental hygiene. 78.45% reported receiving formal training on the 2017 system, most commonly receiving formal training twice. Self-reported confidence in understanding the system indicated, 3.45% were not confident at all, 23.56% were somewhat confident, 51.15% were confident, and 21.84% were very confident. In accurately classifying patients’ periodontal disease status using the system, 3.47% were not confident at all, 26.01% were somewhat confident, 50.29% were confident, and 20.23% were very confident. In using the 2017 system on the clinic floor with students, 3.45% were not confident at all, 27.59% were somewhat confident, 46.55% were confident, and 22.41% were very confident. **Conclusions:** Supportive material in educating clinical dental hygiene faculty on the 2017 AAP classification system should be produced and easily available to those that report no or limited training and those who report low levels of confidence in their understanding, accuracy, and application with students.

Abstract # - 27 Entrustable Professional Activities in Dental Hygiene Education

**Objective:** Entrustable professional activities (EPAs) are units of professional tasks measuring entrustment of learners to perform tasks independently and safely. This exploratory study aimed to develop an initial EPA framework for dental hygiene (DH). **Methods:** Three DH program directors participated in two workshops to generate ideas and gain insight into essential tasks of DH using a nominal group technique. The workshops were audio-recorded, transcribed verbatim, and coded by two analysts to develop an EPA framework for DH. Following this, a survey was developed and distributed to all United States DH program directors. Program directors rated each EPA statement using a validated rubric, the EQual rubric, to assess the alignment and consistency of each EPA. Descriptive statistics for overall and domain-specific EQual rubric scores for each EPA were calculated. Free-text responses to why an EPA should be revised were summarized for EPAs that scored below a predetermined cutoff. **Results:** Six EPAs with associated tasks were developed from the workshops and surveyed by thirty-six DH program directors. The six overarching EPAs include: (1) assessment; (2) diagnosis; (3) plan of care; (4) treatment; (5)
evaluation; and (6) documentation. The overall score for EPAs 2, 3, 4, and 5 was above the EQaul rubric’s overall cutoff of 4.07, indicating alignment with the key domains of the EPA construct. EPAs 1 and 6 scored below the overall cutoff, suggesting that revision may be required. Open-ended responses reveal a need for educational sessions for DH educators to learn about EPAs and the shift moving towards EPA frameworks in health professions. **Conclusion:** The EPAs developed create an initial framework for undergraduate DH education. Refinement and improvements are indicated to finalize the EPA framework. Further research and education sessions are necessary to finalize the DH EPA framework. **Funding:** National Center for Dental Hygiene Research & Practice, Inc., and Crest and Oral-B

**Abstract # - 29 Anadenanthera colubrina Modulates Virulence-Factors of Candida albicans and Inflammatory Response**

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Oral candidiasis is one of the most common fungal infections in humans. Its incidence has increased widely and the antifungal resistance, demanding the search for novel antifungal therapeutic agents. Anadenanthera colubrina (Vell.) Brenan is a plant species that has been proven to possess pharmacological effects, including antifungal and anti-inflammatory activities. This study evaluated in vitro the effects of standardized A. colubrina extract on virulence factors of Candida albicans and its regulation on immune response through C. albicans-host interaction. Antifungal activity was evaluated by Broth-Microdilution Method against reference C. albicans, C. glabrata, C. tropicalis; C. dubliniensis. Anti-biofilm effect was performed on C. albicans mature biofilm and quantified by CFU/mL/g of biofilm dry weight. Proteolytic enzymatic activities of proteinase and phospholipase were assessed by Azocasein and Phosphatidylcholine assays, respectively. Cell Titer Blue Viability Assay determined cytotoxicity effect on Human Gingival Fibroblasts. Co-cultured model was used to analyze C. albicans coexisting with HGF by Scanning Electron Microscopy and fluorescence microscopies; gene expression was assessed by RT-PCR of C. albicans enzymes (SAP-1, PLB-1) and host inflammatory cytokines (IL-6, IL-8, IL-1β, IL-10). Cytokine secretion was analyzed by Luminex. The extract presented an antifungal effect with MIC<15.62 µg/ml against Candida strains. Biofilm and proteolytic activity were significantly reduced at 312.4 µg/ml (20x 15.62 µg/ml) extract concentration. Cell viability was maintained higher than 70% in concentrations up to 250 µg/ml (LD50 = 423.3 µg/ml). Co-culture microscopies demonstrated a substantial decreased in C. albicans growth and minimal toxicity against host cells. Gene expressions of SAP-1/PLB-1 were significantly down-regulated, and host-immune response was modulated by a significant decrease on IL-6 and IL-8 cytokines secretion. A. colubrina had antifungal activity on Candida strains, antibiofilm, and anti-proteolytic enzyme effects against C. albicans. Presented low cytotoxicity to the host cells and modulatory effects on
the host immune response. **Funding:** National Institutes of Health-NIH under award number UNC/CFAR P30AI50410 and funds from ECU, Division of Research, Economic Development, and Engagement, Brazilian Coordination of Improvement of Higher Education Personnel–CAPES (PDSE–Call 47/2017)

**Abstract # - 30 Exploring Synthetic Low Molecular Weight Heparins for Treatment of Periodontitis**

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**Objective:** Periodontitis affects over half of the American population and has no reliable form of treatment for any stage and grade of the disease besides antibiotics, tooth root scaling and planing and periodontal surgery with highly variable outcomes. Because glycosaminoglycans (GAGs) can be anti-inflammatory, we evaluated a synthetic form of a GAG, a low molecular weight heparin/heparan sulfate-like molecule (LMWH) in its applicability as a protective agent against bone loss in a ligature-induced mouse model of bone resorption. **Methods:** The length of the GAGs used was 18 mer based on our previous data showing anti-clastogenic effects. Two sulfation patterns of the GAGs were used: sulfation XX (Drug A) and sulfation X (Drug B). C57/BL6 male mice were divided into the following groups: no treatment (negative control), ligature only, ligature + over the counter (OTC) heparin (>50 mer length), + LMWH 1 μg (Drug A, injected on palatal gingiva between first and second maxillary molars), + LMWH 1 μg (Drug A, injected on both buccal and palatal sites), + LMWH 5 μg (Drug A, palatal) and + LMWH 10 μg (Drug A, palatal) (n=7). Drug B was tested at 1 ug only as a proof-of-concept as this sulfation pattern was less promising than of Drug A in in vitro studies. Animals received injections daily, were sacrificed at day 5 and the maxilla subjected to micro-computed tomography. **Results:** Among the ligated groups, there was statistically significant difference between positive control (ligature only), OTC heparin as well as LMWH 1 μg (Drug A, double injection) (p<0.05). **Conclusion:** A synthetic GAG of heparin/heparan sulfate nature, with 18 mer length and a specific sulfation pattern promotes bone maintenance in an inflammatory in vivo model of alveolar bone resorption. These results are promising for possible development of an alternative treatment for periodontitis. **Funding:** supported by the National Center for Advancing Translational Sciences (NCATS), National Institutes of Health, through Grant Award Number UL1TR002489.
Abstract # - 31 Spectral Characteristics of Speech in Children with Repaired Cleft Palate

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Objective: Children with repaired cleft palate, especially involving the alveolus, have particular difficulty producing sounds such as /t/ and /s/ that are articulated at the alveolar ridge. The purpose of this study was to determine the impact of cleft type on speech of children with repaired cleft palate. Method: Participants included 31 children, 4-6 years of age, divided into 3 cohorts. 10 subjects had repaired unilateral cleft lip and palate with alveolar involvement (CLP), 11 had repaired cleft palate only without alveolar involvement (CP), and 10 were typically-developing (TD) children without clefts for controls. Children were audio recorded repeating 48 words that consisted of minimal pairs contrasting the /t/-/k/ and /s/-/ʃ/ sounds (i.e., tea-key, top-cop, see-she, sock-shock). First spectral moments (M1, mean or centroid frequency) of the target sounds were determined using TF32 software. Finally, 12 adult listeners performed forced-choice identification tasks that targeted the minimal pairs (i.e., choosing if the word sounded like tea or key). Results: ANOVAs and post hoc tests showed significant group differences for both spectral and perceptual findings. There were significant M1 differences for /k/ between both CP and TD (p=0.034) and CLP and TD (p<0.001) groups, with both groups of cleft children having higher M1 values. For /ʃ/, there was a significant difference between CLP and CP (p=0.021), with CLP having a higher M1. There was also a significant /s/-/ʃ/ M1 difference between CLP and CP (p=0.035), with the CLP group showing less spectral distinction. Listeners were least likely to correctly identify the tea-key contrast for children with CLP (TD=93%, CP=89%, CLP=82%, p<0.001). Listeners, however, were least likely to correctly identify the top-cop, see-she, and sock-shock contrasts for children with CP. Conclusions: Cleft type appears to affect some aspects of articulation in children with repaired clefts. Possible contributing factors (e.g., maxillary collapse) are discussed. Funding: DDS short term research fellowship award ASoD

Abstract # - 32 Print Quality of Resin Patterns on Different 3D Printers

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Objectives: The specific aim for this project is to digitally quantify consistency and variation of printed crown resin patterns using different 3D printers. This will help determine whether the cost of equipment significantly affects print quality in relation to a pre-determined, clinically relevant threshold. The results from this study may influence the types of 3D printers in which different dental laboratories invest and could also influence the dentist’s decision to work with different laboratories due to the quality of restoration that they receive (for example by reducing
or increasing the cost based on whether a cheaper or more expensive printer produces a better clinically acceptable crown resin pattern). **Methods:** A prefabricated typodont tooth was prepared for a crown and scanned using a TRIOS 3, 3shape intraoral scanner. From this scan, a crown was designed (with repeatably identifiable landmarks) and the resulting STL file exported. This 3D file will subsequently be printed on the Carbon M2, Straumann p5, and Elegoo Mars 2 Pro 3D printers using various resin materials. Finally, the crown resin patterns will be 3D scanned using the TRIOS intraoral scanner and crown marginal fit/adaptation will be digitally quantified in GeoMagic software (resin pattern fit on prepared tooth as well as printed resin pattern accuracy compared to the digitally designed crown pattern). Measurements will consider volumetric differences (statistically analyzed by ANOVA) and will be replicated by multiple examiners to ensure consistency. Clinically relevant significance will be determined (marginal gap <50μm) between resin patterns printed on different printers. **Results:** The designed crown will be printed, and 3D scans of the prints will be analyzed to determine volumetric differences between the designed crown and the various prints. **Conclusion:** Currently, no conclusions can be made because the project is in progress. **Funding:** DDS Short-Term Research Fellowship. Adams School of Dentistry UNC-CH

**Abstract # - 33 PPARG variants associated with Periodontitis and Type 2 Diabetes Mellitus**

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**Objective:** The genetic architecture of the type 2 diabetes mellitus (T2DM) is well known, but there are incipient evidence on the genetic association of T2DM in conjunction with Periodontitis. Both T2DM and Periodontitis are complex diseases which usually affect individuals as comorbidities. Amongst the more consistent genetic risk marker of T2DM, there is a single nucleotide polymorphism (SNP) in the peroxisome proliferator-activated receptor gamma (PPARG) gene, which is scarcely known regarding Periodontitis. The PPARG gene encodes a transcription factor involved in the management of metabolic and inflammatory complex diseases. The present study aimed to investigate whether SNPs and haplotypes in the PPARG gene could be associated with susceptibility to periodontitis alone, or as a comorbidity of T2DM. Moreover, the gene-phenotype association was evaluated by assessing the subjects’ biochemical and periodontal parameters, and the expression of PPARG and immune response genes. **Methods:** Study subjects with detailed biochemical and periodontal data were: Healthy = 345 with healthy periodontium and without T2DM; Periodontitis (P) = 349 with moderate or severe periodontitis and without T2DM; P+T2DM = 202 T2DM affected together with moderate or severe periodontitis. DNA from buccal cells extracted by salting-out were used to genotype the PPARG SNPs (rs12495364, rs1801282, rs1373640, rs1151999) by TaqMan assays. **Results:**
Multiple logistic regression adjusted for age, sex and smoking habits showed that individuals carrying the rs1151999-GG have 64% lower chance of developing P+T2DM. The CGT haplotype increased the risk of P+T2DM. The rs1151999-GG and rs12495364-TC were associated with reduced risk of obesity, periodontitis, high triglycerides and HbA1c, but there was no association with gene expression. **Conclusions:** We concluded that SNPs and haplotypes in the PPARG gene are associated with Periodontitis and T2DM as comorbidity, besides there were gene-phenotype associations regarding obesity, lipid, glycemic and periodontal characteristics of subjects.

**Abstract # - 35 Women in Science and Healthcare Research (WISHR) Peer Support Initiative**

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**Objectives:** The Women in Science and Healthcare Research (WISHR) Peer Support Initiative at the Adams School of Dentistry (ASOD) is a gender-inclusive research-focused group with the mission to: foster a sense of well-being and belonging, facilitate collaboration, and support and advocate for the advancement of research-affiliated ASOD students, staff, residents, postdocs, and all-levels of faculty. The group was founded through the UNC JEDI Fellows Program and also serves as a Peer Support Pod as part of the Carolina Peer Support Collaborative. **Methods:** We are focused on executing social and networking events as well as professional development workshops that encourage inter-level collaboration and engagement with research projects affiliated with the ASOD. **Results:** At our first organizing meeting in Fall of 2021, we set goals for the types of events to prioritize that would have the most impact towards community building and peer support – in line with the Strategic Initiative at UNC. Our first networking event was held as a part of the UNC Celebration of Research week and featured research cards that attendees customized and traded at the event. The event hosted over 60 registrants with all research-levels and many units represented. **Conclusions:** Here, we describe the successful planning, organization, and launch of the WISHR@ASOD Peer Support Initiative. To date, we have received wide support and enthusiasm across levels and departments. We are committed to taking feedback from members and event attendees to continue to create meaningful and engaging events and encourage research-focused dialogue and collaboration. Moving forward, we plan to focus on social and networking events, including a Breakfast Research Club Social, and a Mentor-Mentee Networking event to help students interested in research pair with research mentors. **Funding:** ASOD Office of Discovery Research and Innovation.
Abstract # - 36 AIF inhibits NLRP3 inflammasome dependent IL-1β induction by sequestering NEK7

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**Objective** Inflammation mediated by IL-1β is central to tissue remodeling for orthodontic tooth movement. Revealing the regulation mechanism of IL-1β is critical for understanding tooth movement biology. NLRP3 inflammasome activation leads to IL-1β release. This study aims to identify novel NLRP3 interactor that regulates IL-1β release. **Methods** HEK293T cells were transfected with vector encoding NLRP3. Immunoprecipitation coupled with mass spectrometry was used to identify NLRP3 interacting protein. Confocal imaging using HeLa cells were used to study the cellular location of interaction. CRISPR/CAS9 was used to generate gene knockout THP1 cell line. **Results** Immunoprecipitation with mass spectrometry identified apoptosis-inducing factor (AIF) as an NLRP3 interacting protein. Confocal imaging showing AIF interacted with NLRP3 in the cytosol. Using recombinant protein, AIF directly interacted with NLRP3. THP-1 monocytes with AIF ablation by CRISPR/CAS9 showed enhanced caspase-1 and IL-1β processing upon NLRP3 inflammasome activation. AIF directly competed with NEK7 to bind NLRP3. **Conclusions** This study identified a novel NLRP3 inflammasome regulator AIF. During inflammasome activation, AIF is released from mitochondria into the cytosol and AIF interacts directly with NLRP3. AIF inhibits NLRP3 inflammasome mediated IL-1β release via sequestering NEK7.

Abstract # - 37 Transitional Digital Restorations for Developmental Dental Defects in Young Patients

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**Objective:** Digital technology is rapidly changing the provision of dental care, though its application and use in young patients has lagged in adoption. This work aims to explore several digitally supported treatment approaches for managing developmental dental defects in the early permanent dentition. **Methods:** A literature review on digital dental technology and its applications to pediatric and adolescent dentistry was completed to assess the current evidence base. Four adolescent patients with amelogenesis imperfecta (AI) received transitional anterior restorations for esthetic and functional rehabilitation using multiple digital workflows. Combinations of restoration type, materials, and fabrication methods were selected to meet the needs of each patient based on their specific AI phenotype and presenting chief complaint. **Results:** The literature search yielded isolated case reports for digital restorative care and limited
data on clinical outcomes in the pediatric population. Cases reported in our series were treated with digitally fabricated veneers and crowns using polymethylmethacrylate or composite materials that were either 3D printed or milled following computer-aided design. Patients reported satisfaction with esthetics and decreased hypersensitivity. Based upon current literature and the cases treated, observed benefits of digital workflows particularly relevant to the younger population include positive effects on patient anxiety, expanded scope of materials, ease of reproducibility, and decreased chair time necessitating patient cooperation. Challenges noted include cost-related barriers and the need for optimal appointment sequencing.

**Conclusions:** Digitally supported restorative approaches offer broad applicability to the pediatric and adolescent population presenting with complex restorative needs. These cases highlight an opportunity for the use of digital workflows in young patients: to aid in the transitional management of developmental dental defects. Consistent with recent trends in precision medicine, digital technology is opening new possibilities and elevating expectations for personalized esthetic and functional care of the mixed and early permanent dentitions.

Abstract # - 38 Optimization of Adeno-Associated Virus Vector-Mediated Gene Transfer to Salivary Glands

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**Objective:** Sjögren’s syndrome is the second most common autoimmune rheumatic disease characterized by lymphocytic infiltration of salivary and lacrimal exocrine glands. Dry eyes and dry mouth are the two most common symptoms and there is currently no cure for this condition. Gene therapy has been reported to be a promising tool to correct and prevent the progression of dry mouth. Adeno-associated virus (AAV) is currently the most widely popular gene delivery viral vector due to its low immunogenicity, long-term expression, and replication defectiveness. Here, we determine the most effective AAV serotype for submandibular gene delivery with the intentions of utilizing the selected serotype to deliver therapeutic genes to combat autoimmune diseases.

**Methods:** We constructed three serotypes of AAV (AAV2, AAV5, AAV6) containing a luciferase expression gene. We injected each AAV serotype in C57BL/6J mouse submandibular glands to assess genetic delivery efficiency through luciferase expression. In vivo imaging was used to observe the progression of luciferase signal over several weeks. At 3 weeks, the glands were harvested and lysed to determine AAV transgene copy number, and protein was extracted for an in vitro luciferase assay. Glands were also fixed and stained to verify the luciferase expression in exocrine cells by immunofluorescence.

**Results:** AAV2 and AAV6 both demonstrated the highest signal for luciferase expression among the three serotypes based on in vitro and in vivo data. However, mice injected with AAV6 demonstrated an undesirable off-target effect by having a 1.5X higher luciferase signal in the liver compared to submandibular glands.

**Conclusions:** These data suggest that AAV2 is a possible viral vector candidate for salivary gland gene therapy. Further studies will focus on potential gene transfer for the treatment of Sjögren’s syndrome.

**Funding:** NIH-5R01HL144661-03
Abstract # - 39 3D Intraoral Tomosynthesis: Adult and Child Bitewing Radiography Dosimetry

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Objectives: The purpose of this study was to measure effective doses (E) and equivalent doses from adult and child posterior bitewing (PBW) examinations using a contemporary stationary intraoral tomosynthesis 3D radiography source (Portray). Methods: Adult and child human tissue equivalent phantoms and optically stimulated luminescent dosimeters were used to collect dose measurements for both adult-4 and child-2-projection PBW examinations with the Portray. Examination parameters were 70 kV, adult/child mAs: 22.4/8.8. Imaging exposures were acquired with and without a direct-digital sensor in the beam path. Results: E (uSv) was 21.2 & 10.1 for adult and 12.3 & 4.7 for child sensor-absent & sensor-present scenarios, respectively. Sensor-present examinations resulted in significant reductions in E for adult and child PBW examinations (P = .0017). Child E was significantly reduced compared to the adult for both sensor-present and sensor-absent conditions (P = .001). Sensor presence yielded a 52-62% reduction in E for adult and child BW, respectively. Sensor presence produced significant reductions in equivalent thyroid dose in both adult and child examinations (P < .0001). However, even with half the number of projections and reduced exposure parameters for child examinations compared to the adult, child and adult thyroid doses were not found to be significantly different. Adding thyroid shielding provided an additional 12% reduction in child equivalent thyroid dose. Conclusions: Adult E for Portray PBW examinations was elevated compared to child E. Inclusion of an intraoral sensor during acquisitions preserved this trend but yielded significant reductions in E for both adult and child PBW examinations. Shielding of thyroid tissues should be a prudent practice during PBW radiography, especially for children, given that the unshielded thyroid doses for both adult and child imaging were similar despite reduced projections and exposure parameters for child examinations.

Abstract # - 40 YouTube: An Innovative Platform in Dental Education

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Objectives. Videos have been implemented in dental education in recent decades and are particularly important amidst the sudden switch to remote learning due to the global pandemic. Though studies indicate benefits associated with video learning, data regarding video effectiveness and user reception in dental education are limited, particularly on Web 2.0 resources like YouTube. Given the increasing integration of technology in learning, dental
educators need evidence to guide implementation of YouTube as a platform in curricula. We hypothesize that a majority (>50%) of dental students will consider YouTube videos helpful and acceptable as supplemental study materials, with no significant difference between slideshow and pencast video formats. **Methods.** A cross-sectional observational study was conducted of anonymous viewers (n= 683) of the Mental Dental® educational YouTube channel. Qualitative remarks and Net Promoter Score were collected through a Qualtrics survey. Learning analytics of the Mental Dental® videos were also evaluated. Finally, a randomized controlled crossover study was conducted of anonymous dental students (n = 82) which involved watching videos and answering questions to compare effectiveness of slideshow to pencast video format. **Results.** The majority of viewers of Mental Dental® videos are dental students (44%) and would likely recommend the platform to a friend or colleague (85%). Audience retention declines steadily at ~1.34% per minute independent of video length. Quiz performance does not differ significantly following slideshow or pencast video consumption and students do not have a significant preference for one lecture style. **Conclusions.** Video-based lectures are used by dental students and viewed as helpful and acceptable. There seems to be no optimal video length to maximize audience retention and the lecture style (slide show vs. pencast) does not significantly impact content learning. **Funding:** DDS Short-Term Research Fellowship Adams School of Dentistry and Southern Association of Orthodontists, both awarded to RT Gross.

**Abstract # - 41 Distinct Biomarker Signatures Define Periodontal Disease Subtypes**

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**Objectives:** Precision oral health seeks to expand on our understanding of periodontal disease heterogeneity and leverage it to optimize treatment selection based on individual biological needs. Our group has previously identified distinct plaque microbial signatures and systemic antibody responses in individuals stratified by the Periodontal Profile Class (PPC) taxonomy. The goal of this study was to identify stable oral inflammatory “fingerprints” of periodontal classes based on longitudinally assessed biomarker information. **Methods:** We used periodontal clinical measurements and biomarker data (Luminex) obtained from the “Biomarkers of Periodontal Disease Progression” longitudinal study, which examined 400 individuals bimonthly over a 1-year period. Clinical measurements were used to stratify individuals into the periodontal classes of Health, Mild, Moderate, and Severe disease. The longitudinal stability of 16 biomarkers derived from gingival crevicular fluid was evaluated by an area under the curve analysis. Periodontal biomarker signatures were derived via principal component analysis of “stable” inflammatory mediators. The association between periodontal classes and these biomarker signatures was tested using ANOVA and a conventional p<0.05 statistical significance criterion. **Results:** Seven
Biomarkers showed significant longitudinal stability over the 1-year study period, including IL1β, IL-6, IL-17, granulocyte colony-stimulating factor (G-CSF), interferon gamma (IFN-γ), and monocyte chemoattractant protein-1 (MCP-1/CCL2) among all 4 periodontal classes. Five periodontal biomarker signatures were created with these stable mediators. Periodontal Health (n=65) was negatively correlated with a signature of “severe inflammation,” which comprised all seven biomarkers evaluated (p<0.001). Mild (n=97) and Moderate disease (n=100) classes correlated with both the IL-1β-dominated “pro-inflammatory” signature and the “immunoregulatory” signature, dominated by IL-6 and G-CSF (p<0.05). Severe disease (n=138) correlated with both the “severe inflammatory signature” and “chronic inflammation,” which was dominated by RANTES and G-CSF (p<0.05). **Conclusions:** We identified stable biomarker signatures among periodontal disease subtypes, which may be useful for designing future biological approaches for targeted oral care. **Funding:** NIDCR-K01DE027087 and DDS Short-Term Research Fellowship ASoD

**Abstract # - 42 Identifying Factors Influencing Orthodontic Program Selection**

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**Objective:** Dental students face rising tuition costs, with the average American dental student graduating with a striking mean debt of $262,119. Students who hope to become orthodontists must select between tuition-based programs with increasing costs that offer little to no stipend support. This study aims to identify factors that applicants consider during their residency decision-making process to clarify the impact, if any, of the educational debt crisis. **Methods:** This is a mixed-methods study with a qualitative and quantitative phase. Semi-structured interviews were conducted with a sample of 15 final-year dental students or first-year orthodontic residents following a topic guide. Interview subjects were purposefully sampled to fall into different debt categories including none ($0, n=2), low ($1-$150,000; n=4), middle ($150,001-$300,000; n=5), or high debt ($300,001-$400,000; n=4). Interviews were analyzed using MAXQDA2020 to understand personal values and influences related to dental school and orthodontic program selection. Qualitative results guided development of a 59-question online survey which was electronically distributed to PASS orthodontic residency applicants (N=182; 31.37% response rate). Results were analyzed to identify factors important to residency selection, with descriptive and bivariate statistics. **Results:** Cost and location were the most important factors for choosing where to apply to residency. Subjects with less debt tended to place less emphasis on program cost than those with higher debt burdens. Preliminary results from the survey corroborate that cost and location are key influencers for residency applicants, along with satisfied current residents, interview experience, and multiple techniques taught in the program. **Conclusions:** Applicants to orthodontic residency programs consider numerous factors when selecting
programs, with cost, location, interview experience, and educational breadth weighted heavily. Cost is a larger consideration for applicants who already carry higher debt loads. **Funding:** Southern Association of Orthodontists Research Award (to T.G.) and American Association of Orthodontists Foundation (AAOF) Martin ‘Bud’ Schulman Postdoctoral/Junior Faculty Fellowship [to L.J].

**Abstract # - 43 Mechanism of anti-microbial activities of Silver Nanoparticles**

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**Objective:** It is hypothesized that the anti-microbial activity of silver nanoparticles (AgNP) is dependent on the redox potential of the transition silver ion converting H2O2 to bactericidal hydroxyl radical (OH). The primary aim is to evaluate the antimicrobial efficacy of silver nanoparticles against cariogenic bacteria. **Methods:** AgNP (5 nm from nanoComposix) titrated in trypticase soy broth (TSB) was tested for growth inhibition of Streptococcus mutans 10449 (Sm) in a 96-well microtiter plate format. Growth at 37°C in ambient atmosphere was monitored kinetically at l660nm (Spectramax M2e from Molecular Devices) compared to a standard curve of 10-fold diluted bacteria in TSB. **Results:** Sm at 104 CFU/ml was inhibited in growth by 25mg/ml AgNP, but growth was not influenced by 12.5mg/ml. Sm was totally recoverable after 24h exposure to 50mg/ml suggesting that inhibition was bacteriostatic. When the target bacteria were increased 10-fold, there was an apparent increase in susceptibility with 12.5mg/ml AgNP resulting in total bacteriostasis. In contrast, titration of H2O2 proved to be bactericidal and dose dependent with log reductions in recoverable CFU at concentrations less than 2mM. These data are consistent with the possibility that AgNP are dependent on Sm generated H2O2 at the bacterial surface to generate bactericidal concentrations of OH. **Conclusion:** Increasing the bacterial density would increase the extracellular levels of H2O2 in the treatment environment resulting in an increased sensitivity. If this is true then exogenous addition of H2O2 in the presence of AgNP would result in synergistic bactericidal activity against Sm. This will be tested in future experiments using combinations of sub-inhibitory concentrations titrated against Sm and other target bacteria. **Funding:** DDS Short-term Research Fellowship ASoD

**Abstract # - 44 Investigation into Long-Term Stability of Anterior Openbite Correction with Aligners**

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**Objective:** (1) To determine long-term stability of anterior openbite (AOB) correction using clear aligners; (2) To investigate factors contributing to AOB correction following active aligner
therapy. **Methods:** Patients gave consent for research and were initially screened for a pre-treatment AOB from two private practices in North Carolina over time periods: 1.1.2013-12.31.2017 and 5.1.2018-1.15.2022. Patients who exhibited an AOB from their initial intraoral center photo were consecutively selected under IRB 18-2570. Severity of each AOB was graded using the validated Photographic Openbite Severity Index (POSI); scores ranged from 1-6. Patient’s initial, treatment completion, and retention intraoral center photos were anonymized and the blinded assessor scored each photograph using POSI. Scores were verified by rescoring 20% of the photographs two weeks after the initial scoring. In addition, the following information was collected from the patient records: age of patient, time in treatment and retention, type of retention (fixed or removable), respective provider, and type of aligner treatment. **Results:** 48 patients (9 male, 39 female) with AOB who received aligner treatment were included in the study. Mean age at treatment initiation was 30 years 5 months (range: 12-70 years). Mean treatment time was 17.6 months (range: 3-37 months). All 48 patients regardless of initial POSI score indicated no AOB at treatment completion (p<0.05). 22 of the 48 patients (46%) had long-term retention records (mean 21 months after active treatment), with all having fixed retention on their upper and lower incisors. 3 of the 22 (14%) long-term retention patients exhibited AOB relapse indicated by a POSI score of 1. **Conclusions:** This non-interventional clinical study provides valuable insight into the stability of AOB treatment via aligners. The results demonstrate that AOB cases in retention exhibiting relapse had relapsed on the terminal fixed retention tooth, indicating the importance of including more teeth into the fixed retention. **Funding:** American Association of Orthodontists Foundation, Southern Association of Orthodontists

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**Abstract # - 45 Molecular Mechanisms Governing Long-Term Drug Tolerance in Salivary Gland Cancer**


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**Objective:** Mucoepidermoid carcinoma (MEC) is the most common salivary gland cancer. Low-grade MECs are effectively treated by surgical resection (>90% 5-yr survival), however, aggressive high-grade tumors are often refractory to conventional therapies and are prone to tumor
recurrence (~35% 5-yr survival). Although multiple clinical trials have been initiated for MEC, including targeted therapies to EGFR, these have all failed and led to a dearth of treatment options. Thus, we investigated the cause of EGFRi monotherapy failure in an effort to identify new therapeutic vulnerabilities in MEC. **Methods:** Mechanisms of EGFR drug tolerance was evaluated in 5 MEC cell lines using drug screens, cell viability, drug titrations/synergy-combinations, immunofluorescence, proliferation, apoptosis, colony formation, 3D-tumor spheroid, single cell proliferation reporters, metabolic assays and RNA-seq. **Results:** The RTKi drug screen identified Erlotinib (EGFRi) as a target and treatment reduced MEC cell 2D colony and 3D tumorsphere formation in a dose-dependent manner but without causing cell death, even supra-therapeutic doses of Erlotinib (25 uM; ~80x IC50). MEC cells enter a reversible growth arrested state but remain viable such that upon drug withdrawal cells commence proliferation. RNA-seq revealed that EGFRi-induced MEC cell quiescence mimics the embryonically conserved state known as ‘diapause’. Lastly, this drug tolerant state is accompanied by mitochondrial biogenesis and the accumulation of lipids and mucopolysaccharides. **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 cell senescence pathways. On-going investigations are focused on understating the role of metabolic rewiring towards EGFRi drug tolerance and on the development of novel combinatorial therapeutics to overcome this unexpected drug tolerant state. **Funding:** Ruth L. Kirschstein National Research Service Award (NRSA) F31 Fellowship (AMM), UNC Dissertation Completion Fellowship (KP-S), NIH/NIDCR R01-DE030123 (ALA), UNC Cancer Research Funds (ALA) and NIH/NCATS TraCS Translational Team Science

**Abstract # - 46 Physical and Functional Limitations in Dental Hygiene and Dental Students**

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**Objective:** This study assesses the relationship between learner level, disability, BMI, physical activity, and functional limitations in dental (DDS) and dental hygiene (DH) students. **Methods:** DDS and DH students from the University of North Carolina at Chapel Hill were invited to participate in an anonymous Qualtrics survey. DDS1, DDS2, and DH1 respondents were categorized as beginners while DDS3, DDS4, and DH2 were advanced. The survey included two validated questionnaires: Oswestry Low Back Pain Disability Questionnaire and Upper Extremity Functional Index (UEFI). Bivariate analyses to assess the relationship between learner level, BMI category, and presence of disability and the average scores of the two questionnaires was performed using Cochran-Manhtel Haenszel row mean score statistics. **Results:** Of the 169 respondents, 157 (93%) consented to participate. Seventy percent of beginners were female, 29% were overweight/obese, and 10% reported a disability. Of the advanced respondents, 67% were female, 31% were overweight/obese, and 7% reported a disability. The average Oswestry Low Back Pain scores were significantly different (p=0.02) for the beginner and advanced
respondents but were not significantly different based on BMI (p=0.43) or disability (p=0.49). The advanced students had a slightly higher average (Q1 = 0.2, Q2 = 0.4, Q3 = 0.8) score than the beginner students (Q1 = 0.1, Q2=0.3, Q3=0.5) indicating a shift towards higher reports of pain. The average UEFI scores were not significantly different (p=0.25) for beginner and advanced students, or for BMI (p=0.33) but were significantly different for those who reported a disability and those who didn’t (p=0.03). Those who did not report a disability (Q1=3.95, Q2=4.0, Q3=4.0) had a slight shift in the distribution compared to those who did not (Q1=3.55, Q2=3.95, Q3=4.0) indicating no correlation is present with clinical experience level with upper extremity functionality. **Conclusion:** Functional limitations remain a concern in the dental profession.

**Abstract # - 47 Prevalence of High-Risk Human Papillomavirus in Oral Squamous Cell Carcinoma**

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**Background:** High-risk human papillomavirus (HR-HPV) infection is a well-established favorable prognostic variable in oropharyngeal squamous cell carcinoma (OPC), leading to deescalated treatment and better outcomes compared to HPV-independent OPC. Studies of HR-HPV in OPC demonstrated the validity of using immunohistochemistry (IHC) with antibody p16 as a surrogate marker to assess the presence of transcriptionally-active HR-HPV in tumors of that site. There is limited published data regarding the prevalence of transcriptionally-active HR-HPV in oral squamous cell carcinoma (OSCC) to validate its use as a standard of care. **Objective:** This study aims to determine the prevalence of HR-HPV infection in OSCC by means of p16 IHC and HR-HPV ISH and to assess the utilization of p16 IHC as a surrogate marker for transcriptionally active HR-HPV in OSCC. **Methods:** This study was approved by our Institutional Review Board. OSCC cases from 2018 to 2019 with p16 IHC and HR-HPV ISH studies diagnosed at the University of North Carolina at Chapel Hill Oral and Maxillofacial Pathology Laboratory were retrieved (n = 107). The hematoxylin and eosin, p16 IHC, and HR-HPV ISH slides were reviewed and scored by three board-certified oral and maxillofacial pathologists. Sixty-nine cases met the inclusion criteria for this study. **Results:** There was 100% concordance between the pathologists. Sixty-four (92.8%) cases were non-reactive for both p16 IHC and HR-HPV ISH. Four (5.8 %) cases demonstrated only p16 immunoreactivity. One (1.4%) case, from the floor of the mouth, demonstrated both p16 and HR-HPV ISH reactivity. **Conclusion:** In this cohort of OSCC, HR-HPV prevalence was low. These results support the more aggressive conventional treatment of OSCC. In view of the discordance in 5.8% of the cases, investigation of other potential HPV etiologic types is warranted.
Abstract # - 48 Correlation of Body Mass Index and Craniofacial Morphology

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Objectives: Adolescent obesity rates have significantly increased in the past 50 years, jumping from 4.6% to 20.6%. Studies had shown elevated Body Mass Index (BMI) accelerates dental and skeletal development, with important implications for orthodontic treatment timing. We aim to determine the influence of BMI on craniofacial dimensions using a database of pre- and post-treatment orthodontic records. Methods: To evaluate associations between BMI and post-orthodontic craniofacial morphology, 400 participants were consecutively chosen (8-15 years, n = 200 overweight and obese BMI >85%, 200 normal weight). Records were analyzed for cephalometric measures and cervical vertebrae maturation staging (CVMS) at treatment start and finish, along with total treatment time and approach (e.g. growth modification, camouflage). Bivariate statistics and linear regression analysis evaluated whether cephalometric dimensions and treatment timing varied with BMI. Results: At treatment start, overweight/obese children and adolescents had a proportionally larger bimaxillary prognathic skeletal pattern compared to those of normal weight. Several cephalometric measures [articulare-gnathion (Ar-Gn), condylion-anterior nasal spine (Co-ANS), sella-gonion (S-Go), nasion-menton (N-Me), anterior nasal spine-menton (ANS-Me), sella-nasion-A point (SNA), sella-nasion-B point (SNB), and sella-nasion-pogonion (SNPg)] were significantly different [statistically (P < 0.05) and clinically (>2 mm or >2 degrees)] between the two study groups, with a positive linear relationship between BMI percentile and craniofacial dimension. Analysis is ongoing to determine whether differences in craniofacial dimensions exist at treatment conclusion. Conclusions: Obese/overweight children and adolescents have proportionally larger antero-posterior and vertical dimensions at the start of treatment, with results pending on post-orthodontic changes. BMI percentile should be a consideration for orthodontic treatment in growing patients. Funding: NIH NIDCR K08 grant to L.J (K08DE030235) and the American Association of Orthodontics Foundation (AAOF) Junior Faculty Fellowship [to L.J.]

Abstract # - 49 Identifying Biomolecular Pathways Which Change Gingivitis Response Under Stress

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Objective: Periodontal disease is an oral disease characterized by chronic inflammation leading to gum recession, bone loss, and tooth loss. The beginning stages of Periodontitis, also known as Gingivitis, starts with the initiation of inflammation by gingival oral epithelial cells in the presence
of microbiota but it was not known how epithelial cell mediate the immune responses to environmental stressors (extreme pH, hypoxia, cortisol). In this study, we examined the molecular impacts of the epithelial immune response under a highly acidic environment.

**Methods:** Human oral epithelial cell culture (HOEC) was generated under an acidic environment (pH=3) by adding HCl to growth media. After equilibration at 37 °C, I stimulated HOECs (in triplicate) with the agonists engaging TLR5 (flagellin) and TLR2/1 (Pam3CSK4) for 2, 6 and 24 hours. Stimulated HOECs grown in only growth media for each line were used as a negative control to determine baseline protein and gene expression. Molecular mediators (RNA) were collected and NanoString Technology's Metabolic and Immune panels were used for analysis.

**Results:** NanoString Technology revealed 96 significant changes in gene expression related to human metabolism and 27 significant changes in gene expression relate to human immunology. Cells under acidic environments were observed to have decreased survival rates.

**Preliminary Conclusions:** HOECs produce an immune different response when in extremely acidic environments. The acidic environment has a lesser effect on the immune pathway compared to the metabolic pathway. Specific pathway conclusions will be reported after pathway analysis is performed on the data. Lower survival rates in the acidic environment point to potentially worse periodontal disease outcomes.

**Funding:** The Wallet Lab, Carines /Maile Lab, UNC Adams School of Dentistry, UNC Summer Undergraduate Research Fellowship (SURF)

**Abstract # - 50 Novel Software-based Observational Coding Protocol for Evaluating Pediatric Dental Anxiety.**

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**Objectives:** Patients troubled by dental anxiety often exhibit disruptive behavior during appointments and avoid routine care, leading to adverse outcomes and reduced quality of life. Use of animal-assisted therapy (AAT) in pediatric dental populations holds promise for behavior management and reducing anxiety and pain perception. Our aim is to develop and validate an observation-based assessment scale that utilizes state-of-the-art coding software (Noldus) and can incorporate objective metrics of stress, to objectively evaluate AAT. **Methods:** Data were collected from a pilot trial on use of AAT in pediatric dentistry. Enrolled subjects (N=14, age 7-13) were assigned to AAT or an active control prior to care. Patients received operative treatment while having video, heart rate, skin galvanic response, and salivary cortisol data collected. A code book, behavioral scale and gold standard video were developed with Noldus Software, under supervision of a behavioral research expert. **Results:** Published scales were referenced in defining initial codes, which were iteratively revised over 5 videos, until investigators confirmed the code book. Videos were analyzed by two blinded and calibrated judges. Preliminary results indicate adequate inter-and intra-examiner agreement for coding anxiety measures in videos of pediatric dental procedures. **Conclusion:** Though validation is ongoing, data are encouraging for successful
development of an objective, observational code book and scale for pediatric dental procedures. **Funding:** American Academy of Orthodontists Fellowship Research Aid Award, Southern Association of Orthodontist Research Award

**Abstract # - 51 Commensal Gut Microbiota: A Novel Regulator of Craniofacial Skeletal Development**

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**Objectives:** Collections of microbes colonize anatomical sites in health to form the commensal microbiota. We and others have shown that the commensal microbiota regulates postnatal bone growth and maturation at non-craniofacial skeletal sites. Diverse genetic and environmental factors impact craniofacial development. However, no known prior studies have investigated commensal gut microbiota effects on the postnatal craniofacial skeleton. The purpose of our study was to discern whether commensal gut microbes influence normal postnatal craniofacial skeletal development.

**Methods:** Female C57BL/6T germ-free mice and excluded-flora mice (specific-pathogen-free mice) were acquired from Taconic Biosciences. Animals were euthanized at age 9-weeks; skulls were dissected for analyses (n=8-11/gp). Skulls were then micro-CT imaged, and 3-dimensional reconstructions were generated for advanced morphometric analyses. One-way ANOVA with Tukey post-hoc test performed; P<0.05 considered significant.

**Results:** Comparing excluded-flora mice to germ-free mice delineated that the commensal microbiota increases cranium length attributed to increased frontal and interparietal bone lengths. Excluded-flora mice also exhibit a decreased cranial base length, with contributions from all three bones of the posterior cranial base: presphenoid, basioccipitus and basisphenoid. We found that EF mice exhibited decreased bone mineral density in both the basioccipitus and basisphenoid bones. We also demonstrate that the interparietal bone showed significantly more cortical thickness in EF mice while the basisphenoid bone had a decreased cortical thickness. We found that both the interparietal and basisphenoid bones had a significantly increased cortical area fraction in EF mice vs. GF mice. **Conclusions:** This work introduces the commensal microbiota as a novel regulator of craniofacial skeletal growth and maturation. Orthodontics and dentofacial orthopedics are commonly employed to correct dental and craniofacial discrepancies. This study underscores that non-invasive interventions in the pediatric microbiome (i.e., probiotics, prebiotics) could be employed as adjuncts to support orthodontic treatment outcomes. **Funding:** ASBMR Rising Star Award; NIH/NIDCR K08DE025337; NIH/NIGMS
Abstract # - 52 Comparison of PortrayTM Stationary Intraoral Tomosynthesis(SIT) and Conventional Bitewing Images.

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Bitewing radiography, a primary diagnostic aid for proximal caries detection, is technique dependent. SIT provides three-dimensional(3D) images and may reduce proximal surface overlap. **Objective:** The objective was to compare the amount of proximal surface overlap between conventional 2D bitewing images and 3D bitewing images using the PortrayTM a newly marketed SIT device. **Methods:** Bitewing radiographs were acquired with conventional 2D radiography (Instrumentarium FocusTM,70kVp,7mA,0.16sec) and the PORTRATM device (Surround Medical Systems, Morrisville, NC, 70kVp,7mA,0.8sec). Eleven Dentsply Rinn adult manikins were exposed. One radiographer acquired conventional images using a size-2 Sirona Schick 33 sensor with a Rinn XCP-ORA® bitewing holder and SIT images using a size-2 CMOS detector with a dedicated holder designed for image acquisition specifically with the SIT unit. Two premolar and two molar bitewing images were acquired per manikin with each device. SIT data sets were reconstructed using the device software. The number of slices generated was determined by the software and are 0.5mm apart and parallel to the sensor plane. The percentage horizontal overlap between enamel of adjacent proximal surfaces was measured using the measurement tools in ImageJ for conventional images and the SIT software for the generated slices. Data were analyzed using a Wilcoxon signed rank test for comparison of proximal overlap. **Results:** Eighty-eight bitewing projections were exposed resulting in 44 paired images. Although more diagnostic proximal surfaces were viewed on the SIT, analysis only included the 210 paired surfaces visible with both techniques. Conventional images resulted in a median overlap of 25%, a minimum of 0%, a maximum of 100%, interquartile range 51%. SIT images resulted in a median overlap of 0%, a minimum of 0%, a maximum of 71% and an interquartile range of 0%. The difference was statistically significant (p<.0001). **Conclusion:** SIT generated images substantially reduced proximal surface overlap compared to conventional bitewing radiography. **Funding:** Surround Medical Systems Incorporated in agreement (SMS-UNC 19-0777) with UNC Adams School of Dentistry

Abstract # - 53 Precision Periodontal Disease Subtypes are Associated with Pre-Term Birth

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Objectives. Studies of the periodontal disease/pre-term birth link have been inconclusive. A precision periodontal phenotyping system is likely to help elucidate this important oral-systemic relationship. We aimed to: 1) Investigate the association between maternal periodontal disease and pre-term birth, and 2) Characterize IgG antibody levels to periodontal pathogens within periodontal disease subtypes. Methods. We examined 1,020 pregnant women<26 weeks’ gestation from a prospective, observational study of Oral Conditions and Pregnancy. All women underwent comprehensive periodontal examinations, provided subgingival plaque, and pre- and postpartum blood samples, which were analyzed for levels of periodontal pathogens and IgG antibodies. Preterm birth was defined as delivery before the 37th week. Periodontal disease was defined by the Periodontal Profile Class (PPC-Stages) system. Relative risk (RR) and 95% confidence intervals (CI) were calculated with bivariate testing using ProcGENMOD. Attributable risk and confidence intervals were calculated from periodontal stage and delivery type (term/preterm). Results. Compared to periodontally healthy women, women with mild and severe periodontitis as well as those with pregnancy gingivitis had: 1) Significantly higher relative risk of pre-term delivery (PPC-Stages II [RR=2.3, 95%CI=1.3-3.8], IV [RR=2.2, 95%CI=1.3-3.7], V [RR=1.9, 95%CI=1.2-3.2], respectively) and 2) Significantly higher IgG antibody levels, especially for the classic pathobionts P. gingivalis and P. intermedia (type III p-value <0.0001). Furthermore, women with mild and severe disease (PPC-Stage II and IV) both had 12% risk of pre-term birth attributable to their periodontal disease whereas women with pregnancy gingivitis had 9% attributable risk of preterm birth. Conclusions. Pre-term birth risk is higher among women with distinct periodontal disease subtypes and elevated levels of IgG antibodies to periodontal pathobionts. Thus, timely treatment for pregnant women with certain types of periodontal disease may reduce pre-term birth risk. Taken together, these findings illustrate the utility of using a precise periodontal disease classification system to investigate oral-systemic health associations.

Abstract # - 54 New Aged Tricalcium Silicates Discoloration of Dentin

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Introduction: Previous studies have shown that bismuth-containing tricalcium silicates cause tooth discoloration due to the reaction between bismuth oxide and sodium hypochlorite. Objectives: The objective of the first part of the study was to determine if sodium thiosulfate could prevent discoloration by inhibiting this chemical reaction from occurring. Newer tricalcium silicates that do not contain bismuth oxide state that no tooth discoloration occurs. The purpose of the second part of the study is to determine the amount of discoloration that occurs in newer-aged tricalcium silicates. Methods: The study included 50 extracted anterior teeth separated and treated in the following protocol groups: 1) 10 mL of 4.12% Hypochlorite, 10 mL saline then white
MTA 2) 10 mL of 4.12% Hypochlorite, 10 mL saline then Bioceramic putty 3) 10 mL of 4.12% Hypochlorite, 1 mL saline then NeoPutty 4) 10 mL of 4.12% Hypochlorite, 10 mL saline then NeoMTA Plus II 5) 10 mL of 4.12% Hypochlorite, 10 mL saline then BioDentine. Color values of L, C and h were taken using a spectrophotometer to calculate ΔE(00), and will be analyzed using 2-way analysis of variance and the post hoc Bonferroni test. **Results:** Results of the first part of the study showed that significant discoloration occurred in all groups. The change in color was reduced by 5% thiosulfate at 8 weeks (P<0.05). However, later time points showed no difference in color among groups. Results of the second part of the study are currently being analyzed. **Conclusions:** Bismuth-containing tricalcium silicates do cause tooth discoloration. Conclusions of the second part of the study are currently being analyzed to determine the amount of tooth discoloration in teeth treated with new aged tricalcium silicates. **Funding:** DDS Short-Term Fellowship

Abstract # - 55 Genome-wide Association Study of Primary Dentition Enamel Diffuse Opacities


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**Objectives:** Enamel diffuse opacities in the primary dentition are the most common type of developmental defects of the enamel (DDE), a highly heterogeneous group of clinically manifest disturbances of amelogenesis that remain poorly understood. In this study, we sought to identify genetic loci associated with diffuse opacities, a relatively common DDE type, in a community-based study of preschool-age children. **Methods:** We used tooth-level DDE data for diffuse opacities, collected in a genetic epidemiologic study of early childhood oral health in preschool aged children in North Carolina (n=6,061). Genotyping was done using the Infinium Global Diversity Array and subsequent imputation to ~340 million markers was based on the TOPMed panel. A genome-wide association study of diffuse opacities was then carried out wherein standardized residuals from zero-inflated negative binomial regression of diffuse opacities on age, sex, and self-reported race/ethnicity were carried forward to genetic linear regression models accounting for genetic ancestry (8 principal components). Single markers (SNPs) with p<5x10^-8 were considered genome-wide significant and all loci with p<10^-6 were prioritized for annotation using Functional Mapping and Annotation of genetic associations (FUMA). **Results:** Three loci demonstrated genome-wide significant evidence of association with diffuse opacities on chromosomes 7, 1, and 17. rs77669438 [p=2.7x10^-11; minor allele (G) frequency=2.6%] located nearby the non-DNA coding gene Y RNA showed the strongest evidence of association. The other two were intergenic regions on chromosomes 1 (rs11440629, p=3.8x10^-9) and 17 (rs139697913, p=4.2x10^-8). The variation in chromosome 1 is in linkage disequilibrium with two functional variants: rs566606 (CADD score=21.4) and rs608266 (Regulome DB score=2b).
Conclusions: The study’s findings highlight three novel loci with potential roles in the etiology of primary dentition DDE’s. These genes and variants will need to be mechanistically investigated and validated to further our understanding of their pathogenesis. Funding: AADR Student Research Fellowship, NIH/NIDCR #U01-DE025046

Abstract # - 56 Streptococcus oligofermentans inhibits Streptococcus mutans metabolic activity and aciduric properties

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Objectives: Our analyses of supragingival biofilm samples from 300 children ages 3 to 5 (50% with caries), using metagenomic (whole genome shotgun sequencing) and metatranscriptomic technologies revealed a negative correlation between DNA of Streptococcus mutans (Sm) and logratio (RNA/DNA) of Streptococcus oligofermentans (So). This study aimed to examine the influence of So on the growth, metabolic activity and aciduric properties of Sm. Methods: Sm and So were incubated as mono-cultures or co-cultured at 1:1 ratio in TSB with or without 1% sucrose in a 96-well plate. To evaluate aciduric and acidogenic properties, the single- and dual-species samples were grown at 370C at 5% CO2 in pH 5.5 or 7.1. The metabolic profile was measured by Isothermal Microcalorimetry using the instrument calScreener™ microcalorimeter (SymCel Sverige AB, Stockholm, Sweden). Data were collected with calView™ software (Version 1.0.33.0, SymCel Sverige AB). Each experiment was performed in triplicate. Results: When grown in co-culture, the growth of Sm was significantly inhibited by So, exhibiting a 2-log reduction in mean CFU/ml. Acid tolerance tests revealed that Sm and So, in single and co-culture growth, were able to grow at an initial pH of 5.5, with mean optical densities (OD650nm) of 0.31±0.01 (Sm), 0.23±0.02 (So) and 0.35±0.03 (Sm-So). Sm further decreased the pH from 5.5 to 4.6 when in mono-culture, but no change in the pH was observed when in co-culture with So. The species showed different metabolic profiles under the same conditions. The metabolism (measured by total heat, J) of Sm was reduced when co-cultured with So, with and without sucrose (from 1.3±0.5 to 0.9±0.3 and from 1.3±0.6 to 1.1±0.4; respectively). Conclusion: In conclusion, S. oligofermentans inhibited S. mutans under neutral and acidic pH conditions and affected its metabolic activity. Funding: Supported by: NIH/NIDCR U01-DE025046 and R03-DE02898
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