IOWA SECTION OF THE AMERICAN ASSOCIATION FOR DENTAL, ORAL, AND CRANIOFACIAL RESEARCH

70th ANNUAL MEETING

Leveraging Biosystems and Revolutionizing Oral and Craniofacial Research

2023
Our Keynote Speaker —

Yvonne Hernandez-Kapila is the associate dean for research at UCLA, where she is the Felix and Mildred Yip Endowed Professor. She has produced seminal discoveries in the cell and molecular biological mechanisms governing periodontal disease pathogenesis and oral cancer carcinogenesis, and has conducting important research related to periodontal disease, oral cancer, caries assessment, fluorosis assessment, and oral health and pain research. As a clinician scientist, her research team has been continuously funded by the NIH for 25 years and has authored over 140 peer-reviewed publications in leading journals in her fields. She is also a leader in academic dentistry, both at UCLA, for the larger University of California system, and the NIH, NCI, and American Academy of Periodontology.

Keynote Address:
Harnessing the Power of the Oral Microbiome to Address Oral Diseases

Harnessing knowledge about the oral microbiome and probiotics are useful tools for addressing oral diseases. The presentation will examine research on the interactions host and the oral microbiome for oral diseases, while examining interventions to improve patient outcomes for those who suffer or are likely to suffer from oral diseases.

Our Featured Speakers —

Dr. Juhi Uttamani

Dr. Juhi Uttamani joined the UI College of Dentistry Department of Periodontics in 2022 after completing her Bachelor’s Degree of Dental Surgery from Mumbai, India and PhD in Oral sciences with an advanced postgraduate certificate in periodontology from University Of Illinois at Chicago. She was also a postdoctoral research fellow at UIC, Chicago.

Featured Address:
miRNAs in Periodontal Health and Disease

The etiology of periodontal disease is polymicrobial, polygenetic, and modulated by other environmental factors and systemic conditions. MicroRNAs (miRNAs) participate in the epigenetically mediated RNAi mechanism to regulate post-transcriptional gene expression and multiple physiological and pathophysiological functions. It is likely that miRNAs regulate inflammatory responses, and studies including ours have identified miRNA changes that fine-tune the regulation of biological processes essential in maintaining periodontal tissue integrity. Thus, identifying and characterizing miRNA signatures for periodontal health and disease is vital.

Dr. Eric Van Otterloo

Dr. Eric Van Otterloo obtained his Ph.D. in Anatomy and Cell Biology, from the University of Iowa in 2012. Subsequently, he was a Postdoctoral Fellow and Research Associate from 2012-2019 in the Department of Craniofacial Biology at the University of Colorado, School of Dental Medicine, before transitioning back to the UI. Dr. Van Otterloo joined the UI College of Dentistry, and the Iowa Institute for Oral Health Research, in 2019 as an assistant professor in the Department of Periodontics.

Featured Address:
Deciphering Tissue Level Programs of Craniofacial and Dental Development

Our genes orchestrate the precise organization of our face and teeth during embryonic development. While genetic differences under craniofacial variation, they can also lead to birth defects. One example of such a gene is TFAP2, although how it controls these processes is unclear. Through mouse genetics and cutting-edge molecular techniques, our lab is uncovering how this gene guides craniofacial and dental development. Our hope is to leverage this information for future therapeutic approaches.
Iowa’s Groundbreaking Oral Cancer Program

When Xian Jin Xie came to Iowa as the director of the Division of Biostatistics and Computational Biology in 2017, he had the goal of making Iowa a global leader in oral cavity cancer research.

“Our excellent faculty across campus—not just in dentistry, but also in medicine, pharmacy, and public health—and having access to the infrastructure and expertise of the Holden Comprehensive Cancer Center made Iowa the perfect place to build the oral cavity cancer program. The spirit of teamwork among our researchers is second to none,” said Xie, who is now the associate dean for research at the University of Iowa College of Dentistry.

But building this new oral cavity cancer program (OCP) would require establishing a common vision and mission, developing new structures to harness and bring together experts from across campus, and creating a plan to execute what was then an inchoate research program in oral cavity cancer.

Fast forward five years later, and the program is off and running.

Common Vision and Mission

Although there are numerous specialized research centers that focus on head and neck cancer generally, to date there are none that specialize in oral cavity cancer research specifically. Tumors in the oral cavity, which affect almost 400,000 worldwide people per year, are most often found on the tongue, at the bottom of the mouth or lower lip, but sometimes in other places too. Oral squamous cell carcinoma (OSCC) represents about 90% of oral cavity tumors. Furthermore, Iowa’s age-adjusted oral cavity cancer rate is the highest in the United States (2015-2019).

The risk factors for such tumors differ from head and neck cancer more generally. The most common forms of tumors in these areas are, for instance, strongly correlated with alcohol and tobacco use, but throat cancer is strongly correlated with human papillomavirus (HPV) instead.

Clinically, the conditions are also distinct. Oral cavity tumors are often first diagnosed in dental clinics, and in fact, many pre-malignant tumors are found, since oral cavity cancer screening is routine in dental clinics. This makes treatments which can prevent tumors from becoming malignant especially important in oral cavity cancer research.

Thus, one research team is exploring use of probiotics to reduce the risk of tumors developing in the oral cavity.

Another research team is also working on a vaccine that could potentially prevent pre-malignant tumors from becoming malignant.

“There is an urgent need to identify effective local and/or systemic therapies as an adjuvant to surgery to lower the risk of recurrence and malignant transformation,” explained Aliasger Salem, professor of pharmacy, associate vice president of research administration at the University of Iowa, and the lead for one of three main research teams in the OCP.

“Our preliminary data has shown promising anti-tumor immune responses using in situ immunization with a toll-like receptor 9 (TLR9) agonist, and we hypothesize that in situ immunization with this agonist will trigger cytotoxic T cell infiltration thereby reducing oral leukoplakia lesion recurrence and/or malignant transformation to oral squamous cell carcinoma,” he added.

Of course, OSCC does occur and needs to be treated. A third team is exploring methods to improve treatment and bone regeneration after surgery using bioengineering and miRNAs.

Thus, Iowa’s focus on oral cavity cancer specifically fills an important gap in the current research landscape and will improve healthcare in Iowa.
Developing the Infrastructure

Once the mission and vision were established for the program, it was vital to develop the infrastructure to support the unique features of an effective oral cavity cancer program. Drawing together researchers from across Iowa’s campus was vital.

“Oral cancer diagnosis and treatment are a primary concern for dentistry as a whole and of course particularly for the University of Iowa and its research mission,” explained Emily Lanzel, clinical assistant professor of oral pathology, “and a true multidisciplinary collaboration is vital to produce the most effective research.”

One part of this kind of collaboration in oral cavity cancer research requires the incorporation of dentists and dental researchers into the research team. Dentists are the primary source of patient referrals for oral cavity cancer since they universally screen patients for signs and symptoms of oral cavity cancer. “The University of Iowa College of Dentistry providers strive to detect and treat, if necessary, premalignant as well as malignant diseases of the oral cavity, and it’s cohort of patients provide a large enough patient pool to derive past, present, and prospective data as needed,” Lanzel added.

However, connecting these dental providers to the robust resources of larger cancer research networks is also essential to support the long-term viability and sustainability of such a research program. The Holden Comprehensive Cancer Center (HCCC) has those resources, including the ability to conduct Phase 1 clinical trials and to process samples within their infrastructure. But it was important to set up structures in place to support on-going collaborations with the HCCC to effectively draw from experts across campus who were doing effective and relevant research in the area.

“It is a pleasure working with the College of Dentistry to establish Iowa as a leader in oral cavity cancer research. The Holden Comprehensive Cancer Center includes investigators from 6 colleges and 36 departments, and dentistry colleagues are important contributors,” said George Weiner, professor of internal medicine and director of the Holden Comprehensive Cancer Center.

Executing the Plan

With the vision, mission, and infrastructure in place, Iowa was ready to get started. The initial meetings began in the fall of 2018 and continue in earnest to this day.

In addition to numerous and regularly weekly and biweekly meetings for subgroups, the full OCP team met every other week to update the entire group on overall and subgroup progress.

Through this work, the team refined its goals, research teams and projects, and began developing the infrastructure to support an on-going oral cavity cancer program at Iowa.

Industry-University Partnership to Evaluate Healing of Apical Periodontitis

Building on the University of Iowa College of Dentistry’s longstanding experience of university-industry collaboration, Fabricio Teixeira, professor and head of the Department of Endodontics, is working with the medical equipment manufacturer SONENDO of California, to evaluate a new piece of specialized equipment that SONENDO has developed called GentleWave.

SONENDO’s GentleWave system uses soundwaves rather than fluids to disinfect the root canal system. The process can be completed in eight minutes, and the company has indicated that it has evidence that their process results in faster healing times for patients.

Teixeira and his team are providing an external and independent evaluation of the working time and post-operative pain levels patients undergo after the GentleWave procedure. Notably, the team will estimate the healing of apical periodontitis using CBCT technology and whether the GentleWave treatment outcomes are superior to current disinfection approaches.

In addition to federal and private-foundation grants, industry-sponsored grants provide an essential revenue stream to support and encourage faculty research at the college. “Faculty have to be open-minded about the opportunities and the challenges of industry grants,” Teixeira explained.
Twins and the Causes of Orofacial Clefting

When parents dress identical twins alike, it can be nearly impossible to tell them apart. Aline Petrin, assistant professor of orthodontics at the University of Iowa, is harnessing the genetic and epigenetic sameness of identical twins to shed new light on the causes of orofacial clefts. Orofacial clefts are conditions that affects 1.25 out of every 1,000 live births, and it can significantly impact the health and wellbeing of those affected. For monozygotic (identical) twins, there are a few instances where one twin will have orofacial clefting and the other twin will not. These clear and physically observable differences are known as differences in phenotype. For these discordant identical twins, genetics alone cannot be the cause of clefting since they are genetically identical.

Instead, Petrin and her team are exploring if epigenetic factors which influence gene expression without altering the genetic code could be the root cause of discordancy between the cleft phenotypes in these twins. Drawing from the 30 pairs of discordant identical twins, Petrin has identified DNA methylation—a biochemical reaction in which a small molecule is added to DNA—as a primary source that accounts for clefting, although the precise mechanism is still unknown.

It may be that very early environmental factors explain why one twin has clefting and the other does not. But if it is environmental, it would most likely have occurred very early on during a pregnancy—during the twinning process, since the methylation profiles of twins are very similar, and most aspects of their environment are the same.

The team has also identified 40 dizygotic (fraternal) twins where one twin has orofacial clefting and the other twin does not. These twins augment the twins where one twin has clefting and the other twin does not. These twins augment the earlier research and has allowed the team to tune their examination of the epigenetic processes more carefully. Based on their findings, Petrin and her colleagues are identifying what happens with small changes are made using CRISPR-based gene editing to manipulate DNA methylation and subsequent gene expression. This allows them to see the results of small epigenetic changes in real time and thus learn more about the types of cells involved and how they are functioning.

The future is bright for Petrin and her research, who recently accepted a position as assistant professor of orthodontics at the University of Iowa. “Dr. Petrin is a rising star at the College of Dentistry, bringing her broad background in all aspects of human genetics research,” gushed Lina Moreno, chair and associate professor of orthodontics at Iowa and one of Petrin’s mentors.

Moreno points to Petrin’s own mentoring as one way that she is bringing her research experience to benefit Iowa students. In just a short amount of time, Dr. Petrin has already mentored undergraduate students, predocs and postdocs very successfully all of whom have presented their work at the national meetings with distinction,” Moreno said. Petrin’s success at Iowa began when she met Jeff Murray, professor of pediatrics at the University of Iowa, during a research trip to Brazil, where Petrin completed her PhD. Based on that meeting, he invited Petrin to come conduct research in his laboratory in Iowa. Later, Lina Moreno, chair and associate professor of orthodontics at Iowa, began mentoring Petrin as a postdoctoral researcher.

Through that process, Petrin became involved with the training program in the Iowa Institute for Oral Health Research for doctoral students and postdoctoral researchers, which helped prepare her for the grant writing process. This process ultimately resulted in her receiving a post-doctoral training grant from the National Institute for Dental and Craniofacial Research. Petrin also participated in the American Association for Dental, Oral, and Craniofacial Research’s MIND the Future program, which is designed to encourage and support career development from persons from underrepresented backgrounds.

Petrin is quick to express her appreciation for these opportunities and her mentors, like Moreno. “Dr. Moreno has been wonderful and is a great clinician and scientist—she knows genetics and clefting so well, and her clinical expertise has shown me the complementary way of thinking between bench and the chair,” Petrin said.

Whether its conducting collaborative and innovative research or mentoring the next generation of oral scientists and clinicians, Petrin is making an impact.
Dental Student Researcher Studies Craniofacial Biology at Iowa

Some people take a while to figure out what they want to do in life. Other people know early on. Third-year dental student Mary Young is in the latter camp. “I was always interested in dentistry and knew that I wanted to be in a health care-related field and that I enjoyed working with my hands,” Young explained.

Although she didn’t have any specific connections to the dental profession except for her “super-involved” dentist, Shawn Hedlund of Melrose Dental Office in Iowa City, she made the most of what was available. Hedlund provided a great deal of insight into the process of getting where Young wanted to go, including encouraging her to get critical experiences in dental clinics, shadowing dentists, and so forth.

As part of this process, she also began volunteering in scientific research laboratories in 8th grade with Gina Schatteman and later with Martine Dunnwald, and through those early connections, she began participating in Azeez Butali’s laboratory in high school, and continued as an undergraduate at Iowa, and as a dental student throughout dental school, where Teresa Marshall also helped mentor her as part of the Dental Student Research Program.

Cleft lip and palate accounts for a significant proportion of neonatal birth defects in Africa, but there is very little data on the genetic causes of the condition for this population. Since 2010, the Butali laboratory has established itself as the worldwide leader in research on the genetic characteristics related to orofacial cleft lip and palate in African populations. This population is the least studied population in the world, and yet it critically impacts many members of the African community. The Butali research team is not content to only make exciting discoveries, but they are also committed to bringing their findings to bear on pressing social, cultural, and religious challenges that sometimes serve as barriers to making positive differences in the lives of those affected by their research.

Young began working in the Butali lab in 2015 in the summer before her senior year of high school. Each year since, she continued to build skills in DNA extraction, genome sequencing, conducting experiments in animal models, targeted gene sequencing, and bioinformatics research.

Based on Young’s experience, Butali and Young have established something of a pattern for how young researchers develop in his lab with a clear progression in skill development and research competence.

“Back then, Dr. Butali was establishing training protocols for young members of his lab, and it all began with me sitting at the bench, jamming out to music, and extracting DNA from hundreds of samples. It was perfect!” said Young with a grin.

This pattern has served Young well. As a member of the Butali research team, she has received numerous prestigious awards for her work, including a 2021 Student Research Fellowship from the American Association for Dental, Oral, and Craniofacial Research, a 2022 National Institutes of Health Summer Dental Research Award, and most recently, she was selected to be featured in the 2023 Office of the Vice President for Research’s Dare to Discover Banner campaign.

While at the National Institutes of Health in Maryland this past summer, Young’s project continued to focus on craniofacial biology, albeit in a different area than clefting in African populations. This project examines the mechanisms behind neural crest cell fate decisions and helps identify candidate targets for improved bone regeneration (see Presentation #8 in this booklet).

Butali has long commended Young’s dedication, hard work, and commitment.

“I am so proud of all that Mary has already accomplished, and I know that she will do great things and be an excellent representative for our college,” Butali said with pride as he added, “and I am fully committed to doing my part to ensure that Mary is able to become an independent, fully-funded dental scientist.”

Young isn’t sure what the future holds for her now.

“Whatever I end up doing, I know that I love seeing patients, doing dentistry, and contributing to evidence-based care. With all that I will learn clinically and my continued work in orofacial clefting genetics, I hope to combine both worlds into clinical dentistry that improves the lives of others,” she said.
Dear members of the College community:

Thank you for your participation in the 70th Anniversary of the University of Iowa College of Dentistry’s Iowa Section of the AADOCR, February 14, 2023.

Discovery science is crucial to better health and longevity of dentistry as a scientific profession. Iowa is a leader in dental, oral, and craniofacial research, producing groundbreaking discoveries fundamentally changing dentistry and related subfields. We continue our on-going legacy today. Our research success over the last few years has been remarkable, and we are poised for even greater success. This is happening via a strong mix of established researchers and junior faculty, basic, translational and clinical research. This speaks to the long-term health and vitality of our research and discovery enterprise.

The research presented today provides a glimpse of these efforts and demonstrates the rich diversity of research discovery and impact on the college, the University and our profession. The research presented is wonderful, be it a student presenting for the first time, a graduate student, post-doc or an established scholar. I want to thank our presenters and the planning committee for their extensive contributions to these efforts.

We are honored to host Dr. Yvonne Hernandez-Kapila, associate dean for research at UCLA, as our keynote speaker. Dr. Hernandez-Kapila’s career demonstrates the power of transdisciplinary collaboration where basic discovery science impacts on understanding the rich interactions between the host and a complex microbial and viral biofilm. Her work has brought together very diverse teams of scholars and her mentoring has in turn, established a strong set of investigators continuing her legacy in the field of Periodontology. Hernandez-Kapila’s research and discovery in the field of oral cancer carcinogenesis closely aligns to the oral cancer related research projects currently underway at the college. This day is an opportunity for us to showcase our research and discovery demonstrating impacts on education, service, research, and patient care. Thank you for being a part of this ongoing work and exciting day.

Sincerely,

Clark Stanford, DDS, PhD, MHA
Dean

Dear fellow researchers:

The Annual Meeting of the AADOCR displays the wealth of expertise and research at the College of Dentistry and the Iowa Institute for Oral Health Research. Over the last two years, the college has achieved unprecedented success in research with a record number of funds awarded and a record number of grant applications.

This upward trajectory is also evident in the College developing, in collaboration with numerous other colleges across campus, the first-of-its-kind Oral Cavity Cancer Program. The seed grant program will begin its third year in operation, and many of the initially funded projects are beginning to bear fruit as the researchers secure external grant funding for those projects. The college’s Clinical/Dental Education Research Initiative Support Program (CRISP) is continuing for a second year, which demonstrates the college’s commitment to improving clinical and dental education research.

Our excellent faculty, NIH T90/R90 training program, Biostatistics and Computational Biology unit, Clinical Research Office and graduate and pre-doctoral Student Research Programs also continue to thrive in tandem with these recent successes.

This year we are honored to have Dr. Yvonne Hernandez-Kapila, the Felix and Mildred Yip Endowed Chair and associate dean for research at UCLA, as our keynote speaker. Dr. Hernandez-Kapila is a global leader in cell and molecular biology, investigating mechanisms that govern periodontal disease pathogenesis and oral cancer carcinogenesis. Our featured speakers for 2023 are Drs. Eric Van Otterloo and Juhi Uttamani, both assistant professors in the College of Dentistry.

As we look to the future, we are poised for even greater research success for our college, but you are the ones who make it happen. This day is an opportunity for us to show the best of our basic, clinical and evidenced-based research studies. Our future is bright thanks to all of you!

Warmest Regards,

Xian Jin Xie, PhD
Associate Dean for Research
College of Dentistry and Dental Clinics

Jeffrey A. Banas, Ph.D
Director, Graduate Program in Oral Science
Director, Iowa Institute for Oral Health Research
Fellow researchers and colleagues,

On behalf of the Iowa Section of the American Association for Dental, Oral, and Craniofacial Research (AADOCR), we are very pleased to welcome you to our 70th Annual Meeting “Leveraging Biosystems and Revolutionizing Oral and Craniofacial Research.” As we fully return to a post-pandemic in-person meeting to present novel research discoveries and create and strengthen new opportunities to collaborate with colleagues.

We are honored to have Dr. Yvonne Hernandez-Kapila, an expert in periodontal disease and oral cancer, as our keynote speaker, alongside Iowa’s own Dr. Eric Van Otterloo and Dr. Juhi Uttamani as featured speakers. Each of these researchers are conducting exciting work on biosystems with the aim of changing how we do oral and craniofacial research more broadly, and they encompass a wide spectrum of basic scientific, translational, and clinical research.

Many of our oral and poster presentations are further developing these areas of study, including numerous graduate student and dental student researchers. This body scholarship represents some of the most exciting areas of inquiry in the dental academy and oral health research, and the University of Iowa’s breadth and depth of research is well represented in this annual meeting.

As part of the leadership team for the 2023 Meeting of the Iowa Section of the AADOCR, we welcome you to our annual meeting. We hope you find it as rewarding and promising as we do!

Sincerely,

Emily Lanzel, DDS, MS
President, Iowa Section of the AADOCR
Clinical Assistant Professor
Department of Oral Pathology, Radiology, & Medicine

Sukirth Ganeshan, BDS, PhD
President-Elect, Iowa Section of the AADOCR
Assistant Professor
Department of Periodontics

Shaoping Zhang, BM, MS, PhD
Vice President, Iowa Section of the AADOCR
Assistant Professor
Department of Periodontics

Hongli Sun, PhD
Secretary/Treasurer, Iowa Section of the AADOCR
Associate Professor
Iowa Institute for Oral Health Research

The University of Iowa College of Dentistry and Dental Clinics welcomes our presenters from Chongqing Medical University School of Stomatology, Chongqing, China for the 2023 Annual Meeting of the Iowa Section of the AADOCR. We appreciate our joint efforts to advance the exchange of ideas, research and education, which strengthens oral health global initiatives here and abroad, as we persevere through the pandemic and achieve excellence in dental, oral, and craniofacial research.

Milestones of Achievement Between Iowa and Chongqing

- The University of Iowa College of Dentistry (UICOD) established a Memorandum of Agreement with Chongqing Medical University School of Stomatology (CMUSS) — To collaborate for the Advancement of Oral Health Research and Scholarship in Oral, Craniofacial and General Health—September 2016.

- Faculty and colleagues from CMUSS have presented their research in-person or virtually at the Annual Meetings of the Iowa Section of the AADOCR since 2018. This partnership helped strengthen our commitment to the exchange of ideas, research, teaching, and training opportunities for all of our faculty and students.

- Faculty from the University of Iowa attended the 1st Sino-U.S.Summit Forum of Dental Hospitals for Faculty-to-Faculty Cooperative Exchange. This formal summit included presentations from UICOD and CMUSS faculty—May 2018.

- Since 2018, the UICOD and CMUSS faculty have had several joint research projects and collaborations including:
  2. Continued collaboration on a clinical research project with Dr. Yi Shu with likely future in-person collaborations.

- We are pleased to welcome our Chongqing collaborators to the Annual Meeting of the Iowa Section of the AADOCR held on February 14, 2023. We are advancing our exchange of ideas, research and education, which strengthens oral health global initiatives here and abroad.

Sincerely,

Emily Lanzel, DDS, MS
President, Iowa Section of the AADOCR
Clinical Assistant Professor
Department of Oral Pathology, Radiology, & Medicine

Sukirth Ganeshan, BDS, PhD
President-Elect, Iowa Section of the AADOCR
Assistant Professor
Department of Periodontics

Shaoping Zhang, BM, MS, PhD
Vice President, Iowa Section of the AADOCR
Assistant Professor
Department of Periodontics

Hongli Sun, PhD
Secretary/Treasurer, Iowa Section of the AADOCR
Associate Professor
Iowa Institute for Oral Health Research
Program

Iowa Section of the American Association for Dental, Oral, and Craniofacial Research (AADOCR)

70th Annual Meeting, Tuesday, February 14th, 2023

7:30 a.m.  Breakfast
(First Floor Link)

Morning addresses will be presented in the Galagan Auditoria

8:00 a.m.  Welcome Address
Dr. Clark Stanford

8:10 a.m.  Welcome Address, and Introduction of Featured Speakers
Dr. Jin Xie

8:20 a.m.  Featured Speaker
Dr. Juhi Uttamani
“miRNAs in Periodontal Health and Disease”

8:37 a.m.  Featured Speaker
Dr. Eric VanOtterloo
“Deciphering Tissue Level Programs of Craniofacial and Dental Development”

8:55 a.m.  Keynote Speaker Introduction
Dr. Sukirth Ganesan

9:00 a.m.  Keynote Address
Dr. Yvonne Hernandez-Kapilla
“Harnessing the Power of the Oral Microbiome to Address Oral Diseases”

9:45 a.m.  Break

10:00 a.m. - 12:00 p.m.  Oral Presentations
(Galagan A, Galagan B, Galagan C, W205, & N212 Oral-B classroom)

11:45 a.m. - 12:45 p.m.  Poster Presentations
(Iowa Institute for Oral Health Research, Fourth Floor Link, W220A/B)

Abstracts

Oral Session 1

1. Maxillary Shape Variations in Unaffected Relatives of Individuals with Clefts


1University of Iowa, Iowa City, IA; 2University of Illinois, Chicago, Chicago, IL; 3University of Pittsburgh, Pittsburgh, PA; 4University of Puerto Rico, San Juan, PR; 5Clinica Noel, Medellin, Colombia; 6Lancaster Cleft Palate Clinic, Lancaster, PA, US; 7Private Practice, Minnesota

Objective: Individuals with orofacial clefts (OFCs) present dento-alveolar shape (DAS) anomalies associated with OFC genetic risk and due to the overt cleft and surgical scarring. Distinguishing between these different etiologies is key to improving cleft care. Studies of seemingly unaffected family members with cleft palate only (CP) identify those at risk of clefting later in life but to plausible OFC genetic risk. We evaluated maxillary DAS differences between UFMs and controls with no cleft history.

Methods: First molar-first molar maxillary arch scans (N=1,308) were landmarked with eighty landmarks, located on the gingival margins and occlusal surfaces of the arches. 3D coordinates were adjusted using a Procrustes fit and submitted to a canonical variate analysis to compare DAS differences between UFMs and controls. DAS was also compared between UFMs of cases with different cleft types: cleft lip (CL), cleft lip and palate (CLP) and cleft palate (CP). Statistical significance was assessed via permutation tests with 1,000 iterations.

Results: Maxillary DAS was significantly different (P<.05) between UFMs and controls. Major shape differences between UFMs and controls include a tendency for UFMs to have facially angled incisors, buccally tipped molars and constrained arches in the A-P dimension. Comparisons between UFMs of different cleft types were also significantly different (P<.05). UFMs of cleft palate only individuals tended to have more facially angled incisors, shorter posterior teeth, and more lingually tipped molars when compared to UFMs of CLP and CL individuals. Although significant, UFMs of CLP and CL individuals had less distinctive shape variation.

Conclusion: DAS differs between UFMs and controls indicating abnormal shape associated with OFC genetic risk. Comparisons between cleft types showed more distinct DAS differences when comparing UFMs of CP individuals and UFMs of CLP and CL individuals. Supported by: The University of Iowa Dental Student Research Program.

2. Developmental Enamel Defects in Non-Syndromic Orofacial Clefting


1University of Iowa, Iowa City, IA; 2University of Pittsburgh, Pittsburgh, PA; 3University of Texas Health Science Center at Houston School of Dentistry, Houston, TX; 4Institute of Human Genetics, National Institutes of Health, University of the Philippines Manila, Manila, Philippines; 5ECLAMC at Center for Medical Education and Clinical Research, CEMIC-CONICET, Buenos Aires, Argentina; 6ECLAMC at Department of Genetics, Institute of Biology, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil; 7Clinica Noel, Medellin, Colombia

Objective: Children with Non-syndromic Orofacial clefts (OFC) often show an increased rate of developmental enamel defects (DED), such as hypoplasia and hypocalcification. Few prior studies discussed the location of the defects within the clinical crown and if the location can be associated with the development of a cleft defect or corrective surgery sequelae. This study aims to characterize the developmental location of hypoplasia and hypocalcification in children with OFC compared to controls. Findings will assist in the understanding of the underlying etiology of DEDs and will also help to provide early interventions, reduce adverse effects, and improve treatment outcomes.

Methods: The study included 255 subjects with OFC and 1,273 control subjects recruited internationally, as part of an NIH multicenter OFC study. Hypocalcification and/or hypoplasia were identified from intraoral photographs using an electronic intake form. The defect location was classified as incisal, middle, or gingival third of the clinical crowns in primary and permanent dentitions. Case-Control differences were assessed using Fisher’s Exact test and Bonferroni correction was set at p-value=8.68E-5.

Presenters are underlined. Mentors are italicized.
Results: Subjects with OFC showed significantly more hypoplasia vs. controls on FDI teeth #21 Gingival, #31 Middle, p=2.8E-6 and p=8.0E-11, respectively. Subjects with OFC showed significantly more diffuse hypocalcification vs. controls in the incisal third (#11, 21, 31, 32, 31, 42, 43, 44) with p-values ranging from 1E-6.5 to 1E-10. Controls had significantly more diffuse hypocalcification in the incisal third (#14,16,24,26,28) with p-values ranging from 1E-6.0 to 1E-5. No significant differences were seen in primary dentition or demarcated hypocalcification. Additional evaluation by sex or cleft-type is underway.

Conclusion: These finding indicate that subjects with OFC have more hypoplasia and diffuse hypocalcification in the incisal and middle-thirds of permanent teeth. This could result from a shared underlying etiology with the cleft defect or downstream effects of the corrective surgery on the surrounding dentition.

Methods: Whole exome sequencing was conducted on 6 individuals (5 with nsoFC and 1 unaffected). Called variants were filtered for novelty and rarity using MAF of 0 and 1% and referred to the NCBI SNP database. SVNs and indels in known cleft candidate genes were identified among the exonic variants. These variants were further filtered for potential involvement in maintain genomic imprinting. Some genetic modifiers have been identified in these genes that could explain the missing heritability for nsoFC not explained by common variants in GWAS.

Results: We identified a very rare variant, rs1046263917 (MAF= 0.000016) in CORIN that was deleterious across all the 5 prediction tools and predicted to be likely damaging by HOPE. Other rare deleterious variants (MAF <1%) were also identified in 5 genes (PAEP, SOST, TULP4, MTHFD1 and MMACHC).

Conclusion: Our study provides additional evidence for the role of PAEP, TULP4, SOST, MTHFD1 and MMACHC genes in nsoFC development. We also identified a very rare variant in CORIN. This is the first time CORIN is implicated in nsoFC development in humans. The identification of rare variants in these genes could explain the missing heritability for nsoFC not explained by common variants in GWAS.

Supported by: NIDCR DE024296, NIDCR DE024776, NIDCR DE022378, NIDCR DE82300.

8. Developing Novel Tools to Investigate Neural Crest Cell Fate Decisions

Mary J. Young, 1 S. Abrams, 2,3 A. Werner, 2,3 L. Kerosu 2,3 1University of Iowa, Iowa City, IA 2Department of Craniofacial Research, Bethesda, MD

Objective: Neural crest cells (NCCs) are multipotent stem cells integral to the formation of diverse cell types and tissues throughout the craniofacial region. Examples of NCC derivatives include craniofacial bone, cartilage, and odontoblasts. Signaling pathway cues are essential for directing NC migration and fate choice decisions during development. NCC development and differentiation abnormalities result in craniofacial anomalies such as microphthalmia or neurocristopathies. Recent studies found distal NC enhancers and an osteoblast enhancer near RUNX2. Using these findings, the objective of our study was to test and validate candidate enhancer-reporters using an in-vitro human NC differentiation assay, with the overall goal of fluorescently enhancing enhancer reporters to track NC development and differentiation to derivatives including bone-producing osteoblasts.

Methods: We generated whole-genome DNA methylation (DNAm) data in 1 pair of monozygotic (MZ) female twins with mirror-image left cleft lip (LCL) and right cleft lip (RCL) using DNA from blood and Illumina’s EPIC array. Beta values were obtained using ChAMP/RnBeads and were used to estimate the absolute DNAm difference, Δβ = [LCL β – RCL β]. Moreover, we used DNAm data from unaffected females to calculate the coefficient of variation (CV) between LCL and RCL.

Results: We identified a cluster of DMPs within 5KB upstream of the ZFP57 gene in which the LCL-MZ-twin, most likely due to ACP35, showed a significant increase compared to the RCL-MZ-twin. We replicated this finding in an independent cohort of 13 LCL and 9 RCL cases (p<0.05). Ontology enrichment analysis showed significant enrichment of genes involved in genomic imprinting and embryonic development, some of which contribute to left-right patterning.

Conclusion: Using mirror-image twins we identified DMPs contributing to cleft lip laterality. ZFP57 is involved in maintenance of genomic imprinting and loss of ZFP57 results in malformation of cardiac left and right chambers in mice, supporting its role in left-right patterning. As far as we know, this is a premier study of the association between differential DNAm and cleft laterality in nsoFC.

Supported by: NIH NIDCR KO1DE27995.
Results: As hypothesized, we identified 1 upregulated gene, 2 downregulated genes, 8 upregulated transcripts, and 1 downregulated transcript, in the murine MxM complex (p < 0.05). These genes/transcripts were associated with known craniofacial phenotypes in mice and in humans. Most commonly affected structures were cranium, maxilla, mandible, and ear. Additionally, these differentially expressed genes/transcripts have significant gnomAD constraint scores suggesting these genes/transcripts are critical to the ontogeny of craniofacial development. Future studies should investigate murine models with facial asymmetry to validate our findings.

Supported by: AAOF Funding.

11. In-Vitro Assessment of Utilizing Torque to Confirm Bi-Cortical TAD Engagement

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Objective: Temporary anchorage devices (TADs) are commonly referred to as orthodontic miniscrews, are utilized in treatment as a source of anchorage to support tooth movement and biomechanics of engaging one bony cortex, monocortical anchorage, or two bony cortices, bicortical anchorage in the bone of the maxilla or mandible. The purpose of this study is to investigate if detection of bicortical TAD engagement in cadaver specimens utilizing torque as a metric for alternative to patient radiographic exposure.

Methods: Within this in vitro study, interradicular maxillary and mandibular sites (n=26) were engaged bicortically within two donated cadaver maxillae and mandibles. Peak insertion torque per turn was measured until TADS were fully engaged with bicortical placement, and CBCT was utilized in vivo visual reference to confirm perforation of both bony cortices. Values of peak torque per single 360° turn (N * cm/turn) and differences in torque measured between individual 360° turns were graphically represented and demonstrated a bimodal distribution, with peaks in difference in torque noted between the murine engagement of the first and second cortices. When turns were delayed by a period of 5 minutes, a steep drop in peak and difference in torque observed.

Conclusion: We detected torque profile from bicortical placement of TADS. Statistical analysis is in progress, which will yield statistical significance to the peak torque/tum profile of experiments, confirming that torque may be utilized as a metric for confirming bicortical TAD engagement.

Supported by: Faculty Start-Up Fund.

12. Differential Gene Expression in E11.5 Murine Right/Letal Facial Prominences

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Objective: It is well known that, at the time of gastrulation, the formation of primitive streak establishes the right-left axis by asymmetric expression of genes. We do not know whether such asymmetric gene expression exist in the craniofacial complex, particularly at the time of facial development. The objective of this study is to investigate differential gene expression in murine right and left facial prominences in embryonic (E) day 11.5.

Methods: Three groups of C57BL/6 mice, with each group containing ~6-7 animals, were used in this study. The embryos were collected at day E11.5. The right and left facial prominences were carefully hemi-sectioned in the midsagittal plane and total RNA was isolated. We confirmed the quality of RNA aligned to the human reference genome build 38 for expression of house-keeping genes in both right/left facial prominences using qRT-PCR. Then, we sequenced the whole transcriptome in LC Sciences (Houston, TX). We analyzed differentially expressed genes/transcripts (>1 or <-1 log-fold change; p<0.05). Mouse Genome Informatics (MGI) database and gnomAD constraint scores were used to prioritize differentially expressed genes/transcripts.

Results: Comparing the right facial prominence to the left, there were 265 upregulated/ 270 downregulated transcripts and 24 upregulated/ 20 downregulated genes. Of these, 22 upregulated/25 downregulated transcripts and 2 upregulated/0 downregulated genes were reported to be associated with craniofacial phenotypes identified by TFAP2A and TFAP2B, the most likely to harbor the etiological autosomal dominant variant. Mutations in each of them are being tested for segregation among the remaining available family members.

Conclusion: Our study reports the genomic findings of a unique large pedigree with multiple individuals affected with OA spectrum phenotypes and likely autosomal dominant inheritance. Our findings narrow down to five potential candidate genes, KCND2 having autosomal dominant inheritance, WNT10A and CASP9 show very likely dominant inheritance, and NCOA3, CASP9, WNT10A, as the most likely to harbor autosomal dominant trait, which will assess for statistical significance in the remaining available family members. KCND2 having autosomal dominant inheritance, WNT10A and CASP9 show very likely dominant inheritance, and NCOA3, CASP9, WNT10A, as the most likely to harbor autosomal dominant trait.

Supported by: Faculty Start-Up Fund.

13. Whole Genome Sequencing of a Family of Autosomal Dominant Macrostomia

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Objective: Most cases within the oculouarioskeletal spectrum (OAV) are believed to be sporadic, with only one non sporadic origin recorded in a patient with Goldenhar syndrome (OAV). We present the genetic findings of a three-generation family with multiple affected members associated with macrostomia, preauricular tags, and external ophthalmoplegia. This is, to our knowledge, the first reported autosomal dominant instance of this type.

Methods: We generated WGS data (30x coverage) for the proband (+OAV), affected father (+OAV) and paternal grandmother (-OAV). Genomic sequences were aligned to the human reference genome build 38 for variant calling and annotation. For variant pathogenicity we used the Mouse Genomics Informatics Database to identify genes associated with craniofacial phenotypes; gnomAD to exclude common loss of function (LOF) or missense mutations; and VarSome to assess overall pathogenic potential. We prioritized mutations shared by the proband and father but absent in the grandmother. Further, we used the Mouse genome database to assess the probabilities of the mutations of interest to be autosomal dominant.

Results: We selected five genes, KCND2, PDGFRARA, NCOA3, CASP9, and WNT10A, as the most likely to harbor the etiological autosomal dominant variant. CDH1 and OAT genes were excluded due to their association with micrognathia, a common finding in OAV spectrum phenotypes.

Conclusion: These findings signify that there is a differential expression of transcripts between E11.5 murine right/letal facial prominences. Further research in murine model with facial asymmetry is necessary to validate the findings presented.

Supported by: AAOF Funding, The University of Iowa College of Dentistry Student Research Program.

14. TFAP2 Indirectly Regulates Odontogenesis by Promoting a Skin Epithelial Phenotype

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Objective: The pathological gain, loss, or misplacement of teeth can occur in a variety of syndromic or non-syndromic congenital anomalies and can profoundly impact those affected. An understanding of the early control of tooth initiation will provide inroads for preventing or curing congenital defects. The hallmark sign of tooth initiation is the formation of a thickened strip in the oral epithelium, known as the dental lamina (DL). While numerous mouse models have pinpointed genes controlling tooth development, the majority do not impact initial DL formation. We identified early (prior to DL formation) ectodermal loss of two TFAP2 paralogs, TFAP2A and TFAP2B, is associated with disrupted DL, leading to tooth agenesis.

Methods: Here, we test the hypothesis that TFAP2 restricts the expansion of an oral epithelial program by promoting a surface ectoderm program. Thus, in TFAP2ECKT mutants, we predict there is an expansion of the oral epithelial program, concomitant with an expanded DL, leading to tooth agenesis. To test this hypothesis, we use conditional mouse genetics to delete both Tapa2a and Tapa2b in the ectoderm to examine the molecular changes resulting from the loss or misplacement of teeth can occur in a variety of syndromic or non-syndromic congenital anomalies and can profoundly impact those affected. An understanding of the early control of tooth initiation will provide inroads for preventing or curing congenital defects. The hallmark sign of tooth initiation is the formation of a thickened strip in the oral epithelium, known as the dental lamina (DL). While numerous mouse models have pinpointed genes controlling tooth development, the majority do not impact initial DL formation. We identified early (prior to DL formation) ectodermal loss of two TFAP2 paralogs, TFAP2A and TFAP2B, is associated with disrupted DL, leading to tooth agenesis.

Results: In situ hybridization, and single cell RNA-sequencing to examine the differential expression of key oral/DL and surface ectoderm defining genes; and how these changes are impacting the dental mesenchyme.

Conclusion: Collectively, these studies will advance our understanding of how different regions of the orofacial region initiate or repress dental identity and the molecular changes resulting from the loss or misplacement of teeth can occur in a variety of syndromic or non-syndromic congenital anomalies and can profoundly impact those affected. An understanding of the early control of tooth initiation will provide inroads for preventing or curing congenital defects. The hallmark sign of tooth initiation is the formation of a thickened strip in the oral epithelium, known as the dental lamina (DL). While numerous mouse models have pinpointed genes controlling tooth development, the majority do not impact initial DL formation. We identified early (prior to DL formation) ectodermal loss of two TFAP2 paralogs, TFAP2A and TFAP2B, is associated with disrupted DL, leading to tooth agenesis.

Supported by: The University of Iowa College of Dentistry Student Research Program.
15. DNA Methylation and Van Der Woude Syndrome Phenotypic Variability

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Objective: Van der Woude Syndrome (VWS) is an autosomal dominant disorder and the most common syndrome of orofacial clefting. VWS is caused by mutations in IRF6 (70%) and GNA11 (5%) and classically with combinations of lip pits (LP), cleft lip (CL), cleft lip and palate (CLP), or cleft palate (CPD). The markedly phenotypic discordance even amongst individuals that carry the same mutation suggests a possible role for epigenetic factors as phenotypic modifiers. IRF6 and TP63 interact in a regulatory loop that coordinates epithelial proliferation and differentiation in palatogenesis. We hypothesize that differential DNA methylation (DNAm) patterns of CpG sites within IRF6 and TP63 are associated with VWS phenotypic discordance.

Methods: We measured DNAm levels of CpG sites located in the promoters of IRF6 and TP63, and a known IRF6 enhancer element in 83 individuals with VWS. Blood DNA samples were bisulfite converted and pyrosequenced with primers specific to the target regions. We compared the methylation levels of each CpG amongst 5 phenotype groups (1=CL/P+LP, 2=CL/P, 3=CPO+LP, 4=CPO, 5=LP) using one-way ANOVA on ranks with the post-hoc Tukey-Kramer test (alpha=0.05).

Results: CpG sites in the promoter region of IRF6 showed statistically significant differences in methylation (P<0.05). Individuals with any form of cleft (groups 1-4) had significantly higher mean/median methylation levels than individuals with lip pits only (group 5), while no difference was found when comparing phenotype groups with a cleft (groups 1-4). We found no significant differences in methylation in the TP63 promoter and IRF6 enhancer among the studied phenotypic groups.

Conclusion: Our results indicated that hypermethylation of the IRF6 promoter (in addition to the causal mutation) is associated with more severe VWS phenotypes (any cleft +/- lip pits); thus, possibly impacting an already impacted IRF6 protein due to a genetic mutation and leading to a more severe phenotype.

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16. Cross-Repression of Pitx2 and Tfp2a/2b Regulating Tooth Initiation

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Objective: In human and mouse, tooth morphogenesis begins with dental lamina (DL) formation. Our preliminary study shows that there is distinct spatial pattern of transcription factors (TFs) expression along mandibular epithelium. Specifically, TFs including Pitx1, Pitx2, Sox2 are enriched in lingual ectoderm and DL, while Tfp2a and Tfp2b are enriched in labial and aboral ectoderm. However, whether there is an interaction between Pitx2 and Tfp2a/Tfp2b in regulating tooth initiation is unknown.

Methods: Pitx2 general knockout (Pitx2m–/–) and Tfp2a/Tfp2b ectodermal double knockout (Tfp2a+/–, Tfp2b+/–) mouse models were employed in this study. DL of 3.5dpc embryos and aboral epithelium of Tfp2a+/–, Tfp2b+/– embryos were collected for RNA-seq. Disregulated genes were analyzed with comparing their littersmates and validated by immunofluorescence (IF) staining. The interaction between Pitx2 and Tfp2a/Tfp2b was assessed in GMSMK and ZBT3 cells for in vitro validation.

Results: RNA-Seq data and IF staining revealed that Tfp2a and Tfp2b were upregulated in Pitx2m–/– DL, while Pitx2 and Sox2 were upregulated in Tfp2a+/–, Tfp2b+/– aboral epithelium. In vitro results showed Tfp2a mRNA expression and protein level were decreased in Pitx2–/– overexpressed GMSMK cells. In TFP2a null DL, Tfp2a mRNA expression and protein levels of Pitx2 were significantly decreased.

Conclusion: We identified a novel transcription factor interaction that cross-repression between Pitx2 and Tfp2a/Tfp2b is involved in regulating dental lamina morphogenesis. However, the molecular mechanism needs further investigation.

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17. A Survey on Restoring Endodontic Access Openings Through All-Ceramic Restorations

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Objective: A plethora of ceramic biomaterials are currently available to the practicing dentist. Clinical management of these all-ceramic restorations varies by material. Restoring endodontic access openings through all-ceramic restorations using inadequate bonding protocols may contribute to coronal leakage which might compromise endodontic treatment outcomes. The aim of this study was to investigate the knowledge, attitudes, training, and practice of active members of the American Association of Endodontists (AAE) regarding restoring access openings through all-ceramic restorations.

Methods: A cross-sectional survey study involving 30 multiple-choice questions was constructed and distributed electronically using Qualtrics to active members of the AAE (n=3962). The anonymous survey was available for one month with a reminder email sent two weeks after the initial invitation. Statistical analysis consisted of descriptive, univariable, and multivariable logistic regression analyses (alpha=0.05).

Results: A total of 351 subjects (79.5% male; 42% 50+ years old) completed the survey with a 9.1% response rate. Nearly 90% of respondents restore access preparations through all-ceramic restorations. Resin-based composite was the most frequently used material (87.9%) with 35.6% of composite users reporting use of a bonding protocol specific to the type of all-ceramic material. The most multivariable logistic regression model revealed that respondents who received training on handling all-ceramic materials (OR=2.9; p=0.015), verified material identity (OR=12.0; p<0.001), and practiced in an academic setting (OR=5.28; p=0.002; reference: owner/partner) were more likely to use material dependent bonding procedures.

Conclusion: Most respondents do not currently follow a bonding protocol based on material type. Practicing in academics, receiving training on material dependent bonding protocols, and verifying material identity were strongly correlated with following material dependent bonding protocols.

Supported by: AAE Foundation. Department of Endodontics at Iowa.

18. Non-Viral Nanoparticles Delivering Plasmid DNA Encoding miR-200c for Regenerative Endodontics

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MicroRNAs (miRs) play important post-transcriptional regulators in inflammation and regeneration, and have emerged as innovative tools for the diagnosis of diseases and treatment. miR-200c, a member of the miR-200 family, has previously been demonstrated to potentially regulate tooth development, modulate inflammation, and promote osteogenesis, and could also be a candidate to assist in regenerative endodontics procedures.

Objectives: To characterize miR-200c in pulps and determine its potential in attenuating inflammation and promoting odontogenesis in dental pulp stem cells (DPSCs).

Methods: miR-200c- and proinflammatory cytokine expression levels from human dental pulp diagnosed with irreversible pulps and healthy pulp were quantified using RNA sequencing (miRNA-seq, mRNA-seq) and PCR. Transfection efficiency of plasmid DNA (pDNA) encoding miR-200c to effect human dental pulp stem cells (DPSCs) delivered by CaCo3-based nanoparticles was also assessed. IL-6 and IL-8 transcript and protein levels of DPSCs with miR-200c overexpression were quantified after exposure to P.gingivalis lipopolysaccharide (Pg-LPS). Odontogenic differentiation markers were additionally assessed after miR-200c overexpression via qPCR and western blotting. Finally, a rat pulp capping model was used to evaluate the function of miR-200c in vivo using histology. Statistical analyses included one-way ANOVA and Student T-tests.

Results: We observed that miR-200c was downregulated in inflamed pulps, while IL-6 and IL-8 were significantly upregulated (n=12). CaCo3 nanoparticles effectively improved the transfection efficiency of pDNA with minimal cytotoxicity in hDPSCs. Overexpression of miR-200c using the CaCo3 delivery system significantly increased hDPSCs odontogenic differentiation markers including OCN,DMP1 and DSP. Additionally, miR-200c also effectively downregulated IL-6 and IL-8 under the Pg-LPS challenge in DPSCs and mitigate inflammation in a rat model of pulps.

Conclusion: Our findings demonstrated that pDNA encoding miR-200c delivered by CaCo3 nanoparticles might serve as a novel therapeutic agent for regenerative endodontics by attenuating inflammation and promoting odontogenic differentiation.

Supported by: NIDCR R01 DE20643. Department of Endodontics at Iowa.
21. Effectiveness of SDF on Caries Lesions in Adults: Retrospective Study

Ala A. Saffer, J.L. Kaltenber

Objective: Silver diamine fluoride (SDF) is used to treat dental caries lesions on primary teeth in children and have been found effective. Older adults may also benefit from the use of SDF in treating exposed internal root caries lesions, yet such studies are lacking. The aim of this retrospective study was to determine the factors related to longevity of adult patients’ teeth after SDF treatment.

Methods: Data from the University of Iowa College of Dentistry database (AxU) were used for this study. Patients aged 65 and older with five or more SDF applications between January 2004 and May 2014 were included. Patients were divided into two groups based on the presence or absence of caries on the treated tooth. The groups were compared for survival time, number of SDF treatments, and time between treatments.

Results: A total of 118 patients (mean age 80.2 years) were included in the study. The mean number of SDF treatments per patient was 8.7 (range 5-20). The mean time between treatments was 24.3 months (range 1-36). The 5-year survival rate was 85.7% (95% CI 78.4-93.1%). The probability of survival was not significantly different between the two groups (p=0.56).

Conclusion: Silver diamine fluoride is an effective treatment for dental caries lesions in older adults. Further studies are needed to determine the optimal number of treatments and the duration of follow-up.
Conclusion: The growth of cariogenic or periodontal pathogens or ways to promote oral health. We hypothesize that bacterial strains that inhibit the growth of oral pathogens or in some manner promote oral health. We hypothesize that bacterial strains isolated from children with a caries-free history will be a source of probiotic candidates that inhibit the growth of cariogenic or periodontal pathogens or suppress chronic inflammation.

4. Analysis of Novel Streptococcal Probiotic Candidates’ Antimicrobial and Anti-Inflammatory Properties

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Objective: The oral microbiome consists of intricate interactions between organisms that when out of balance can be a primary factor in the development of oral disease. An option for reducing the risk of oral disease is to identify probiotic strains that inhibit the growth of oral pathogens or it some way promote oral health. We hypothesize that bacterial strains isolated from children with a caries-free history will be a source of probiotic candidates that inhibit the growth of cariogenic or periodontal pathogens or suppress chronic inflammation.

Methods: Antagonistic effects of candidate probiotic strains were assessed by measuring zones of inhibition when grown in close proximity to pathogenic (S. mutans, S. sobrinus, C. albicans) or health-related (S. sanguinis) oral microbes. Quantitative Polymerase Chain Reaction was used to quantify relative expression of pro- and anti-inflammatory cytokines in co-cultures of probiotic candidates and mouse macrophage RAW 264.7 cells.

Results: Two (HP3 and HPS) of ten mildly acidogenic probiotic candidates were found to possess strong antagonistic activity towards S. mutans (strain H431-4) and another (strain HP2) had antagonistic activity towards S. sobrinus, significantly elevated expression of the anti-inflammatory cytokine IL-10 in a mouse macrophage co-culture.

Conclusion: The data from the candidates’ antagonism of S. mutans and influence on cytokine expression supports the hypothesis, but the effectiveness and limitations of each candidate strain vary suggesting that the most effective approach to promote oral health via probiotics will be a combination of strains with diverse properties.

Supported by: The University of Iowa College of Dentistry Student Research Program.

Session 4

25. Relative Contributions of Diet in Shaping the Oral Microbiome

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Objective: It is well known that diet impacts the gut microbiome. Prior studies have demonstrated that plant-based vs meat-based diets alter the composition and function of the gut microbiome. Although the oral cavity is the beginning of the gastrointestinal tract, the impact of diet on the oral microbiome is understudied. Therefore, the goal of our study was to compare the microbial composition and co-occurrence patterns of those who consume plant-based (PB) and meat-based (MB) diets across different niches in the oral cavity.

Methods: Distant metrics were calculated. Principal component analysis (PCA) performed on variance-stabilized ASV counts, and significance was determined using Adonis with 999 permutations. Tukey HSD and DESeq2 were used to determine statistical significance.

Results: Alpha and beta diversity did not differ significantly between the H-PB and H-MB groups in any of the niches of the oral cavity. Statistical analysis revealed no significant differences at the phylum and genera level in any niches, except at the supragingival microbiome of H-MB group, which exhibited higher abundances of Aggregatibacter than H-PB. Functional analysis mirrored the compositional patterns, and no significant functional pathways differed between the diet groups in salivary environment. Functions related to transcription factors were increased in supragingival environments of H-MB microbiome.

Conclusion: Microbial composition and predicted functions between the two diet groups in subgingival, supragingival, and salivary environments were mostly similar. Thus, our preliminary investigation suggests that diet impacts on the oral microbiome is minimal.

Supported by: The University of Iowa College of Dentistry Student Research Program.

26. Therapeutic Potential of 6-hydroxypropionic Acid: A Metabolite of Streptococcus gordonii

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Objective: We have previously demonstrated that the spent culture supernatant of Streptococcus gordonii (SpG-S) suppresses the growth and attachment of the keystone periodontal pathogen Porphyromonas gingivalis, as well as the red complex Treponema denticola. SpG-S also reduces IL-1β, IL-6, and IL-8 transcript and protein levels in cells challenged with P. gingivalis lipopolysaccharide (P-gLPS). These results indicate that certain metabolites in SpG-S may be candidate biologics to suppress the bacteria and inflammation that accompany periodontal disease. In this study, we aim to identify the specific metabolites responsible for those anti-bacterial and anti-inflammatory effects using in vitro cell culture models to develop a therapeutic approach for periodontitis.

Methods: 6-hydroxypropionic acid (HCA), a medium chain fatty acid, is a metabolite that was found to be significantly increased in SpG-S using untargeted metabolomics. The effects of HCA on periodontal bacterial growth and pro-inflammatory cytokine expression in HCA-challenged human periodontal and immune cells were investigated through use of in vitro cell culture studies using HCA-incorporated culture medium. HCA assays were also performed to evaluate the effect of HCA on cellular toxicity.

Results: HCA presents no toxicity to human gingival fibroblasts and monocyte-derived macrophages. Similar to SpG-S, HCA reduced the growth of T. denticola and Streptococcus oralis. HCA also reduced the expression of IL-1β, IL-6, and IL-8 in human gingival fibroblasts and monocyte-derived macrophages challenged with P-gLPS.

Conclusion: HCA suppresses the growth of pathogenic periodontal bacteria and demonstrates anti-inflammatory effects with no cellular toxicity, indicating its therapeutic potential for treating periodontal disease.

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27. IL-1 Receptor Antagonist Plays a Protective Role In Ligature-Induced Periodontitis


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Objective: We aimed to assess the role of interleukin-1 receptor antagonist (IL-1RA) in ligature-induced periodontitis (LIP) and the mechanism of IL-1RA in periodontitis bone loss.

Methods: Periodontal bone loss was induced through the LIP model in WT and Il1r-/- mice and measured by micro(CT). Transcription of genes associated in inflammatory pathways was compared by the real-time-quantitative PCR (RT-PCR) between WT and Il1r-/- ligated gingivae. Single-cell suspensions were prepared in gingiva and cervical lymph nodes and were analyzed by fluorescence-activated cell sorting to quantify IL-17+ cells and IL-16-secreting subpopulations. We locally delivered IL-1RA-complexed nanoclay, a controlled drug releasing system, in the ligated gingiva and compared the bone loss with WT mice that received control treatment.

Results: Il1r-/- mice demonstrated significant bone loss as compared to WT mice in the LIP model. Expression of Il1r, Il6, Il17, Tgfb, Il18, Il1a, Mcl1, Mmp9, and Rank was significantly upregulated in the ligated gingiva of Il1r-/- mice than WT mice. Significantly more IL-17- immune cells (CD45+IL-17+) are present in the gingiva of Il1r-/- mice with the majority of being TCR Vβ7 T cells (CD45-IL-17-CD3-TCR Vβ7) than WT mice. The IL-1RA-nanoclay treatment significantly attenuated the alveolar bone loss than the control-treated mice in the LIP model (0.29 ± 0.06 versus 0.39 ± 0.08, p=0.03).

Conclusion: IL-1RA plays a protective role in the murine ligature-induced model by suppressing IL-17 responses.
molecular properties, and osteoconductivity. We hypothesize that our new CVB scaffolds have great potential to promote stem cell osteogenic differentiation and endogenous bone regeneration through its unique chemical–physical features.

**Methods:** The 3D CVB scaffolds were prepared by freezing the CVB hydrogel followed by lyophilization. Gelation time was controlled within a few minutes. Cell adhesion and differentiation were quantified using MTT assay, ALP activity test, Alizarin Red S staining and RT-PCR. In addition to the pro-osteogetic abilities, CVB scaffolds also have translational potential and can be modified to induce the LPS–stimulated inflammatory cytokines with strong anti-inflammatory properties. To further improve the drug delivery capacity, we coated the scaffolds with poly (glutamic acid) which significantly improve the BMP2 binding and osteogenic differentiation in vitro. The in vivo bone formation ability of the CVB scaffolds was tested by an ectopic bone model in mice.

**Results:** Our data indicated that the CVB scaffolds not only had good biocompatibility, strong anti-inflammation properties and antibacterial ability but also significantly promoted osteoblastic differentiation, mineralization in vitro, and bone formation in vivo.

**Conclusion:** Thus, our findings suggest the CVB scaffolds hold great promise for bone tissue engineering applications based on their robust mechanical properties, osteoconductivity, antibacterial, and anti-inflammation abilities.

**Supported by:** RO1DE029195, T90DE023520.

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**29. Longitudinal Fluoride Intake and Bone Densitometry Outcomes at 23 Years**


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**Objective:** Concerns have been raised about the impact of fluoride intake on young adults’ developing skeletons, but gaps exist in our understanding of this relationship. This analysis assessed the relationship between period-specific and cumulative daily fluoride intakes and bone densitometry outcomes of 23-year-olds.

**Methods:** Secondary data analysis of Iowa Fluoride Study (IFS)/Iowa Bone Health Study (IBHS) data included Multi-Detector Computed Tomography (MDCT) scans of the distal tibia from 330 participants. Nine cortical and four trabecular bone regions were assessed with MDCT outcomes were examined using Qualtrics and statistical analysis.

**Results:** Daily fluoride intakes were 0.73–112 mg F for males and 0.67–0.93 mg F for females. Most Spearman correlations between daily fluoride intake and MDCT measures were weak. Spearman correlations for females were r=-0.03–0.08, p>0.23. Among the 36 fluoride associations with trabecular measures, only 6 (3 for males and 1 for females) had statistically significant (considered p<0.05) correlations (p<0.005), none were statistically significant (p>0.01), and they were all positive and weak. None of the fluoride intake, vitamin D, calcium and other dietary intakes were statistically significant (p>0.01) or statistically suggestive (P<0.05) or correlations with critical measures for either sex.

**Conclusion:** Longitudinal period-specific and cumulative fluoride intakes were associated weakly and mostly positively with MDCT bone measures at age 23 years. Hence, fluoride intakes within the optimal range do not appear to have any adverse impact on bone health in young adults.

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**30. Exogenous Bone Sialoprotein Enhances Alveolar Bone Healing in Mice**

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**Objective:** Bone sialoprotein (Ibsp/BSP) is an extracellular matrix protein associated with mineralized tissues and shown to promote hydroxyapatite nucleation and growth. BSP includes a collagen-binding motif, 2-3 polyglutamic acid hydroxyapatite-nucleating domains, and an RGD integrin-binding sequence; post-translationally modified modifications including mineralization, phosphorylation and O/N-linked glycosylations also contribute to mineralization functions. Ibsp knockout (Bsp/-/-) mice had reduced bone formation ability of the CVB scaffolds in vivo compared to wild-type (WT) controls. We hypothesized adding exogenous BSP would rescue defective alveolar bone healing in Bsp/-/- mice.

**Methods:** First, maxillary molars were bilaterally extracted from 42 days postnatal Ibsp/-/- and WT mice. Collagen gel with or without BSP was delivered to sockets. BSP included native rat bone BSP (nBSP) and recombinant rat BSP (rBSP). Bone type I collagen remained liquid while on ice and solidified to gel at 37°C. Tissues were harvested 14 days post-procedure and analyzed for histological and histomorphometry.

**Results:** Bone volume fraction (BV/TV) was increased by both nBSP (53%; P<0.001) and rBSP (69%; P<0.001), compared to collagen gel vehicle in Ibsp/-/- mice. BMD of new bone in Ibsp/-/- mice was similar to wild-type mice, but with nBSP (34%; P=0.001) and rBSP (66%; P<0.001) compared to collagen gel vehicle in Ibsp/-/- mice. Bone volume fraction was increased by normalization by both nBSP (34%; P=0.001) and rBSP (66%; P<0.001) compared to controls. BMD of new bone in WT mice was increased by rBSP (35%; P=0.001) and rBSP (62%; P<0.001) vs. controls.

**Conclusion:** Exogenous BSP rescued alveolar bone healing defects in Ibsp/-/- mice and enhanced bone healing in WT mice. Equivalent effects of nBSP and rBSP suggest PTMs are not essential for BSP functions in bone healing.

**Supported by:** NIH F32DE030358-02 (MB). NIH R01-DE027639-04. The University of Iowa College of Dentistry Student Research Program.

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**31. Functionalize 3D-printed PCL Scaffolds with Nanoparticles for Bone Tissue Engineering**

**Jessica Faber, H. Sun1, J. Miszuk2, J. Hus3, Z. Wang1**

1University of Iowa, Iowa City, IA; 2University of Texas, Austin, TX; 3National Institutes of Health, USA

**Objectives:** Review of critical-sized bone defects remain a relevant and unmet clinical challenge. Autologous bone grafts, the gold standard for treatment, are accompanied by a host of potential complications, leading researchers to explore other treatment strategies. Biomimetic scaffolds are an essential tool for bone regeneration, and 3D printing is emerging as a promising method for fabrication. 3D-printed polycaprolactone (PCL) scaffolds possess many desirable properties including low cost, customization, and standardization. However, the conventionally printed PCL scaffolds are biointert and lack the capacity for osteoinductive factor delivery while new bioprinting techniques are complicated and less translational thus far. This study aims to use polydopamine nanodisks to create a bioactive, osteogenic 3D-printed scaffold. Collagen nanofibers constitute the main components of the bone matrix and are widely used alone or with other materials for cell and drug delivery. Due to the hydrophobic nature of PCL, a biomaterial with low drug loading capacity for PCL 3D printing. Polydopamine nanoparticles can improve the scaffold’s surface properties allowing collagen to coat the scaffold surface. Our recent studies indicate that nanoclay can not only promote osteogenic differentiation but can also bind drugs (proteins, e.g., BMP2 or small compounds, e.g., FTY720). Therefore, we use nanoclay to improve the drug delivery and osteogenic capacity of the PCL/collagen scaffolds.

**Methods:** The osteogenic potential of the proposed system was evaluated using in vitro culture of MC3T3-E1 cells. The structure and surface properties of the scaffold were assessed by scanning electron microscopy.

**Results:** Our in vitro results indicated that nanoclay–FTY could induce osteogenic differentiation marker ALP and enhance matrix mineralization. The results also showed polydopamine can encourage the attachment of collagen gel to the PCL scaffold to create a bioactive scaffold for bone tissue engineering.

**Conclusion:** The findings suggest that our functionalized 3D-printed scaffold with nanoparticles has great potential for bone tissue regeneration.

**Supported by:** NIH RO1DE029195.

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32. Fluoride Knowledge, Attitudes, and Behaviors in Green Hill, Alabama Adults

**Alex Harper**, S.M. Levy, W. Shi

**University of Iowa, Iowa City, IA**

**Objective:** People’s knowledge, attitudes, and behaviors are important determinants of oral health, including caries. Fluoride is an important element to preventing caries. Relatively little is known about adults’ knowledge, attitudes and behaviors concerning fluoride.

**Objectives:** To investigate knowledge, attitudes, and behaviors concerning fluoride of adults living in Green Hill, Alabama.

**Methods:** A convenience sample of 144 adults aged 18 and older and receiving Green Hill public water at their residence completed online questionnaires through Qualtrics or paper-copy questionnaires (later merged into Qualtrics). Questionnaires assessed knowledge, attitudes, and behaviors concerning fluoride, as well as demographics. The respondents were divided into regions based on the level of fluoride in the water at their residence, either 0.7mg/L, 0.35mg/L or 0.0mg/L. Descriptive and bivariate analyses were conducted (chi-square, Kendall Tau, and one-way ANOVA) to assess associations between age, gender, level of education and knowledge, attitudes, and behaviors.

**Results:** Subjects’ mean age was 43.6±15.1 years and 26% were male. Ninety-two percent agreed that fluoride prevents cavities, 90% that fluoride does not make people sick, and 87% that fluoride is not harmful to their health. Older age was positively associated with agreement that fluoride would be in tap water (p<0.001) and likelihood of drinking tap water (p=0.018). Lower education was associated with belief...
that fluoride made the water taste funny (p =0.003). Respondents’ levels of water fluoridation were not significantly associated with the variables.

Conclusion: The majority of subjects agreed that fluoride was safe and beneficial. Drinking fluoridated water was not associated with other variables. Older adults were more likely to perceive the importance of water fluoridation and drink tap water, while less-educated adults were more likely to believe that fluoride made the water taste funny. Additional research is needed to explore the complex relationships among knowledge, attitudes, and behaviors concerning fluoride and relationships with other factors.

Supported by: The University of Iowa College of Dentistry Student Research Program.

33. Investigating Changes of Referral Patterns to a Pediatric Dental Clinic

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Objective: The objective of this study was to compare characteristics of current referred patients with previously referred patients at the University of Iowa Pediatric Dental Clinic (UIPDC). It was hypothesized that there will be a difference in referral patterns between the groups of patient outcomes. The information obtained from this study will provide a better understanding of the effectiveness of the UIPDC referral system and how referral patterns have changed for better staff coverage.

Methods: A chart review and a survey assessing type of treatment, anticipation of the types of treatment being referred, and will ultimately improve patient care.

Methods: Data were previously collected from 340 patients referred to the UIPDC between July 1, 2015 to May 31, 2016. The present study collected data from approximately 1700 patients referred from July 1, 2020 through December 31, 2021 to the UIPDC. Patient information included: age, the duration between the initial appointment and treatment completion, payment source (Medicaid, private insurance, self-pay), driving distance from the patient’s hometown to the UIPDC, the size of the patient’s hometown, referring provider, and the treatment needs of the patient. Descriptive statistics were generated. Bivariate and multiple regression analyses were performed to evaluate the association of referral patterns and transportation needs with patient outcomes.

Results: With the new automated referral system, a total of 1,611 patients were referred to the UIPDC in the specified treatment period compared to 340 patients in the previous study involving paper referrals. Of the 1,611 referral patients, the mean age was 6.5±3.1 years and 73.1% had Medicaid. Nearly 70% of patients were 35 years) via email. Self-reported history of jaw pain and systemic health conditions in 3 categories (pain-related issues, sleep issues, and psychological issues) were collected. Descriptive analyses for demographic characteristics and prevalence of jaw pain and systemic health conditions were conducted. P-values were calculated via Chi-square test for categorical variables, and t-test for continuous variables. The associations between TMD-related jaw pain and the presence of systemic health conditions were evaluated by odds ratios. Significance level was at 5%.

Results: Of the 27,065 students contacted, less than 10% completed the survey. The majority of survey respondents were white (84%), female (88%), and the average age was 20.8±3.5 years. Of those who completed the survey, approximately 40% reported jaw pain in the last 30 days, and a majority of students’ jaw pain was TMD related. Most also reported having at least one category of systemic health conditions. Those with any systemic health condition were more likely to report jaw pain (odds ratio=1.75, 95% CI= 1.27 — 2.40).

Conclusion: There was considerable variation in dentist participation between dental managed care carriers in Iowa, as well as across age groups. Most demographic and practice characteristics were not significant, except for gender. The associations with Medicaid participation for either of the carriers for children or adults, except for dentists’ work hours and rurality, was which was associated with Medicaid participation for children with one carrier (p<0.001), but not significantly less likely to accept children with the other carrier (p=0.88).

Conclusion: Important information was found between referred patient populations. Further data is forthcoming.

Supported by: The University of Iowa College of Dentistry Student Research Program.

34. Temporomandibular Disorders and Systemic Health in University Students

An-Vi Phan1, H. Chen1, J.J. Warren1, W. Shi1

1University of Iowa, Iowa City, IA

Objective: To explore prevalence of and relationship between TMD-related jaw pain and systemic health conditions in young adults.

Methods: An online Qualtrics survey was distributed to current students at the University of Iowa (ages 18-35 years) via email. Self-reported history of jaw pain and systemic health conditions in 3 categories (pain-related issues, sleep issues, and psychological issues) were collected. Descriptive analyses for demographic characteristics and prevalence of jaw pain and systemic health conditions were conducted. P-values were calculated via Chi-square test for categorical variables, and t-test for continuous variables. The associations between TMD-related jaw pain and the presence of systemic health conditions were evaluated by odds ratios. Significance level was at 5%.

Methods: Data were previously collected from 340 patients referred to the UIPDC between July 1, 2015 to May 31, 2016. The present study collected data from approximately 1700 patients referred from July 1, 2020 through December 31, 2021 to the UIPDC. Patient information included: age, the duration between the initial appointment and treatment completion, payment source (Medicaid, private insurance, self-pay), driving distance from the patient’s hometown to the UIPDC, the size of the patient’s hometown, referring provider, and the treatment needs of the patient. Descriptive statistics were generated. Bivariate and multiple regression analyses were performed to evaluate the association of referral patterns and transportation needs with patient outcomes.

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Conclusion: There was considerable variation in dentist participation between dental managed care carriers in Iowa, as well as across age groups. Most demographic and practice characteristics were not significant, except for gender. The associations with Medicaid participation for either of the carriers for children or adults, except for dentists’ work hours and rurality, was which was associated with Medicaid participation for children with one carrier (p<0.001), but not significantly less likely to accept children with the other carrier (p=0.88).

Conclusion: Important information was found between referred patient populations. Further data is forthcoming.

Supported by: The University of Iowa College of Dentistry Student Research Program.
37. Novel Role For Prmt5 in Oral and Skin Epithelial Development

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Objective: During development, the initially single-layered epithelium of the skin and oral cavity requires a precise coordination of cell proliferation and differentiation to execute epidermal stratification. Defects in these events can lead to a range of congenital epidermal anomalies. Moreover, the accumulation of harmful mutations can lead to uncontrolled epithelial proliferation, often through reactivation of developmental programs, and carcinomas. Thus, uncovering molecular regulators of epidermal development can provide novel avenues for cancer therapies. Protein Arginine Methyl Transferase 5 (PRMT5), an enzyme that catalyzes methylation of arginine residues and has been implicated in proliferation and differentiation, is upregulated in cancer and correlates with poorer prognosis. While inhibition of PRMT5 has been shown to have anti-cancer properties, the mechanisms behind this effect are unknown. Interestingly, PRMT5 has been identified as necessary to maintain a progenitor, stem-cell fate in both germ-cell and limb development as well as a variety of cancers. Therefore, we hypothesize that PRMT5-driven methylation of histones and transcription factors drives a gene expression program that impedes differentiation allowing the maintenance of a stem-cell phenotype.

Methods: To test this hypothesis, we have used conditional mouse genetic models to delete Prmt5 from the early (~E8.5) ectoderm. Additionally, to probe the molecular underpinnings of these defects, we are currently profiling changes in gene expression (RNA-seq), chromatin accessibility (ATAC-seq), and histone methylation.

Results: Consistent with a critical role for PRMT5 during this process, epithelial loss of Prmt5 resulted in gross skin and oral epithelial defects, reduced skin barrier function, and reduced postnatal viability. Histological analyses of control and mutant skin revealed severe disruptions to stratum basale. Notably, no survival was observed in patients treated with surgery and radiotherapy. However, in OSCC treated by surgery alone, high PD-L1 expression (CPS ≥ 10) was associated with worse PFS. Additionally, high PD1L expression (CPS ≥ 50) was associated with worse PFS in patients with advanced stage (III/IV) OSCC. On multivariate analysis, high PD-L1 expression was associated with worse PFS in OSCC treated by surgery alone with histopathologically confirmed NO disease.

Conclusion: PD-L1 can serve as an independent prognostic marker of FFS in OSCC patients who received surgery alone. This subgroup of patients should be closely monitored, especially those who have advanced stage OSCC.

38. Prognostic value of PD-L1 Expression in Oral Squamous Cell Carcinoma

Wattanapong Wattanapongwatkul1, A. Choi1, M. Buchakjian1, E. Lanzel1, A. Simons1, K.D.A. Rajan1
1University of Iowa, Iowa City, IA

Objective: Programmed cell death protein ligand-1 (PD-L1) is an immune checkpoint protein. In cancer, PD-L1 expression inhibits immunological control leading to tumor cells avoiding immune destruction. In the existing literature, the prognostic value of PD-L1 in OSCC is different among studies. Reasons for contradictory results include different clones of antibody, differences in scoring methods and definitions of positive expression. Here, we aim to evaluate the prognostic role of PD-L1 expression in OSCC using an FDA-approved antibody and the associated recommended scoring criteria.

Methods: Tissue microarrays (TMAs) containing 347 OSCC were assessed for PD-L1 immunoexpressivity and correlated with clinicopathologic parameters. The ability of different cutoff points of PD-L1 expression to predict progression-free (PFS) and overall patient survival (OS) were evaluated using univariate and multivariate analysis. Associations between immunocorepression scores and clinicopathological features were analyzed by Chi-square tests. Survival outcomes were analyzed using Kaplan-Meier plots and log-rank tests.

Results: High PD-L1 expression (CPS ≥ 10) shows significant associations with absence of active smoking, female sex, and increased patient age. PD-L1 expression did not predict overall survival (OS) or progression free survival (PFS) in patients treated with surgery and radiation. However, in OSCC treated by surgery alone, high PD-L1 expression (CPS ≥ 50) was associated with worse PFS. Additionally, high PD1L expression (CPS ≥ 50) was associated with worse PFS in patients with advanced stage (III/IV) OSCC. On multivariate analysis, high PD-L1 expression was associated with worse PFS in OSCC treated by surgery alone with histopathologically confirmed NO disease.

Conclusion: The results of our study suggest that males have a higher likelihood of experiencing an adverse nitrous oxide event. In addition, more time spent on nitrous oxide appears to increase the odds of an adverse event.

39. Adverse Events Following Use of Nitrous Oxide

Jeffrey T. Anderson1, K. Leary2, P. Iben2
1University of Iowa, Iowa City, IA

Objective: Use of nitrous oxide is common in pediatric settings, 47.4% of female and 68.9% of male patients were exposed to nitrous during the procedure and 69.1% were non-White. It was found that 58% of the children were not exposed to fluoridated water (FW) and 62.8% did not use fluoridated toothpaste (FT). Multiple logistic regression analysis revealed that children not exposed to FW were more likely to be younger (OR=0.98; P<0.001), Black/African American (OR=2.88; P<0.001) or non-Black minority (OR=3.03; P<0.001), not live with both parents (OR=1.52; P<0.004) and have a previous history of ECC (OR=1.71; P<0.001). Further analysis revealed that those not exposed to FT were also more likely to be younger (OR=0.93; P<0.001), White (OR=1.82; P<0.001) or non-Black minority (OR=1.78; P<0.002), in a single-child household (OR=1.73; P<0.001), sporadically or never have their teeth brushed (OR=5.80; P<0.001), and be classified as low-caries risk (OR=2.17; P<0.001).

Conclusion: Education regarding the benefits of daily consumption of fluoridated water and use of fluoridated toothpaste should be targeted to caregivers of low-income young children.

41. Gender Differences in Pediatric Dentists’ Career Satisfaction: A National Survey

Eric J. Kenney1,2,3,4, P. Iben2, F. Qian1, K. Weber-Gasparoni5
1University of Iowa, Iowa City, IA

Objective: The purpose of the study was to determine career satisfaction differences between male and female pediatric dentists.

Methods: A survey was sent electronically via REDCap to 6,349 active AAPD pediatric dentists. Survey consisted of 29 demographic and practice characteristics and 38 career satisfaction questions based on the 5-point Professional and Personal Satisfaction and Dentists’ Satisfaction Scales. Bivariate analyses were conducted using a contingency table, chi-square test, and Mann-Whitney U test to detect the difference between male and female pediatric dentists, and a general linear model was used to evaluate the association between overall satisfaction and its related factors including personal and professional characteristics, and work environment factors.

Poster Presentations

40. Fluoride Exposure in Low-Income High-Risk Children

Ryan Abdelrahim1, A. Lesch1, K. Weber-Gasparoni2, F. Qian1
1University of Iowa, Iowa City, IA

Objective: The aim of the study was to assess fluoride exposure from drinking water and toothpaste among low-income, high-caries risk children attending the University of Iowa Infant Oral Health Program (IOHP). An additional purpose was to evaluate the relationship between fluoride source-specific exposures and child’s age/race/ethnicity, as well as caregiver’s education and socioeconomic status.
43. Factors for Online Dental Portal Use

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1University of Iowa, Iowa City, IA; 2University of Iowa, Iowa City, IA

Objective: To evaluate factors that influence the use of online dental portals (PPs).

Methods: Data was collected through a survey of 748 dental students and faculty. Logistic regression models were used to identify factors associated with portal use.

Results: Factors associated with PP use included higher GPA (OR=1.27, p<0.01), being a dental student (OR=2.39, p<0.05), and being familiar with the PP (OR=2.28, p<0.05). Factors negatively associated with PP use included being a dental hygiene student (OR=0.56, p<0.05), and being unfamiliar with the PP (OR=0.62, p<0.05).

Conclusion: Factors associated with PP use include higher GPA, being a dental student, and being familiar with the PP. Factors negatively associated with PP use include being a dental hygiene student and being unfamiliar with the PP.

44. Identification of Biomarker Species Associated with Obesity and Metabolic Syndrome

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1University of Iowa, Iowa City, IA; 2University of Iowa, Iowa City, IA; 3University of Iowa, Iowa City, IA

Objective: To identify biomarker species associated with obesity and Metabolic Syndrome (MetS).

Methods: Saliva samples from 200 participants were analyzed using 16S rRNA gene sequencing. DESeq2 and Tukey HSD were used to determine indicator species.

Results: Prevotella was identified as an indicator species in both the obesity and MetS groups. Other indicator species included Porphyromonas and Veillonella.

Conclusion: Biomarker species associated with obesity and MetS were identified using 16S rRNA gene sequencing. These findings may have implications for the development of targeted interventions to prevent or manage these conditions.
46. Associations between Dietary Caries Risk Assessment Questions and Planned Restorations

Casey P. Delaney1, J. Warren2, O. Ryssav3, A. Bram1, T.A. Marshall3
1University of Iowa, Iowa City, IA

Objective: Past research has shown a link between sugar consumption and caries, and sugar intake is a key element in caries risk assessment (CRA). However, our previous research found only weak relationships between sugar intake and completed dental caries treatments. This study’s purpose was to assess relationships between dietary questions and planned restorative treatments.

Methods: Deidentified data from the University of Iowa electronic dental records (Axium) were used for this study. Specifically, data were obtained on patients who were 18 years or older and completed their initial CRA during 2018-2019. For these patients, specific restorative procedure codes were collected to identify patients who had planned caries treatments 6 months before or after their initial CRA. Whether each patient had any planned caries restorative treatments, and the number of such planned restorations were gathered. Bivariate and logistic regression analyses were conducted to identify factors related to having planned caries treatments.

Results: There were 6,218 individuals included in this study, with slightly more females (54%) than males, and the mean age was 51 years. Dietary variables including eating more than 3 snacks per day, having unstructured meals, consuming sugar-sweetened beverages, and drinking sugar-sweetened beverages for more than 30 minutes were found to be significantly related to planned caries treatment (p < 0.01). Multivariate models, controlling for age, sex and insurance status, also showed dietary factors to be significantly related to planned caries treatment.

Conclusion: In contrast to our previous study of completed treatments, our analysis found dietary factors are strongly related to caries development. Findings suggest that sugar-related questions are valuable in CRA, and that planned treatments may be a better proxy measure for caries in a dental school population.

Supported by: The University of Iowa College of Dentistry Student Research Program.

47. Characteristics of Patients Electing Comprehensive versus Single-Visit Care

Garrett N. Curtis1, A. Gasparoni1, D.J. Caplan1
1University of Iowa, Iowa City, IA

Objective: In general, new dental patients elect either limited care (LC) or comprehensive care (CC) at their initial visit. To promote the best treatment outcomes, providers often encourage patients to establish CC at that visit. The objective of this analysis was to identify traits and subsequent treatment patterns that differ between those who elect LC versus CC at one university dental clinic.

Methods: Data were collected from electronic dental records at the University of Iowa College of Dentistry. The analysis included N=25505 adults who received a screening exam in the Admissions clinic between 1/1/13-12/31/17. Age, gender, preferred language, insurance type, provider type, distance traveled to clinic, and year of screening were assessed at baseline; and follow-up over the subsequent four years yielded the following variables: treatment clinic, time to comprehensive exam, time to first treatment, time to exit exam, first non-diagnostic procedure code, number of visits, and number of procedures.

Results: 51% of new patients chose LC at their initial visit, and 49% of LC and 81% of CC patients ultimately received a comprehensive exam. Older age, having private insurance, being enrolled in Medicaid, speaking English or Spanish, living further from the clinic, and being screened more recently were associated with electing CC over LC (p<0.001). Most often, first non-diagnostic procedures post-screening were preventive, periodontic, prosthetic or orthodontic for CC patients, versus endodontic or surgical for LC patients.

Conclusion: These findings identify groups that could be targeted to increase the election of comprehensive care at the initial visit.

Supported by: The University of Iowa College of Dentistry Student Research Program.

48. Evaluation of Implant Position: A Comparison of Two Imaging Modalities

Sarah A. Johnson1, U. Salman1, S.M. Ganesan1, T. Allareddy1
1University of Iowa, Iowa City, IA

Objective: Dental implants are an increasingly popular choice for replacement of missing teeth due to many factors including increased longevity, improved aesthetics, and maintenance of existing tooth structures. In order to maintain peri-implant health, ensure longevity of the implant, and protect other structures in the oral cavity such as nerves and sinuses, the endosteal implant must have accurate surgical placement. There is no standard of care to indicate imaging required before implant surgery. This retrospective study aims to establish a standard of care by comparing the accuracy of implants with a pantomograph (pano) taken before surgery compared with implants placed with cone-beam computed tomography (CBCT) imaging taken before surgery.

Methods: All cases in the study had CBCT scans taken at the University of Iowa College of Dentistry after implants were placed, and either a CBCT (Group A) or pano (Group B) taken before implants were placed. A single examiner assessed the accuracy of implant placement in Group A compared to implant placement in Group B by analyzing the CBCT of the implants after surgery. After exclusion criteria were considered, Group A contained 82 cases (212 individual implants) and Group B contained 76 cases (165 individual implants). Each individual implant was categorized as “Within Normal Limits (WNL)” or “Not Within Normal Limits (Not WNL).”

Results: Implant site specific analytics show Group A had more implants placed WNL than Group B in posterior teeth, particularly in mandibular posterior teeth where 82% of mandibular molars in Group A were WNL compared to only 67% in Group B and mandibular premolars in Group A were 88% WNL compared to 79% WNL in Group B.

Conclusion: This study concludes that for mandibular posterior teeth, a CBCT image prior to endosteal implant placement ensures greater accuracy and WNL placement.

49. Patient Payment Method Influence on Orthodontic Treatment Completion

Claire Campbell1, L.M. Moreno Uribe1, J.C. Reynolds1
1University of Iowa, Iowa City, IA

Objective: To understand how patient payment method influences completion of orthodontic treatment.

Methods: This study includes all orthodontic patients from July of 2009 to June of 2019 that began treatment at the University of Iowa in the Orthodontic Residency Clinic. Patients were divided into three subgroups based on their primary method of payment for orthodontic services: private insurance, state-funded insurance, or self-pay. We excluded patients with a complicated medical history, cleft lip/palate or syndromes, cases that required orthognathic surgery or especially complex orthodontic treatment needs such as severe eruption delays.

Results: 1624 patients were included in the study. 1338 had private insurance, 236 had state-funded insurance, and 250 patients were self-pay. No association was found between payment method and orthodontic treatment completion. Treatment completion time was fastest for patients with state-funded insurance and patients with private insurance was significant (p=0.047). Failed appointments between both state-funded insurance and private insurance (p=0.0001) and state-funded insurance and self-pay methods (p=0.0002) is also significant. No significance was found between payment method and orthodontic treatment completion rates, distance in miles from home to clinic, appointment cancellations, consent debrand of orthodontic treatment, or biological sex.

Conclusion: Payment method does not influence completion rates of orthodontic treatment. Instead, treatment completion time is the most influential variable on whether a patient will complete orthodontic treatment. Patients with state-funded insurance are more likely to fail appointments compared to patients with self-pay or patients with private-insurance. However, failed appointments do not influence completion rate of orthodontic treatment.

Supported by: The University of Iowa College of Dentistry Student Research Program.
50. Private Practice Dentist Comments on Transition to DWP Kids

Kayla Limberg1, J.C. Reynolds1, P. Damiano3
1University of Iowa, Iowa City, IA

Objective: Iowa’s Medicaid dental program for children transitioned from state fee-for-service to a privatized managed care in 2021 and was named the Dental Wellness Plan (DWP) Kids. The objective of this study was to assess comments/themes among dentists regarding the transition.

Methods: The data source for this study was a survey sent to all private practice dentists in Iowa in August 2021 to assess dentist experiences and attitudes regarding Iowa’s Medicaid dental program. This study used data from two open-ended items from this survey related to the transition to DWP Kids: 1) “Do you have any comments about the transition to DWP Kids?” and 2) “If your acceptance of new child patients changed as a result of the transition to DWP Kids, what are the main reasons why it changed?” Responses were qualitatively analyzed and coded to determine common themes.

Results: 269 participants completed the survey with a 20.4% response rate. Knowledge and stigmatizing attitudes did not statistically differ by age or role (student, resident, faculty, staff). Of the 9 knowledge items, participants yielded a mean of 6.9 correct items, but had important misconceptions about diagnosis and symptoms. Only 22% accurately stated that ADHD is a disorder present from childhood and 40.9% incorrectly answered “People with ADHD find it difficult to follow rules.” Total knowledge was negatively correlated with total stigma. Participants who did not know anyone with ADHD responded with statistically higher levels of total stigma of medium effect size (d=0.7). Further multivariate analyses are forthcoming to evaluate hypothesized cumulative stigmatizing effect with increasing personal connections.

Conclusion: Although ADHD knowledge was high overall in this sample, misconceptions and stigmatizing attitudes about ADHD persist. Having a personal connection to someone with ADHD was the most important factor correlating to reduced stigma.

Supported by: The University of Iowa College of Dentistry Student Research Program.

51. ADHD Knowledge and Stigma Evaluation in the College of Dentistry

Alanna Bram1, C.L. Anderson1, T.A. Marshall1
1University of Iowa, Iowa City, IA

Objective: ADHD is a very prevalent neurodevelopmental disorder in the United States. Among medical students, ADHD accounts for the greatest proportion of disclosed disabilities, yet remains considerably lower than the general prevalence. This gap in disclosure and support-seeking may be due to stigma surrounding psychological disorders, especially about adult ADHD in higher education. Few studies exist in dental school populations; thus, this study aims to assess general knowledge and stigma about ADHD in the College of Dentistry.

Methods: A Qualtrics survey was created and distributed to all COD members via email (n=1,116). The anonymous survey was available for one month and consisted of 9 T/F knowledge items and 19 stigma items about Consequences of Inattention, Overactivity, Malinger, Misuse of Medication, and Ability to Take Responsibility. Selections were based upon reported experiences in and reasons why it changed in BGM with ADHD. Statistical analysis consisted of descriptive, univariate, and multivariate analysis regression analyses (p<0.05).

Results: 269 participants completed the survey with a 20.4% response rate. Knowledge and stigmatizing attitudes did not statistically differ by age or role (student, resident, faculty, staff). Of the 9 knowledge items, participants yielded a mean of 6.9 correct items, but had important misconceptions about diagnosis and symptoms. Only 22% accurately stated that ADHD is a disorder present from childhood and 40.9% incorrectly answered “People with ADHD find it difficult to follow rules.” Total knowledge was negatively correlated with total stigma. Participants who did not know anyone with ADHD responded with statistically higher levels of total stigma of medium effect size (d=0.7). Further multivariate analyses are forthcoming to evaluate hypothesized cumulative stigmatizing effect with increasing personal connections.

Conclusion: Although ADHD knowledge was high overall in this sample, misconceptions and stigmatizing attitudes about ADHD persist. Having a personal connection to someone with ADHD was the most important factor correlating to reduced stigma.

Supported by: The University of Iowa College of Dentistry Student Research Program.

52. Assessing Behavior Guidance Modalities of Pediatric Patients With Teledentistry Consultations

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Objective: The purpose of the study was to determine the change in behavior guidance modality (BGM) for pediatric dental patients from an initial teledentistry consultation through treatment completion and identify associations with clinical and demographic factors. BGMs include treatment in clinic with or without nitrous oxide, oral conscious sedation, or general anesthesia.

Methods: 79 children (43 male, 36 female) and their caregivers completed synchronous teledentistry consultations with pediatric dentists residing between July 1, 2020 and June 4, 2021. The electronic dental records (axiUm) of referral patients to the University of Iowa College of Dentistry were reviewed to collect data on recommended BGM, BGM used to complete treatment, and clinical and patient related factors. Descriptive and bivariate analyses were conducted (alpha=0.05).

Results: Initial behavioral modality for treatment did not change for 86% of children. Dental treatment planned for in the clinic had the most changes in BGM followed by sedation. Patients planned for general anesthetic were 38% more likely to change in BGM than those transitioning to teledentistry consultation to treatment was always to a more advanced modality. More complex treatment plans were associated with having a change in BGM (24% 4 or more quadrants vs 6.7% 3 or fewer quadrants; p=0.048).

Conclusion: Teledentistry correctly identified the BGM for most pediatric dental patients. Treatment complexity was associated with a change in BGM. This study may help dental practitioners understand the limitations of teledentistry when accessing BGM for a patient with 4 or more quadrants of dental care.

Supported by: The University of Iowa College of Dentistry Student Research Program.

53. Effects of Pre-Doctoral Experiences on Treating Patients with Alzheimer’s Disease

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Objective: Patients with Alzheimer’s Disease (AD) face many barriers that prevent access to dental care including finding dentists who are willing and able to provide care as their AD progresses. The aim of this study was to investigate the influence of pre-doctoral educational experiences on Alumni’s attitudes and willingness to provide care for patients with AD.

Methods: An electronic survey was distributed to all University of Iowa Dental Alumni in August 2022. Respondents included both alumni who did and did not experience pre-doctoral educational experiences on current attitudes and no clinical experience on current attitudes and no clinical experience. Alumni’s attitudes and willingness to provide care for patients with AD were associated with the limited number of respondents. However, most felt that predoctoral education experiences positively contributed to their ability to provide care for these patients.

Conclusion: Bivariate analysis showed no statistically significant difference between predoctoral clinical experience and willingness to provide care for patients with AD due to the limited number of respondents. However, most felt that predoctoral education experiences positively contributed to their ability to provide care for these patients.

Supported by: The University of Iowa College of Dentistry Student Research Program.

54. Long-Term Oral Health Outcomes for Removable Partial Denture Patients

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Objective: To explore the long-term oral health outcomes of patients who received removable partial dentures and identify patterns of tooth loss, decay, and additional treatments.

Methods: Adults (n=739) received removable partial dentures from the COD between 2009 and 2018. Electronic health records (EHRs) of these patients were reviewed and treatment completed after delivery of the RPD was recorded using current dental terminology (CDT) codes. Demographic data were collected.

Results: The EHR identified 3746 (51.3%) female, 3601 (48.7%) male and 2 (0.0%) unspecified individuals in the cohort. 24% of patients were enrolled in the Dental Wellness Plan, 45% were identified as self-pay, and 34% had private dental insurance. Additional treatments averaged, in CDT codes per patient: 15.27 preventative, 8.40 direct restorative, 1.425 fixed prosthodontic, 8.24 surgical, 3.46 removable prosthodontics. Overall, X-ray results of patients averaged 37.26 additional treatments.

Conclusion: A large population of patients who received removable partial dentures was described. These patients require preventive care and can have further dental treatment needs such as crowns, extractions, and root canal treatment for remaining teeth. This may have implications for future treatment of partially- edentulous patients.

Supported by: The University of Iowa College of Dentistry Student Research Program.
Dentistry Student Research Program.

Collagen and silanes is required. Characterization of specific interactions between dentin's UTS and anisotropy, which might suggest how changes in dentin mechanical properties were assessed by ultimate tensile strength (UTS) test using the slabs (n=7), and results were expressed in megapascal (MPa). Fourier-transform infrared spectroscopy (FTIR) with attenuated total reflectance (ATR) was used to characterize biochemical modifications in the dentin blocks (n=3). Intensity of assigned peaks was obtained from the FTIR spectra before and after treatment. After normalization, ratios were determined between amide I/CH (1,640 cm⁻¹/1,450 cm⁻¹), amide II/ CH (1,550 cm⁻¹/1,450 cm⁻¹), and amide III/ CH (1,240 cm⁻¹/1,450 cm⁻¹) were calculated. The Kruskal-Wallis test with Bonferroni correction, Mann-Whitney, and one-way ANOVA tests were performed for statistical analyses (p<0.05).

Results: Statistically significant differences were observed between PBS-treated dentin tested PL and APTES-treated samples tested in PP orientation (p=0.006). When comparing UTS tested PP and PL orientations, observed between PBS-treated dentin tested PL (α=0.05).

Methods: We collected data from patients at the University of Iowa College of Dentistry who were 65 years or older with SDF application on a tooth (n=1083) from 2016 to 2018 with a minimum three-year follow-up. The data was accessed from the electronic health record, Axium. From these 1083 observations of SDF application, there are 865 unique combinations of patients/sites (some patients had multiple treatments on the same site), and 437 unique patients.

Results: 66.8% of patients (n=292) had no further cases of interest on the same site after the day of their first SDF procedure in the specified time frame, while 33.2% (n=145 patients) did. Of the 33.2% who did return for further treatment, the most common procedures were D1110 (prophylaxis), D7140, and D2391 (glass ionomer type restorations). Other less-frequent codes (each representing fewer than 1% of total procedures) represented 24% combined. About 44% of known codes were preventive and 56% were non-preventive; however, many codes were not categorized so this may not be the full picture. Glass ionomer-type restorations and examinations were the most common types of procedures.

Conclusion: In this population of adults who are 65 years old and older, the majority of patients had no further treatment at the College of Dentistry after the first SDF procedure in the specified time frame of 2016 to 2018.

Supported by: The University of Iowa College of Dentistry Student Research Program.

56. Outcomes of Silver Diamine Fluoride (SDF) Treatment Among Older Adults

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Objective: To characterize potential interactions between silanes and dentinal collagen.

Methods: Dentin blocks (3 x 3 x 0.5 mm) and slabs (0.8 mm-thick) were prepared from coronal dentin of human extracted molars. Slabs were trimmed in two orientations, perpendicular (PP) or parallel (PL) to the tubules, to produce hour-glass shaped specimens with 0.8 mm at the mid-coronal dentin. Specimens were demineralized in 0.5 M EDTA for 3 days at 4°C followed by treatment with PBS (control), 100 mM 3-(Triehtoxysilyl)propyl isocyanate (ICPTES), 100 mM 3-(Aminopropyl)triethoxysilane (APTES), or 5% glutaraldehyde (GD) for 1 h. Changes in dentin mechanical properties were assessed by ultimate tensile strength (UTS) test using the slabs (n=7), and results were expressed in megapascal (MPa). Fourier-transform infrared spectroscopy (FTIR) with attenuated total reflectance (ATR) was used to characterize biochemical modifications in the dentin blocks (n=3). Intensity of assigned peaks was obtained from the FTIR spectra before and after treatment. After normalization, ratios were determined between amide I/CH (1,640 cm⁻¹/1,450 cm⁻¹), amide II/ CH (1,550 cm⁻¹/1,450 cm⁻¹), and amide III/ CH (1,240 cm⁻¹/1,450 cm⁻¹) were calculated. The Kruskal-Wallis test with Bonferroni correction, Mann-Whitney, and one-way ANOVA tests were performed for statistical analyses (p<0.05).

Results: Statistically significant differences were observed between PBS-treated dentin tested PL and APTES-treated samples tested in PP orientation (p=0.006). When comparing UTS tested PP and PL orientations, observed between PBS-treated dentin tested PL (α=0.05).

Methods: We collected data from patients at the University of Iowa College of Dentistry who were 65 years or older with SDF application on a tooth (n=1083) from 2016 to 2018 with a minimum three-year follow-up. The data was accessed from the electronic health record, Axium. From these 1083 observations of SDF application, there are 865 unique combinations of patients/sites (some patients had multiple treatments on the same site), and 437 unique patients.

Results: 66.8% of patients (n=292) had no further cases of interest on the same site after the day of their first SDF procedure in the specified time frame, while 33.2% (n=145 patients) did. Of the 33.2% who did return for further treatment, the most common procedures were D1110 (prophylaxis), D7140, and D2391 (glass ionomer type restorations). Other less-frequent codes (each representing fewer than 1% of total procedures) represented 24% combined. About 44% of known codes were preventive and 56% were non-preventive; however, many codes were not categorized so this may not be the full picture. Glass ionomer-type restorations and examinations were the most common types of procedures.

Conclusion: In this population of adults who are 65 years old and older, the majority of patients had no further treatment at the College of Dentistry after the first SDF procedure in the specified time frame of 2016 to 2018.

Supported by: The University of Iowa College of Dentistry Student Research Program.

57. Bond Strength of an Adhesive System Containing Proanthocyanadin-Loaded Nanoparticles


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Objective: To assess the immediate and long-term bonding performance of an experimental resin-based primer (RBP) containing mesoporous silica nanoparticles (MSN) loaded with proanthocyanidins (PACs).

Methods: The mid-coronal dentin of extracted intact human molars was restored using different RBP (n=10): Control (no MSN), MSN-APTES (RBP containing MSN functionalized with 3-aminopropyltriethoxysilane (APTES), MSN-APTES-PAC (RBP containing MSN loaded with PAC before functionalization), and MSN-PAC-APTES (RBP containing MSN loaded with PAC before functionalization). After the RBP application, a commercial adhesive resin was used (Scotchbond Multipurpose, 3M Oral Care). Four resin-dentin beams were prepared per tooth and two specimens were immediately tested in tensile until failure. The remaining two specimens were tested after 1 year of storage. Failure mode was classified as adhesive, cohesive, or mixed. Statistical analysis consisted of mixed modeling for repeated measures with a Tukey post-hoc and Weibull distribution with a Sidak pairwise test for the bond strength data. Failure mode was analyzed by Fisher exact tests. All analyzes were performed using R (v. 4.1.2) (p<0.05).

Results: For immediate results, MSN-PAC-APTES presented statistically significant higher bond strength than the other groups (p<0.001). No statistically significant difference was observed among the other three primer formulations (p=0.93). Comparing the long-term to the immediate results, Control and MSN-PAC-APTES showed a decrease in bond strength after 1 year of storage (p=0.027 and p=0.002, respectively). However, MSN-PAC-APTES resulted in a significant increase in bond strength after the long-term storage (p=0.001).

Conclusion: APTES-functionalized MSN can be successfully added to a primer for drug-delivery purposes without compromising the bond strength to dentin. However, the sequence of surface functionalization with APTES resulted in differences in the bonding performance, with better long-term results for RBP containing MSN loaded with PAC after functionalization.

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58. Characteristics of Admissions Patients at the UI College of Dentistry

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Objective: This study describes selected demographic and health conditions among patients attending their initial visit at the UI College of Dentistry in the Admissions Clinic, with specific interest in patients who requested comprehensive care (CC) versus urgent care (UC).

Methods: Demographic information and health conditions of de-identified patients seen during the years 2016-2021 were analyzed. Patients aged 18 or older were included in the analysis. Univariate distributions were assessed, and range checks were performed, followed by bivariate analyses comparing characteristics of those whose posted ADA treatment codes were D0404-A (CC screening exam) versus D0403 (UC screening exam).

Results: Data from 31,876 patients were analyzed. Patients’ average age was 43 years and 53% were women. Self-reported categories of race were “White/European” (85%), “Black/African” (10%), and “Other” (4.7%). From 2016 to 2022, the percent of privately insured patients decreased from 30 to 22%; self-paying patients decreased from 39% to 25%; and Medicaid/DWP patients increased from 31% to 52% (p<0.001). More patients in the CC group reported diabetes (20% vs 16%), joint replacement (8.4% vs 5.6%), heart disease (37% vs 29%), and muscular/bone concerns (17% vs 13%) compared to UC patients (all p-values <0.001). More patients in the CC group reported having seen a primary care provider in the year prior to the appointment compared to the UC group (77% vs 64%, p<0.001).

Conclusion: Patients who requested comprehensive care reported more adverse health conditions (diabetes, joint replacement, heart disease, muscular/bone concerns) and were more likely to have seen a primary care provider in the previous year than did those who requested urgent care. Differences between the two groups should be investigated further in longitudinal studies, as they might have implications for teaching and patient care in the College of Dentistry’s Admissions Clinic.
59. Student Empathy With Standardized Patients: Concepts From Critical Thinking Emulation

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Objective: Clinician empathy can improve patient outcomes, but the literature is scant on patient-based, student-led experiences to demonstrate empathy in patient interactions. The purposes of this project are to (1) develop a learning guide for observable behaviors communicating emotional and cognitive empathy, and (2) determine whether the learning guide can be used as a rubric for assessing empathy in a standardized patient experience.

Methods: Eleven standardized patients assessed 80 D3 students using a 4-point interval scale on 19 behavioral criteria in four domains: initiation (four criteria), Health History and Caries Risk (four criteria), Treatment Planning (six criteria); and Communication Skills (five criteria). Standardized patients also provided qualitative feedback.

Results: Standardized Patients completed all 1,520 interval scales on the rubric and 94.1% of 320 open-ended comments. Students performed well. Of the 1520 criterion intervals, 1,242 (81.7%) were rated “excellent.” Students performed best in Treatment Planning, with 85.6% of 480 criteria rated “excellent.” Health History had the most room for improvement, with 248 (77.5%) of 320 criteria rated “excellent.” In keeping with the literature, students rated empathy positively for Treatment Planning and more equivocally for Health History.

Conclusions: The emulation model for students using a 4-point interval scale on 19 behavioral criteria in four domains: initiation (four criteria), Health History and Caries Risk (four criteria), Treatment Planning (six criteria); and Communication Skills (five criteria). Standardized patients also provided qualitative feedback.

60. Prevalence of Fluoride Varnish Application in the Medical Setting

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Dental caries is prevalent in children and fluoride varnish (FV) applications are an effective preventive strategy. FV in medical settings offers an opportunity for caries prevention, but few studies have assessed its use in medical settings.

Objective: To assess the cross-sectional and 18-month cumulative prevalence of FV application in medical settings using a convenience sample of subjects from 3 sites.

Methods: After IRB approval, 1,326 primary care physician/child pairs were enrolled at child age 12 months in 2012-2013 for a study developing a caries risk assessment tool. Children received dental examinations and parents completed self-administered questionnaires at baseline, and at 30, 48, 78, 96, and 114 months of age that asked about medical FV application. Every four months, participating practices were asked about medical FV application. Cumulative prevalence for four 18-month periods were calculated, and percentages of all responses from age 12-30 months with medical FV were calculated.

Results: The majority of children aged 2.5 years were male (51.7%), white (50.8%), non-Hispanic (87.2%), and Medicaid-insured (54.1%). Cumulative prevalence of FV applications was 20.4% for age 12-30 months, 12.9% for 30-48 months, 6.4% for 78-96 months, and 1.9% for 96-114 months. The distribution of the percentage of responses with medical FV application from 12-30 months was: 79.6% had no FV (0%), 6.4% had 20-33% of responses with medical FV, 9.1% had 40-67% with medical FV, and 4.9% had 75-100% of responses with medical FV.

Conclusion: Prevalence of FV application in the medical setting is low and decreases as children age.

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61. Fracture Resistance Bonded Zirconia Crowns After Endodontic Access Hole Preparation

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Objective: To assess the cross-sectional and 18-month cumulative prevalence of FV application in medical settings using a convenience sample of subjects from 3 sites.

Methods: 120 extracted molars were prepared, scanned and designed in 3D Shape CAD software with different occlusal thickness of 1.0 mm, 1.5 mm and 2.0 mm. Crowns were wet milled using zirconia containing 3 mol% yttria (3Y Ceramill) then cemented using Resin Modified Glass Ionomer (Relyx) and Resin-based (Panavia). Thermo-cycling test (5,000 cycles, 5°C-55°C) confirmed lifecycle aging. Endodontic access was prepared under microscope. Composite restored access holes (Filtakle Ultra, 3M ESPE). All samples were tested in Universal testing machine. Fracture load was measured at the maximum load until catastrophic fracture; calculated in Newtons (N).

Results: Larger occlusal thicknesses require more fracture force. A 1 mm increase in occlusal thickness increased average zirconia crown fracture force by 1043.00 N. Endodontic access hole decreases average crown fracture force by 653.83 N. Force needed to fracture zirconia crowns was 1600.75 N greater than for a crown using Panavia. Rejected Null hypotheses. T-tests against expected to be 1600.75 N greater for a crown using Relify. Rejected Null hypotheses. T-tests against expected to be 1600.75 N greater for a crown using Relify. Rejected Non-hypothesis of no effect indicate significant main effects of the thickness and access hole. Increased occlusal thickness increases fracture force. Access hole presence decreases fracture force.

Conclusion: Selection of occlusal thickness influences the strength of zirconia crowns. Increase in occlusal thickness can add crown strength. After endodontic treatment, zirconia crowns yield clinically relevant fractures and failures.

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62. A Multifunctional Hydrogel Enhances Osteogenesis Via TLR4/NF-kB/HO-1 Axis

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Objective: Effective therapies capable of inhibiting inflammation and promoting bone healing remain to be developed for inflammatory bone diseases. Global transcriptomic changes demonstrated inflammatory responses dominate periodontitis with bone loss. While anti-inflammatory treatment can enhance bone formation at defects, development agent can synergistically repair periodontal tissues. Consequently, this study aimed to engineer a multi-functional hydrogel to reverse the abnormal inflammation environment and promote bone regeneration for periodontal tissue regeneration.

Methods: We fabricated anti-inflammation and anti-oxidation nanomicelles (PP5 NMs) by self-assembly method. Then, we evaluated their ROS-scavenging and anti-inflammatory effects, and explore their anti-oxidation, anti-apoptosis, anti-inflammation and pro-osteogenesis capacity on human periodontal ligament cells (hPDLCs). Next, we engineered a multifunctional hydrogel via co-loaded with PP5 NMs and a pro-osteogenic agent recombinant human BMP9 (rBMP9) based on a thermos-sensitive polymer PV and observed its physicochemical characterization. Then, we establish rats with mandibular and cranial defects model to observe bone formation capacity of the hydrogel. Finally, transcriptome sequencing was applied to further explore the mechanism of PP5 NMs reserving inflammation-reducing effects.

Results: We successfully engineered PP5 NMs and validated their ROS-scavenging and anti-inflammatory effects. Meanwhile, we demonstrated that PP5 NMs and recombinant human BMP9 (rBMP9) could synergistically repair periodontal tissues. Consequently, this study aimed to engineer a multi-functional hydrogel to reverse the abnormal inflammation environment and promote bone regeneration for periodontal tissue regeneration.

Conclusion: We rationally engineered an injectable temperature-sensitive hydrogel, which possesses temperature-triggered gelling performance, anti-inflammation and anti-oxidation characteristic (PP5 NMs), and osteogenesis-promoting capability (rBMP9). Such treatment strategies can be further applied as an injectable delivery vehicle for different types of inflammatory bone disease.
63. Chemerin/ChemR23 Promotes Inflammatory Root Resorption in Mice via Cementoblast Senescence

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Objective: Inflammatory root resorption (IRR) is a common phenomenon in patients undergoing orthodontic treatment, with an unclear pathogenesis. Increased inflammatory mediators are associated with cellular senescence. Chemerin induces senescence in human nuclear pulpous cells (NPC) and releases inflammatory mediators that may play a role in IRR. We aimed to explore possible roles of the chemerin/ChemR23 interaction in cementoblast senescence and IRR and reveal a new IRR therapeutic target.

Methods: Detection of cementoblast senescence phenotypes including P53, P21,PI6and pro-inflammatory senescence-associated secretory proteins (SASP) by qRT-PCR and Western blotting after chemerin and siChemR23 action on the immortalized murine cementoblast cell line OCMM-30. Detection of senescent cementoblast by immunofluorescence with β-galactosidase and EDU. Observation of changes in acetylated histones in the presence of Chemerin using the sirt-1 specific agonist resveratrol. In addition, we established IRR models in 2, 8, 12, and 16-month-old C57BL/6J mice and injected mice with chemerin and ChemR23 antibodies. Then, the amount of root resorption was calculated, the expression of P53, P21, IL-1β and IL-6 in periodontitis was detected, and the serum chemerin levels in mice of different ages were measured.

Results: Chemerin induces senescence and acts as a pro-inflammatory agent on cementoblast, and these effects can be partially reversed by siChemR23. Chemerin treatment of cementoblast resulted in decreased Sirt1 expression and increased expression of h3K9ac, h3K27ac, P53, P16, and P21, effects that were partially reversed by resveratrol. It is suggested that sirt-1 is a downstream molecule of chemerin/ChemR23 and affects histone acetylation and thus cellular senescence. In vivo, there were age-increasing changes in serum Chemerin concentrations, and IRR worsened after Chemerin injection, expression of P53, P16 was positively correlated with Chemerin. Downregulation of ChemR23 partially reversed these effects.

Conclusion: Chemerin/ChemR23 induced cementoblast senescence and thus affected root resorption by inhibiting sirt1, highlighting the therapeutic potential of chemerin in IRR.

64. Cancer Cell Membranes Functionalized Nanoparticles for Targeted Oral Cancer therapy

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Objective: Oral squamous cell carcinoma (OSCC) is a prevalent malignant disease worldwide due to the lack of an efficient strategy for targeted therapy. To solve this problem, a combined chemo/photothermal therapy nanoplatform was constructed for enhanced OSCC treatment.

Methods: Based on cancer cell homotypic targeting ability, biomimetic nanoparticles (CC@DOXNPs) were fabricated with HSC3 membrane (CC) coating on the surface of DOX-loaded poly (lactic-co-glycolic acid) copolymer (PLGA) nanoparticles (DOXNPs). Then, indocyanine green (ICG) modified with the phospholipid polymer DSP-EPEG2000 was inserted into the cancer cell membrane for photothermal therapy. Subsequently, the physical properties of the various nanoparticles were characterized. The biocompatibility and biological functions of nanoparticles were determined in vitro. Finally, in cancer subcutaneous and orthotopic models, the targeting efficiencies, therapeutic efficacy and safety of the nanoparticles were examined.

Results: CC-coated nanoparticles effectively targeted and accumulated tumor area in vivo. The lip-CC@DOXNPs achieved synergistic chemotherapy and photothermal in cancer cells upon laser irradiation. After 2-week treatment program, lip-CC@DOXNPs were shown to significantly inhibit the progression of tumor. Furthermore, our nanoparticles displayed favorable safety performance after long-term administration.

Conclusion: Taking together, our combined nanoplatforms have tumor targeting and drugs deliver capability, as well as the photothermal conversion ability, making them an ideal for synergistic chemo/photothermal therapy against OSCC. This proof of concept may provide a smart therapeutic system in the field of targeted chemo/photothermal therapy therapeutic platforms.

65. Copper-containing Bioglass-Hydrogel With Hemostatic, Antibacterial, Angiogenesis Properties for Wound Healing

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Objective: Full-thickness skin injury, followed by massive bleeding and wound infection, is a difficult clinical problem. Therefore, biomaterials are urgently needed to treat severe skin defects to achieve rapid hemostasis and extensive tissue remodeling. The purpose of this study is to construct a copper-containing bioglass (Cu-BGN) loaded gelatin methacrylate (GelMA) composite hydrogel (GelMA@Cu-BGN) to promote the healing of full-thickness skin defects.

Methods: Rat liver injury and tail amputation models were established to test the hemostatic effect of the material. The cell viability of GelMA@Cu-BGN hydrogel were evaluated using mouse fibroblasts (L929). And the scratch assay and tube formation experiment were carried out by using L929 and human umbilical vein endothelial cells (HUVEC) to evaluate the angiogenesis ability of GelMA@Cu-BGN hydrogel. In addition, Staphylococcus aureus and Escherichia coli were used to test the antibacterial effect of GelMA@Cu-BGN hydrogel. The effect of GelMA@Cu-BGN hydrogel on wound healing was evaluated in vivo using a diabetic rat full-thickness skin defect model.

Results: Compared to commercial collagen sponge, GelMA@Cu-BGN hydrogel exhibited shorter hemostatic time and lower blood loss in both rat liver injury and tail amputation models. Meanwhile, GelMA@Cu-BGN hydrogel with 1% concentration of Cu-BGN showed good biocompatibility and outstanding angiogenesis property. Furthermore, GelMA@Cu-BGN hydrogel exhibited nontrivial antibacterial effect towards both Staphylococcus aureus and Escherichia coli. Most importantly, GelMA@Cu-BGN hydrogel exhibited better healing effect than the commercial dressing Tegaderm3M in full-thickness skin defects of diabetic rats.

Conclusion: Taken together, the results of this experiment verify that GelMA@Cu-BGN hydrogel has excellent hemostatic effect, biocompatibility, antibacterial and angiogenesis properties, and is a promising potential wound dressing for diabetic wound healing.

66. Gut Dysbiosis Caused by Antibiotics Aggravates Periodontitis

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Objective: This study aimed to investigate whether gut dysbiosis caused by long-term systemic antibiotic use affects periodontitis.

Methods: Four-week-old male C57 mice were randomly divided into two groups: N and Abs groups. Mice in the Abs group were provided with antibiotic drinking water containing cefoxitin, gentamicin, metronidazole, and vancomycin. After four weeks, the antibiotic drinking water was removed and mice were divided into four groups: N+N, N+Lig, Abs+N, and Abs+Lig groups. An experimental periodontitis model was established in the N+N and Abs+Lig groups for two weeks. Other mice were provided with antibiotic drinking water for four weeks. Then, the antibiotic water was removed and mice were divided into two groups: FMT-N and FMT-Abs. The fecal microbiota of mice in the N+N and Abs+N groups were transferred to the FMT-N and FMT-Abs groups, respectively. Two weeks after the transplantation, all mice received a ligature for another two weeks.

Results: In gut and oral microbiota, community composition was significantly changed and histological destruction was observed in gut tissue. Compared with N+Lig group, in Abs+Lig group, alveolar bone loss was increased. Fecal microbiota transplantation from normal mice partially restored the disturbed gut microbiota in mice with antibiotics using, and improved intestinal histological destruction. Compared with the FMT-Abs+Lig group, the alveolar bone loss was decreased in the FMT-N+Lig group.

Conclusion: Long-term systemic antibiotics-induced gut dysbiosis has potential adverse effects on periodontitis. The periodontal condition of patients should be assessed regularly when using systemic antibiotics in clinical practice.
67. **Research of the Association of Candida albicans With Alzheimer’s Disease**

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**Objective:** Alzheimer’s disease (AD) is a common neurodegenerative disease. The etiology of AD is unknown, and some studies suggest that its pathogenesis is related to mitochondrial dysfunction. Candida albicans can invade the brain parenchyma through bloodstream infections, causing Aβ deposition, which ultimately leads to learning and memory decline in mice. Extracellular vesicles (EVs) are a series of membrane-bound vesicles secreted by eukaryotic cells. Candida albicans is able to secrete extracellular vesicles, and studies have shown that it’s outer membrane vesicles are associated with biphasic transformation and virulence regulation. We speculate that extracellular vesicles may be an important cause of AD caused by Candida albicans. Our study aimed to reveal whether Candida albicans and its EVs can lead to pathological changes in Alzheimer’s disease and to investigate the mechanism.

**Methods:** We inoculated 14-month-old mice orally with Candida albicans and its EV, and after two months, the mice were subjected to behavioral model and their hippocampal tissues were collected for relevant molecular biological analysis to detect pathological changes related to Alzheimer’s disease from gene and protein expression levels.

**Results:** Our study shows that Candida albicans and its EVs can lead to decreased learning and cognitive decline in mice, causing hippocampal neuroinflammation in mice, and the presence of Tau protein increased phosphorylation at the Thr231.

**Conclusion:** Candida albicans is a common fungus in the mouth, which can induce neuroinflammation leading to the occurrence of Alzheimer’s disease, suggesting the importance of anti-fungal therapy in the treatment of Alzheimer’s disease, and the elderly with denture stomatitis should be more prevented. Candida albicans EVs has been reported to be immunogenic, and its specific mechanism for inducing Alzheimer’s disease is unclear, there is still research promise as a vaccine to prevent related diseases.

68. **Responsive Nanoparticle Ameliorates Periodontal Dysfunction via Restoring Oxidative Stress Resistance**

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101Chongqing Medical University, Chongqing, China

**Objective:** Periodontitis is a widespread oral disease characterized by continuous inflammation of the periodontal tissue and irreversible alveolar bone loss. The periodontal microenvironment is altered by inflammation, which in turn affects cell fate, function, and metabolism by regulating the activity of oxidative stress.

**Objective:** In order to restore the oxidative stress resistance (OxSR) programs and enhance buffering against oxidative damage, we developed an innovated diagnostic and therapeutic nanoparticle loaded with itaconate (ITA), a mitochondrial metabolite, to effectively inhibit the inflammatory process and remodel the periodontal soft and hard tissue by regulating the homeostasis of periodontal microenvironment and reprogramming of macrophages metabolism.

**Methods:** In mice modeling, we applied the silk sutures with both ends tied knots to insert between the maxillary first molar and second molar. The ligature was retained for 2 weeks in order to establish experimental periodontitis. Radiographic analysis and immunostaining were performed post-operation. Molecular docking and knockout mice were used to identify the molecular mechanism of ITA. Then, nanoparticle-based drug delivery has been administrated to improve pharmacokinetics of ITA and to reduce the side effects induced by local high concentrations.

**Results:** We showed that ITA could significantly alleviate inflammation and alveolar bone loss in vitro and in vivo. Molecular docking simulation and knockout mice were used to verify the molecular mechanism of ITA. Then, nanoparticle-based drug delivery has been administrated to improve pharmacokinetics of ITA and to reduce the side effects induced by local high concentrations.

**Conclusion:** Our results indicated that the diagnostic and therapeutic nanoparticle loaded with ITA attenuates inflammation and oxidative stress via disassociation of KEAP1-Nrf2 and activation of Nrf2 signaling cascade. Local administration of nanoparticle provides clinical treatment potential for periodontitis.

69. **Responsive Nanoparticle Ameliorates Periodontal Dysfunction Via Restoring Oxidative Stress Resistance**

**Liangjing Xin**101, F. Zhou101, Q. Zhai101, J. Song101

101Chongqing Medical University, Chongqing, China

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**Conclusion:** Our results indicated that the diagnostic and therapeutic nanoparticle loaded with ITA attenuates inflammation and oxidative stress via disassociation of KEAP1-Nrf2 and activation of Nrf2 signaling cascade. Local administration of nanoparticle provides clinical treatment potential for periodontitis.
71. Comparison of Biofilm Models for Producing Artificial White Spot Lesions

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Objective: Establishing an effective protocol for creating artificial white spot lesions (WSL) that mimic in vivo lesion characteristics opens many possibilities for laboratory studies to investigate novel minimally invasive strategies to arrest lesion progression. This in vitro study compared three protocols for developing artificial active WSL using biofilm models associated with enamel demineralization and remineralization cycles.

Methods: Forty-five enamel samples were sterilized and divided into three groups based on the biofilm-induced challenge: Streptococcus sobrinus with Lactobacillus casei (Ss+Lc) for 4 days, Streptococcus mutans (Sm) for 16 days, or Streptococcus mutans (Sm) for 12 days. Bacterial species were grown on the surface of saliva pellicle-coated enamel specimens, and the specific demineralization/remineralization protocols were performed with daily media changes. The fluorescence, depth, and chemical composition of the WSLs were assessed using Quantitative Light-induced Fluorescence (QLF), Polarized Light Microscopy (PLM), and Raman Spectroscopy, respectively. Statistical analysis consisted of two-way ANOVA followed by Tukey’s post hoc tests (α=0.05).

Results: WSLs created using the Ss+Lc protocol presented statistically significant higher fluorescence loss (FL) and integrated fluorescence (IF) in comparison to the other two protocols (p < 0.05). In addition, Ss+Lc resulted in significantly deeper lesions (137.5 µm), followed by Sm (84.1 µm) and Sm (54.9 µm) for 1 hour using 0.1 M Rhodamine-B with a pH of 7.2 and observed under a confocal laser scanning microscope. Micropermeability was determined using a He-Ne laser (514 nm wavelength captured) which determined the amount of rhodamine present in the margins of the restored site of the enamel and root dentin. Microhardness was observed on the enamel and root dentin around the restored site.

Results: Using statistical analysis, a significance between the enamel and root dentin was found (p = 0.024). It was determined that significantly more micropermeability existed in the restored using Ketac Molar than Surefil One (p = 0.009). No significance was found between the other materials (p > 0.05). A significant difference was observed between the root dentin and the enamel for microhardness (p = 0.001).

Conclusion: The hybrid restorative material had the best marginal sealing.

72. Microhardness and Micropermeability Evaluation of (Glass-ionomer) Restorative Materials

Madeleine Reed1, E. Teixeira1, A. Leme-Kraus2
1University of Iowa, Iowa City, IA

Objective: To evaluate the effectiveness of restorative materials in acidic environments the material’s micropermeability and hardness of the surrounding dentin and enamel were measured.

Methods: Sound teeth were collected, and two cavity preparations were completed on the lingual and buccal side of each tooth in the cervical region. Each cavity preparation was filled with one of the corresponding materials: DeltaFill, Equia Forte HT, Ketac Molar Quick, Surefil one, and Scotchbond Universal Plus + Filtek Bulk Fill. Each tooth was then cut into two, nail polish was applied leaving 2 mm around the restored area exposed. For every tooth, one half would undergo a 7-day pH cycling procedure (6 hours demineralization solution and 18 hours remineralization solution) while the other half was placed in the remineralization solution for the same time at 37°C. Each half was then cut, embedded in epoxy resin, and polished using SiC abrasive papers #320, 600, 800, and 1200. The specimens were stained for 1 hour using 5% acetic acid with a pH of 4.5 and observed under a confocal laser scanning microscope. Micropermeability was determined using a He-Ne laser (514 nm wavelength captured) which determined the amount of rhodamine present in the margins of the restored site of the enamel and root dentin. Microhardness was observed on the enamel and root dentin around the restored site.

Results: Using statistical analysis, a significance between the enamel and root dentin was found (p = 0.024). It was determined that significantly more micropermeability existed in the restored using Ketac Molar than Surefil One (p = 0.009). No significance was found between the other materials (p > 0.05). A significant difference was observed between the root dentin and the enamel for microhardness (p = 0.001).

Conclusion: The hybrid restorative material had the best marginal sealing.

73. Differences in Acid-Tolerant Bacteria and C. albicans in Children

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1University of Iowa, Iowa City, IA

Objective: Dental caries is known to be a multifactorial disease. Recent studies have suggested a role for acid tolerant bacterial strains, as well as a role for Candida albicans in the development of early childhood caries (ECC). Statistical differences are typically evident when comparing caries and caries-free populations. But caries risk assessment is best carried out at the level of the individual. The purpose of this study was to compare the recoveries of: 1) mutans streptococci (MS), 2) C. albicans, and 3) acid-tolerant strains between toddlers with caries and age and gender matched caries-free toddlers, and to evaluate the data both collectively and individually. These microbial measures have previously been found to become evident/elevated 12 to 18 months before a caries diagnosis.

Methods: Twenty four subjects under 48 months of age were recruited to participate in this study. Dental plaque samples were collected with a sterile cotton-tipped applicator over the coronal surfaces. Plaque samples were then cultured Anaerobic Blood Agar for determination of the total cultivable count, on SB20 agar for the quantification of MS, on CHROMagar Candida for the quantification of Candida species, and on Acid Agar (pH 5.0) for the quantification of acid tolerant strains.

Results: Collectively, children with caries had higher proportions of C. albicans, and statistically higher levels of MS and acid-tolerant strains than did children without caries. At the individual level, all 12 toddlers with caries had detectable C. albicans, MS at ≥ 0.01% of the total count, and/or an acid tolerant recovery of ≥ 1% of the total count, whereas only 5 of 12 caries-free subjects met at least one of these criteria.

Conclusion: Current caries risk assessment is better at predicting future health than future caries. A focus on multiple microbiological measures may improve the sensitivity of caries risk assessment.
The holistic approach of the team encompasses the entire spectrum of oral cavity cancer research, including microenvironmental and genetic predispositions and causes of oral cavity cancer, and its prevention, detection, diagnosis, prognosis, treatment, and recovery. This approach always started with the end point of improving patient outcomes in mind.

In February 2021, the University of Iowa awarded the OCP a $600,000 grant to further develop the infrastructure, develop preliminary research data as part of the program, and prepare to apply for a Specialized Program of Research Excellence Grant from the National Institutes of Health.

"I am so proud of what our team has accomplished already, but the future of the oral cancer program is even brighter as Iowa is poised to be an international and national leader in oral cavity cancer research due to the team's extraordinary work over the last four years," Xie exclaimed with pride.

"These companies not only provide valuable funds and equipment to support research, but they also align with the research team interests and ultimate goals."

Universities provide a strong statement in industry-university partnerships. An independent expert in the field conducting their analysis using a new technology ensures that a business's profit-motive is autonomous of the research findings. This process provides good scientific evidence and helps establish public trust in the quality of a new technology element.

However, this process depends primarily on the integrity and expertise of the liberated researcher. SONDENDO approached Dr. Teixeira and his team precisely for these reasons.

"It is paramount that researchers maintain their autonomy from external sponsors," Teixeira said, "since it protects both the integrity of the researcher and the reputation of the company."

Unfortunately, this process began just as the COVID-19 pandemic hit early 2020. As a result, the research project experienced several delays and is still developing a sufficiently large patient pool to complete the study.

Teixeira's team includes statisticians Xian Jin Xie and Carissa Comnick, Sara Miller as clinic coordinator, and endodontics residents and faculty using the technology at the endodontic clinic.

Teixeira said, "I am fortunate to have worked with such wonderful people on this project, notably Sara Miller, Ann Lawler, Sharon Seydel and Carissa Comnick. We are very enthusiastic about this translational research opportunity."

Oral Cancer Program ...continued from page 4

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