UCSF SCHOOL OF DENTISTRY PRESENTS

Research and Clinical Excellence Day

Monday, April 5, 2021
A VIRTUAL EVENT

1–3:30 p.m.
Poster Session
followed by three-minute thesis style
oral presentations and clinic cases

5–6 p.m.
Plenary Speaker and Outstanding Clinician Award Presentations

FEATURED SPEAKERS:

Darnell Kaigler, Jr., DDS, MS, PhD
Associate Professor of Dentistry
Department of Periodontics & Oral Medicine
University of Michigan School of Dentistry

Ray Stewart, DMD, MS
Professor
Department of Orofacial Sciences
Chair, Division of Pediatric Dentistry

For more information, contact
Roger Mraz at roger.mraz@ucsf.edu

dentistry.ucsf.edu/research

UCSF School of Dentistry

AGENDA

UCSF School of Dentistry Research and Clinical Excellence Day
April 5, 2021
EVENT LINK: https://ucsf.zoom.us/j/5550588373

1:00 – 1:10pm

Welcome and Opening Remarks
Sarah Knox, PhD
Chair, Research and Clinical Excellence Day Committee

Michael Reddy, DMD, DMSc
Dean and Professor
UCSF School of Dentistry

1:10 – 2:30pm

Virtual Poster Session

2.30 – 3:30pm

3-Minute Oral Presentations
Faculty Chair: Julie Sneddon, PhD

Ellie Babaie, PhD
(Mentor: Dr. Stefan Habelitz)
"Human Dentin Caries Lesion Mineralizes by PILP-treatments"

Carl Buchanon II, DDS
(Mentor: Dr. George Taylor)
"Association Between Tobacco Smoking and Periodontal Health in Underserved Adolescents"

Eric Coy
(Mentor: Dr. Stuart Gansky)
"Automated Gradient-Boosting Models Accurately Score Intraoral Plaque in Non-Standardized Images"

Ramin Farhad
(Mentor: Dr. Aaron Tward)
"Generation of Large-scale Chromosomal Deletions in Primary Human Keratinocytes"

Amanda Gramacy
(Mentor: Dr. Cristin Kearns)
"Industry Messaging About Sugar and Oral Health: A Content Analysis of Food Company Websites"

Tiffany Huang
(Mentor: Dr. Richard A. Schneider)
"Runx2 Isoforms Differentially Regulate Mmp13 Promoter Activity"

Andrew Lee, DDS
(Mentor: Dr. John KS Tong)
"Natural Tooth Pontic as Single Tooth Replacement: Clinical Cases"

April Martinez
(Mentor: Dr. Yvonne Kapila)
"Nisin Probiotic Prevents Periodontal Disease and Related Inflammatory Host Response While Promoting Regenerative Periodontal Cells and a Shift Toward a Healthy Oral Bacteriome and Virome"

Muruudul Otgonbold
(Mentors: Dr. Michael Le, Dr. Ben Chaffee)
"Tobacco Use Prevention and Cessation Counseling at UCSF Dental Center: Pre-Doctoral Students' Behaviors, Knowledge, and Perceived Support"

Marrina Ran
(Mentor: Dr. Nathan Young)
"Assessing Facial Aesthetics Using in Silico Generated 3D Models"

Lea Sedghi
(Mentor: Dr. Yvonne Kapila)
"Processed Carbohydrates Drive Changes in Oral Biofilm Abundance and Architecture"

Jinsook Suh, PhD
(Mentor: Dr. Christine Hong)
"Loss of p75NTR Impairs Bone Formation in Mice"

Vyshiali Sundararajan
(Mentor: Dr. Alfa-Ibrahim Yansane)
"Barriers to Dental Care Utilization Among Children Lacking Follow-up Care Within After-school Dental Screening Programs"

Erin Welter
(Mentor: Dr. Benjamin Chaffee)
"Dental Sealant Utilization Patterns Among California Medicaid-Eligible Children"

Yan Zhang
(Mentor: Dr. Christine Hong)
"Mandibular And Cranium Skeleton Malformation Of CD271-null Mice"

Emily Zhou
(Mentor: Dr. Jing Cheng)
"Development and evaluation of an oral health mobile application"

Kristen Zung, DDS
(Mentor: Dr. Maria Thompson)
"Custom Intraoral Splints for the Head and Neck Radiation Patient"

Mentor of the Year Award
Presented by Wesley Kao, President, John C. Greene Society

3:30 – 5:00pm

BREAK

5:00 – 5:30pm

Plenary Speaker
Darnell Kaigler, Jr. DDS, MS, PhD
Associate Professor of Dentistry
Departments of Periodontics & Oral Medicine
University of Michigan School of Dentistry
"Dentistry 2021 and Beyond: A True Blend of Art and Science"

5:30 – 6:00pm

Outstanding Clinician Award
Ray Stewart, DMD, MS
Professor
Department of Orofacial Sciences
Chair, Division of Pediatric Dentistry
"Defining a Master Clinician: Personal Thoughts and Considerations"

6:00 – 6:10pm

Announcement of Award Winners
Stuart Gansky, MS, DrPH
Associate Dean for Research

Closing Remarks
Sarah Knox, PhD
Chair, Research and Clinical Excellence Day Committee

Darnell Kaigler, Jr. DDS, MS, PhD | **Plenary Speaker** | Dr. Darnell Kaigler Jr. is the Major M. Ash Collegiate Professor of Periodontics at the University of Michigan in the Department of Periodontics and Oral Medicine, School of Dentistry, and the Department of Biomedical Engineering, College of Engineering. A native of Detroit Michigan, Dr. Kaigler earned a Bachelor of Science degree from Morehouse College in Atlanta GA, and later became the first student to complete a dual D.D.S./Ph.D. degree at the University of Michigan. Dr. Kaigler went on to receive additional clinical training, earning certificates in operative dentistry and periodontics.

He currently teaches in the pre-doctoral and graduate periodontal programs at the University of Michigan and is Co-director of the pre-doctoral dental implant program. In addition to teaching, he has a federally funded research program where he directs a research laboratory and is the lead investigator of multiple clinical trials. His research focuses on the development and implementation of stem cell-based therapies for the regeneration of oral tissues. Outside of his research and teaching responsibilities at the University of Michigan, Dr. Kaigler participates in patient care in a multi-specialty group practice in downtown Detroit. Dr. Kaigler is also a member of several professional organizations, including serving as the Immediate-past President of the Midwest Society of Periodontology.

Presentation: "Dentistry 2021 and Beyond: A True Blend of Art and Science"

Abstract: Due to the evolution of our scientific knowledgebase which has expanded exponentially the past 20 years, innovative technologies and novel treatment paradigms will flood dentistry for the next 20 years. "Personalized medicine" approaches and evidence-based clinical practice will merge to shift the dental profession from one where technical skills have historically been the focus to one where critical-thinking skills and science will become the focal point. The goal of today's discussion is to discuss how dental practice has changed over the past 20 years, and how emerging technologies and approaches which will transform dentistry over the next 20 years. Cases will be presented which provide examples of how the profession will incorporate technological and scientific advancements in the future management of complex clinical problems. The presentation will serve as the framework for a discussion on how, in dentistry, the success of a clinician over the next 20 years will be contingent upon them having a fundamental understanding and appreciation of research and science.

Ray Stewart, DMD, MS | Outstanding Clinician Award | Dr. Stewart has over 45 years of academic and clinical experience in Pediatric Dentistry. He earned a DMD from University of Oregon, a Certificate in Pediatric Dentistry, following a residency and fellowship at UO Health Science Center, and a MS degree in Medical Genetics. Dr. Stewart joined the faculty at UCLA as Director of the Craniofacial Anomalies Clinic and Program Director of Pediatric Dentistry at UCLA-Harbor General Hospital, where he attained the rank of Associate Professor. He authored three books in Pediatric Dentistry and Genetics as well as numerous book chapters and scientific articles. His postdoctoral textbook "Pediatric Dentistry - Scientific Foundations and Clinical Practice" remains a must read for graduate students even today.

Dr. Stewart left this academic career to devote full time to private practice in 1982. Dr. Stewart purchased a solo pediatric practice in the Central Coastal area of California. Before retirement in 2010, the practice had become one of the largest private, non-corporate pediatric group practices in the US, with over seven offices, two surgicenters, a hospital operating suite, an affiliated orthodontic practice, ten doctors, and over 150 employees, serving six counties in Central California. During his career he bought and sold multiple practices and established a non-profit foundation with a school based mobile clinic program. After retiring from full time clinical practice, Dr. Stewart became the Executive Director of the California Society of Pediatric Dentists and the California Society of Pediatric Dentistry Foundation, having served as CSPD President earlier in his career. He was also a trustee and officer in the American Academy of Pediatric Dentistry and is a diplomate of the American Board of Pediatric Dentistry and a fellow in AAPD. In 2015, he became a Director of the Institute for Pediatric Dentistry. In 2015, after resigning his executive directorship at CSPD, he returned to his first love – teaching graduate pediatric dental residents at UCSF as a full Professor. He assisted the department in establishing a dental clinic at the new UCSF Benioff Children's Hospital. In 2019 he was appointed as Chairman of the Division of Pediatric Dentistry where he has also served as the Interim Program Director of the Pediatric Dentistry Residency program since July of 2019. He is currently Co-Principal Investigator on a HRSA training grant with the Division of Pediatric Dentistry and the Division of Dental Public Health.

Presentation: **"Defining a Master Clinician: Personal Thoughts and Considerations"**

ABSTRACTS

1) Title: Dental Patients' Perceptions and Desired Content from Patient Health Portals

S AMIRKIAI, E OBADAN-UDOH

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: The purpose of this study is to capture the dental patient's perspective on patient health portals (PHPs) and their desired content. PHPs have been utilized in medicine with great success, but have been rarely utilized in dentistry. They encourage patient engagement and move us one step closer to achieving the triple aim of healthcare. In order to design a successful PHP for dental patients, we need to examine the specific features that would be important for dental patients to have, as well as the barriers and facilitators.
Methods: We conducted a cross-sectional study of English speaking, adult patients within the predoctoral, faculty, and resident clinics at the UCSF dental center from July to October 2020. Patients were approached in the waiting rooms and asked to complete an 18-item self-administered survey. The survey captured patient demographics, preferences/desired content, and facilitators/barriers of PHPs. Descriptive statistics and bivariate analysis were conducted.
Results: A total of 325 people participated in the survey. Majority of participants had a bachelor's degree, access to the internet access, government insurance, and had a combined household income of <$50,000/year. The top three patient desired dental health information for PHPs included completed procedures, past visit summaries, and date of last visit. Top three desired oral health topics on PHPs included signs of gum disease/proper management, cavity prevention, and proper toothbrushing/flossing techniques. Highest perceived barriers included high cost and privacy/security concerns. Highest perceived facilitators include user-friendly portal and ability to monitor own health.
Conclusions: This study illustrates dental patients' preferences for oral health information through a PHP and can inform the development of dental PHPs. Dentists need to work to overcome the identified barriers in order to increase patient engagement.
Support: The Buchanan Dental Clinic.

2) Title: Role of California School Nurses in Addressing Children's Oral Health

J CHANG, B LIN, KS HOEFT

UCSF School of Dentistry, Department of Preventative and Restorative Dental Sciences, Division of Pediatric Dentistry, and Center to Address Disparities in Children's Oral Health (CANDO)

Objectives: School nurses are uniquely positioned to provide oral health resources and to increase dental care access for children. The purpose of this project was to understand the current oral health-related knowledge, practices, and training among school nurses in California.
Methods: Through our partnership with the California School Nurse Organization (CSNO), an online Qualtrics survey was sent to its members consisting of school nurses and school nurse administrators. Survey questions asked about (1) demographics of the schools supported by respective school nurses, (2) oral health needs of the students they support, (3) previous oral health training taken, (4) forms of educational programs they would be interested in, as well as (5) school nurse perceptions on their role within dental care.
Results: 226 school nurses completed the survey, representing 16% of the total CSNO membership. Altogether, the participants supported 658 schools and oral health issues were common for students at 80% of these schools. While school nurses had reported that they currently offered oral health services such as providing referrals for dental homes and follow-up visits, reviewing oral health documentation required for kindergarten students, providing general oral health education to students, and performing dental screenings, 45% of participants felt that their current oral health training was inadequate. There was much expressed interest in more comprehensive interdisciplinary dental training sessions, such as through online modules and handbooks or toolkits. Overall, 97% of the participating school nurses believed that they could play a role in preventing and reducing dental decay in children.
Conclusions: Our findings have indicated that California school nurses recognize a need for oral health support in their students and believe school nurses could play a bigger role with additional training in oral health-related knowledge and skills.
Support: UCSF School of Dentistry Program in Global Oral Health.

3) Title: Effect of PP2A Activity on the Severity of Craniofacial Birth Defect Phenotype

J CHOI (1), H. RICHBOURG (2), R MARCUCIO (2)

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1) UCSF School of Dentistry, 2) UCSF School of Medicine, Department of Orthopedic Surgery

Objectives: Human holoprosencephaly (HPE) is a disorder where the forebrain of the embryo fails to develop into two hemispheres. The underlying mechanism of phenotypic variation in HPE-affected individuals, even with the same genetic mutation, remains unknown. NOSIP (Nitric Oxide Synthase Interacting Protein) has been shown to alter PP2A's activity, which is involved in Sonic hedgehog (SHH), a crucial brain signaling pathway in early craniofacial development. It is known that loss of NOSIP leads to an increase in PP2A activity at E18. We aim to quantify the PP2A activity level in NOSIP wildtype and mutant embryos to determine if there is a correlation between increased PP2A activity and the severity of craniofacial phenotype.
Methods: E10.5 - E12.5 NOSIP wildtype (WT), heterozygous (HET), and knockout (KO) embryos were collected. Embryo heads with similar phenotypes were either 1) sectioned for Basescope staining for NOSIP gene expression; or 2) processed for PP2A activity using a PP2A immunoprecipitation phosphatase assay kit.
Results: Mild to severe phenotypes were observed in both HET and KO, but only HET can appear unaffected. HPE also affects facial and airway structures such as narrow face, cleft lip/palate and micrognathia. NOSIP expression is ubiquitous in WT E10.5 – 12.5, but was overall reduced in unaffected HETs. At E11.5, PP2A activity level decreased in HETs and KOs compared to WTs, whereas E12.5 PP2A activity level increased in HET compared to WT. Biological replicates were not consistent, likely due to loss of agarose beads during washes.
Conclusions: PP2A is likely not a main mechanism driving increased variation in phenotype severity. Given that protein pathways are being affected by NOSIP KO, we need to identify new NOSIP target proteins. Specific PP2A kit did not appear reliable for low protein concentrations..
Support: UCSF School of Dentistry Dean's Office.

4) Title: Automated Gradient-Boosting Models Accurately Score Intraoral Plaque in Non-Standardized Images

E COY (1), W SANTO (1), B JUE (1), H LINDAU (2), F RAMOS-GOMEZ (2), S GANSKY (1)

1) UCSF School of Dentistry, Center to Address Disparities in Children's Oral Health, 2) UCLA School of Dentistry

Objectives: To develop and test automated image selection and intraoral plaque-scoring.
Methods: 1650 plaque-disclosed primary teeth (d-g) from 437 photographs (iPhone7 or Canon cameras) were evaluated from UCSF/UCLA trials (pilot, baseline). Data cleaning, transformations, statistical modeling, machine learning (ML), and data visualizations utilized Jupyter Notebooks, Python (3.7), OpenCV and Sci-kit Learn libraries, with Laplacian filter preprocessing. Image selection and plaque-scoring used 8 ML classification models. Mean plaque-scoring algorithm used 8 ML regression models. Models were tuned with a 70:30 train:test split, stratified 5-fold cross-validation (unstratified in regression models), and hyperparameter optimization. Area-under-the-curve receiver operating characteristic curve (AUC-ROC) and R^2 determined best classification and regression models, respectively, compared to calibrated clinician-scientist ratings. Training time was a secondary metric. Manual segmentation used Photoshop's lasso tool. Average and dominant hue, saturation, brightness values, score confidence, and image clarity were features for training plaque-scoring algorithms.
Results: Best performing models were: Support Vector Machine-Gaussian model for image selection, AUC-ROC >0.99 and 0.76s of training time; Gradient-Boosting classification and regression models for the single-tooth and mean plaque-scoring algorithms with AUC-ROC of 0.89 with 0.76s training and R^2 of 0.75 with 1414.67s training, respectively. Eleven images required color-correction via hue displacement.
Conclusions: Accurate automated plaque-scoring is attainable without high computational and financial costs of training deep learning models (DL). The single-tooth plaque-classification model may yield evaluating patients' hygiene by monitoring objective measures. Additionally, the mean plaque scoring model may standardize evaluating hygiene product efficacy. Automated plaque-scoring is attainable with little user manipulation; however, implementing automated tooth segmentation and synthetic sample generation with DL training may strengthen validity further for clinical, research, and teledentistry applications by eliminating manual image preprocessing.
Support: Delta Dental Foundation, NIH/NIDCR UH3DE025514 and U01DE025507.

5) Title: Knowledge and Attitudes of Dental Researchers: A Precision Health Survey 2021

S ELLMAN, AA LAZAR

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: Precision Health research has improved patient-treatment outcomes. However, it is unclear how often dental researchers use these methods.
Methods: Dental researchers were surveyed via email using Qualtrics. We surveyed researchers who had performed a clinical trial that was conducted within the United States and published on clinicaltrials.gov. The validated survey instrument consisted of 19 multiple choice questions concerning precision health evaluation.
Results: A total of 68 researchers were surveyed, ranging from general dentists and specialists to researchers who specialize in dental and oral health research. Approximately forty-nine percent (33/68) of respondents indicated their research was not aligned with precision health, while thirteen percent (9/68) of respondents indicated it was aligned with precision health. Thirty-eight percent (26/68) either declined to respond or left this response blank.

Conclusions: Of the dental researchers surveyed, a majority of respondents did not use precision health methods for their clinical studies. These results elucidate a potential lack of knowledge of the importance of precision health, in that some patients may differ in response to treatment from the overall "average" group's response, and providing treatment without awareness of this difference may produce unpredictable or even harmful outcomes. Awareness and knowledge of precision health is fundamental to patient centered outcome research (PCORI), and ensuring researchers gain this understanding and apply it to their research will help to advance dental research and the patient experience.
Support: N/A.

6) Title: Working Toward a Three-Dimensional Method to Study Secondary Palate Defects in Mouse Models of Human

M FEINBERG (1), S MINCER (2), M O'NEILL (1), C TENG (1), C PERCIVAL (2), J BUSH (1)

1) UCSF School of Dentistry, Department of Cell & Tissue Biology, 2) Stony Brook University, Department of Anthropology

Objectives: As one of the most common congenital conditions, cleft lip with or without palate occurs in 1 of 700 live births worldwide. Although the lip and palate are three-dimensional structures with complex morphogenesis, current methods for studying their development are limited to two dimensions. We aim to understand what is occurring beyond two-dimensional histological sections by developing a three-dimensional approach in quantifying shape change in the palate. We focus on craniofrontonasal syndrome (CFNS), which is characterized by a variety of craniofacial anomalies including cleft palate. CFNS occurs from loss-of-function mutations to the X-linked EFNB1 gene that encodes the EPHRIN-B1 protein. In this study, we use a CFNS mouse model to begin generating a three-dimensional approach that might be generalizable for analyzing gene/protein expression and tissue morphology.
Methods: Embryos were dissected at E13.5 and co-stained for Ephrin-B1 and nuclei. Subsequent confocal image stacks were organized and downsampled using Fiji software. Ephrin-B1 expression was segmented via growth-from-seeds technique and rendered into a three-dimensional model using Slicer software. Landmarking of the secondary palate was performed on Amira software. Palatal measurements were taken in R to investigate structural differences in controls and heterozygous mutants.
Results: Control secondary palates exhibit Ephrin-B1 expression at different levels along the anterior-posterior axis. Heterozygous loss of Efnb1 in females resulted in mosaic patterns of Ephrin-B1-expressing and non-expressing cells. The average mutant palatal shelf area is smaller compared to controls. Overall, methods were successfully executed.
Conclusions: Though this project is in the early stages of applying three-dimensional methods to quantify protein expression in CFNS, we believe that utilizing these methods to study palatal pathogenesis is promising. This will hopefully pave the way for application to other cleft palate mutant models and provide further knowledge on the three-dimensional basis for cleft palate.
Support: Department of Cell & Tissue Biology, NIH/NIDCR R01DE023337, and NIH/NIDCR 1F32DE030367.

7) Title: Nisin Inhibits Oral, Colon, and Thyroid Cancer Cells In Vitro

J GENG, M BACINO, A RADAIC, P KAMARAJAN, Y KAPILA

UCSF School of Dentistry, Department of Orofacial Sciences

Objectives: Cancer is the 2nd leading cause of death in the United States, and it accounted for more than 21% of total deaths in 2016 and 2017. Treatment of various cancers is difficult due to the unique pathophysiology and resistance mechanisms that emerge overtime. Therefore, seeking alternative cancer treatment that overcomes the limitation of traditional cancer therapy continues. Nisin is a naturally occurring broad-spectrum bacteriocin. Building upon prior studies which have demonstrated the efficacy of nisin in abrogating oral cancer, our study aimed to explore nisin as an antiproliferative and inhibitor of migration in a wide range of aggressive cancers (colon, thyroid, breast, prostate, and lung cancer).
Methods: Oral (HSC-3), colon (HCT-15 and DLD-1), thyroid (TPC-1, 8505C), lung (A549) and breast (MCF-7) cancer cell lines were cultivated in 37C 5% CO_2 and sub-cultivated every 2-3 days. Nisin effects on cancer cells were evaluated using a scratch assay, proliferation assay, or apoptosis assay. Unchallenged cells were used as a negative control.
Results: Nisin exhibited a significant dose-dependent effect on cancer cell proliferation and/or migration. Oral cancer cell proliferation was inhibited from 90% and migration was inhibited up to 95% for the highest Nisin doses compared to controls. Colon cancer (HCT-15) cell proliferation was inhibited up to 60%, and migration was inhibited up to 95% for the highest Nisin doses compared to controls. Colon cancer (DLD-1) cell proliferation was inhibited up to 60%, and migration was inhibited up to 85%. Thyroid cancer (TPC-1 and 8505C) cell proliferation was inhibited up to 75% for the highest Nisin doses compared to controls.
Conclusions: This work demonstrates that nisin inhibits oral and colon cancer cell proliferation and migration, and inhibits thyroid cancer cell proliferation in vitro. Studies on lung and breast cancer cells are ongoing. Thus, nisin has broad anticancer cell properties.
Support: The John Greene Fund, AAP Sunstar Innovation Grant, and NIH R01DE025225 grant to YLK.

8) Title: Industry Messaging about Sugar and Oral Health: A Content Analysis of Food Company Websites

A GRAMACY, CE KEARNS

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: Since 2010, Americans for Food and Beverage Choice (AFBC), an industry front group led by the American Beverage Association, has opposed sugary beverage taxes throughout the United States. The objective of this study was to identify oral health messages promoted by AFBC and their methods of dissemination.

Methods: We conducted a content analysis of the websites of AFBC and its eight industry members: the American Bakers' Association, Sugar Association, American Beverage Association, National Grocers Association, Food Marketing Institute, Consumer Brands Association, Corn Refiners Association, and the National Confectioners Association. Web pages were identified using both a "Google-Site search" and search terms "dental", "caries", "teeth", "oral", "fluoride", "tooth", "decay", "dentist", and "toothpaste", and subsequently screened for relevance. Oral health messages and dissemination methods were organized into themes.

Results: Fifty-one web pages contained oral health messaging content, which we categorized by the main topic: product strengths (n=8), opportunities (n=6), and threats (n=37). The types of threats addressed included dietary guidelines (n=12), consumer and policymaker attitudes (n=9), research (n=5), soda taxes (n=4), corporate social responsibility (n=4), and marketing (n=3). Within the 37 web pages addressing threats, we identified 72 specific message responses which aligned with six key themes: casting doubt on causes of tooth decay (38%), questioning the singling out of sugary beverages for policy action (10%), promoting corporate social responsibility (18%) promoting non-dietary solutions for caries (26%), engaging in product promotion (5%), and suggesting decreasing rates of caries prevalence (3%). AFBC and its members disseminated their oral health messages through blog posts, press releases, journal articles, annual and promotional reports, web pages, and infographics

Conclusions: AFBC and its eight industry members are actively disseminating oral health messages with the aim to discredit evidence that justifies sugar reduction policies. These misleading oral health messages should be countered by the oral health community.

Support: UCSF School of Dentistry Program in Global Oral Health, NIDCR K08DE028947.

9) Title: Implementation of Dental Therapy Education in the United States

M HOLLAND (1), A KOTTEK (1,2), M WERTS (1,2), E MERTZ (1,2)

1) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, 2) UCSF Healthforce Center

Objectives: As more states authorize the use of dental therapists as a workforce model to improve access to dental care in the United States (US), additional education programs will be needed. The establishment of accreditation standards by the Commission on Dental Accreditation (CODA) in 2015 legitimized the pursuit of dental therapy (DT) education programs across the US, but also created challenges integrating with existing programs. This study examined the development of DT education programs across the US.

Methods: Qualitative data was collected through a literature review and interviews with key stakeholders. Interviews relevant to education (n=21) were coded and analyzed in Dedoose guided by the Consolidated Framework for Implementation Research (CFIR).

Results: States that have implemented DT education have followed two models: DT alone and combined dental hygiene-therapy. Education programs have to meet state or tribal requirements and have compatibility within existing educational systems (e.g., other accreditation standards, degree credit requirements, training capacity). Only one of three current DT programs (Ilisagvik College) has achieved CODA accreditation. The development of DT education in the US has largely been influenced by the goals of key stakeholders amongst the various states who champion health equity and diversity in healthcare.

Conclusions: Education programs that link dental therapy to existing dental hygiene programs are finding tensions between complying with CODA standards and state legislative mandates. The future success of both DT and dental hygiene-therapy education programs may rely not only on meeting CODA standards, but also on interstate collaboration for broader professional mobility and standardization.

Support: W.K. Kellogg Foundation.

10) Title: Runx2 Isoforms Differentially Regulate Mmp13 Promoter Activity

T HUANG (1), SS SMITH (2), D CHU (2), RA SCHNEIDER (2)

1) UCSF School of Dentistry 2) UCSF School of Medicine, Department of Orthopedic Surgery

Objectives: Striking a precise balance between the deposition and resorption of bone during jaw development is critical to prevent jaw length defects. Jaw length is affected by expression of Runt-related transcription factor 2 (Runx2) in osteoblasts, which regulates expression of the bone-resorbing collagenase, Matrix metalloproteinase 13 (Mmp13). This study uses avian species with different jaw lengths to test the extent to which Runx2 isoforms differentially regulate the Mmp13 promoter and cause downstream effects on bone resorption.

Methods: Chick, quail, and duck Mmp13 promoter constructs were transfected into DF-1 (chick) cells or CCL-141 (duck) cells along with Runx2 isoforms (1A1, 1B1, 1B2, 2A1, 1B1, 2B2) and β-galactosidase, as control for transfection efficiency. We identified two single nucleotide polymorphisms (SNPs) directly downstream of the RUNX2 binding element in the Mmp13 promoter that distinguish chick/quail (AG) from duck (CA). We swapped these SNPs between species and assessed the effects on Mmp13 promoter activity using a luciferase assay. Each experiment was done with n=6 with 3 experimental replicates.

Results: Runx2 isoforms lacking middle exon 5 (Runx2 1B1, 1B2, 2B2) had a downregulating effect on luciferase activity in chick/quail promoters, whereas Runx2 isoforms containing exon 5 (Runx2 1A1, 2A1) had an upregulating effect. Inclusion of

chick/quail 'AG' SNPs in the duck Mmp13 promoter upregulated promoter activity compared to the endogenous promoter. Likewise, inclusion of duck 'CA' SNPs in the chick/quail promoter downregulated promoter activity compared to the endogenous promoter.

Conclusions: Mmp13 promoter activity is upregulated by Runx2 isoforms containing middle exon 5, which includes a nuclear localization signal, suggesting that Runx2 can regulate Mmp13 promoter activity through inclusion or exclusion of different domains. Species-specific SNPs adjacent to the Runx2 binding element in the Mmp13 promoter modulate promoter activity, suggesting that genetic variation may influence Runx2 transcription factor binding, leading to downstream effects on bone resorption.

11) Title: Caries Quality-Adjusted Life Year Proxy for WIC Participants

N IRIBARREN (1), TK LIN (2), Z ARRIOLA (2), H LINDAU (2), F RAMOS-GOMEZ (3), SA GANSKY (1)

1) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, 2) UCSF School of Nursing, Department of Social and Behavioral Sciences, 3) University of California, Los Angeles, School of Dentistry

Objectives: To determine a valid caries-proxy in primary teeth for quality-adjusted life year (QALY) evaluating preferences of participants in the Supplemental Nutrition Program for Women, Infants, and Children (WIC). Since no primary caries QALY estimate exists, researchers use similar childhood diseases (e.g., otitis media) as proxies. However, caries QALY proxy suitability has not been evaluated systematically.

Methods: A discrete choice experiment (DCE) survey administered to California parents (n=461) included a sub-group of WIC participants (n= 194). The DCE asked parents to compare preferences between childhood diseases (e.g. otitis media, tonsillitis, gastritis, allergic rhinitis, cold sores, and 5 caries stages) presented in pairs. WIC parents have children under age 5. Disease preference rankings were analyzed with conditional logistic regression clustered within-person to estimate odds ratios (ORs) and 95% confidence intervals (CIs) using STATA 16.0.

Results: WIC parents' demographic characteristics were: 65% White, 12% Black, 12% Other, 10% Asian; 38% Hispanic; 43% below federal poverty level; 53% male; mean age was 35 (SD= 10.0). WIC parents significantly preferred caries stage 1 compared to chronic otitis media (OR= 0.22, 95%CI: 0.05-0.94), acute tonsillitis (OR= 0.15, 95%CI: 0.04-0.62), chronic tonsillitis (OR= 0.20, 95%CI: 0.04-0.94), acute gastritis (OR: 0.24, 95%CI: 0.06-0.98), chronic gastritis (OR= 0.10, 95%CI: 0.02-0.51), caries stage 4 (OR= 0.16, 95%CI: 0.04-0.71), and cold sores (OR= 0.16, 95%CI: 0.04-0.68). Compared to chronic gastritis, parents preferred caries stage 2 (OR= 0.19, 95%CI: 0.04-0.89) and stage 5 (OR= 0.17, 95%CI: 0.04-0.87).

Conclusions: WIC participants preferred enamel lesions over otitis media which indicates otitis media is an inaccurate proxy for the earliest caries level. Multiple caries stages are preferred over chronic gastritis. Thus, otitis media may be reasonable for later caries stages, but further examination of parent preferences and utilities are needed for cost analyses.

12) Title: Biomineralization of Human Penile Tissue with Phenotypic Resemblance to Bone

H JUNG (1), M HENNEFARTH (1), P USTRIYANA (1), M KANG (1), R WHITE (2), S SRIRANGAPATANAM (3), T LUE (3), M STOLLER (3), A SHINDEL (3), G LIN (3), S HO (1,3)

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Objectives: To investigate the colocalization of inorganic and organic constituents within mineralized and mineralizing human Peyronie's plaque (PP) using microspectroscopic methods.

Methods: Surgically excised human PPs were imaged using micro-X-ray computed tomography. Spatial maps of elements including calcium (Ca), phosphorus (P), and zinc (Zn) were generated using microprobe X-ray fluorescence spectroscopy (XRF). X-ray and XRF maps were analyzed to determine elemental counts in regions of higher and lower mineral densities. Ultrastructural characterization of the tissue specific to regions of higher and lower mineral densities was conducted using scanning electron microscopy and energy dispersive X-ray spectroscopy.

Results: Mineralized PP contained lamellae and osteocytic-like lacunae. The mineral density of PP on average (1003.75 mg/cc) was comparable to MDs of dental tissues (cementum: 1220 mg/cc, dentin: 908.79 mg/cc), alveolar bone: (1192.88 mg/cc), and cortical portion of skeletal bone (1043.88 mg/cc). It was significantly higher than the MD of trabecular portion of skeletal bone (174.20 mg/cc). A lower pore density (0.080%) of smaller diameter pores was observed in higher MD PP compared to higher pore density (0.72%) of larger diameter pores in lower MD PP. Higher counts of Ca and P were localized in the higher MD PP, and higher counts of Zn were localized in the lower MD PP.

Conclusions: The less mineralized Peyronie's plaque was enriched with Zn. Localization of Zn-associated biomarkers such as matrix metalloproteases and tissue nonspecific alkaline phosphatase and dentin matrix protein 1 are warranted to elucidate the effect of Zn in association with Ca and P on biomineralization of PP.

13) Title: Evolutionary Developmental Analysis of Enamel Microstructure in Relation to Amelogenin Self-Assembly Domain

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Objectives: Investigation into the origin of guided apatite fiber formation along evolutionary lineages will enhance our understanding of enamel's structural characteristics. This study compares the primary sequence of an amelogenin domain that drives self-assembly into nanoribbons from frog and human with their enamel microstructures.
Methods: The 15P2 domain from human amelogenin predictably self-assembles into ribbon-like structures. To investigate how early this characteristic arose in evolution, we surveyed the most primitive species for which this domain was available: the Western clawed frog. Both frog-15P2 (PQHPGYVNF(pS)YEILS) and human-15P2 (PGHPGYINF(pS)YEVLT) contained a phosphorylated serine residue, as in native amelogenin. Peptides were suspended in a calcium phosphate solution and subsequently analyzed by atomic force microscopy (AFM). For further investigation into enamel microstructure, teeth samples from 7-gill shark, longnose gar, crocodile, western clawed frog, opossum, flying fox, and human were obtained, polished, acid-etched, and analyzed by AFM. Amelogenin sequences were accessed from UniProt database and were aligned using Clustal Omega.
Results: Despite sequence differences between human and frog-15P2, ribbon formation was observed in both samples albeit with slightly different outcomes. Human-15P2 predictably formed ribbons at the earliest time point analyzed (2 days). Delayed kinetics were observed for frog-15P2, which did not demonstrate ribbon formation until 6 days after initial suspension in calcium phosphate solution. Frog-15P2 ribbons exhibited similar dimensions as Human-15P2, measuring 3.5–4 nm in thickness. Overall, similarities in the 15P2 region are observed across species: evolutionary and sequence analyses suggest that this 15P2 domain provided amelogenin with the ability to self-assemble into nanoribbons in early animals.
Conclusions: This study suggests that the evolutionary conserved P2-domain has the function to facilitate self-assembly into nanoribbons even in early species. Other domains on the amelogenin gene may be critical for guided mineralization of apatite ribbons and organization into enamel rods as observed in mammalian enamel.

14) Title: Dental Providers See the Value of Evidence-Based Dentistry: A Bumpy Road

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Objectives: At the end of 2013, Willamette Dental Group (WDG) implemented an evidence-based dentistry model through the use of Caries Management by Risk Assessment (CAMBRA) and Periodontal Management by Risk Assessment (PEMBRA). Previous research has shown clinical effectiveness of CAMBRA and PEMBRA, however, evidence is lacking about implementation in real-world settings. This study seeks to assess providers' perceptions and acceptability of implementation of the CAMBRA/PEMBRA model in a large dental care organization.
Methods: Semi-structured interviews of WDG providers across 10 offices located in the Pacific Northwest and Idaho asked their opinions on the facilitators and barriers of implementation of WDG's Proactive Dental Plan were conducted in 2014 and 2016. Interviews were audio-recorded, transcribed, and coded for emerging themes through Dedoose.
Results: 36 providers were interviewed (23 from 2014 and 13 in 2016), including dentists, hygienists, dental assistants, and dental care advocates. Providers report that implementation was aided by an alignment of philosophy between providers and WDG as well as quality of care audits, which tied in financial incentives. Providers saw the value of evidence-based dentistry enacted through a more proactive preventive approach to patient care, as patients are more involved with their own health outcomes, and care is standardized across the organization. Despite compensation incentives, providers believe WDG is not selling dental procedures, but rather profiting from getting patients healthy. Providers' main concern with the implementation of the model is the inflexibility of the clinical decision support tools built into the electronic health record, which can put patients into boxes, despite an appeal process.
Conclusions: Despite some concerns about the uncompromising nature of the computer program used to implement the risk-assessment-based Proactive Dental Care Plan, dental providers at WDG welcome the use of evidence-based dentistry and see it as the future of a more calibrated approach to dentistry.

15) Title: UCSF Dental Clinic Patient Experience with Vulnerabilities During COVID-19

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Objectives: Vulnerabilities, such as not having a safe place to sleep and difficulty accessing food, may constrain patients' ability to access healthcare and pursue healthy lifestyles. UCSF predoctoral patients who experienced vulnerabilities were compared to those without to examine differences between their pain score, satisfaction score, and barriers to care.

Methods: This cross-sectional survey conducted during the COVID-19 pandemic 11/2020-1/2021 included three validated instruments: vulnerability, pain, and overall satisfaction. Participants were English speaking adults and patients at the UCSF predoctoral Dental Clinic. Fisher's exact test and multivariable logistic regression were generated.

Results: Of the 81 respondents, 58 (72%) had self-reported vulnerabilities. Those who experienced vulnerabilities were not employed (84%, n=68, p-value: 0.012), not able to receive dental care when needed (85%, n=69, p-value: 0.04), and lived close to the clinic (within 25 miles: 78%, n=63, p-value: 0.048). Those who needed care but did not receive it were 9.9 times (Adjusted 95% CI: 2.2-52.1, p-value: 0.003) more likely to experience vulnerabilities. Those living closer (Adjusted OR: 2.5, 95% CI: 0.5 to 12.5, p-value: 0.25) and not employed (Adjusted OR: 10.7, 95% CI: 2.2 to 52.1, p-value: 0.003) were more likely to experience vulnerabilities. Among 38 participants (47%) exhibiting pain, nearly all (89%) reported vulnerabilities (mean pain score: 3.3, 95% CI: 2.6-3.99). Those without vulnerabilities were slightly more satisfied (0.4: 95% CI: -2.8 to 3.7, t-test p-value:0.8).

Conclusions: After vulnerable patients were able to access dental care, they were nearly equally as satisfied with their care as those without self-reported vulnerabilities. However, vulnerable patients reported more pain and encountered more obstacles during COVID-19 that affected their ability to access care.

Support: The Buchannan Dental Clinic.

16) Title: Generating a Model to Study Lysosome pH Dynamics in Stem Cell Differentiation

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Objectives: An increase in intracellular pH is necessary for embryonic and adult stem cells differentiation; however, the role of organelle pH dynamics in stem cells remains undetermined. The purpose of this project was to generate a mouse embryonic stem cell (mESC) model in the naïve state expressing a fluorescent lysosome pH (pHlys) biosensor to resolve pHlys dynamics during mESC differentiation.

Methods: The Barber Lab developed pHLARE (pH Lysosomal Activity REporter), a biosensor containing lysosomal transmembrane protein LAMP1 fused with sfGFP and mCherry. Fluorescence ratio of pHlys-sensitive sfGFP and cytosolic pH-insensitive mCherry allows quantitative measurements calibrated with nigericin buffers to determine pHlys.

To transfect pHLARE plasmid into mESCs, we tested Lipofectamine3000 and electroporation at 250V. We used Gibson assembly to subclone pHLARE into a novel lentivirus plasmid with an EF1α promoter, known to facilitate expression of heterologous proteins in mESCs. The lentivirus was used to infect mESCs, and pHLARE expression was determined after 48h by spinning disk confocal fluorescence microscopy.

Results: Lipofectamine transfection resulted in limited pHLARE expression. Cells expressing pHLARE had swollen lysosomes and abundant vacuoles. Electroporation resulted in higher efficiency and abundant cell death after 24h. Additionally, live cells lost expression after 48h. Infection with lentivirus after replacing the plasmid's CMV promoter with the EF1α promoter was the most successful. Expression of pHLARE retained after 48h with no visible effects on lysosome morphology. We are generating mESCs stably expressing pHLARE to quantify pHlys dynamics during differentiation.

Conclusions: Stably expressing recombinant proteins in naïve mESCs is notably difficult. Methods using transfection, including lipid-mediated reagents and electroporation, resulted in limited expression and cell viability. Lentivirus transfection, resulted in good expression efficiency, limited cell death, and no change in lysosome morphology. With this approach we can now generate naïve mESC stably expressing pHLARE to resolve pHlys dynamics during differentiation and lineage specification.

Support: Dr. Caroline Damsky and Dr. Peter Sargent.

17) Title: Nisin Probiotic Prevents Periodontal Disease and Related Inflammatory Host Response while Promoting Regenerative Periodontal Cells and a Shift Toward a Healthy Oral Bacteriome and Virome

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Background: Dysbiosis of the oral microbiome mediates chronic periodontal disease, including its characteristic bone loss and host inflammatory response. Treatment with antibiotics and probiotics have been used to modulate the microbial, immunological, and clinical landscape of periodontal disease with some success. Antibacterial peptides or bacteriocins, such as nisin, and nisin-producing probiotics, such as Lactococcus lactis, have not been examined in this context. However, they warrant examination because of their well characterized biomedical benefits in eradicating biofilms and oral pathogenic bacteria, while also modulating immune mechanisms.

Objectives: The goal of this study was to examine the potential for nisin and its nisin-producing probiotic to abrogate periodontal bone loss and modulate the composition of the oral microbiome and inflammatory landscape.

Methods: A polymicrobial mouse model of periodontal disease was employed for this purpose.

Results: In the context of disease, nisin and a nisin-producing L. lactis probiotic significantly decreased the levels of the periodontal pathogens, alveolar bone loss, the oral inflammatory response, and the host-antibody response to these pathogens. Surprisingly, nisin enhanced the number of gingival fibroblasts, periodontal ligament cells, and bone lining cells. Nisin and probiotic treatment significantly shifted the oral bacteriome and virome towards the healthy control state. This shift was characterized by a unique signature where health was associated with a Proteobacteria, whereas 3 retroviruses were associated with disease. These and

other specific disease-associated microbial species were highly correlated with IL-6 levels. The ability to shift the oral microbiome towards health is a useful approach to treating periodontal disease in vivo. Nisin's ability to shift the oral microbiome towards health, mitigate oral disease and the host immune response, and promote a regenerative periodontal phenotype may benefit the regenerative potential of the periodontium and negate systemic effects associated with periodontal disease and its pathogens.
Conclusions: N/A

18) Title: Impact of Children's Night Clinic and Give Kids a Smile Day Use on Patient Oral Hygiene, Oral Health-Related Quality of Life, and Access to Dental Care

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Background: The Children's Night Clinic (CNC) at UCSF provides preventive care, holding care, and counseling toward obtaining Denti-Cal to uninsured children in the Bay Area. Give Kids a Smile Day (GKASD) is an annual event that provides similar services, but without regard to insurance status.
Objectives: The objectives of this study are to 1) assess change in oral hygiene behaviors in children using CNC or GKASD 3 months after their first visit, 2) assess change in oral health-related quality of life in children using CNC or GKASD 3 months after their first visit, and 3) measure the percentage of children reporting dental insurance coverage 3 months after their first visit.
Methods: We had parents of children attending CNC and GKASD fill out an enrollment form and a pre-questionnaire evaluating outcome variables. We contacted parents 3 months after to fill out an identical post-questionnaire. We used chi-square analysis to evaluate differences between CNC and GKASD groups as well as between baseline and follow-up groups, using a significance level of 0.05.
Results: 41 participants filled out the pre-questionnaire, 16 from CNC and 25 from GKASD. 8 participants filled out the post-questionnaire. There were statistically significant associations between baseline group (CNC versus GKASD) and outcome variables of insurance status, last dental visit, and snacking habits, with p-values of 5.5x10-6, 0.0014, and 0.0023, respectively. The percentage of patients with insurance coverage increased from 62.5% at baseline to 75% 3 months post-visit. There were no statistically significant differences between baseline and follow-up groups.
Conclusions: CNC and GKASD do not target the same patient populations and may not address the same disparities in oral disease burden. Since we did not observe any differences between baseline and follow-up groups, both clinics may need to work on improving dental insurance counseling and delivery of OHI and preventive care.

19) Title: Polymer-Induced Liquid Precursor (PILP) Promotes Remineralization of Natural and Artificial Root Caries Lesions

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Objectives: The Polymer-Induced Liquid Precursor (PILP) system has been shown to remineralize artificial carious dentin lesions by reintroducing apatite mineral into the collagen fibrils, restoring substantial mechanical properties of carious tissues (i.e. functional remineralization). This project applies the PILP remineralization technology to both artificial and natural root caries (class V) lesions with various pretreatments and evaluates the effectiveness of the PILP-method to restore nanomechanical properties of these lesions.
Methods: Natural and artificial carious lesions were analyzed. The natural lesions were divided into three subgroups, each pretreated with A) Papacarie (R) (enzyme-based caries removal), B) excavation with a bur, or C) no pretreatment. All samples were remineralized in a calcium phosphate (CaP) or PILP solution for a period of either 30 or 90 days. The samples were then analyzed using optical microscopy, atomic force microscopy (AFM), and nanoindentation to characterize functional remineralization.
Results: Remineralization of natural root caries in PILP solution showed higher amount of open dentinal tubules than those in CaP solution by optical and atomic force microscopy. Samples pretreated with Papacarie followed by PILP solution treatment showed the most open and uniform arrangement of tubules. However, remineralization in CaP solution yielded a higher amount of surface mineral precipitation and deposition, confirmed with a shrinkage study. The CaP samples showed higher shrinkage (30 um) compared to PILP samples (2 um). Nanomechanical studies of CaP dentin samples showed an improvement of the elastic modulus, but it remained significantly lower than sound dentin.
Conclusions: Structure analysis suggests that Papacarie pretreatment followed by PILP treatment is the most effective method to promote remineralization of root caries. More analysis with nanoindentation is necessary to determine the effectiveness of this method in restoring nanomechanical properties of these lesions.

20) Title: Osteocyte Cellular Network and Sclerostin Expression in Aged Mouse Mandible

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Objectives: Mechano-stimulation of the osteocyte Lacunocanalicular Network (LCN) diminishes osteocytic expression of the bone formation inhibitor sclerostin (SOST). SOST repression through mechanostimulation is lost by blocking the transforming growth factor beta (TGFβ) pathway, which is accompanied by LCN degeneration. However, the extent to which lost LCN mechanosensitivity and SOST regulation is related to age-related changes to bone density in the mandible is unknown. This study aims to elucidate how the combined influences of age and TGFβ signaling impact bone mass and osteocyte activity via sclerostin expression in the mandible.

Methods: Mandibles from 4-mo and 15-mo male mice with osteocyte specific ablation of TGFβ receptor II (TβRII$^{ocy-/-}$) were dissected. Left mandibles were decalcified, frozen in OCT, sectioned and stained with fluorescent markers for 3D imaging of the LCN. Contralateral mandibles were scanned by μCT to quantify bone density, then decalcified, paraffin embedded, and sectioned for sclerostin immunofluorescence. ImageJ was used to analyze canalicular tortuosity and percentage of osteocytes expressing sclerostin.

Results: 4 mo. old TβRII$^{ocy-/-}$ mice displayed higher sclerostin expression and decreased bone mass compared to WT controls, but no change in canalicular tortuosity. 15 mo. WT mice showed increased tortuosity as well decreased sclerostin expression and higher BMD than young WT mice. 15 mo. old TβRII$^{ocy-/-}$ mice showed increased canalicular tortuosity and lower sclerostin expression similar to their age-matched WT controls, but no age-related changes to BMD.

Conclusions: At young ages, loss of the TGFβ signaling pathway prevents mechanical repression of sclerostin and leads to lower bone mass in the mandible. Increased osteocyte canalicular tortuosity in the mandible of middle aged (15 mo.) mice may lead to increased mechanical repression of sclerostin and increases to bone mass. Although middle-aged TβRII$^{ocy-/-}$ mice generate osteocyte tortuosity and show reduced levels of sclerostin, they display lower BMD traditionally seen in elderly bone.

21) Title: Effects of p75NTR on Craniofacial Development Utilizing Geometric Morphometric Analysis

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Objectives: The objective of this study was to investigate how p75NTR, a nerve growth factor receptor encoding gene, affects the size and shape of cranium and mandible in conditional knockout mice.

Methods: The p75NTR gene was conditionally knocked out in mesenchymal cells using Cre-LoxP recombination by crossing p75NTR flox with Prx1-Cre transgenic (Prx1-Cre) mice for the study. The mice were randomly divided into four groups: 1) Control mice at 4 weeks age (p75NTR fl/fl-4W), 2) p75NTR cKO mice at 4 weeks age (Prx1-Cre; p75NTR fl/fl-4W), 3) Control mice at 12 weeks age (p75NTR fl/fl-12W), and 4) p75NTR cKO mice at 12 weeks age (Prx1-Cre; p75NTR fl/fl-12W). Micro computed tomography (Micro-CT) was conducted on the craniofacial bones and then, geometric morphometric analysis was performed using 3D Slicer image processing platform. To assess morphology and size differences between p75NTR fl/fl mice and Prx1-Cre; p75NTR fl/fl mice depending the ages, 44 landmark points were placed on the craniums, and 19 landmark points were placed on the mandibles. Also, Principal Components Analysis (PCA) of the landmarks and linear representation of the bones were performed.

Results: In both 4 week and 12 week mandibles, the Prx1-Cre; p75NTR fl/fl mice had a condylar process that was blunted, curved, and protruded according to the linear representation. However, the angular process, coronoid process, and incisor alveolus are less protruded compared to p75NTR fl/fl mice.

Prx1-Cre; p75NTR fl/fl-4W and Prx1-Cre; p75NTR fl/fl-12W mouse craniums exhibited a phenotypic difference when compared to craniums of p75NTR fl/fl-4W and p75NTR fl/fl-12W mice.

Conclusions: Conditional knockout of p75NTR induces a phenotypic change in craniofacial development in both young and adult mice that is detectable by geometric morphometric analysis.

22) Title: Assessing Facial Aesthetics Using in Silico Generated 3D Models

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Objectives: This study used landmark-based three-dimensional geometric morphometrics to generate novel human faces that model the effect of sagittal profile (ANB), asymmetry (LAS), and facial aesthetics (FAES). We used these models to test the hypothesis that the perception of FAES is positively associated with congruent orthodontic measures of sagittal profile (ANB) and low asymmetry, while misaligned upper/lower jaw (Angle Class II or III) and higher asymmetry are negatively associated.

Methods: Using 17 landmarks, we generated an average male and female face from a sample of cone beam computed tomographic (CBCT) scans (N=364, ANB range 0.1-10.6, age 15-35), then calculated a multivariate regression to describe shape vectors associated with ANB, LAS, and FAES. We produced models spanning a range of predicted outcomes for each variable (N=41). A group of people (N=56) rated these models for FAES and LAS using a visual analogue scale (VAS). Individuals with the highest, lowest, and intermediate FAES were altered to produce forty-six models, which were rated for FAES.

Results: The data indicate that FAES-based transforms follow a curvilinear relationship where the extremes have lower FAES ($R2=0.7051$, $p=0.0032$). Class I sagittal profile classification has the highest FAES (48.68) compared to Class II (40.99) or III (43.75). LAS negatively correlates with FAES ($R2=0.8724$, $p=0.00023$) and positively with ability to note asymmetry ($R2=0.8758$, $p=0.00021$). This study's FAES scores followed a similar pattern as predicted from a previous study but were on average 21.04 points higher for female models and 14.74 points higher for male models.

Conclusions: Consistent with previous findings, FAES is positively associated with skeletal correlates of jaw functionality (normal ANB and low asymmetry), suggesting surgical advancement needed to improve ANB or LAS will lead to increased FAES. Differences between raters in perceived FAES may reflect individual preferences, whereas common factors suggest a convergence on functionally associated outcomes.

Support: Department of Oral and Maxillofacial Surgery.

23) Title: HIV-Associated Invasion of Oral and Cervical Epithelial Cancer Cells

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Objectives: The incidence of oral and cervical epithelial neoplasia in human immunodeficiency virus (HIV)-infected individuals is substantially higher than that in HIV-negative individuals. HIV may increase the risk of malignancy in epithelia by induction of an epithelial–mesenchymal transition (EMT) that leads to invasion of neoplastic cells.

Methods: HPV-16-infected and uninfected oral and cervical epithelial cells were co-cultivated with activated HIV-infected and -uninfected peripheral blood mononuclear cells (PBMCs), CD4+ T lymphocytes, and macrophages. EMT induction of epithelial cells was detected by mesenchymal morphology after Giemsa staining of cells. The invasion activity of EMT cells was examined by their transmigration via collagen-coated Transwell inserts with HIV-infected cells in the lower chamber of inserts.

Results: Cocultivation of HPV-16-positive and -negative oral and cervical cancer epithelial cells with activated HIV-infected and -uninfected PBMCs showed induction of EMT cells with a spindle-like shape. Transmigration of HPV-16-positive and -negative oral and cervical cancer cells toward activated HIV-1-infected and uninfected PBMCs in the lower chamber of the inserts showed that both HIV-infected and uninfected PBMCs increased EMT induction of HPV-negative and -positive cancer cells. Transmigration of HPV-16-positive and -negative oral cancer cells toward HIV-1-infected and uninfected CD4+ T lymphocytes and macrophages showed transmigration of both HPV-16-positive and -negative oral cancer cells. Transmigration of cancer epithelial cells was greater toward HIV-infected CD4+ T lymphocytes and macrophages than uninfected lymphocytes and macrophages. Inhibition of HIV-1 replication by azidothymidine reduced transmigration of cancer cells.

Conclusions: Our findings suggested that direct and indirect interaction of HIV-infected or uninfected activated PBMCs, CD4+ lymphocytes, and macrophages with HPV-positive or -negative oral and cervical cancer cells may induce EMT of cancer cells. HIV-infected cells may express and secrete chemokine and cytokines, which may promote migration and invasion of EMT cancer cells via paracrine manner.

Support: Dr. John Greenspan & Dr. Deborah Greenspan.

24) Title: Community Engagement is an Integral Part of Dental Therapy Advocacy

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Objectives: The lack of access to dental care in the U.S. is being addressed in part by the authorization of dental therapists. Community engagement (CE) is believed to be crucial to the successful adoption of this new workforce model, given opposition by organized dentistry. This study identifies the characteristics of CE within successful dental therapy (DT) efforts in Alaska (AK), Washington (WA), Oregon (OR), and New Mexico (NM).

Methods: A literature review (n=27) on DT and CE informed qualitative data analysis of interview transcripts (n=36) from key DT stakeholders, which were coded inductively using Dedoose software. Excerpts relating to each code were analyzed, summarized, and deductively assigned a level of CE guided by the Active Community Engagement (ACE) Continuum.

Results: The CE efforts in each state shared five key themes: tribes exchanging ideas, the use of media to promote DT, tribal members as leaders, the role of champions and empowered community members, and partnerships with external organizations. When mapped to CE attributes, OR and NM strongly demonstrated each of the five CE efforts. Both AK and WA were strongest in building local capacity to advocate to institutions and governing structures, OR was strongest in community involvement in assessment, and NM was strongest in access to information. Both inclusion in decision making and local capacity to advocate to institutions and governing structures were the most prevalent CE efforts across all four states.

Conclusions: These findings demonstrate the importance of CE in implementing health solutions, particularly when faced with political opposition. In the case of DT authorization, CE was critical, however, no one CE formula was found to be necessary.

Support: W.K. Kellogg Foundation, AAP Sunstar Innovation Grant, and NIH R01DE025225 grant to YLK.

25) Title: Exploration of Bleaching with Remineralization in Repair of Hypomature Enamel

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Objectives: To date, there are no known non-surgical therapies for hypomature enamel, a highly prevalent condition. KLK4 knockout mice lack KLK4 enzyme, a proteinase key in enamel maturation that digests proteins in enamel left from secretory stage, allowing for the enamel to more fully mineralize. This study focused on whether hypomature KLK4 knockout mice enamel would be successfully repaired with sodium hypochlorite and calcium phosphate mineralization treatment.
Methods: KLK4 KO incisors were set in epoxy and polished to expose a sagittal cross section. Mice incisors were then exposed to 3% sodium hypochlorite for 5 minutes, and then set in 1.5 mM PO4, 2.5 mM Ca pH 7.4 tris buffer for 24 hours. Samples were analyzed at baseline, after bleaching and after remineralization using Atomic Force Microscope (AFM) scans, nanoindentation, and SEM scans.
Results: AFM and SEM scans revealed a mineral layer on the surface of KLK4 enamel subjected to deproteinization and remineralization. However, nanoindentation demonstrated a minute increase in elastic modulus (from 10.8 to 11.55 Gpa), with a small decrease in hardness (0.4 to 0.38 Gpa). These changes were not enough to recover the elastic modulus or hardness of a comparable wild type mouse enamel.
Conclusions: Simple calcium phosphate solution when applied to hypomature KLK4 samples after bleaching does not repair enamel. Further investigation of remineralization with Polymer-Induced Liquid-Precursor and casein phosphopeptide–amorphous calcium phosphate is needed.
Support: UCSF School of Dentistry, Department of Orofacial Sciences, Center for Dental, Oral & Craniofacial Tissue & Organ Regeneration (C-DOCTOR), UCSF School of Dentistry, Department of Preventative and Restorative Dental Sciences.

26) Title: Dental Sealant Utilization Patterns Among California Medicaid-Eligible Children

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Background: Dental sealants, a safe, cost-effective preventive treatment, are a covered child benefit under the California Medi-Cal (Medicaid) Dental Program.
Objectives: This project aims to identify patterns in California Medicaid-eligible children's sealant utilization by race/ethnicity, county, and county-level characteristics to characterize potential disparities
Methods: Data from the California Health and Human Services Open Data Portal were used to describe patterns in dental sealant utilization among Medicaid beneficiaries ages 6-9 years according to demographic and geographic characteristics from 2013-2018. Sealant utilization was compared across race/ethnicity, county, and county level-characteristics (e.g., population density, median income) obtained from other public data sources. Data analyses were performed using STATA 16.0.
Results: Statewide, age 6-9 Medicaid sealant utilization was little changed from 2013 (17.3%) to 2018 (17.2%), far below the national Healthy People 2020 Goal (28.1%). Age 6-9 sealant utilization differed by race/ethnicity, but racial/ethnic differences were largely consistent over time. In 2018, sealant utilization was highest among Hispanic/Latinx children (19.1%). and lowest among American Indian or Alaskan Native children (7.1%). County-level sealant utilization was strongly correlated with county characteristics: total population (Spearman rho=0.63), population density (Spearman rho=0.59), and median household income (Spearman rho=0.37).
Conclusions: Dental sealants are substantially underutilized among California Medicaid-eligible children, with no county or statewide race/ethnicity group reaching the Healthy People 2020 Goal and particularly stark disparities between urban and rural counties. Additional research should examine sealant utilization facilitators and barriers to inform efforts to improve sealant utilization, particularly in underserved demographic groups.
Support: The Lee Hysan Fund.

27) Title: Understanding the Molecular Mechanism Responsible for Enamel Defect in Nckx4-null Mice

C YOON, Y ZHANG

UCSF School of Dentistry, Department of Orofacial Sciences

Objectives: Understanding intricate processes during amelogenesis is crucial for healing Amelogenesis Imperfecta (AI), a congenital disorder resulting in deformed enamel. Starting with protein-guided hydroxyapatite growth, enamel formation completes with a mineralized tissue composed of 98% minerals. Mutations in human gene NCKX4, a calcium transporter, cause AI with worn-down hypomaturation enamel. This study investigated molecular mechanisms for enamel defect in Nckx4-/- mice by comparing their enamel matrix to that of Klk4-/- mice, in which the causative factor responsible for hypomaturation enamel has been identified.
Methods: Incisal sagittal sections, providing all developmental stages of amelogenesis, were collected from hemimandibles of Nckx4-/- and Klk4-/- mice. The histology of Nckx4-/- and Klk4-/- mouse enamel was compared by Hemotoxylin & Eosin staining. The presence of amelogenins, comprising 95% of enamel matrix proteins, was immuno-stained on incisal sagittal sections with an amelogenin antibody. Total proteins were collected from mouse developing enamel matrix and analyzed by SDS-PAGE.

Quantitative PCR assessed klk4 expression in Nckx4-/- maturation ameloblasts, and KLK4 enzyme activity of Nckx4-/- enamel matrix was analyzed by incubating enamel with a quenched fluorescent peptide..

Results: H&E staining showed that similar to Klk4-/- enamel, matrix remained at the end of maturation stage of Nckx4-/- enamel, while matrix was completely absent at the same stage of wt mouse enamel. Immunostaining and SDS-PAGE indicated that amelogenins failed to be appropriately hydrolyzed and removed in both Nckx4-/- and Klk4-/- mouse enamel. Although Nckx4 deletion upregulated the expression of KLK4, KLK4 activity was reduced in Nckx4-/- enamel.

Conclusions: Our findings show that NCKX4 is critical for enamel formation by not only transporting calcium into enamel for hydroxyapatite growth but also modulating KLK4 activity to remove enamel matrix proteins - both are necessary for normal enamel biomineralization.

Support: UCSF School of Dentistry, Department of Orofacial Sciences, R01 DE027076 to YZ.

28) Title: Mandibular and Cranium Skeleton Malformation of CD271-null Mice

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1) UCSF School of Dentistry, Department of Orofacial Sciences, 2) UC Berkeley, 3) Carnegie Mellon University, 4) Diablo College, 5) UCLA School of Dentistry

Objectives: Investigate the effect of neural crest stem cell marker CD271 gene deficiency on mandibular and cranium dysmorphology in mice and explore origin-based impacts on craniofacial development using generalized procrustes analysis.

Methods: Micro-computed tomography (Micro-CT) was performed on the entire skull of CD271 knockout mice and inbred wildtype mice at 4 weeks age and 12 weeks age. The image data sets were processed using 3D Slicer (Version 4.11.0, Massachusetts, USA) followed by segmentation of the skulls. Landmark points on the cranium and mandible were placed to capture anatomical variation of the reconstructed skull models. Generalized procrustes analysis based on 3-D landmark points was performed to evaluate all patterns of morphological changes of craniofacial skeleton, including cranium, maxilla and mandible caused by loss of CD271. Furthermore, conventional outline, angles, linear distance measurement and principal components analysis of landmark sets were conducted to evaluate generalized and localized morphometric variations. Bone volume and size analysis were also performed to elucidate craniofacial development phenotypes.

Results: The overall dimensions and bone volume of the cranium and mandible were smaller in homozygous CD271-null mice compared to wildtype. Generalized procrustes analysis on mandible suggested CD271-null mice mandible had shorter condyle, reduced mandible height and shape malformation. CD271-null mice also exhibited distinguishable changes in overall shape of cranium, with distortion in nasal bone, maxilla and occipital bone compared to wildtype. The shape differences in mandible and cranium was statistically significant (P<0.05) tested by principle component analysis with Procrustes ANOVA.

Conclusions: Generalized procrustes analysis revealed impaired mandibular and cranium development in CD271-null mice compared to wildtype. Our findings suggest neural crest stem cell marker CD271 gene is greatly involved in mice craniofacial development, and knockout of CD271 will result in craniofacial dysmorphology in mice.

Support: This study was partly supported by NIH/NIDCR K08 DE 024603 and UCSF Dental Student Research Fellowship Program.

29) Title: Development and Evaluation of an Oral Health Mobile Application

E ZHOU, E CHENG, H LONG, J CHENG

Department of Preventative and Restorative Dental Sciences, UCSF School of Dentistry

Objectives: Excessive dietary sugar and poor oral hygiene are major causes of dental caries. This study aims to design, create and evaluate a mobile app to provide oral health education to pre-adolescents and track their daily sugar intake and oral hygiene.

Methods: Literature review and market research of existing apps were conducted to create initial designs. The app (developed using the platform Appery.io), has three components: 1) education: contains videos about oral hygiene, dietary sugar, and cariogenesis; 2) tracking: daily brushing, flossing, and sugar intake, which also includes a custom-made video to explain how sugar/acid causes caries and to give instructions for tracking cariogenic food; 3) summary: displays daily progress. UCSF dental patients aged 8-14 and their parents/guardians were enrolled, asked to try the app, and give initial feedback through a survey (pre). Then they were asked to use it for a week and complete a follow-up survey (post).

Results: 35 participants were enrolled (average age 10.86±1.94), 32 and 30 completed the pre and post survey, respectively. 94% had never used an oral hygiene app before. Participants thought the app was easy-to-navigate (94% pre, 87% post), attractive design (84% pre, 77% post), and beneficial in improving their oral hygiene (84% pre, 90% post). The app had an average rating of 4.47/5 (pre) and 4.44/5 (post). The 30 participants who completed the study used the app for an average of 5.4±2.2 days during the week. Overall, majority users (66% pre, 67% post) would recommend the app to their friends.

Conclusions: High acceptance, utilization, and satisfaction of the mobile app suggests that a comprehensive tool that combines education, tracking and feedback has great potential to benefit children's oral health outlook. More research is needed to evaluate long-term effects in sugar and caries reduction.

Support: Lee Hysan Fund, Delta Dental Community Foundation Research Grant.

30) Title: Diet and Nutrition Principles and Practices Taught in the UCSF School of Dentistry Pre-Doctoral Curriculum: Recommendations for Improvement

MCF CHEN, CE KEARNS

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, Division of Oral Epidemiology and Dental Public Health, Philip R. Lee Institute for Health Policy Studies

Objectives: Nutrition education is under-emphasized in the training of dentists. The objective of this study was to assess the adequacy of nutrition education in the University of California, San Francisco School of Dentistry (UCSF-SOD) pre-doctoral curriculum.
Methods: Nutrition education hours and topics in the UCSF-SOD predoctoral curriculum as of January 2021 were collected from digital syllabi and course materials using keyword searches (e.g. diet, metabolism, sugar) and compared to Academy of Nutrition and Dietetics (AND) dental curriculum recommendations. Semi-structured interviews were conducted with a convenience sample of faculty with nutrition topics in their course and/or curriculum oversight (n=6) to assess the importance, adequacy, and potential improvements to nutrition education.
Results: The UCSF-SOD curriculum mentions nutrition topics within 48.6 course hours. Topics covered included: biochemistry, CAMBRA, policy, diet assessment, counseling, oral cavity biomechanics, and relationships to diseases. In comparison to AND recommendations, 29% of didactic and 25% of clinical and research topics were covered. All faculty interviewed believed nutrition education is important and 83% believed nutrition education is inadequate. Faculty recommendations for nutrition education improvement included: creating a new lecture series (n=1), "scaffolding" nutrition education throughout the 4 years (n=1), integrating nutrition education in UCSF dental post-graduate programs into the pre-doctoral curriculum (n=1), reducing the nutrition counseling fee (n=1) and increasing students' nutrition counseling code use (n=2). Key barriers included: lack of a Commission on Dental Accreditation (CODA) competency (n=4), limited curriculum space (n=3), limited clinic time (n=2), and faculty calibration (n=2).
Conclusions: Nutrition education in the UCSF-SOD pre-doctoral curriculum does not meet AND standards and is considered inadequate by the majority of faculty sampled. Opportunities for improvement include forming a nutrition education curricular group that includes nutrition faculty and regular evaluation of clinical implementation of nutrition counseling. However, the lack of a CODA competency and curriculum space are significant barriers.
Support: ADEA Academic Dental Careers Fellowship Program; CEK was supported by National Institute of Dental & Craniofacial Research Award Number K08DE028947.

31) Title: Learning During the COVID-19 Pandemic: Dental Students' Academic Engagement, Satisfaction and Group Cohesiveness

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UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: UCSF School of Dentistry substantially redesigned its education delivery modalities to allow greater social-distancing during the COVID-19 pandemic. This study examines student perceived educational engagement, satisfaction, and group cohesiveness during the implemented blended online/in-person curriculum that featured extensive online remote content delivery.
Methods: Cross-sectional anonymous surveys were distributed electronically to all dental students enrolled at UCSF School of Dentistry (N=59 responses from approximately 400 learners) via social media postings, e-mail, and schoolwide news announcements to assess learner-reported perceptions and behaviors. This survey consisted of closed-ended questions and an open-ended feedback section. Survey items were piloted to assess comprehension and psychometric properties. Additional items were selected from existing UCSF dental graduate exit surveys and validated measures of educational engagement and group cohesiveness. Descriptive statistics (e.g., mean, percentage) were calculated with standard indicators of precision.
Results: 56% of respondents indicated that they are very or extremely engaged during remote instruction; but 75% indicated that they often or always have a hard time staying focused during remote lectures. 42% of students were moderately satisfied with remote instruction, and 32% were slightly or not at all satisfied. Regarding group cohesiveness, 35% of students reported that they agree or strongly agree that they feel close to people at this school. When students were asked if they would attend UCSF if they could do it all over again, 50% reported that they would.
Conclusion: Although necessary during the pandemic, many students reported suboptimal academic engagement, satisfaction, and connectedness under remote learning. A more successful remote educational component may be needed to assure students achieve their learning and career goals. These results can be used to assess the effectiveness of current practices, identify learner groups at risk of worse academic outcomes, and inform potential improvements, particularly should aspects of remote instruction be retained.
Support: N/A.

32) Title: Health Policy Competence for Health Professions: The Case for Dentistry

E LEE, K TONG, E MERTZ

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: Healthcare providers with health policy competence are more able to engage with policy-making and improve the healthcare delivery system. At UCSF, the Schools of Pharmacy, Nursing, and Medicine all integrate this topic into their core curricula. The aim of this study is to examine existing courses at UCSF and to assess the value of incorporating health policy into the School of Dentistry curriculum.

Methods: We assessed the health policy curricula of the three professional schools and one graduate division through discussions with course director(s), reviews of course content and context, and by conducting student interviews. Additionally, we surveyed other dental schools to evaluate if health policy has been implemented into dental-specific curricula. Finally, we reviewed the structure of UCSF School of Dentistry's pre-doctoral curriculum to assess the capacity to implement additional courses.

Results: The UCSF Schools of Medicine, Pharmacy, and Nursing have well-established health policy courses. While underlying curriculum designs differ, each school dedicates a considerable amount of time to teaching health policy. Student reflections give insights into effective practices for teaching core topics and point to common challenges. Course directors universally believe that policy competence is imperative to enabling future health care providers to both shape their profession and advocate for their patients.

Conclusion: Despite continued efforts to update the dental curriculum, healthcare policy is rarely taught in dental schools. Given the multitude of challenges underway in the dental care system, the lack of health policy competency denies future providers the knowledge needed to understand and advocate for changes that are important to the future of the dental profession. The UCSF School of Dentistry is well-poised to engage future providers in healthcare policy as part of their pre-doctoral training, drawing upon resources and experiences from the School of Medicine, Pharmacy, and Nursing.

Support: N/A.

33) Title: Attitudes and Behaviors Associated with Ethics and Professionalism Among UCSF Dental Students and Faculty

Y HUANG, A MILLER, A TONG, G TAYLOR

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: This survey aims to investigate the ethical and professional environment in UCSF School of Dentistry's (SOD) predoctoral clinics, by evaluating attitudes and behaviors of students and faculty regarding ethics- and professionalism-related scenarios. Our hypothesis is no significant differences exist in student and faculty responses to the scenarios.

Methods: We conducted a cross-sectional, anonymous online survey of students and faculty at Parnassus and Buchanan campuses. Participants responded to ethics- and professionalism-related scenarios in the predoctoral clinic using Likert scales to rate degree of acceptability or prevalence of such events, reasons for occurrence, and how they would respond. Non-parametric analysis determined significance of differences among the participant groups using $p \leq 0.05$ for statistical significance.

Results: The 244 participants included, D1= 46, D2=42, D3=14, D4=23, IDP3=21, IDP4=10, Faculty = 88. A higher proportion of faculty rated switching chairs, violating infection control, not getting start-checks, double-booking chairs, and prioritizing student requirements significantly more unacceptable than students (51.2% vs 31.4%, 90.9% vs 67.1%, 92.9% vs 69.9%, 63.16% vs 43.57%, 95.2% vs 80.2%, respectively). Students' most common reasons for believing unethical incidents occurred were to save time, the need for acquiring patients, insufficient time and insufficient faculty. Top reasons for faculty were the need for patients and unenforced standards. Loyalty to students, student I.D. confidentiality, self I.D. confidentiality were the most common reasons students not reporting incidents.

Conclusion: This study identified significant differences between students and faculty in responding to presented scenarios. These findings suggest the need for additional ethics instruction to achieve greater consistency in our ethical and professional standards.

Support: N/A.

34) Title: Association between Food Insecurity and Periodontal Health in Underserved Adolescents

L MARTINEZ-RUBIO (1), B LAURENCE (2), T MARSHALL (3), CM FARMER-DIXON (4), G TAYLOR (1)

1) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, 2) Howard University College of Dentistry, 3) University of Iowa School of Dentistry, 4) Meharry Medical College School of Dentistry

Objectives: This study aims to investigate an association between food insecurity (FI) and poor periodontal health (PPH) in adolescent study populations in Washington, DC and Nashville, TN.

Methods: This cross-sectional secondary data analysis enrolled adolescents ages 12-17 and their caregivers after obtaining informed consent and assent. Data capture included participants' demographic, medical history, health behavior, and an intraoral exam. The principal exposure, FI, was defined using two USDA screening questions: worry about running out of food, and having sufficient money to purchase food in the past 12 months. Calibrated examiners assessed periodontal status by using random half-mouth exams for probing pocket depths (PPD) and bleeding on probing (BOP) with all first and second molars included. If any PPD was ≥ 5mm, the examiners included all teeth. Univariable analysis determined a periodontal health case-definition based on distribution of the presence or absence of ≥ 2 sites having PPD ≥ 4 mm with BOP at those sites. Multivariable stepwise logistic regression tested the association of FI with covariates including oral health self-care, having a dentist, eating pattern, number of meals per day, gender, body mass index, and emographic characteristics, including age, care-giver's education, and annual family

income. The analysis excluded participants with missing values for any covariates. P-value ≤ 0.05 determined statistical significance.

Results: Complete data for 339 participants indicated 15.6% met the periodontal case definition. Of those, 25% with FI and 12.5% without FI, respectively met the case definition. The multivariable logistic regression stepwise selection routine identified FI as the only statistically significant variable associated with the PPH definition, having 2.37 greater odds of meeting the PPH case-definition (odds ratio=2.37, 95% confidence interval: 1.2, 4.6).

Conclusion: This study suggests FI may be associated with PPH using a very conservative case-definition for the outcome.

Support: UCSF Preventive and Restorative Dental Sciences, National Dental Association Foundation with the support of Colgate-Palmolive.

35) Title: Intersection of Dentistry and Voter Engagement

D NGUYEN, K HAHN, D NGUYEN

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Background: The simple act of voting in democratic societies is a measure of civic participation and community engagement. Research shows that voters are more likely to show interest in politics, make charitable donations, and get involved in community affairs. It is not uncommon to find measures on the ballot that benefit dentistry by generating money for public health initiatives and research.

Objectives: Data obtained will help better understand which issues are important to dental students and to discern dental student attitudes towards civic participation.

Methods: Data was collected using a Qualtrics survey polling US dental students. The 20 question survey had diverging branches depending on the response of the participant and was distributed to 12 dental schools in 11 ASDA districts.

Results: The survey was answered in full by 717 respondents, of whom 83% voted. Over 80% of dental students believed that a candidate's support of the dental profession did not sway the vote for dental students when it came to casting candidate votes. About 17% of dental students did not vote, stating, "too busy," or, "could not make it to the polls," as main reasons. The difference in the proportion of dental students that voted in the 2020 election compared to medical students who voted in the 2016 election was not statistically significant at the 0.05 level (p=0.24). The most important issues to dental students are healthcare, COVID-19, economy, climate change, president, and human rights.

Conclusions: Since there are fewer dentists in the workforce than physicians, pharmacists, and nurses, it is even more important for dentists to engage in their civic duties, including voting, because access to healthcare can be determined by legislation. Training dental students with curricula that establishes civic engagement as a professional duty may lead to policies that improve the oral health of the general public.

Support: This project was possible due to support from Dr. Diana Nguyen and ADEA.

36) Title: Tobacco Use Prevention and Cessation Counseling at UCSF Dental Center: Pre-Doctoral Students' Behaviors, Knowledge, and Perceived Support

M OTGONBOLD, BV HOANG. M LE, BW CHAFFEE

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: To describe current knowledge, behaviors, and perceived support among pre-doctoral students at UCSF Dental Center in performing consistent and effective tobacco use prevention and cessation counseling (TCC).

Methods: We administered an anonymous survey instrument to current pre-doctoral clinical students starting in Fall Quarter 2020 (D3, D4, ID3, and ID4 cohorts). This instrument contained 29 items in 3 categories: knowledge, behaviors, and perceived support. Descriptive analyses were performed.

Results: There were 69 completed surveys. While 99% viewed cigarettes as very to extremely harmful, 46% viewed cannabis/marijuana as very to extremely harmful. Students indicated familiarity with TCC knowledge and the 5A's; however, they had the least familiarity with pharmacological products and additional support resources at 45% and 38% not at all or slightly familiar, respectively. While providing TCC was their responsibility (96%) and would increase job satisfaction (86%), students indicated confidence level at 55% and adequate training at 51%. Many students were satisfied with time (45%) and confidential space (51%) for TCC, but few reported satisfaction with the referral system (13%), faculty support (24%), and administrative support (34%). Students reported asking about (97%) and documenting (96%) tobacco use, only 17% arranged follow-up and 16% referred patients to California Smokers' Helpline. Patient educational pamphlets (79%) and information placard (75%) were rated as more acceptable resources than refresher course (61%) and clinical skills training (68%).

Conclusions: There was a general lack of follow-through to help patients quit, some of which is contributed by lack of support. Students perceived TCC as one of their duties as future clinicians and more efforts need to be taken to improve the quality of education and implementation of TCC to improve the quality of patient care. The results of this study might inform strategies to improve TCC education and practices at UCSF Dental Center.

Support: N/A.

37) Title: Natural Tooth Pontic: A Systematic Review

A TONG, E LEE, A LEE, R VADERHOBLI

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: For patients with a hopeless anterior tooth, it is a unique challenge to deliver an aesthetic, comfortable, and immediate replacement. This literature review aims to provide an exhaustive overview of published clinical cases that implement natural tooth pontics (NTP) as treatment for tooth replacement--summarizing patient selection, indications, and technique employed. Additionally, this review compares the NTP against other commonly used tooth replacement methods, and provides a guideline for clinicians who wish to expand their repertoire of immediate tooth replacement options.

Methods: An electronic search for case studies and case series was conducted through EMBASE, PubMed, and Google Scholar. Search terms included keywords such as "resin-bonded", "natural tooth", and "pontic." In addition, hand searches of references and related reviews were conducted for additional articles.

Results: Out of the 2,857 articles pulled from the initial search, a total of 83 were selected based on the inclusion and exclusion criteria. While there are multiple factors leading to the loss of anterior teeth, the most common causes for tooth loss were trauma or severe periodontitis. Patients' age range from 4 to 76 years old. A variety of techniques were employed. In the collection of cases ranging (1 week to 11 years) the NTPs are found to be satisfactory, stable periodontally, functionally durable, and had good aesthetics and emergence profile. In this review, we detailed material selection, pontic design for gingival aesthetics, and case selection for the NTP technique.

Conclusions: The use of natural tooth pontics can be an inexpensive and immediate alternative to conventional fixed bridges or RPDs. They allow for better caries detection on the abutment teeth and ease of repair in the case of debonding of the pontic-abutment connectors. However, careful case selection for patient compliance in cleaning, and periodic follow-up is necessary for predictable and favorable outcomes.

Support: N/A.

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38) Title: Impact of COVID-19 on Orthodontic Education in Predoctoral and Postdoctoral Programs in the United States, Canada and Puerto Rico

A VAKILI (1), BW CHAFFEE (1), S OBEROI (2)

(1) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, (2) UCSF School of Dentistry, Department of Orofacial Sciences

Objectives: The aim of the study was to characterize the impact of the COVID-19 pandemic on predoctoral orthodontic and postdoctoral orthodontic education.

Methods: Electronic surveys were distributed via email to predoctoral orthodontic program directors, at all accredited dental schools in the United States and Puerto Rico (n=66), postgraduate orthodontic program directors at accredited programs in the United States, Puerto Rico, and Canada (n=73), and to craniofacial orthodontic fellowship program directors in the United States (n=5). Responses were collected from September to October 2020 and analyzed separately for predoctoral and postdoctoral programs.

Results: The predoctoral orthodontic survey received 25 responses (response rate 38%). Of the responding programs, 62% percent of predoctoral orthodontic directors indicated significant curriculum modifications due to the COVID-19 pandemic. However, reported orthodontic curriculum hours per year were largely unchanged due to the COVID-19 pandemic. Of the responding programs that had graduate orthodontic programs where dental students can observe, assist, and gain clinical experience (n=14), all but two reported not allowing or limiting observation or assisting opportunities for dental students during the COVID-19 pandemic. The postdoctoral orthodontic survey received 30 responses (response rate 39%). Postdoctoral programs were affected by various clinic modifications including financial limitations, SARS-CoV-2 testing, decreased clinical hours, amongst other modifications. For orthodontic residents and craniofacial fellows i this resulted in fewer patients seen per week and a decrease in clinical hours.

Conclusions: The COVID-19 pandemic has had a measurable impact on orthodontic clinical education for the predoctoral and postdoctoral orthodontic programs evaluated. Overall, less patient care was delivered, potentially resulting in delayed treatment for patients and fewer training opportunities for learners, particularly for predoctoral dental students, whose clinical observation hours were limited. The COVID-19 pandemic has likely negatively impacted orthodontic educational opportunities for the current cohort of dental learners, potentially exemplifying challenges throughout dental academia.

Support: ADEA ADCFP Fellowship.

II. GRADUATE CATEGORY

39) Title: Distinct Subpopulations Exist Within the Oral Mucosa to Facilitate Wound Repair

J COOK (1), M GRIFFIN (4), D BOFFELLI (3), R ZWICK (2), M LONGAKER (4), O KLEIN (2)

1) UCSF School of Dentistry, Oral and Craniofacial Sciences Graduate Program, 2) UCSF School of Dentistry, Department of Orofacial Sciences, 3) UCSF School of Medicine, Department of Pediatrics and Institute for Human Genetics, 4) Stanford University, Department of Plastic and Reconstructive Surgery

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Objectives: The oral mucosa (OM) repairs wounds more efficiently than any other barrier site in the adult human body, allowing for scarless healing in just 1-3 days. Rapid re-epithelialization is a hallmark of the tissue, yet it is unknown whether the regenerative abilities of the epithelium are cell-intrinsic or facilitated by signaling from the surrounding mesenchyme. This project investigates the heterogeneous population of fibroblasts in the oral mucosa, probing the complex signaling networks between epithelial cells and fibroblasts during the wound healing process.

Methods: To define the identities of oral mucosal fibroblast (OMF) subpopulations responsive to wounding, we examined the transcriptional responses of OMFs to mechanical injury in a mouse model. 6-8-week-old C57Bl/6 mice received matched 2-mm wounds within their buccal mucosa and scalp skin. Mice were euthanized 1-, 2-, 4- or 7-days post-wounding, and whole tissues prepared for single-cell RNA sequencing alongside unwounded samples. Our analytical approach defined fibroblast subtypes in the wound bed in comparison to the skin, as well as evaluated whether they drive epithelial regeneration by investigating the crosstalk between epithelial and mesenchymal cell populations using network analysis.

Results: Our dataset contains cells from multiple compartments of the tissue, including populations from the epithelium, mesenchyme and immune system. Using packages in both R and Python, we clustered the cells and performed network analysis to establish exact pathways and gene networks that are up-regulated due to wounding. Our analysis reveals five subpopulations of fibroblasts with unique cluster markers, together with several pathways related to wound response that warrant further investigation.

Conclusions: Collectively, these data reveal that the OM is home to a diverse population of fibroblasts that play roles in all aspects of wound healing. Our ongoing studies involve tracking the behavior of these subpopulations in response to wounding in vivo to determine their functions throughout regeneration.

Support: NIDCR 5F30DE029987-02; UCSF Discovery Fellowship; TRDRP T31IR1739.

40) Title: Generation of Large-scale Chromosomal Deletions in Primary Human Keratinocytes

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1) UCSF School of Dentistry, Oral and Craniofacial Sciences Graduate Program, 2) UCSF School of Medicine, Department of Otolaryngology - Head and Neck Surgery, Program in Craniofacial Biology

Objectives: Large-scale chromosomal deletions frequently occur in the progression of oral squamous cell carcinoma (OSCC). However, the precise contributions of such genetic insults to tumorigenesis have yet to be elucidated. Here, we introduce a methodology for the generation of chromosomal deletions in primary human keratinocytes to establish their roles in OSCC progression.

Methods: Eighteen different combinations of CRISPR/Cas9 vectors coding for guide RNAs (gRNAs) that flank two of the commonly deleted regions in OSCC tumors at the LRP1B and CSMD1 loci were transfected into primary human keratinocytes null for TP53 and CDKN2A. Genomic DNA (gDNA) was harvested 24 hours post-transfection and analyzed via endpoint PCR and Sanger sequencing to assess for the presence of deletions. Edited cells were sorted via fluorescence-activated cell sorting (FACS) and the efficiency of creating these deletions was analyzed via TaqMan copy number assay qPCR. Cells were maintained in culture for several passages to assess for changes in viability and presence of competitive growth when in a mixed population with non-edited cells.

Results: Large-scale deletions (~1 Mb) were created and confirmed via endpoint PCR and Sanger sequencing, in which all 18 gRNA combinations created successful deletions. We further sought to create a pure population of cells harboring the deletions by isolating edited cells via FACS. TaqMan copy number assay qPCR on harvested gDNA indicated a 10-45% reduction in the copy number of loci of interest. The edited keratinocytes could be repeatedly passaged without any signs of differentiation. Lastly, these deletions did not provide the cells with a proliferative advantage in two-dimensional culture when mixed with non-edited cells.

Conclusions: Chromosomal deletions occur at a high frequency in OSCC tumors. Here, we demonstrate the introduction of successful large-scale deletions in primary human keratinocytes that can be further utilized to study the role of these events in OSCC tumorigenesis.

Support: This study was supported by Program in Breakthrough Biological Research, UCSF School of Dentistry OHNRG pilot grant, and the NIDCR DE029890.

41) Title: Processed Carbohydrates Drive Changes in Oral Biofilm Abundance and Architecture

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1) UCSF School of Dentistry, Oral and Craniofacial Sciences Graduate Program, 2) UCSF School of Dentistry, Department of Orofacial Sciences, 3) UCSF School of Medicine, Department of Gastroenterology, 4) UCSF School of Dentistry, Department of Preventative and Restorative Dental Sciences, 5) UCSF School of Medicine, Department. of Urology

Objectives: Pathologic changes in the oral microbiome are associated with dietary shifts corresponding to evolution of the westernized diet, of which processed carbohydrates are a primary constituent. Diets rich in processed carbohydrates are associated with increased incidence of periodontal disease, however this mechanism is not well understood. Disruptions **in grain structure** due to processing result in increased starch bioavailability to oral bacteria and moreover decreased grain texture and masticatory challenge, possibly encouraging biofilm formation and dysbiosis. Here, we sought to determine the effects of processed carbohydrates on oral biofilm architecture, abundance, and growth kinetics to better understand their role in microbial dysbiosis related to disease progression.

Methods: Biofilm architecture was assessed using an in vitro approach replicating growth of oral biofilms in carbohydrate digestion byproducts from processed vs. unprocessed grains or high carbohydrate vs. ketogenic diets (n=3). Biofilm architecture was analyzed using scanning electron microscopy (SEM). To assess the effect of diet texture on biofilm abundance, mice (n=1) were assigned hard or soft diets and dentogingival surfaces were imaged using SEM. Growth curve analysis was performed via a spectrophotometer for 20 hours (n=3).

Results: Biofilms grown in digests from different diets demonstrated striking variation in architecture (Figure1A), suggesting differences in bacterial composition. The hard diet group demonstrated reduced biofilm abundance compared to the soft diet group (Figure1B), suggesting that increased dietary texture decreases biofilm abundance. Increased growth kinetics were observed among oral bacteria grown in processed grain and high carbohydrate digests (p<0.0001), suggesting increased bioavailability of starch components to bacteria.

Conclusions: These findings suggest that processed carbohydrates impact biofilm abundance, composition, and growth kinetics. As integration of periodontal pathogens is dependent on prior microbial succession within biofilms, these results advise that initial changes in biofilms in response to processed carbohydrates may serve as a stimulus for pathogen integration and dysbiosis.

42) Title: miR-181a/b-1 regulates osteocyte metabolism

J YOON (1), T ALLISTON (2)

1) UCSF School of Dentistry, Oral and Craniofacial Sciences Graduate Program, 2) UCSF School of Medicine, Department of Orthopaedic Surgery

Objectives: Decreased bone quality contributes to fracture risks, independently of bone mass deficits. Bone from mice with bone quality defects due to age or genetic perturbations exhibits perilacunar/canalicular remodeling (PLR) suppression and impaired metabolic function, which prompted us to identify molecular regulators of energy metabolism. With recent discoveries revealing biological functions of microRNAs in physiological and pathological processes, microRNAs have gained potential as therapeutics and could also be utilized to treat craniofacial bone quality defects. However, the functions of microRNAs in osteocytes and bone quality remain relatively unexplored. Therefore, we focused on miR-181a/b, which regulates osteoblast differentiation by modulating mitochondrial metabolism and osteoclast apoptosis, and sought to uncover the role of miR-181a/b in osteocyte function.

Methods: Using microRNA target prediction databases (TargetScan, DIANA-microT), we screened for potential miR-181a/b targets, many of which were involved in mitochondrial biogenesis and cellular metabolism. Putative targets previously confirmed to directly interact with miR-181a/b in other cell types were considered for subsequent experimental validation. Expression of Sirt1, Pten, and Nrf1 proteins in OCY454 osteocyte-like cell line transfected with miR-181a/b inhibitors was evaluated by Western blotting. We measured oxygen consumption rate and extracellular acidification rate, which indicate oxidative phosphorylation and glycolysis, respectively, using Seahorse XFe24 Analyzer. Data from 3 independent experiments with 3-4 replicates/experiment were analyzed using an unpaired two-tailed t-test.

Results: miR-181a/b inhibition in OCY454 upregulated the expression of Sirt1, Pten, and Nrf1 protein levels, supporting these as promising targets (p<0.5). miR-181a/b ablation significantly decreased oxidative respiration whereas glycolysis remained unchanged. Furthermore, in the absence of miR-181a/b, total and oxidative ATP production rates were significantly reduced, indicating decreased overall cellular energy usage (p<0.5).

Conclusions: Our work reveals the novel role of miR-181a/b in controlling osteocyte metabolism and provides motivation to better understand the extent to which miR-181a/b regulates osteocytic PLR and bone quality in vivo.

III. POSTDOCTURAL/RESIDENT CATEGORY

43) Title: Human Dentin Caries Lesion Mineralizes by PILP-treatments

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Objectives: Degradation of collagen fibrils by autogenous and exogenous enzymes has been considered an impediment to the functional repair of dentin caries. This study evaluated the efficacy to remineralize natural carious lesions in dentin from teeth that have been stored for over five years using the Polymer-Induced Liquid Precursor (PILP) method comprising polyaspartic acid.

Methods: Human third molars (n = 8) presenting deep lesions in dentin were selected from a tooth bank that had been sterilized and stored in deionized water for five years. Remineralization using the PILP-method was tested on two different specimen types: A) Intact coronal tooth samples – tooth roots were removed at mid-pulp level and crown immersed in mineralizing solutions; B) in addition to removing roots, teeth were sectioned sagittally across lesion, analyzed by nanoindentation and then immersed in mineralizing solutions. Changes in the nanomechanical properties of lesions were evaluated at 3 months for group A and B. In addition, mineral densities using microcomputed tomography (μCT) were monitored for A at 0, 1, and 3 months.

Results: This study showed that there is a direct correlation between mineral density and micromechanical recovery when using PILP in both sectioned and whole teeth (P<0.05). Moreover, the lesion volume of occlusal cavities decreased significantly at 3

months treated with PILP (P<0.05) due to increasing mineral density reaching the level of sound dentin. The increased in mineral density closely matched with the recovery in nanomechanical properties, confirming functional mineralization. Interestingly, despite the many years of storage, strong recovery in mineral density and properties was observed in the discolored zone of the lesion associated with infected dentin.

Summary: This study shows that severe dentin caries lesions can be repaired by remineralization contradicting a common hypothesis that collagen fibril integrity degrades by hydrolysis and dentin properties therefore cannot be restored by remineralization.

44) Title: Association between Tobacco Smoking and Periodontal Health in Undeserved Adolescents

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1) UCSF School of Dentistry, Department of Orofacial Sciences, Division of Pediatric Dentistry, 2) Howard University College of Dentistry 3) Meharry Medical College School of Dentistry 4) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: Currently cigarettes are the most frequently used addictive substance among high school students. This study aimed to evaluate the association between tobacco smoking and periodontal health (PH) among underserved adolescents aged 12-17 years old in Washington D.C. and Nashville, TN.

Methods: This cross-sectional study was a secondary data analysis of the association of tobacco smoking and PH in middle- and high school-students using a bivariable Chi-square test for the PH outcome variables. The categorical periodontal case definition was the presence or absence of probing pocket depths ⩾4mm and bleeding from those pockets at ⩾2 sites. The periodontal measures were derived from clinical examination of pocket probing depths and bleeding on probing by calibrated examiners. A questionnaire to the participants provided information about tobacco use. Exposure to tobacco was specified using different dimensions of its use: i.e. type of product (cigarette versus e-cigarette), number of times per week smoking, number of years smoking, recency (smoked within the past 30 days), and ever smoked versus never smoked.

Results: For type of product used, there were no individuals who met the poor PH case definition (no p-value could be estimated). Number of cigarettes used, number of e-cigarettes used, and number of cigarettes or e-cigarettes used per week resulted in no significant associations (no p-value could be estimated). The analysis found non-statistically significant differences for duration of smoking in years for cigarettes and e-cigarettes (p=0.7651); recency of smoking (cigarettes p = 0.5465) or (e-cigarettes p=0.5534). For those who ever smoked cigarettes and for those who ever smoked e-cigarettes there were no significant differences in PH outcomes (p = 0.5224, p = 0.3835), respectively.

Conclusions: Our findings indicated there was no significant association between tobacco smoking and poorer PH in this study population.

45) Title: Barriers to Care Experienced by the UCSF Pre-doctoral Dental Clinic Patients during Coronavirus Pandemic

H KAVALI, A LE

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objectives: The objective of this study was to identify whether UCSF dental clinic patients who have not received needed dental care in the last 12 months experienced more barriers to care when compared with the patients who received needed dental care during the coronavirus pandemic.

Methods: A cross-sectional survey was conducted at UCSF dental clinic (2020-2021). Patients who were 18 years and older and English-speaking were enrolled in the study. The primary data were collected using a validated questionnaire via Qualtrics survey. Chi-square, Fisher's exact analyses and bivariate logistic regression models were generated to evaluate barriers to dental care.

Results: 81 patients responded to our survey. Most patients (75%) reported that they delayed care and did not receive the needed dental care (60%) because of the coronavirus pandemic. Among those (59%, 48/81) that did not receive the needed dental care, 80% reported having financial issues that prevented them from visiting a dentist (p-value: <0.001), 35% had difficulties finding a dentist who could provide the services that they needed (p-value: 0.02), and 50% had difficulty in taking time off from work to visit a dentist (p-value: 0.01). Those who had financial difficulties were 6.8 times (95% CI: 2.3-20.2, p-value: 0.001) more likely to have not received the needed dental care while adjusting for distance to the clinic (OR >25 miles (ref: within 25 miles): 0.72, 95% CI- 0.22-2.83, p-value: 0.80).

Conclusions: The results of this survey suggest that there is a need to develop public health interventions to address these barriers to care faced by the individuals from different socio-economic backgrounds and to increase the utilization of dental services.

Support: N/A.

46) Title: Loss of p75NTR Impairs Bone Formation in Mice

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1) UCSF School of Dentistry, Department of Orofacial Sciences 2) UCLA School of Dentistry

Objectives: Investigation of the functional role of p75NTR on skeletal development in mice and exploration of critical signaling pathways/molecules related to p75NTR-mediated dysregulation of bone formation.

Methods: The p75NTR-knockout (p75NTR KO) mice and wild type mice were sacrificed at P0, P7, P28 and P84, and skeletal phenotype analysis was performed using whole mount skeletal staining, Micro-CT and histochemistry methods. To determine the osteogenic properties of bone marrow-derived mesenchymal stem cells in the mice (mBMSCs), cells were isolated from whole bone marrow cell populations and assessed for osteogenic potential through mineralization and NanoString nCounter gene screening. To eliminate off-target effects from traditional gene knockout, the Prx1-Cre transgene was used to produce specific deletion of p75 in mesenchyme. (Prx1-Cre; p75NTRf/f). Bone development in young and adult Prx1-Cre; p75NTRf/f mice was examined through body size measurement and Micro-CT analysis.

Results: At birth, p75NTR KO mice did not differ in size or weight from their wild-type littermates and exhibited normal patterning by visual inspection. From P7 onwards, p75NTR KO mice displayed significantly shorter bodies and limbs than controls. With young and adult mice at P28 and P84 respectively, mutants showed marked reductions in the length of long bones as well as impaired skeletogenesis when assessed by Tb.Th., Tb.Sp., Cb.Th., and BV/TV. From P7 to P84, mutants also displayed notable defects in the ossification of several cartilage-based structures. Consistent with the p75NTR KO mice, Prx1-Cre; p75NTRf/f also showed long bone growth retardation. When p75NTR-deficient MSCs were induced to undergo osteogenic differentiation, osteogenic potential was markedly suppressed, and genetic markers related to bone and cartilage development were downregulated.

Conclusions: Our results demonstrate that p75NTR deficiency in mice impairs postnatal skeletogenesis and p75NTR deficiency in MSCs suppresses osteogenic differentiation capacity, highlighting the importance of p75 in skeletal biology.

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47) Title: Barriers to Dental Care Utilization among Children Lacking Follow-up Care within After-school Dental Screening Programs

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UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, Dental Public Health Residency Program

Objectives: This study aims to identify barriers to dental care utilization among children lacking follow-up care after three consecutive years' of school dental screening programs.

Methods: A prospective observational study whose data was previously collected. Dental screening was carried out by the Healthier Kids Foundation (HKF) from October 2017- March 2020 in 29 different elementary schools in San Jose, CA and children ranged in age from 0 to 18 years children less than 18 years of age. Children with and without dental care follow-up in those 29 elementary schools were included in the study. Logistic regression for repeated measures was performed to determine the association between patient characteristics and treatment needs and status of dental disease.

Results: The study sample consisted of 176 children without dental follow-up and 13,969 children with dental follow-ups. Each child had three dental screenings over the three-year period. Among the 176 children without dental follow-up, non-white (78.4) and non-English speaking (65.91%) students were predominant which was found to be statistically significant difference (p < 0.05) between missed and completed dental follow-up groups. Among the children without dental follow-up, 22.73% of children belonged to a special needs group and it was only 7.67% in the completed dental follow-up group. Again, a statistically significant difference (p < 0.05) was observed between the number of special needs children who were in the missed and completed dental follow-up groups.

Conclusions: This study has identified several existing barriers that are preventing children fro m seeking dental treatment in a timely manner. It is important to address these barriers to make school screening programs and referrals a success.

Support: N/A.

IV. RESEARCH ASSOCIATES

48) Title: PILP treatment with various Calcium Cements on Artificial lesions

P SHARMA, E BABAIE, N BHANUSHALI, S HABELITZ

UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences

Objective: Polymer-induced liquid precursors (PILP) increases intrafibrillar remineralization. To increase proof of PILP from initial concept, we investigate ability of anionic polyelectrolytes like Polyaspartic acid (pAsp) alone or in combination with other processes directing agent of Poly(allylamine hydrochloride) (PAH), polyacrylic acid (PAA) integrated into PILP-based restoratives, including self-setting cement. For deep artificial lesions, self-setting cements based on calcium phosphate (CaP) and Bioglass in conjunction with PILP were used to repair caries-affected dentin for intrafibrillar remineralization. Other characteristics of cement like setting time, solubility, PILP release, Ca ion release will be evaluated to optimize these cement formulations in addition to testing for efficacy to remineralize dentin.

Methods: Deep artificial dentin lesions with 700 μm depth of demineralization were prepared by immersing in acetate buffer pH 4.5 for 168hrs. Lesions were restored with PILP cement and recapped with flowable composite, followed by immersing in SBF solution

for 4 weeks to allow remineralization. Four different PILP cements based on CaPs and bioglass combined with pAsp and/or pAsp with PAA and PAH were employed. Also included the control group by immersing in calcium phosphate solution. Remineralized lesions were evaluated for changes in the nanomechanical profile (E-modulus), solubility, PILP release, Ca ions release, and set times.

Results: Nanoindentation lesions showed functional mineralization at slop zone of lesions for all PILP cements compared to control and demineralized sample ($P<0.05$). The PILP release capability closely correlated with Ca2+ release results in all PILP formulations. Higher recovery of E modulus profile was observed when there was increased PILP and Ca ions release. Bioglass cement showed higher biodegradation rate compared to other cements. Achieved the highest improvement in recovery of mechanical properties with combination of pAsp and PAH.

Conclusions: Results from this study support dentin's functional remineralization by using the PILP-method calcium phosphate cement.

49) Title: Flavored Cannabis Product Use Among Adolescents in California

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1) UCSF School of Dentistry, Department of Preventive and Restorative Dental Sciences, 2), University of Iowa College of Public Health, Department of Community and Behavioral Health

Objectives: Tobacco, nicotine, and cannabis use poses risks to adolescent health, including potential oral health effects. Given the well-documented role of flavors in encouraging youth tobacco use and diversity of the cannabis market, we aimed to describe flavored cannabis product use, both smoked and aerosolized ("vaped"), among a sample of adolescents.

Methods: We administered in-person school-based surveys to 1,423 students in 8 Northern California public high schools (data collection: 2019-2020) to record flavored tobacco and cannabis use as part of an ongoing study of adolescent tobacco-related attitudes and behaviors.

Results: Among all participants, 21% reported using cannabis (any form) in the past 30 days, and 23% reported past 30-day use of any tobacco (including e-cigarettes). Use of flavored cannabis among past 30-day cannabis users, most often fruit-flavored, was common for both smoked (48%) and vaped (58%) products. The prevalence of any flavored cannabis use for smoked and vaped products exceeded the flavored product use for cigarettes (44%) but was less than for e-cigarettes (76%) and smokeless tobacco (68%).

Conclusions: Use of flavored cannabis products was common in this population and comparable to flavored use for tobacco products. Given that youth-appealing flavors may contribute to underage cannabis use, emerging cannabis control policies should consider lessons from tobacco control to prevent youth cannabis use.

V. CLINICAL CASES

50) Title: Natural Tooth Pontic as Single Tooth Replacement: Clinical Cases

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Objectives: For patients with a hopeless anterior tooth, it is a unique challenge to deliver an aesthetic, comfortable, and immediate replacement. This literature review aims to provide an exhaustive overview of published clinical cases that implement natural tooth pontics (NTP) as treatment for tooth replacement--summarizing patient selection, indications, and technique employed. Additionally, this review compares the NTP against other commonly used tooth replacement methods, and provides a guideline for clinicians who wish to expand their repertoire of immediate tooth replacement options.

Methods: An electronic search for case studies and case series was conducted through EMBASE, PubMed, and Google Scholar. Search terms included keywords such as "resin-bonded," "natural tooth," and "pontic." In addition, hand searches of references and related reviews were conducted for additional articles.

Results: Out of the 2,857 articles pulled from the initial search, a total of 83 were selected based on the inclusion and exclusion criteria. While there are multiple factors leading to the loss of anterior teeth, the most common causes for tooth loss were trauma or severe periodontitis. Patients' age range from 4 to 76 years old. A variety of techniques were employed. In the collection of cases ranging (1 week to 11 years) the NTPs are found to be satisfactory, stable periodontally, functionally durable, and had good aesthetics and emergence profile. In this review, we detailed material selection, pontic design for gingival aesthetics, and case selection for the NTP technique.

Conclusions: The use of natural tooth pontics can be an inexpensive and immediate alternative to conventional fixed bridges or RPDs. They allow for better caries detection on the abutment teeth and ease of repair in the case of debonding of the pontic-abutment connectors. However, careful case selection for patient compliance in cleaning, and periodic follow-up is necessary for predictable and favorable outcomes.

51) Title: Custom Intraoral Splints for the Head and Neck Radiation Patient

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UCSF School of Dentistry, Department of Oral and Maxillofacial Surgery, General Practice Residency Program

Background: Oral complications in patients undergoing head and neck radiation are well documented in literature; mucositis, tissue fibrosis, dysgeusia and dysphagia symptoms can greatly affect quality of life. In recent years, intraoral tissue-sparing devices have been made by dentists collaborating with radiation oncologists to push healthy tissues away from radiation targets, thereby increasing quality of life of cancer patients beyond their treatment. Additionally, dentists often rely on dosage maps provided by radiation oncologists to guide treatment plans for invasive procedures such as extractions and other surgeries. Therefore, accurate dosage measurements are important measurements in avoiding osteoradionecrosis and creating preventive oral care plans.
Objectives: Our goal is to create customized intraoral devices that not only spare tissues to decrease radiation-related oral complications, but also collect real-time radiation dosages to teeth.
Methods: At the UCSF Dental Oncology clinic, a scan of patient's mouth is acquired using Primescan intraoral scanner. The intraoral device is designed using Meshmixer CADCAM software and printed with Sprintray printing resin. The guard is 3-5mm thick and includes features such as radiation film and sensor slots, and tongue deviation extensions. After post-processing, the device is fitted intraorally and the patient's bite is opened to an ideal spot, fixed with dental putty, and radiation-sensing film is placed in the device slots. During the patient's radiation treatment, the device is worn and the mouth is opened with putty; spatial fixation is confirmed through daily CBCT alignment. After treatment concludes, measured dosages are compared to dosages estimated by treatment planning system (TPS) software.
Results: As this is an ongoing endeavor, some results are pending. In cases of nasal, skull-base, and parotid cancers, there is significant reduction of radiation to the tongue using the intraoral device.
Conclusions: Structure analysis suggests that Papacarie pretreatment followed by PILP treatment is the most effective method to promote remineralization of root caries. More analysis with nanoindentation is necessary to determine the effectiveness of this method in restoring nanomechanical properties of these lesions.

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