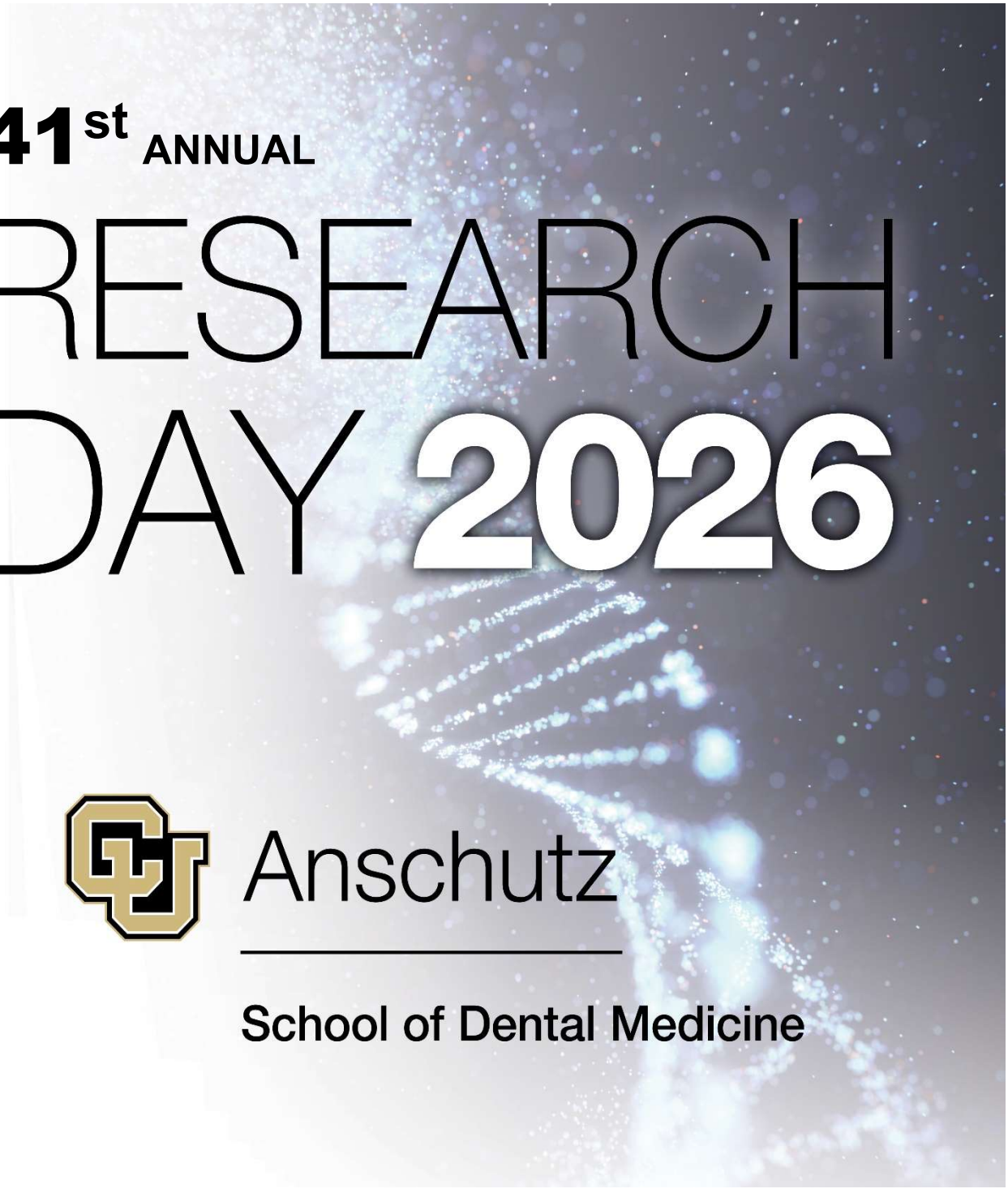

41st ANNUAL RESEARCH DAY 2026

Anschutz

School of Dental Medicine

Friday, February 27, 2026

9 a.m. - 4:30 p.m.

Anschutz Health Sciences Building, Elliman Conference Hall

Anschutz Medical Campus

University of Colorado
Anschutz

School of Dental Medicine

41st Annual Research Day

February 27, 2026
Elliman Conference Hall, CU Anschutz

8:00-8:30	Poster check-in
8:30-8:50	Participant & Judges briefing
9:00-9:30	Poster Preview
9:30-11:30	Poster Judging
11:45-1:00	Lunch
1:00-1:05	Dr. Stansbury – Welcome
1:05-1:10	Dean Kassebaum
1:10-2:15	Keynote Speaker, Samantha Brugmann, PhD "Dissecting ciliopathies: From molecular mechanism to potential treatments"
2:15-2:25	Comfort break
2:25-2:50	Nisali Piyasena, BS, DDS Candidate 2027 and Mason Gueller, BS, DDS Candidate 2029 "The Antimicrobial Effects of Acrylated Hydroxyazobenzene Copolymers"
2:50-3:15	Grace Gustafson, BS "A developmental buffering mechanism of initiation codon mutations"
3:15-3:40	Maria Campana, PhD "PDGFRa/b heterodimer activation negatively affects downstream ERK1/2 signaling and cellular proliferation"
3:40-4:05	Shahbaz Katebzadeh, DMD, MS, ABPD Diplomate "Healthy lungs, Healthy Smiles: Where Airway Care Meets Oral Care"
4:05-4:25	Awards and Recognition

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SPEAKER BIOGRAPHIES

41st Annual SDM Research Day 2026

KEYNOTE SPEAKER

Samantha A. Brugmann, PhD

Professor, Division of Developmental Biology, Department of Pediatrics, Cincinnati Children's Hospital Medical Center

"Dissecting ciliopathies: From molecular mechanism to potential treatments"

Dr. Samantha Brugmann is a developmental biologist studying craniofacial development and disease. Her long-term goal is to help children with craniofacial anomalies by generating tissue amenable for surgical repair. To achieve this goal, her lab specifically focuses on the role the primary cilium during craniofacial development and the craniofacial anomalies that arise when the cilium do not function properly. Projects in her lab utilize avian, murine and human-induced pluripotent stem cells to gain a better understanding of the molecular mechanisms associated with craniofacial anomalies. In addition to using existing animal models to understand human craniofacial disorders, her lab also sequences patients and generates cell-based models to uncover novel genetic causes for craniofacial ciliopathies.

Dr. Brugmann will provide an overview of new knowledge in craniofacial and ciliary biology; and the introduction to specific skills and techniques related to craniofacial research. Her talk will describe the role of the cellular organelle; the primary cilium, during craniofacial development. It will focus on molecular readouts and address possible modes of treatment for diseases caused by aberrant primary cilia.

PROGRAM SPEAKERS

“The Antimicrobial Effects of Acrylated Hydroxyazobenzene Copolymers”

Nisali Piyasena, BS, DDS Candidate 2027

Nisali graduated from the University of New Mexico in 2023 with a B.S. in Chemistry, where her research-focused curriculum enabled her to work in two laboratories during her undergraduate education. She conducted computational chemistry and molecular dynamics studies of the PICK1 protein to better understand its role in various disorders, including substance use disorder, under the direction of Dr. Yi He. She also participated in molecular biology research on Ribosomally synthesized and Post-translationally modified Peptides (RiPPs), natural products with diverse functions, including antibiotic activity, under the direction of Dr. Mark Walker. Now a third-year dental student, Nisali has spent the past two years contributing to the development and clinical incorporation of AHA copolymers, under the direction of Drs. Devatha Nair and Michael Schurr. In addition to her research involvement, she serves as Vice President of the CUSDM Research Group and currently leads a flagship project supported by CUSDM aimed at addressing the significant dental shortage in New Mexico, reflecting her commitment to advancing the field of dentistry through research, leadership, and service.

Mason Gueller, BS,

DDS Candidate 2029

Mason Gueller is a first-year dental student at the University of Colorado School of Dental Medicine. He graduated from Brigham Young University in 2024 with a BS in Microbiology and has always had a strong interest in the bacteria that positively and negatively affect the human body. Working for two years as a pharmacy technician and three as a dental assistant, Mason has experience in different facets of the healthcare world and is interested in learning more about the human body through his studies at dental school. He has been a part of Drs. Devatha Nair and Michael Schurr laboratories since June 2025 and primarily focuses on how Acrylated Hydroxyazobenzene affects the oral microbiome of denture patients.

Grace Gustafson, BS,
Graduate Research Assistant

“A developmental buffering mechanism of initiation codon mutations”

Grace Gustafson is a current PhD candidate in the Molecular Biology program at the University of Colorado Anschutz in the laboratory of Dr. James Nichols studying genetic buffering mechanisms in craniofacial development. She began her undergraduate training at Rensselaer Polytechnic Institute, where she studied bioenergetics and biochemistry of aerobic and anaerobic bacteria. She then completed her undergraduate studies at Arizona State University while working in the laboratory of Dr. Rozalyn Anderson at the University of Wisconsin-Madison. Here she contributed to a study showing a molecular link between sarcopenia prevention and caloric restriction in aged rhesus macaques as well as a study of circulating lipids and their capacity to predict metabolic syndrome in aged rhesus macaques among other projects. Ms. Gustafson’s PhD work in the Nichols laboratory, has moved into the field of craniofacial development, and harnessing molecular techniques to understand how some mutants can be phenotypically buffered. A start codon mutant in the zebrafish *mef2ca* gene, a key player in lower jaw development, has a shockingly mild craniofacial phenotype compared to a full knock-out. Her thesis project utilizes biochemical techniques to uncover RNA and protein mechanisms that allow for this partially rescued function. Ms. Gustafson’s research is funded through the National Science Foundation Graduate Research Fellowship that was she awarded in 2024.

Maria Campana, PhD

Postdoctoral Fellow

“PDGFRa/b heterodimer activation negatively affects downstream ERK1/2 signaling and cellular proliferation”

I am a biochemist specializing in enzymatic membrane proteins, with interdisciplinary training in chemistry, biochemistry, and molecular biology. My research career began at Florida International University studying the sequence specificity of mung bean nuclease, followed by a master’s degree at St. John’s University developing rapid separation techniques for impure compounds and designing luminescent osmium complexes for polyanion detection. For my Ph.D. at Syracuse University, I defined the structural and catalytic features of the membrane-bound enzyme ghrelin O-acyltransferase (GOAT), creating the first high-resolution structural model of GOAT, identifying critical residues for enzyme function, and generating fluorescent ghrelin-mimetic inhibitors that illuminated novel substrate interactions and unexpected subcellular localization. As a postdoctoral fellow in the Fantauzzo laboratory at the University of Colorado Anschutz, I have expanded my expertise to receptor tyrosine kinases, developing tools Visualize and purify PDGFRα/β heterodimers and investigating their activation, trafficking, and interacting partners in vitro. Supported by expert mentors in craniofacial biology and cell trafficking, my work integrates biochemical, structural, and cell-biological approaches and positions me to pursue an independent research career focused on the function and regulation of enzymatic membrane proteins. Dr. Campana is the principal investigator of a Postdoctoral Individual National Research Service Award (F32) grant from the National Institute of Dental and Craniofacial Research.

Shahbaz Katebzadeh, DMD, MS, ABPD Diplomate

Clinical Assistant Professor, Children's Hospital Colorado and School of Dental Medicine, University of Colorado Anschutz Medical Campus

"Healthy Lungs, Healthy Smiles: Where Airway Care Meets Oral Care"

Dr. Shahbaz "Boz" Katebzadeh is a Clinical Assistant Professor of Pediatric Dentistry at Children's Hospital Colorado and the University of Colorado School of Dental Medicine. He provides comprehensive hospital-based dental care for medically complex children. His journey in pediatric dentistry has been deeply rooted in a passion for leadership, research, innovation, and the persistence for excellence. Dr. Boz has proven track record in both preclinical and clinical sponsored research. He has authored and co-authored numerous publications in peer reviewed journals. Currently, Dr. Boz is principal investigator on two research studies. The first is entitled *"Assessment of Use and Efficacy of Artificial Intelligence while Preparing for American Board of Pediatric Dentistry Certification: A Mixed Methods study.* His second study and presentation today will be on *Healthy Lungs, Healthy Smiles (HLHS)* study, funded through his **American Board of Pediatric Dentistry Sue Seale Award**, which examines interdisciplinary oral health assessment and oral dysbiosis in children on long-term airway support. His research focuses on the oral–lung axis, microbial diversity, developmental anomalies, and improving integrated care models that bridge dentistry with pediatric subspecialties to enhance outcomes for vulnerable populations.

POSTER SESSION

DDS/ISP Dental Student Abstracts

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Cross-Talk Between Oral Biofilms and Vascular Plaque Inflammation

Authors: **Syed Hanan Rufai,** Bruce A. Dye, Devatha P. Nair

Background: Dental plaque-induced periodontitis and atherosclerotic cardiovascular disease are chronic inflammatory conditions traditionally studied independently. Emerging literature suggests overlapping compositional, inflammatory, and mineralization pathways between oral biofilms and arterial plaques, warranting integrated evaluation of shared biological mechanisms.

Aim: To evaluate compositional, microbial, and inflammatory similarities between dental plaque and arterial atherosclerotic plaque through analysis of existing studies.

Methods: An integrative literature review was conducted using PubMed, The New England Journal of Medicine, The Lancet and reference list screening. Eligible studies included biochemical, histologic, imaging, spectroscopic, and molecular analyses of human arterial plaques, as well as clinical studies assessing periodontal pathogens in vascular tissues. Outcomes assessed included plaque composition (lipid, collagen, mineral content), detection frequency of periodontal pathogens, and inflammatory marker expression. Descriptive statistics were used to summarize pathogen detection rates and outcome frequencies across studies.

Results: Across included studies, lipid-rich cores, collagenous extracellular matrix, inflammatory macrophages, and calcium phosphate mineralization were consistently identified in arterial plaques. Periodontal pathogens, particularly *Porphyromonas gingivalis*, *Tannerella forsythia*, and *Treponema denticola*, were detected in approximately 30–60% of arterial plaque samples in studies employing nested PCR, compared with ≤ 20% using conventional PCR, indicating method-dependent detection differences. Inflammatory mediators (IL-1β, IL-6, TNF-α) and matrix metalloproteinases were reported in both dental and arterial plaques. Considerable heterogeneity existed, with some studies reporting absence of oral pathogens despite advanced periodontal disease.

Conclusion: Dental and arterial plaques demonstrate shared compositional and inflammatory features, including lipid accumulation, mineralization, and immune activation. Detection of periodontal pathogens in arterial plaques is variable and influenced by methodology. Findings support biological parallels between oral and vascular plaque pathology without establishing causality.

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Advancing Prosthodontics: Multi-Material 3D Printing for Durable Dentures

Authors: **Christian Hansen,** Anna Gartner, Jeffrey Stansbury

Introduction: Digital dentistry has driven interest in 3D-printed dentures, yet PMMA-based resins still suffer from low flexibility, poor fracture toughness, and minimum thickness requirements. We developed urethane-based resins designed to improve mechanical properties via non-covalent interactions. These formulations are compatible with vat photopolymerization and multi-material inkjet printing and have shown efficient, high-performance denture fabrication.

Over 44 million Americans rely on dentures. Studies of denture wearers show major complaints regarding poor fit, frequent repair, and dissatisfaction with denture function.

Aim: Our goal is to develop denture materials that are both cost-effective and superior to PMMA in performance.

Methods: Resins were synthesized using a 1:1 molar ratio of urethane to acid functional groups and monomers. Test bars (2×2×20 mm) were photopolymerized under 365 nm light, achieving 92% conversion (FT-IR). Post-curing was performed at 80 °C under dual 365/405 nm light. Mechanical testing included flexural strength, modulus, and toughness via three-point bending. Additional samples were immersed in 37 °C water for 48 hours to simulate oral conditions.

Results: These formulations are capable of non-covalent bonding between a given acid with their urethane functional group. This allowed for control of hydrophobicity within the crosslinking network formed by cured resins. Most analog PMMA dentures as well as vat-printed digital dentures have brittle properties, however, addition of a small amount of an oligomeric urethane dramatically toughened dentures to the point that they are effectively unbreakable.

Conclusion: High-performance urethane-based monomers show great promise for denture base and tooth applications. We have demonstrated that they can be processed by both single-step inkjet printing and two-step DLP printing. These methods can lower production cost as well as improve accessibility and clinical performance. Further research is needed to refine formulations, especially to meet the demands of the oral environment where moisture is unavoidable.

Funding Source: NIH/NIDCR (R21DE032797/Stansbury) and the University of Colorado Anschutz Acceleration Initiative (AAI-2406)

Category: DDS/ISP Dental Student at the CU School of Dental Medicine

Title: Solitary Median Maxillary Central Incisor: A Pediatric Case with a 12-Year Follow-Up.

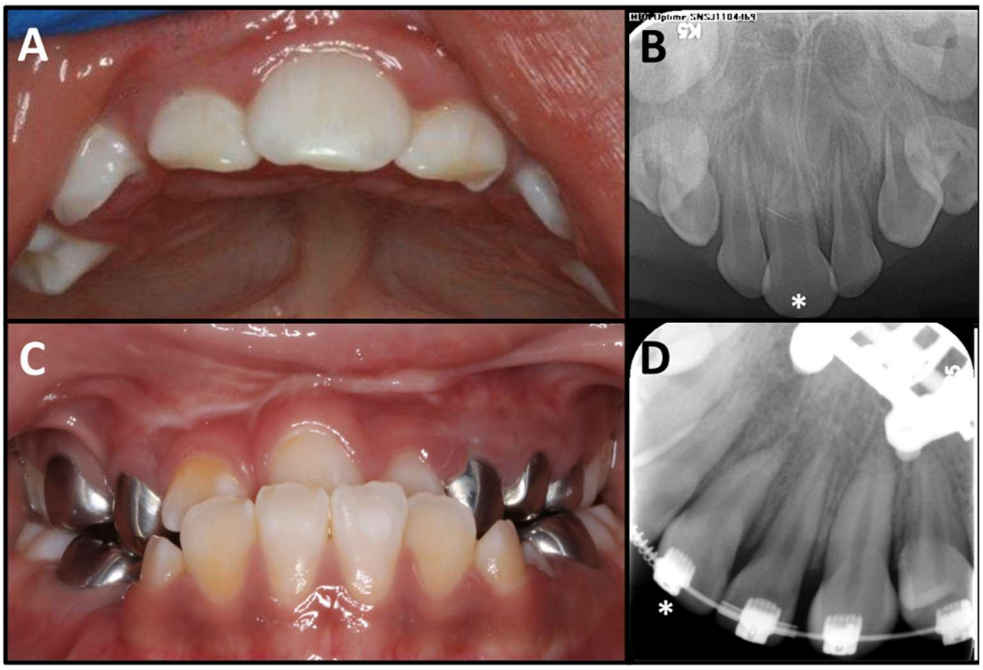
Authors: Shahbaz Katebzadeh, DMD, MS1; Andrew Bigelow, BS2; **Jaelynn Florence, BS2**; Anne R. Wilson, DDS, MS1; Catherine Flaitz, DDS, MS.3; Chaitanya Puranik, BDS, MS, MDentSci, PhD1

Abstract: Solitary median maxillary central incisor (SMMCI) syndrome features multiple developmental anomalies in the midline of the head and body with autosomal dominant inheritance. In the cephalic region, the maxilla, cranial bones and nasal structures can be affected, with a unique dental anomaly described as an SMMCI in both the primary and permanent dentitions. The dental anomaly may also occur as an isolated finding on the spectrum of holoprosencephaly. Other body anomalies include organ malformations and short stature. This report describes a Hispanic female followed from infancy through adolescence with SMMCI, with structural and organ anomalies, including choanal atresia, pyriform aperture stenosis, and short stature. There was a history of in-utero methimazole exposure for maternal management of hyperthyroidism. Dental findings included a single median maxillary central incisor in the primary and permanent dentitions, symmetric alveolar ridges, anterior crossbite, lack of maxillary frenum and incisive papilla, and a prominent linear scar of the vestibule. The patient received orthodontic correction. This case reinforces the importance of reviewing maternal health during pregnancy and documenting all congenital anomalies when unusual dental anomalies, such as SMMCI, are identified to better understand potential contributing factors.

Background: Solitary median maxillary central incisor (SMMCI) is a rare developmental anomaly characterized by the presence of a single maxillary central incisor at the midline. It arises from disruption of midfacial development between the 35th and 38th days of gestation and may be associated with additional genetic mutations. It is important that SMMCI is recognized early on for appropriate long-term multidisciplinary care. The patient in this case study demonstrated congenital pyriform aperture stenosis and choanal atresia, both of which required surgical intervention during infancy. Cardiac anomalies and airway dysfunction were also identified. Classic dental features of SMMCI were also present, including absence of the incisive papilla, a V-shaped palate, and a symmetric single incisor crown.

Case: A Hispanic female followed from 15-months-old to 14-years-old. Her medical history included chronic lung disease due to prematurity, patent foramen ovale, functional heart murmur, persistent left superior vena cava, conductive hearing loss, and obstructive sleep apnea. Growth parameters were below the fifth percentile. At three months of age, she underwent nasal endoscopy with sublabial and transnasal repair of congenital pyriform aperture stenosis with stent placement. The well-healed sublabial incision was clinically relevant to early maxillary growth. At age two, genetic and metabolic evaluations revealed a maternal history of hyperthyroidism with

in utero methimazole exposure. Medical imaging conclusively ruled out holoprosencephaly. Oral examination revealed SMMCI with symmetrical alveolar ridges, a V-shaped palate, absence of the maxillary labial frenum and incisive papilla, a linear scar of the anterior vestibular mucosa, and extensive caries. The patient remains under multidisciplinary follow-up for craniofacial growth and orthodontic evaluation. Genetic evaluation to discern the etiology of the congenital anomalies excluded holoprosencephaly, although dental findings were not assessed.



Conclusion: This case is unique in that in utero exposure to methimazole was recognized with SMMCI but, the findings from this single case are not generalizable. This report underscores SMMCI as a potential diagnostic marker for broader midline and systemic anomalies. It also emphasizes the importance of early recognition and multidisciplinary management in patients with SMMCI.

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Viscosity Optimization of Acrylated Hydroxyazobenzene (AHA) Resins for 3D-Printed Denture Applications

Authors: Aesha Kothamdi, Humberto Escobedo, Devatha Nair, and Michael Schurr

Background & Aim: This study evaluates the viscosity of novel resin formulations for compatibility with inkjet-based 3D printing systems for denture fabrication. Acrylated hydroxyazobenzene (AHA) copolymers exhibit antimicrobial activity against *Streptococcus mutans*, a primary colonizer of denture biofilms that contributes to denture stomatitis and serves as a reservoir for systemic infections. *S. mutans* also works synergistically with *Candida albicans* to promote biofilm formation associated with inflammatory diseases, including infective endocarditis and atherosclerosis. Clinical translation of AHA-containing denture materials requires optimization of resin viscosity, a critical parameter influencing printability, extrusion consistency, and structural integrity.

Methods: Resin formulations containing 0%, 0.5%, and 2% AHA were prepared using a standardized inkjet 3D-printing resin base with 2 wt% benzoyl peroxide as the initiator. Samples were maintained at controlled temperatures (room temperature, 30 °C, and 50 °C). Viscosity measurements were obtained using a Brookfield rotational viscometer, with fifteen measurements collected per formulation to assess flow behavior and reproducibility. Infrared spectroscopy was used to evaluate acrylate conversion over time and assess premature polymerization.

Results: Incorporation of AHA increased resin viscosity compared to controls; however, viscosity remained consistent across increasing AHA concentrations, with all values falling within standard deviation. All formulations demonstrated viscosity ranges compatible with inkjet-based 3D printing.

Conclusions: All AHA-containing formulations exhibited viscosity ranges compatible with inkjet-based 3D printing. Increasing temperature produced predictable viscosity reductions while remaining stable within each temperature condition. Infrared spectroscopy revealed minimal acrylate conversion over time, indicating limited premature polymerization and supporting storage and processing stability. Future studies will evaluate the antimicrobial efficacy of printed AHA-containing materials to confirm functional retention after fabrication and post-processing, advancing clinical translation for denture applications.

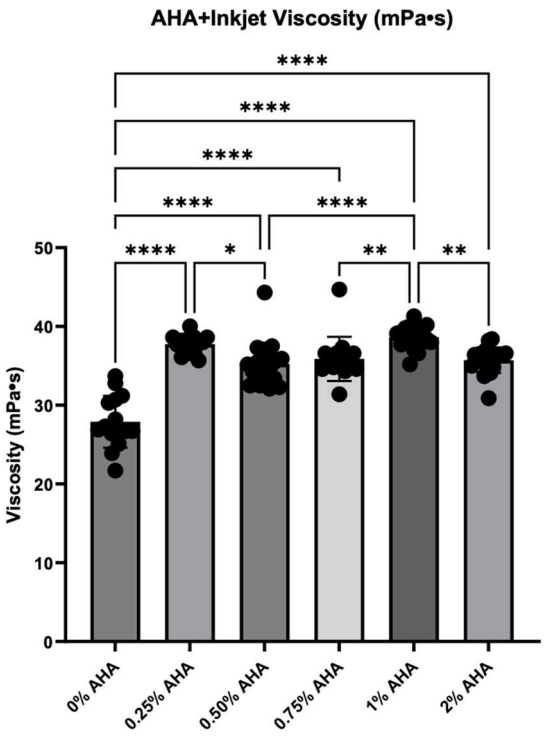


Figure 1. Viscosity of AHA-containing inkjet resin formulations (mPa·s).

Funding Source: University of Colorado Anschutz Acceleration Initiative (AAI-2406)

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Addressing Oral Health Disparities in New Mexico

Authors: **Nisali Piyasena,** Tanya Wright, DDS

Introduction: New Mexico faces a substantial shortage of dental providers, with numerous designated Health Professional Shortage Areas (HPSAs) and the absence of a four-year dental school. These disparities limit access to information and resources for younger generations, making it difficult to produce and retain New Mexican dentists.

Aim: This project aims to reduce these disparities by expanding access to dental education and mentorship, with the long-term goal of addressing the state's dental provider shortage.

Methods: Mentorship, presentations, and campus visits with New Mexican pre-dental undergraduate students to guide preparation for dental school - Oral health education and career outreach for elementary, middle, high school, and college students in underserved communities.

Results: The most impactful component of this project was the mentorship of more than 35 New Mexican pre-dental college students, eight of whom were admitted to dental schools during the 2024-2025 and 2025-2026 application cycles. Participants consistently identified limited access to resources, hands-on experiences, and mentorship as barriers to considering a dental career. The project received strong positive feedback for increasing accessibility to these critical supports. In addition, presentations educated and highlighted the importance of oral health and the need for dentists in their communities to more than 100 students, ranging from elementary school to college. Engagement was sustained through interactive presentations, demonstrations, and hands-on activities, thereby increasing interest in dentistry.

Conclusion: This project highlights substantial gaps in dental education, mentorship, and pre-dental resources in New Mexico, making it difficult to pursue dentistry. Bolstering educational outreach and providing targeted support for pre-dental students increases awareness, strengthens dental school preparation, and improves access to the profession. These efforts represent a meaningful step toward addressing New Mexico's shortage of dentists.

Funding Source: University of Colorado School of Dental Medicine Office of Student Affairs

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Changes in Dental Students' Empathy Levels

Authors: **Jordyn Bashore,** Mackenzie Korbel, Clare Houliston Kylee Wilhelm, Danielle Renaud, Clare Houliston, Dr. Jay Tippets, Dr. William McMunn, and Jennipher Murphy

Introduction: Affective, or emotional, empathy is the capacity to vicariously share the same sentiments with other individuals. Within dentistry, emotional empathy can help to build personal connections between patients and providers. However, it may also put providers at risk of experiencing distress and burnout, as they become affected by the negative experiences of their patients.

Objectives: This study seeks to evaluate changes in empathy levels among dental students as they progress through their graduate education.

Methods: The Toronto Empathy Questionnaire (TEQ) is administered to dental students to provide numerical data on empathy levels. The TEQ is administered to each dental school cohort every fall and spring semester for longitudinal analysis of empathy scores.The TEQ was chosen due to its evidence based validity and reliability as well as its ability to provide numerical data on empathy levels at a given point in time.

Results: There was no significant difference between the Class of 2026's average empathy scores in Spring 2024 (M=31.0), Fall 2024 (M=32.1), Spring 2025 (M=33.1), Fall 2025 (M=32.4), and Spring 2026 (M=31.5), p=0.10. The Class of 2026 initially consisted of 102 respondents, but this number decreased to 18 across five data collection points. There was no significant difference between the Class of 2027's average empathy scores in Fall 2024 (M=31.8), Spring 2025 (M=32.3), and Fall 2025 (M=31.8), p=0.696. The Class of 2027's response count dropped from 69 to 39 respondents over three data collection points. There was no significant difference between the Class of 2028's average empathy scores in Spring 2025 (M=31.3), Fall 2025 (M=31.6), and Spring 2026 (M=31.5), p=0.80. There was no significant difference between the Class of 2029's average empathy scores in Spring 2026 (M=31.7) and Fall 2025 (M=31.7), p=0.47.

Conclusion: As students progress through their dental school education, empathy levels may significantly change over time. Longitudinal analysis is conducted through continued data collection every fall and spring semester in each cohort. Response rates vary due to the voluntary nature of our research collection and our commitment to maintaining data integrity. A decrease in response rate may provide insight into burnout and a decrease in emotional empathy. We began a related study to obtain situational-based data regarding students' emotional empathy and burnout.

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: Material Development for Direct 3D-Printed Orthodontic Aligners: Mechanical Characterization

Authors: **Christine Teleaga**, Austyn Salazar, Anna Gartner, Dr. Liu, Dr. Stansbury

Introduction: Clear aligner therapy has become a widely adopted orthodontic technique due to its comfort and aesthetic advantages, yet conventional fabrication relies on thermoplastic sheets formed over 3D printed models, a process that introduces dimensional inaccuracies affecting aligner thickness, force delivery, and treatment outcomes. The multi-step manufacturing process, which often requires outsourcing to external laboratories, also increases treatment time and cost. These limitations highlight the need for alternative approaches. Direct 3D printing of orthodontic aligners presents a promising solution, but for this approach to gain broad clinical application, property improvements are needed in the photocurable resins to enable predictable and controllable orthodontic forces.

Materials and Methods: Samples were formulated in a stoichiometric combination of acid and urethane monomers. Three-point bending tests were performed to assess flexural modulus, strength, work of fracture, and stress relaxation. Wet samples were kept at 37 °C for 48 hours to simulate the oral environment.

Results: Acid-reinforced urethane formulations exhibit properties within clinically relevant ranges, either meeting or exceeding previously reported aligner material properties (2 GPa modulus and 80-100 MPa strength). The combination of polycaprolactone (PCL) diol and triol methacrylates produced encouraging results with a modulus of 2.3 GPa and flexural strength at 134.6 MPa. Formulations based on urethane dimethacrylate (UDMA) + monourethane dimethacrylate (MUDMA) and hexaurethane trimethacrylate (HUTMA) were also tested, both dry and wet. While within the targeted range, the wet properties of these formulations are lower than the dry properties, prompting further work to reduce this discrepancy.

Conclusion: While current results support the practical approach of applying the acid-urethane materials for direct-print 3D aligners in clinical settings, the high cost of these monomers may limit widespread application. Ongoing research focuses on identifying a urethane monomer that balances mechanical performance with cost-effectiveness to further advance the development of direct-print orthodontic aligners for clinical use.

Formulation	Modulus (GPa)	Flexural Strength (MPa)
HUTMA+HEA-ITAN+20% MUDMA	4.88 (0.28)	148.2 (8.7)
HUTMA+HEA-ITAN+20% MUDMA wet	3.23 (0.32)	126.5 (11.1)
UDMA+MUDMA+HEA-ITAN+D3MA	3.34 (0.18)	124.1 (16.0)
UDMA+MUDMA+HEA-ITAN+D3MA wet	1.98 (2.29)	88.1 (2.8)
PTT+MAA	3.6 (0.20)	176.4 (13.8)
PTT/PDD (1:1) +MAA	2.3 (0.10)	134.6 (5.4)

Funding Source: NIH/NIDCR grant R21DE032797/Stansbury

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: The Role of Radiographic AI in Dental Education and Patient Communication

Authors: **Jack Nielsen**, Matthew Whiteley DMD, Jennipher Murphy, Benjamin Crockett DMD MS

Introduction: The University of Colorado School of Dental Medicine integrated Overjet artificial intelligence (AI) for radiographic analysis. While the software shows promise for diagnostic support, its specific impact on the educational environment and its efficacy as a visual tool for patient education require investigation.

Aims: The study aimed to evaluate the impact of AI on student self-assessment and determine the effect of AI visualization tools on patient communication and perceived case acceptance. .

Methods: A cross-sectional observational study utilizing a digital survey was distributed to faculty and students. The instrument used Likert-scale items to measure educational sentiment and communication efficacy, alongside qualitative open-ended questions.

Results: Participants indicated that AI visual annotations effectively enhance the ability to explain treatment needs to patients. Regarding education, respondents reported that comparing their own findings against the AI output helped them identify diagnostic patterns they might otherwise miss. However, general utilization of the software remained low, with nearly half of the participants reporting no use in the prior four months.

Conclusion: Overjet AI is perceived as a valuable asset for patient communication and a supportive tool for pattern recognition. However, its integration into routine clinical education is currently limited by low utilization rates.

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: User Trust, Ethical Considerations, and Technical Barriers of AI in Dentistry

Authors: **Mackenzie Korbel,** Matthew Whiteley DMD, Jennipher Murphy, Benjamin Crockett DMD MS

Introduction: As AI transitions from theoretical models to clinical application, user trust is closely tied to ethical considerations. Formal investigation is required to ensure AI enhances rather than replaces clinical judgment and to identify barriers to adoption.

Aims: This study aimed to measure user trust, identify ethical concerns regarding data misuse, and assess the perceived ease of use among faculty and students.

Methods: Faculty and students completed an anonymous digital survey. The instrument utilized Likert-scale items to quantify ethical concerns and technical impact, supplemented by qualitative feedback regarding software challenges.

Results: Participants recorded high levels of concern regarding ethical risks, specifically worrying that students might over-rely on AI at the expense of manual skills. There was also significant concern that insurance providers could utilize AI analysis to deny claims for necessary treatments. Qualitatively, users identified technical friction, such as bulky integration and the requirement for multiple logins, as a primary barrier to routine use.

Conclusion: Significant ethical concerns and technical hurdles currently hinder the full adoption of AI. Successful implementation requires addressing software efficiency and establishing clear pedagogical guiderails to prevent over-reliance.

Category: DDS/ISP Dental Student in the School of Dental Medicine

Title: A Pilot Curriculum in Facial Neuromodulators for Predoctoral Dental Students

Authors: William McMunn III DDS MD, **Matin Sanaei**, Riley Spillar, Micaela Gibbs DDS MHA, Jennifer Murphey MS Ed, Emanouela Carlson DDS

Introduction: With rising demand for minimally invasive peri-oral aesthetics, dentists-where permitted- are uniquely positioned to deliver facial neuromodulator therapy. Under the Colorado Dental Practice Act, recent provisions formalize dentists' scope in neuromodulator services. In response, CUSDM developed a pilot course for senior dental students integrated within the oral surgery curriculum. **Objectives:** This study seeks to evaluate changes in empathy levels among dental students as they progress through their graduate education.

Aim: This pilot aimed to engage senior dental students in facial neuromodulator therapy using active learning strategies, and to assess their perceptions regarding scope of practice, confidence, and future integration into clinical care. The course reinforced biomedical sciences (anatomy, embryology, pharmacology), while exploring student perceptions around scope of practice, patient expectations, and clinical readiness to provide these services. Active learning included a structured combination of didactic instruction, simulation, and live patient experiences.

Methods: The 12-hour training module included the below, all conducted under faculty supervision: • Didactic instruction (4 hours): Anatomy, pharmacology, patient selection, medico-legal considerations, and clinical protocols. • Simulation training (4 hours): Manikin-based practice to build technical confidence. • Live patient experience (4 hours): Injections and peer observation under faculty supervision. Student perceptions were measured via a 5-point Likert scale survey administered at three points: pre-course (baseline beliefs around scope, demand, interest); mid-course (perceptions after didactic and simulation components, including areas of improvement); and post-course (confidence, safety, readiness to integrate).

Results: Preliminary data indicate increased student confidence and perceived relevance of neuromodulator therapy. Simulation emerged as a pivotal component, bridging theory and practice. Students reported improved understanding of scope and ethical integration into dental care. Final data from the live patient session is forthcoming, but early feedback suggests growing readiness to offer these services.

Conclusion: This pilot demonstrates how structured, evidence-based training can shift student perceptions and prepare graduates to responsibly integrate neuromodulator therapy into dental practice. Grounded in ethics and patient-centered care, the module offers a scalable model for future CE and curricular innovation.

Graduate Student Abstracts

Category: Graduate students in labs at the School of Dental Medicine

Title: Identifying the subcellular compartment(s) that serves as the major signaling platform for PDGFR homodimers and heterodimers

Authors: Gabriela M. Padilla, Maria B. Campaña, Katherine A. Fantauzzo

Introduction/Background: Signaling through the platelet-derived growth factor receptor (PDGFR) family of receptor tyrosine kinases (RTKs) plays critical roles in craniofacial development in mammals. *PDGFRA* variants are associated with non-syndromic cleft/lip palate, while *PDGFRB* variants cause syndromes with craniofacial phenotypes, including Penttinen syndrome and Kosaki overgrowth syndrome. PDGFRa and PDGFRb can homodimerize or heterodimerize in response to PDGF ligand binding, unleashing an intracellular signaling cascade. We recently adapted a bimolecular fluorescence complementation (BiFC) approach that enabled us to visualize and purify individual PDGFR dimers *in vitro*, revealing differences in the timing and extent of dimer activation, signal molecule binding, internalization, trafficking and downstream signaling. Moreover, our results supported an emerging theme in the RTK field that these receptors signal at sites other than the plasma membrane and require internalization to maximally activate downstream signaling.

Aim: The aim of this study is to identify the subcellular compartment(s) that serves as the major signaling platform for the various PDGFR dimers.

Methods: We will employ the PDGFR-BiFC system using craniofacial-relevant primary mouse embryonic palatal mesenchyme (MEPM) cells derived from embryos in which the stop codon of the endogenous *Pdgfra* and/or *Pdgfrb* locus was replaced with a BiFC fragment(s).

Results: We have validated increased fluorescence intensity, colocalization of the BiFC signal with PDGFR proteins and phosphorylation of the receptors and downstream signaling proteins Akt and Erk1/2 upon PDGF ligand stimulation of PDGFR-BiFC primary MEPM cells.

Conclusion: Our studies will provide significant insight into the mechanisms underlying the spatial and temporal regulation of RTK signaling during mammalian craniofacial development.

Funding Source: NIH/NIDCR grants R01DE027689 (to K.A.F.) and K02DE028572 (to K.A.F.)

Category: Graduate students in labs at the School of Dental Medicine

Title: Characterizing the role of Akt-mediated phosphorylation of Srsf3 during mouse craniofacial development

Authors: Charles W. Griffin, Thomas E. Forman, Katherine A. Fantauzzo

Introduction/Background: Signaling through the platelet-derived growth factor receptor alpha (PDGFRa) is critical for craniofacial development in humans and mice. Mutations in *PDGFRA* are associated with cleft lip/palate in humans and *Pdgfra* mutant mouse models display facial clefting phenotypes. We showed that Akt phosphorylates the RNA-binding protein (RBP) serine/arginine-rich splicing factor 3 (Srsf3) downstream of PI3K-mediated PDGFRa signaling in mouse embryonic palatal mesenchyme (MEPM) cells, promoting Srsf3 nuclear translocation. We further demonstrated that ablation of *Srsf3* in the mouse neural crest cell (NCC) lineage leads to severe midline facial clefting, due to defective cranial NCC proliferation and survival.

Aim: The aim of this study is to assess the role(s) of Akt-mediated phosphorylation of Srsf3 during craniofacial development.

Methods: To identify proteins with decreased interaction with Srsf3 in response to PDGF-AA ligand stimulation of MEPM cells, we performed Srsf3 immunoprecipitation followed by mass spectrometry. Further, we generated an *Srsf3* phosphomutant knock-in allele ($Srsf3^{A7}$) by replacing the terminal serine residue in the seven Akt consensus motifs in Srsf3 with an alanine residue. To circumvent $Srsf3^{A7/A7}$ embryonic lethality, we generated transheterozygous $Srsf3^{A7/fl}$;$Wnt1\text{-}Cre^{+/Tg}$ embryos and separately introduced a $ROSA26^{mTmG}$ allele to examine NCC distribution.

Results: We identified and biochemically confirmed a significantly decreased interaction of Srsf3 with the RBP Rbm8a upon PDGF-AA ligand stimulation of MEPM cells. Further, we showed that $Srsf3^{A7/fl}$;$Wnt1\text{-}Cre^{+/Tg}$ embryos exhibit facial process hypoplasia and severe midline facial clefting at mid-gestation, with reduced GFP intensity in the facial processes at E9.5-E10.5.

Conclusion: Our findings highlight the requirement for RBP post-translational modification during craniofacial development.

Funding Source: NIH/NIDCR grants R01DE030864 (to K.A.F.) and F31DE032252 (to T.E.F.), NIH/NIGMS grant T32GM141742

Category: Graduate students in labs at the School of Dental Medicine

Title: Alternative RNA splicing of transcripts encoding protein serine/threonine kinases downstream of PDGFR signaling in the facial mesenchyme

Authors: Cassandra B. Minne, Brenna J.C. Dennison, Eric D. Larson, Katherine A. Fantauzzo

Introduction/Background: Craniofacial development is a complex morphogenetic process, disruptions in which result in highly prevalent human birth differences. Signaling through the platelet-derived growth factor receptors (PDGFRs) plays critical roles in this process in humans and mice.

Aim: The aim of this study is to identify the gene expression changes that mediate cellular activity downstream of PDGFR signaling.

Methods: We sequenced maxillary process mesenchyme RNA from E11.5 mouse embryos that lack *Pdgfra*, *Pdgfrb* or both in the neural crest lineage.

Results: DESeq2 analysis identified 23, 20 and 25 genes that were differentially expressed between *Pdgfra*$^{fl/fl}$*;Wnt1-Cre*$^{+/Tg}$, *Pdgfrb*$^{fl/fl}$*;Wnt1-Cre*$^{+/Tg}$ and *Pdgfra*$^{fl/fl}$*;Pdgfrb*$^{fl/fl}$*;Wnt1-Cre*$^{+/Tg}$ samples as compared to wild-type, respectively. In contrast, rMATS analysis detected over 5,000 differential alternative RNA splicing (AS) events per genotype compared to wild-type, with most events involving skipped exons. Gene ontology analysis of the genes encoding the transcripts in the skipped exon category of each genotype revealed an enrichment for protein serine/threonine (S/T) kinase activity functioning within the PI3K and/or MAPK signaling pathways. Alternatively-spliced transcript *Rps6ka3* encodes a protein S/T kinase (Rsk2) required for proper craniofacial development in humans and mice. We predict that increased inclusion of *Rps6ka3* exons 2 and 3 in *Pdgfra*$^{fl/fl}$*;Wnt1-Cre*$^{+/Tg}$ embryos will generate an upstream open reading frame that represses translation of the main coding sequence. Accordingly, Rsk2 protein levels are significantly reduced in *Pdgfra*$^{fl/fl}$*;Wnt1-Cre*$^{+/Tg}$ E11.5 facial process mesenchyme.

Conclusion: AS is the predominant mechanism of gene expression regulation downstream of PDGFR activity in the facial mesenchyme, serving to regulate intracellular signaling.

Funding Source: NIH/NIDCR grants R01DE027689 (to K.A.F.) and R01DE030864 (to K.A.F.), NIH/NIGMS grant T32GM136444.

Category: Graduate Students in labs at the School of Dental Medicine

Title: Variable paralog expression underlies heritable incomplete penetrance of craniofacial phenotypes

Authors: Abigail Mumme-Monheit, Nicole Moss, Nicole Costantino, Faith Frasier, and James T. Nichols

Introduction/Background: Many genetic craniofacial birth differences display incomplete penetrance, in which some individuals with a mutation display a phenotype, and others do not. However, mechanisms of incomplete penetrance remain elusive. Using a zebrafish model of the craniofacial disorder *MEF2C* Haploinsufficiency Syndrome, we developed a system to study heritable incomplete penetrance. Zebrafish *mef2ca* mutants can be selectively bred to drive craniofacial phenotype penetrance up or down, generating high- and low-penetrance strains. There are six highly conserved zebrafish *mef2* paralogs; yet *mef2ca* is the only paralog required for craniofacial development. We found that following selective breeding, expression of *mef2* paralogs is greater in the low-penetrance strain than the high-penetrance strain, and that there is standing variation in paralog expression in unselected wild types. We have evidence that there is also standing variation in DNA methylation among individuals which can be selected upon.

Aims: These findings motivate the hypothesis that heritable variation in DNA methylation, regulating compensatory paralog expression, underlies incomplete penetrance.

Methods: This work uses a range of genetic, transgenic, molecular, and transcriptomic techniques in the zebrafish system.

Results: Disabling these paralogs in addition to *mef2ca* loss, worsens *mef2ca* mutant-associated phenotypes, phenocopying the high-penetrance strain. Forcing *mef2* paralog expression in cells normally expressing *mef2ca* fully compensates for *mef2ca* loss by rescuing target gene expression, phenocopying the low-penetrance strain. New selective-breeding experiments evaluate differences in the genome, transcriptome, and methylome that segregate with penetrance.

Conclusion: These findings indicate that variable DNA methylation regulating compensatory paralog expression is a mechanism of incomplete penetrance observed in *MEF2C* Haploinsufficiency Syndrome and other craniofacial genetic disorders.

Funding Source: NSF GRFP 1938058 to AMM, NIH/NIDCR R01DE029193 to JTN

Category: Graduate Students in the labs at the School of Dental Medicine

Title: Multimaterial 3D-inkjet printed removable partial dentures will provide competitive material properties despite oxygen infiltration

Authors: **Dongjoon E. Choe**, Dr. Jeffrey Stansbury, Dr. Sean Keyser, Anna Gardner, Austyn Salazar

Objective: Removable partial dentures (RPDs) are utilized as prosthesis for missing teeth allowing for mastication function and presenting a full smile. However, conventional RPDs utilize metal clasps that lead to limitations such as an undesirable metal appearance, metal allergies, and temperature sensitivity. Therefore these limitations are addressed through non-metal clasp dentures (NMCDs) that utilize resin based clasps instead of metal. Two forms of NMCDs exist, thermoplastic NMCDs and thermoset NMCDs. This research focuses on the development of a thermoset NMCD material that provides better mechanical properties than the popularized thermoplastic NMCDs currently on the market. Additionally, this research focuses on materials that are capable of being printed from a 3D-multimaterial inkjet printer to allow for quicker production time, and lower overall cost for the patients.

Results: The resulting data has concluded that the best found formulations for thermoset materials provide desirable mechanical properties identified via a mechanical test system (MTS) configured for three-point bend testing. These mechanical properties approach 100 MPa of flexural strength, 2 GPa for modulus, and 10 MPa in toughness. Additional tests performed towards NMCD clasp elasticity include resistance towards stress relaxation, maintaining 80% of its form over 11 minutes, and a resilience of 68% to bounce back to its form after strain. Unfortunately due to the hydrophilic nature of acid-urethane polymers, many of the thermosets have experienced significant degradation in mechanical properties once submerged in 35°C water over 48 hours. As a solution, 5 wt% of oligomeric material was substituted into the formulation to combat the water absorption, resulting in improved modulus and toughness after water submersion. Additionally, these materials have shown a linear progression of mechanical properties as they transition between a lower modulus material to a higher modulus material. This provides an identifiable map of material ratios that should allow the printer to organize specific mechanical properties in different locations of the printed object.

Conclusion: For NMCDs, the studied thermoset materials have shown significantly better material properties than thermoplastic materials. Furthermore, these materials do not cause suffering from metal allergy, temperature sensitivity, or undesirable appearance as traditional RPDs have. The goal with this material is to print NMCDs utilizing a 3D-multimaterial inkjet printer that can transition between two distinct materials, allowing for a more flexible base, and very rigid teeth all in a singular print.

Funded by: University of Colorado Anschutz Acceleration Initiative (AAI-2406)

Category: Graduate Students in labs at the School of Dental Medicine

Title: Investigating the developmental origins of understudied median appendages

Author(s): Margaret Keating, Raelyn Begay, Grace Gustafson, Raisa Bailon-Zambrano, Lindsey Barske, James T. Nichols

Introduction/Background: Limb overgrowth and reduction differences such as polydactyly and amelia are relatively common. Many clinical cases of congenital limb differences still lack a definitive mechanistic diagnosis, highlighting a need for new insight The developmental origins of the evolutionarily ancient median appendages - dorsal, anal, and caudal fins - are often ignored, leaving large gaps in knowledge. Therefore, by studying the developmental origins of median fins, I will inform fundamental mechanisms of vertebrate appendage development from a largely unexplored angle. Two extraordinary zebrafish mutants with opposing phenotypes allow me to gain insight into the developmental genetics of median fins. Fish homozygous mutant for *eomesa,* a T-box transcription factor, lack dorsal fins and have reduced anal fins. Conversely, fish homozygous mutant for the paired box transcription factor *pax9* have remarkable ectopic anal to caudal fin skeleton.

Aims: Through mutant analysis, I will test the hypothesis that *eomesa* and *pax9* function opposingly in a linear pathway to specify cells to become median fin skeletal cells.

Methods: Hybridization chain reaction RNA fluorescent in situ hybridization, transgenes, skeletal preparations

Results: Double mutant analysis revealed that *pax9* is epistatic to *eomesa,* suggesting a simple linear pathway where *eomesa* represses *pax9* which in turn, represses cells from becoming median fins.

Conclusion: My work revealed a novel genetic interaction between *eomesa* and *pax9*. By studying the function of these genes, I will uncover mechanisms by which progenitor cells are specified to become median fins, informing fundamental mechanisms of appendage development.

Funding Source for research: 5T32GM141742-05

Category: Graduate Students in labs at the School of Dental Medicine

Title: *Gal4VP16*: The Serendipitous Discovery of a Decanalizing Transgene

Authors: Nicole T. Costantino, Grace E. Gustafson, James T. Nichols

Introduction/Background: Development tends to produce reproducible, wild-type structures despite genetic perturbation. Known as canalization, this phenomenon is widely observed but poorly understood. Some individuals are more canalized than others, likely accounting for phenotypic variation among mutant animals. We fortuitously discovered a “decanalizing transgene” that reproducibly breaks canalization in different developmental contexts. This tool provides a fresh inroad for understanding this widespread, mysterious phenomenon. A strength of the zebrafish system is live imaging with transgenic reporters. One popular modality is the Gal4VP16/UAS system in which the yeast-viral chimeric protein, Gal4VP16, is driven in the tissue to be studied using regulatory sequences. In turn, Gal4VP16 transcriptionally activates whatever transgene is placed downstream of UAS sequences.

Aims: We aim to understand how the Gal4VP16 transgene unexpectedly disrupts developmental canalization and to elucidate the molecular mechanisms underlying this decanalizing effect. First, we aim to uncover if the transactivation domain of Gal4VP16 cell autonomously titrates TATA-box binding protein (Tbp). Then, we aim to determine if Gal4VP16 squelches chaperone expression.

Methods: In a previous study, we introduced a Gal4VP16 transgene expressed in cranial neural crest cells into *fras1* mutant zebrafish to study craniofacial phenotypes. Transgene dosage, integration site, regulatory sequences, and coding regions were systematically evaluated to understand the requirements for decanalization. Bulk RNA-sequencing was performed to determine transcriptional changes between transgenic animals and non-transgenic siblings. These data were interpreted in the context of known molecular interactions between Gal4VP16 and general transcriptional machinery.

Results: We initially discovered that *fras1*-associated phenotypes became more highly penetrant in transgenic mutants compared with non-transgenic siblings. Wild-type siblings were overtly unaffected by the transgene; thus we reasoned that this transgene was perturbing canalization or disrupting the mechanisms that keep development on track in mutants.

We published that this effect was dose-dependent, did not involve the UAS sequences, needed stable transgene integration, but that integration site did not matter. More recently, we published that this transgene also decanalizes phenotypes associated with a different craniofacial mutant, *mef2ca*. In new work, we determined that the Gal4VP16 coding region is required for decanalization while the regulatory sequences have no effect. Preliminary evidence suggests that the effect is autonomous to the cells where the mutant gene functions and that mutants affecting other developmental processes, specifically fin development, are also sensitive to Gal4VP16 decanalization. We performed bulk RNA-sequencing, finding that chaperone encoding genes are

downregulated in transgenic animals compared with sibling controls. Previous studies in yeast and mammalian cell culture demonstrate that Gal4VP16 protein physically interacts with the TATA-box binding protein “squelching” its transcriptional activity. We are currently testing a model where Gal4VP16 decanalizes development by sequestering the TATA-box binding protein resulting in downregulation of molecular chaperones which function to produce reproducible, wild-type structures despite genetic perturbation.

Conclusion: By exploring the still mysterious mechanisms of canalization from this exciting new angle, this work will yield insights into the molecular basis of buffering by utilizing this powerful tool.

Funding Source for research: NIH R01DE029193; NIH R01DE030448; NSF 2439026

Category: Graduate Students in labs at the School of Dental Medicine

Title: The alx gene family confers identity to frontonasal cranial neural crest cells

Author(s): Nadia Wright, Jennyfer M. Mitchell, Abigail Mumme-Monheit, Raisa Bailon-Zambrano, Colette Dolby, Kent Riemondy, Daniel M. Medeiros and James T. Nichols

Background: The midface arises from a distinct population of cranial neural crest cells (CNCCs) located anterior to the segmented pharyngeal arches, yet the mechanisms that establish and maintain their unique identity remain poorly understood. Mutations in human ALX genes cause frontonasal dysplasia, a severe congenital midfacial disorder. In zebrafish, *alx* genes are strongly expressed in frontonasal CNCCs, and loss of *alx* function results in dramatic craniofacial defects accompanied by ectopic expression of pharyngeal arch–associated genes, suggesting that *alx* may suppress pharyngeal arch identity in the frontonasal domain.

Aims: To determine whether *alx* establishes frontonasal identity through cell-autonomous regulation of cranial neural crest cells and to define the molecular mechanisms by which *alx* distinguishes the frontonasal domain from pharyngeal arch one.

Methods: Cell autonomy will be assessed by analyzing tendon and muscle patterning following *alx* loss and by testing whether transplantation of wild-type CNCCs rescues mutant phenotypes in non–neural crest–derived tissues. Single-cell RNA sequencing will identify transcriptomic identity changes in CNCCs and neighboring cell types in severe *alx* combinatorial mutants. Alx3 genomic binding sites will be mapped using ChIP-seq, and heat shock experiments will test whether *alx* is sufficient to impose frontonasal identity when ectopically expressed in pharyngeal arch one.

Results: These approaches are expected to determine whether *alx* regulates frontonasal identity cell autonomously in CNCCs and to identify direct Alx3 targets that distinguish frontonasal and pharyngeal arch identities.

Conclusion: These studies will provide mechanistic insight into how *alx* genes pattern the anterior-most craniofacial region. By defining the developmental origins of ALX-associated midfacial malformations, this work will advance our understanding of craniofacial development and frontonasal dysplasia.

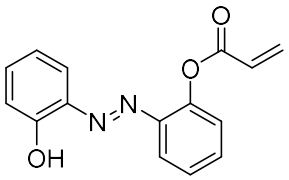
Funding Source for research: NIH NIDCR 5R01DE030448

Postdocs & Residents Abstracts

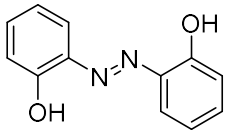
Category: Postdoctoral Fellows and Residents, CU School of Dental Medicine

Title: Cost Reduction in Research for Antibacterial Dental Coating

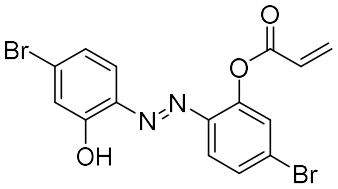
Authors: Sean Norris, PhD., Devatha Nair, PhD.



Acrylated Hydroxy Azobenzene
AHA



2,2'-Dihydroxyazobenzene
OH-Azo



Brominated Acrylated Hydroxy Azobenzene
Br-AHA

Purpose: Chemical costs can limit the ability for a lab to do continued work due to financial constraints. Acrylated hydroxy azobenzene (**AHA)** has been shown to be an antibacterial coating in denture materials that helps balance the oral microbiome. This molecule has an added advantage of light-based optomechanical properties that can break apart biofilms and reduce antibacterial resistance. The core starting material of this project, dihydroxy azobenzene (**OH-Azo**), costs about $100/g, which greatly limits the ability to investigate all aspects of the final product; each reaction that may fail or have poor yields costs enough that it becomes a hurdle to justify. In order to continue and expand research into the mechanism and further reactivity, the cost of the core **OH-Azo** needed to be synthesized at a much lower cost.

Methods: Literature searches, chemical synthesis knowledge, and cost analysis guided the project to synthesize the **OH-Azo** core through a low-cost, though low-yielding, reaction. The reaction allows homocoupling of anilines to form azobenzenes. To investigate different properties of similarly acrylated azobenzenes and check the viability of the reaction to other starting materials, a brominated acrylated hydroxy azobenzene (**BrAHA)** was synthesized and is being further investigated for similar properties.

Conclusion: This is a step forward for combating antibacterial resistance as well as ensuring that research into these molecules continues. This project highlights how high-cost materials can negatively impact research and future goals.

Funding Source: University of Colorado Anschutz Acceleration Initiative grant (AAI2406),

Category: Postdoctoral Fellows and Residents in the School of Dental Medicine

Title: Antimicrobial Additives to Combat Microbial Growth on Denture-Base Materials

Authors: H. Escobedo, S. Lopez, J. Stansbury, M. Schurr, D. Nair

Background: Denture stomatitis is driven by poor hygiene & synergistic C. albicans–S. mutans biofilms, highlighting the need for materials with built-in antibacterial & antifungal activity. Prior work in our labs showed that polymerized acrylated hydroxy azobenzene (AHA) can remove biofilms via light-induced motion and selectively inhibits S. mutans. Catechol and eugenol have broad antimicrobial potential. This work evaluates AHA combined with catechol or eugenol in denture resins to target both organisms.

Method: Denture resins (bisphenol A-glycidyl methacrylate and triethylene glycol dimethacrylate, 70:30wt%) with 1wt% azobisisobutyronitrile were modified with 0.5wt% AHA with or without 0.25–2 wt% eugenol or dopamine acrylamide and polymerized at 80°C in 0.8mm x 6.5mm spacers. Samples tested in S. mutans on agar (1×10^5 CFU/mL, 24h, 37°C, 5% CO2) were measured for inhibition zones and in growth curves for C. albicans (10^6 CFU) and S. mutans (10^5 CFU) tracked over 0–6h. Cytocompatibility was assessed via MTT using direct contact with L929 murine fibroblasts. Number of samples $n\geq3$. Result C. albicans and S. mutans growth varies depending on formulations. AHA+catechol increased S. mutans inhibition zones up to 40% while AHA+eugenol up to 20%. AHA+catechol also accelerated S. mutans growth suppression relative to either component alone. No significant effects were observed on C. albicans. L929 metabolic activity remained unchanged ($p>0.05$) for formulations containing up to 0.5wt% AHA and 2wt% catechol.

Conclusion: AHA+catechol denture formulations show strong potential to enhance S. mutans inhibition and may weaken its synergy with C. albicans in denture-related stomatitis. The next phase of this work will evaluate these formulations suppression on C. albicans yeast to hyphae transition and disrupt dual-species biofilms under dark and light-induced condition.

Funding Source: National Institute of Dental and Craniofacial Research (R21DE032135/Nair) and the University of Colorado Anschutz Acceleration Initiative grant (AAI2406)

Category: Postdoctoral Fellows and Residents in the School of Dental Medicine

Title: Differential Srsf3 protein interactions upon PDGFRa signaling in mouse embryonic palatal mesenchyme

Authors: Evan C. Brooks, Thomas E. Forman, Katherine A. Fantauzzo

Introduction/Background: Craniofacial development is a complex morphogenetic process, disruptions in which result in highly prevalent human birth differences such as cleft lip/palate. Signaling through platelet-derived growth factor receptor alpha (PDGFRa) plays critical roles in this process in humans and mice. We previously identified the RNA-binding protein Srsf3 as an effector of PDGFRa signaling in mouse embryonic palatal mesenchyme (MEPM) cells that regulates alternative RNA splicing following phosphorylation-dependent translocation into the nucleus.

Aim: The aim of this study is to identify proteins that differentially interact with Srsf3 depending on its phosphorylation in response to PDGF-AA ligand stimulation.

Methods: MEPM cells were treated with PDGF-AA ligand for 0, 15 or 60 min. Srsf3-interacting proteins were isolated via immunoprecipitation and analyzed by mass spectrometry.

Results: Our screen identified 52 unique proteins, 20 and 32 of which had increased and decreased spectral counts upon PDGF-AA ligand treatment, respectively. These proteins included 17 that have previously been implicated in RNA binding, including the RNA-induced silencing complex protein Ago2. Variants in human *AGO2* cause Lessel-Kreienkamp syndrome, with some patients exhibiting dysmorphic facial features. Consistent with the mass spectrometry results, we have biochemically confirmed the increased interaction of Srsf3 with Ago2 upon PDGF-AA ligand stimulation of MEPM cells via immunoprecipitation and western blotting. This interaction occurs independently of RNA, suggesting a direct physical interaction between these proteins.

Conclusion: Future studies will focus on whether this protein-protein interaction affects Srsf3 subcellular localization and/or Srsf3-mediated alternative RNA splicing, as well as identifying the domains through which Srsf3 and Ago2 interact.

Funding Source: NIH/NIDCR grants R01DE030864 (to K.A.F.) and F31DE032252 (to T.E.F.)

Category: Postdoctoral Fellows and Residents in the School of Dental Medicine

Title: Balancing Strength and Toughness in Glassy Photopolymers via Acid–Urethane Covalent–Noncovalent Network Design

Authors: Sean Keyser, Anna Gartner, Jeff Stansbury, University of Colorado

Introduction: Polymer network design has traditionally centered on covalent crosslink density as the primary control of mechanical performance. Increasing crosslink density raises modulus, but also constrains chain mobility and limits energy dissipation, driving brittle failure and a fundamental strength–toughness tradeoff. Vinyl-Urethane based systems are valuable because they integrate covalent bonding along with hydrogen bonding, enabling access to both strength and toughness in glassy, highly crosslinked networks. Building on these covalent–noncovalent characteristics, acid–urethane chemistry reorganizes intermolecular interactions to produce low-viscosity systems that form networks with emergent mechanical properties exceeding those of urethane-only materials. This work examines how covalent and noncovalent interactions can be independently tuned to optimize mechanical performance in glassy photopolymers.

Methods: Photocurable resin systems were formulated to independently control covalent and noncovalent network contributions. Covalent crosslink density was tuned through mono- and divinyl monomer content, while secondary interactions were engineered through acid–urethane chemistry. Monomers included UDMA, UDA, IBOA, HDDA, AA, MAA, MUMA, and MUDA. Resin viscosity was measured rheologically, conversion by near-IR spectroscopy following UV curing and post-curing, and mechanical performance by three-point bending to determine modulus, flexural strength, and work of fracture (WoF).

Results: Reactive dilution reduced viscosity but weakened secondary interactions and produced limited gains in toughness. In contrast, vinyl carboxylic acids reorganized urethane interactions through preferential acid–urethane bonding, lowering viscosity while increasing noncovalent reinforcement in the cured network. These systems formed glassy, highly crosslinked networks with high modulus and flexural strength and exhibited substantial increases in WoF relative to urethane-only and dilution-based formulations.

Conclusions: Decoupling covalent crosslink density from secondary hydrogen-bonded interactions enables independent control of network structure and energy dissipation in glassy photopolymers. This balanced design produces emergent combinations of strength and toughness that surpass conventional urethane systems and establishes a general framework for high-performance, printable polymer networks.

Funding Source: University of Colorado Anschutz Acceleration Initiative grant (AAI2406)

Category: Postdoctoral Fellows and Residents in the School of Dental Medicine

Title: Evolution in the lab: uncovering heritable genetic elements contributing to phenotypic buffering

Authors: Moss, N.D., Mumme-Monheit, A., Costantino, N., Frasier, F., Nichols, J.T.

Introduction/Background: Decades of research have enabled clinicians and scientists to correlate disease-associated phenotypes with specific genetic mutations. However, the genotype–phenotype relationship is often oversimplified. In some human diseases, the same genetic mutation can result in a wide spectrum of phenotypes, ranging from severe manifestations to individuals who show no overt phenotype at all. One example of this phenomenon is human *MEF2C* Haploinsufficiency Syndrome, which exhibits a broad range of craniofacial and neurodevelopmental differences, reflecting incomplete penetrance. It remains unclear which factors buffer or modulates the penetrance and severity of these phenotypes.

We can model this disease in the laboratory using zebrafish to better understand the factors that contribute to phenotypic buffering. Similar to humans, mutations in the zebrafish ortholog *mef2ca* result in craniofacial phenotypes with variable severity and penetrance. Over several years of selective breeding, our lab has demonstrated that factors buffering phenotypic penetrance are heritable. We now have true-breeding strains of *mef2ca* mutant zebrafish with high penetrance and severe phenotypes, as well as strains with low penetrance and relatively mild phenotypes. By comparing these “high” and “low” penetrance strains, we can uncover the heritable and genetic elements that buffer the genotype–phenotype relationship.

Aims: Determine the underlying heritable factors contributing to phenotypic buffering in the zebrafish model of *MEF2C Haploinsuffiency syndrome.*

Methods: Using the zebrafish model system we explore factors contributing to phenotypic buffering of *mef2ca* mutations. We combine whole genome, methylome, and transcriptome data to uncover heritable and functional impacts of selective breeding in *mef2ca*-high and *mef2ca*-low phenotypic penetrance strains.

Results: These experiments will identify genomic regions (e.g., SNPs) and changes in DNA methylation that correlate with altered gene expression. Our previous work has shown that increased expression of *mef* paralogs in *mef2ca* mutant zebrafish can reduce phenotypic penetrance and severity. We hypothesize that selection has acted on cryptic genetic variation present in the general zebrafish population and that our genome and methylome sequencing experiments will uncover either mutations in upstream regulators of *mef* paralog activation or differences in DNA methylation patterns at *mef* paralog promoters.

Conclusion: Through this work we aim to discover mechanisms of genomic regulation and adaption that allow for buffering against *mef2ca* mutations in zebrafish and better understand global mechanisms buffering incomplete penetrance.

Funding Source for research: NIDCR R01DE029193 to JTN

Laboratory Professional Staff Abstracts

Category: Laboratory Staff Profession working at the School of Dental Medicine

Title: The BioXclude® Membrane Enhances Outcomes of Scaling and Root Planing in Current Smokers

Authors: Karo Parsegian,[1] Kerri Font,[2] Robert Magley,[3] **Allison Kessler**,[1] Pirin Becker,[4] Matthew Burns,[5] and Sangeetha Chandrasekaran.[1]

Affiliations: [1]Division of Periodontics, Department of Diagnostic Sciences and Surgical Dentistry, School of Dental Medicine, University of Colorado Anschutz Medical Campus (Aurora, CO, USA); [2]Private practice (Highlands Ranch, CO, USA); [3]Research Scientist, Solvita (Kettering, OH, USA); [4]Associate Director, Clinical Systems and Informatics, School of Dental Medicine, University of Colorado Anschutz Medical Campus (Aurora, CO, USA); [5]Strategic Market Development, Maxxeus (Kettering, OH, USA)

Introduction: Smoking is a major risk factor for periodontitis that negatively impacts the outcomes of scaling and root planing (SRP)

Aim: To evaluate the effect of BioXclude® membrane as an adjunct to SRP in current smokers.

Methods: All experimental protocols were approved by the Institutional Review Board. Untreated adult patients with periodontitis and with probing depths (PD) ≥5mm in ≥2 quadrants received SRP alone (control sites) or SRP with an 8×8 mm BioXclude® membrane placed subgingivally at debrided sites (test sites), according to site assignment. All had supra- and subgingival debridement at 1, 3, 6, and 9 months post-SRP. A least squares regression model was fitted to evaluate the effects of treatment group, smoking status, and their interaction (treatment group × smoking status) on PDs. Post hoc pairwise comparisons between test and control sites within subjects were adjusted using Bonferroni correction (p <0.05).

Results: Among 27 eligible participants, 12 had both test and control sites (split-mouth design), while the remaining 15 had only test or control sites. Among test patients, 4 were current smokers, and 11 were never-smokers, whereas there were 3 current smokers and 9 never-smokers in the control group. All participants had statistically similar periodontal characteristics at baseline. BioXclude® was associated with significantly greater PD reductions in current smokers compared to control sites within the same smoking category at 1 month (-1.7mm vs. -0.6mm) and 9 months (-1.9mm vs. -0.3mm). The reductions in PDs were more consistent in test vs. control sites (p=0.026). PD reductions at test sites were statistically similar between current and never-smokers throughout the follow-up period, whereas control sites in current smokers showed consistently poorer outcomes compared to control never-smokers.

Conclusion: The BioXclude® membrane significantly improved SRP outcomes in current smokers.

Funding Source: This study was supported by a research grant from Snoasis Medical, LLC.

Category: Laboratory Staff Professionals working at the School of Dental Medicine

Title: Characterization of the role of Srsf3 in the mouse facial ectoderm

Authors: Erin Binne, Brenna J.C. Dennison, Katherine A. Fantauzzo

Introduction/Background: Craniofacial development is a complex morphogenetic process that requires a precise interplay of multiple cell types to generate the frontonasal skeleton. Defects in craniofacial development comprise one of the most prevalent birth differences in humans. We have demonstrated that the RNA-binding protein Srsf3 is expressed in the mesenchyme of the pharyngeal arches and facial processes in the mouse embryo, as well as the overlying ectoderm.

Aim: The aim of this study is to characterize the role of Srsf3 in the mouse facial ectoderm.

Methods: We combined an *Srsf3* conditional allele with the *Crect* transgene, which drives Cre recombinase activity in the cranial ectoderm beginning at E8.5. We assessed craniofacial phenotypes of control and *Srsf3* conditional knockout (*Srsf3* ect cKO) embryos through whole-mount DAPI staining, Ki67 immunofluorescence analysis and TUNEL staining of the lateral nasal (LNP), medial nasal (MNP), maxillary (MxP) and mandibular (MdP) processes.

Results: While *Srsf3* ect cKO embryos exhibited no obvious morphological defects through E10.5, these embryos had dysmorphic lambdoid junctions where the LNP, MNP and MxP fuse by E11.5. Further, these embryos had significant changes in the area of all facial processes and a significant increase in the angle of the nasal pit at E11.5. Ki67 immunofluorescence analysis and TUNEL staining at E9.5 and E10.5 revealed that the only change in cell proliferation or cell death, respectively, was a significant decrease in the percentage of Ki67-positive cells in the LNP ectoderm at E10.5.

Conclusion: Conditional ablation of *Srsf3* in the mouse facial ectoderm results in dysmorphic lambdoid junctions, stemming from cell proliferation defects in the LNP ectoderm at E10.5.

Funding Source: NIH/NIDCR grant R01DE030864 (to K.A.F.)

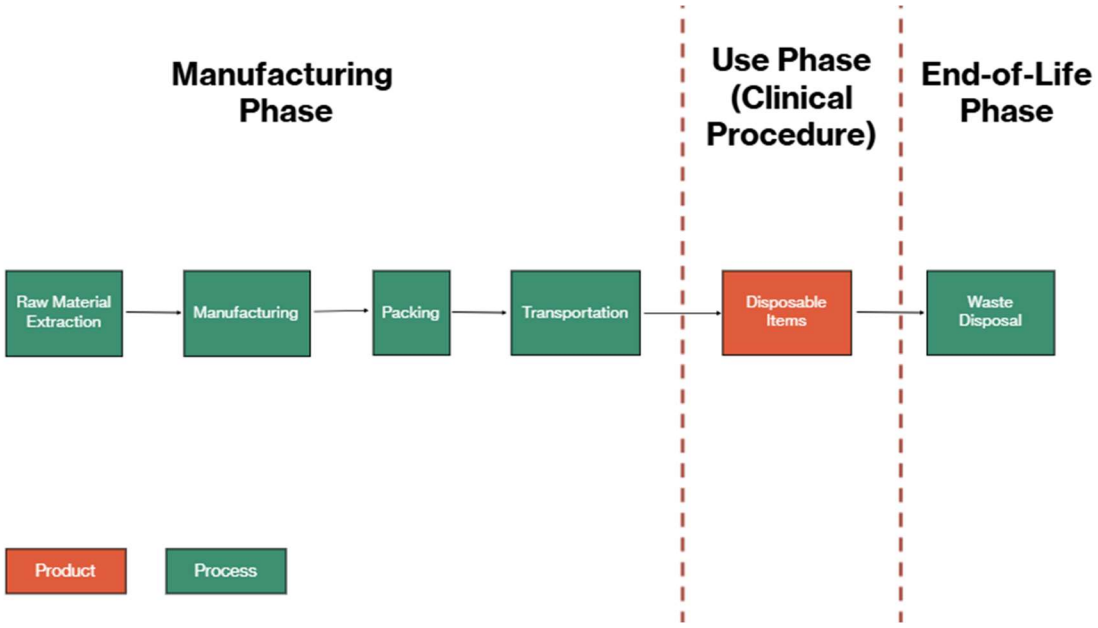
Category: Laboratory Staff Profession working at the School of Dental Medicine

Title: Assessing the Environmental Impact of a Restorative Composite Procedure: A Life Cycle Study Conducted in a Dental School Clinic

Authors: **Sebastian Lopez,** Taylor Sedivec, Saanvi Amara, Chaintanya Puracnik, Bruce Dye, Devatha Nair

Background: Dental restorative procedures are among the most common clinical interventions in the US, with approximately 240 million adults having at least one dental filling, equating to millions of fillings placed each year. This high demand for restorative care drives substantial use of materials and generates significant amounts of single-use plastic waste. To understand the environmental implications of producing, using, and disposing of restorative materials at the School of Dental Medicine, a Life Cycle Assessment (LCA) framework was implemented.

Methods: An LCA evaluated the material-related impacts of a single dental filling procedure. Material inventories were developed through direct observation and waste audits at CU Dental clinics and a private dental practice in Colorado. Restorative materials and single-use consumables were evaluated within a cradle-to-grave system boundary encompassing raw material extraction, manufacturing, use-phase consumption, and end-of-life disposal. Clinic energy use, patient travel, and staff commuting were excluded to maintain a materials-focused scope. Life cycle inventory modeling utilized database datasets and material composition proxies, and impacts were evaluated using midpoint impact categories to enable comparison of the two practices.



Outcomes/Results: Although tooth preparation and filling placement vary across providers and clinics, all settings used the same material types. The LCA identified differences in quantities of materials used per filling as the primary driver of impact variation. The CU clinics consumed more single-use items on average than the private practice, resulting in higher cradle-to-grave burdens from disposable plastics. These findings emphasized material-use intensity as the dominant environmental hotspot.

Conclusion: With material types held constant, practice behaviors and clinical workflow proved to be the primary drivers of environmental impact. Streamlining protocols and providing targeted training on efficient material use can help reduce avoidable waste. Future work should evaluate the effectiveness of these interventions in real clinical settings, explore digital tools that support sustainable decision-making, and assess how integrating sustainability principles into dental education influences long-term provider behavior.

Funding Source: School of Dental Medicine**,** Dean's Innovation Grant 2025

Category: Laboratory Staff Profession working at the School of Dental Medicine

Project Title: Evaluating Azobenzene Nanogel Additives in Dental Adhesives with Microtensile Strength Testing

Authors/Investigators: Lahari Vallamkonda*, Sebastian Lopez, Devatha Nair

Background: On average, composite fillings last around 5-7 years. One reason for restoration failure is weakened adhesive interface. This study proposes a higher bonding strength with the addition of azobenzene nanogels (AB-NG) in traditional bonding agents due to their light-propelled reactions that make the adhesive penetrate deeper into the dentin tubules.

Methods: Adhesives were synthesized using AB-NG (2.5wt%), bisphenol A-glycidyl methacrylate /hydroxyethyl methacrylate (60:40wt%), ethanol (12wt%), camphorquinone (2wt%), and ethyl 4-N,N-dimethylamino benzoate (2wt%). Redox initiators were added by separating the mixture into two vials. Benzoyl peroxide (4wt%) was added to one vial, and dimethyl-p-toluidine (2wt%) was added to the other. A control adhesive without AB-NG was also prepared.

Human third molars were obtained, the roots and crowns were removed using a diamond saw, and restorations were placed on each molar using the AB-NG and control adhesives. The teeth were sectioned into 0.9x0.9mm beams, each ~2mm long (n>20). Microtensile bond strength testing was performed on each beam to obtain their respective break stress values.

Outcomes/Results: Around 10 break stress values will be collected for both control and AB-NG beams. It is expected that the average break stress values for AB-NG will be higher than the control beams.

Conclusion: Incorporation of AB-NG into commercial adhesives is a promising approach to increase bond strength and extend the retention of composite restorations. Future testing will involve evaluating columns that undergo long-term physiological conditions encountered in the oral cavity.

Funding Source: NIH/NIDCR 1R21DE032135 (Nair)

Category: Laboratory Staff Professionals working at the School of Dental Medicine

Title: Novel non-volatile acidic comonomers for use in urethane-based systems

Authors: Anna Gartner, Sean Keyser, Austyn Salazar, Jeff Stansbury

Objectives: Previous studies have demonstrated that incorporating (meth) acrylic acid (MAA/AA) into urethane-based polymers significantly enhances their mechanical properties. However, the volatility of these acids limits their suitability for open-air applications. This study aims to develop non-volatile alternative acids to M/AA that provide similar network reinforcement in urethane-based formulations.

Methods: Commercial and synthetically derived acid-functional monomers were combined with urethane (meth)acrylates at a 1:1 molar ratio of acid to urethane functional groups. Multiple acid-urethane combinations were evaluated to determine their relative performance. Resin viscosity was measured and degree of conversion was assessed after ambient photocuring and again following thermal post-curing. Mechanical properties, including flexural modulus, flexural strength, and work of fracture (WoF), were evaluated using three-point bending tests.

Results: MAA and AA, which have the minimum possible spacing between the acid and vinyl groups, demonstrated the lowest viscosity as reactive diluents and the and the highest performance in terms of copolymer modulus and flexural strength when paired with UDMA. In contrast, carboxyethyl acrylate (CEA), with increased spacing between its acid and vinyl functional groups, exhibited somewhat reduced modulus and strength as the UDMA copolymer. Novel acids derived from hydroxyethyl acrylate (HEA) reacted with itaconic or nadic anhydride introduced even greater spacing between the acid and terminal acrylate group. Notably, the internal itaconic vinyl group in HEA-ItAN is conjugated with the carboxylic acid and contributes to crosslinking. Copolymers of HEA-ItAN or HEA-Nadic with UDMA achieved moduli comparable to MAA and AA formulations, but showed slightly reduced flexural strength.

Conclusions: Although the alternative acid monomers did not outperform the small molecule (meth)acrylic acids in terms of overall polymeric mechanical properties, they offer valuable opportunities for tailoring material properties and their reduced volatility makes them promising candidates for open-air applications.

	Conversion (%)	Modulus (GPa)	Flexural Strength (MPa)	WoF (MJ/m^3)
UDMA+AA	-	4.03 (0.23)	187.1 (7.5)	9.3 (3.4)
UDMA+MAA	85.6 (0.9)	4.22 (0.25)	184.7 (23.2)	10.3 (6.4)
UDMA+CEA	-	3.54 (0.19)	151.9 (8.1)	8.5 (3.2)
UDMA+HEA-ItAn	87.0 (0.4)	4.17 (0.25)	162.0 (10.5)	4.4 (0.8)
UDMA+HEA-Nadic	97.0 (0.5)	3.96 (0.14)	159.3 (9.6)	8.0 (3.3)

Funding Source: NIH/NIDCR grant R21DE032797/Stansbury

Category: Laboratory Staff Professionals working at the School of Dental Medicine

Title: A *shox*(ing) discovery: a dorsoventral jaw patterning node

Author(s): Lindsey Neukirch, Byron Brown, Colette Dolby, Abigail Mumme-Monheit, James T. Nichols

Introduction/Background: Mutations in the SHOX gene in humans can cause a variety of craniofacial and skeletal differences such as micrognathia, shortened and curved bones, and general short stature. There is little research being done on this gene because *Shox* is not present in mice, but it is highly conserved among other organisms. Previous research has shown that *shox* is expressed in the pharyngeal arches during different stages of craniofacial development. Dorsoventral patterning of the lower jaw has been well characterized in zebrafish, with the Endothelin pathway (*edn1*) patterning the ventral domain, while the Jagged-Notch (*jag1b*) pathway patterns the dorsal domain.

Aims: This leads us to believe that *shox* mediates crosstalk between Endothelin and Jagged-Notch signaling in the pharyngeal arches to pattern the intermediate domain.

Methods: All experiments were preformed using the zebrafish model system.

Results: *shox* expression decreases in both *edn1* and *jag1b* mutants. When shox is mutated, it displays phenotypes of both *edn1* and *jag1b* mutants.

Conclusion: Additional experiments will be performed to determine if Jag-Notch and Endothelin target genes misexpressed in *shox* mutants. It is also unclear if there are any appendage phenotypes present in *shox* mutants. This will help create a better understanding of SHOX deficiency syndrome in humans.

Funding Source for research: NIDCR R01 DE029193 to JTN, NIDCR R01DE030448 to JTN

Category: Laboratory Staff Professionals working at the School of Dental Medicine

Title: RNA Polymerase III subunit Polr3a is required for development of craniofacial cartilage and bone in zebrafish

Authors: Bailey Lubash, Roxana Gutierrez, Kade Fink, Colette Hopkins, Jessica C. Nelson, Kristin E. N. Watt

Introduction: RNA Polymerase III (Pol III) transcribes noncoding RNAs including 5S ribosomal RNA (rRNA), transfer RNAs (tRNA), and others essential for ribosome biogenesis and translation. Although Pol III is required in all cell types, pathogenic variants in genes encoding subunits of Pol III, including *POLR3A*, lead to tissue-specific phenotypes including craniofacial differences.

Methods & Results: We examined *polr3a* mutant zebrafish to determine the function of Pol III during craniofacial development. These mutants display hypoplasia of neural crest cell (NCC)-derived craniofacial cartilage and bone by 5 days post fertilization. Assessment of cell death and proliferation in the NCC population during embryonic stages surprisingly revealed no significant changes, indicating that early NCC development proceeds normally. At larval stages, increased cell death was observed throughout the head, including within the craniofacial cartilage. These changes coincide with a global reduction of pre-tRNA transcripts and reduced ribosome biogenesis in *polr3a* mutant zebrafish. We next performed single-cell RNA-sequencing to determine tissue-specific transcriptional changes. Analysis revealed both global and tissue-specific changes, demonstrating distinct transcriptional responses to the loss of polr3a across multiple tissues in the head. Within the cartilage, we identified upregulation of stress response pathways, including upregulation of *tp53*. *tp53* inhibition rescued the global cell death observed throughout the head during the larval stages but did not rescue the craniofacial bone phenotype observed in *polr3a* mutants.

Conclusion: These studies provide new insight into the role of *polr3a* during craniofacial development and suggests that there are *tp53*-independent mechanisms underlying the observed craniofacial anomalies.

Funding: This work was funded by R00DE030971 to KENW, R00NS111736 to JCN, and startup funds from the CU Anschutz School of Dental Medicine.

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Category: Laboratory Staff Professionals working at the School of Dental Medicine

Title: RNA polymerase I and III subunit Polr1c in neuronal development and disease

Authors: **Lauren Sands**, Camille Goo, Laura White, Kristin Watt

Funding Source: K99/R00DE030971 and startup funds from the CU Anschutz School of Dental Medicine

Faculty Abstracts

Category: Faculty, CU School of Dental Medicine

Title: Bridging Dental Roles: Intraprofessional Learning Among Dentistry, Hygiene, and Assisting Students

Authors: Lindsey Yates, DDS, FACD, FNAP, Tamara Tobey, DDS, MA, Laurice De la Rosa, RDH, Ashley Ridilla, MA, RDH, Heidi Heath, BS, CDA, EDDA, Jennipher Murphy, MS Ed, Raquel Baroni de Carvalho, PhD, MSc, BDS

Purpose: Interprofessional education is defined as two or more professions learning about, from, and with each other. Intraprofessional education is the learning between individuals of different disciplines within the same profession. Both promote effective collaboration to improve healthcare outcomes and aim to reduce disparities and costs. CU SDM hosts an annual intraprofessional workshop with second-year dental students, dental hygiene students, and dental assisting students. They are divided into intraprofessional teams, led by intraprofessional faculty, and engage in learning activities designed to bridge their disciplines and begin development of dental team cohesion. They review educational/licensure requirements, various practice settings, roles/responsibilities, concepts of teamwork/communication, and a clinical case. A post-workshop evaluation is completed by attendees; we will present the November 2024 results.

Methods: The evaluation was conducted using Qualtrics, to assess student attitudes regarding teamwork and its effect on their ability to provide patient-centered care.

Results: Out of 130 attendees, 87 completed the evaluation (43 dental medicine, 34 hygiene, 9 assisting). As a result of the workshop, 86% of respondents felt more comfortable working as part of an interprofessional team, 98% felt more confident that interprofessional teamwork can improve the patient experience and patient care, and 87% found this collaborative workshop contributed to their ability to provide patient-centered care. Respondents (74%) reported interest in attending more intraprofessional sessions like this one.

Conclusion: This intraprofessional workshop represents a milestone; for many participating students, it was their first time interacting with a student from a different discipline within the dental profession. Attendees reported the experience was valuable as it offered both learning and networking opportunities.

Category: Faculty, CU School of Dental Medicine

Title: Student Perceptions of Elevating Periodontal Education with Enhanced Digital Media

Authors: Amy DeStaffany, Manti Lehn, Karo Parsegian

Purpose: Efficient periodontal instrumentation is essential for high-quality patient care and dental education. Video-assisted instruction can enhance learning, but its effectiveness depends on content quality and visualization. The present pilot study describes the development of high-resolution instructional videos demonstrating periodontal armamentarium and instrumentation and evaluates their perceived usefulness among predoctoral dental students at the University of Colorado.

Methods: The Institutional Review Board granted ethics exemption (protocol #22-2099). Videos were recorded in 8K resolution and demonstrated instrument selection, ergonomics, adaptation, angulation, and activation of strokes using a typodont with transparent gingiva and simulated supra- and subgingival deposits. To assess educational value, a cross-sectional survey was conducted among dental students.

Results: Sixteen students evaluated previously used videos; 37.5% rated them “Extremely useful,” and 50% “Very useful.” Fourteen students evaluated new videos; 64.3% rated them “Extremely useful,” and 42.9% “Very useful.” All participants indicated they would refer to the new videos in the future. Thematic analysis of open-ended responses revealed five dominant themes: clarity, zoom, technique, realism, and accessibility. Students valued improved resolution and close-up views for observing fine motor movements and instrument sharpness.

Conclusion: High-resolution instructional videos improved students’ perceived usefulness and confidence in periodontal instrumentation. Suggestions for future enhancements included adding closed captions, written explanations, and demonstrations on natural teeth to increase authenticity. Future studies should evaluate the impact of these resources on clinical performance.

Category: Faculty, CU School of Dental Medicine

Title: Monomeric and polymeric properties of low viscosity monourethanes

Authors: Anna Gartner, Austyn Salazar, **Jeffrey Stansbury**

Purpose: Due to the mechanical property advantages associated with urethane-urethane noncovalent interactions, polymers based on reactive urethane oligomers and monomers are extensively utilized including as components of several types of dental materials. However, the beneficial urethane hydrogen bonding effects in these polymers complicate resin formulation with high viscosity that is typically addressed by adding reactive diluents that then compromise polymer performance potential. A solution to minimize resin viscosity and maintain high urethane content is monourethane monomers that have inherently low viscosities without dilution. This study highlights how structural differences in novel monourethane monomers affect viscosity and polymeric mechanical properties compared with urethane dimethacrylate (UDMA).

Methods and Materials: A structurally diverse array of monourethane monomers with either mono- or di-(meth)acrylate reactive groups were synthesized and characterized. Viscosity measurements were conducted at room temperature. A UV photoinitiator was added to these liquid monomers and the degree of conversion in irradiated disc specimens was measured by near-IR and then optionally were post-cured to higher conversion. Three-point bend bars were photocured and tested to obtain flexural modulus and strength results.

Results: The monomers with molecular weights ranging from <200 to >500 g/mol demonstrated viscosities that spanned from 28 to 350 mPa.s with most being well below 100 mPa.s while for comparison, the viscosity of UDMA is ~8900 mPa.s. The photocured degree of conversion for the homopolymers was 48-97% and this range increased to 75-100% conversion after post cure. For reference, UDMA homopolymer produced conversion values of 68 and 88%, respectively. The flexural modulus of the monourethane homopolymers that were both photocured and photo/thermal post cured was 2.8-4.1 GPa as compared with UDMA at 3.1 GPa. Flexural strength was highly structure dependent with the monourethanes ranging between 102 and 158 MPa with three of these being statistically equivalent to UDMA homopolymer at 158 MPa.

Conclusion: Mechanical properties of UDMA homopolymer are quite good although this is an impractical photopolymerizable formulation due to viscosity. Dilution of UDMA with TEGDMA to a viscosity of 55 mPa.s, which is similar to many of the monourethane monomers here, drops the flexural modulus and strength to 2.8 GPa and 136 MPa, respectively. Monourethane homopolymers can match mechanical properties of UDMA while offering viscosities approximately two-orders of magnitude lower. Besides potential use without need for comonomer dilution, these new monourethane monomers provide interesting options as reactive diluents for UDMA or BisGMA formulations that maintain high noncovalent reinforcement without high viscosity.

Funded by NIH/NIDCR R21DE032797 and University of Colorado Anschutz Acceleration Initiative (AAI2406)