Journal of the William Jarvie Society

Volume 64, Spring 2021

Editor-in-Chief
Glenna Lee '22

Associate Editors
Emily Horowitz '22, Heather (Hyesung) Kim '22, Kira Chen '23

"When apparently we have reached the limits of possibility, new avenues of progress and advancement are opened to our view and advances which shall make our knowledge of today seem in the light of the future to be but the densest ignorance."

William Jarvie, 1905

Table of Contents

Pre-Doctoral Student Abstracts

Molecular, Cellular, Tissue, System, Regenerative Medicine, & Organism Biology and Physiology

Social and Behavioral Sciences, Education, Health Services, and Global Oral Health

Post-Doctoral Student Abstracts

Message from the Editor

As the Editor-in-Chief of the 2020-2021 academic year, I am delighted to present the 64th edition of the Journal of the William Jarvie Research Society. The exceptional content of this year's journal, especially during the midst of the COVID-19 pandemic, demonstrates why the College of Dental Medicine is one of the top research institutions in the dental field. The high quality of research at Columbia is also a reflection of the unwavering dedication of the faculty mentors.

I would first like to thank Dr. Carol Kunzel and Kelli Johnson for their assistance and guidance during the preparation of this journal. The success of Birnberg Research Day and the continuation of CDM's tradition of research excellence would not have been possible without their efforts. Additionally, I would like to thank Dean Christian Stohler, Dean James Fine, and Dean Dana Wolf for their continued support of student research at CDM. The emphasis on research within our education truly makes CDM a unique and progressive dental school.

This journal was prepared with the assistance from my associate editors: Emily Horowitz, Heather (Hyesung) Kim, and Kira Chen. Their time, efforts, and energy were indispensable to the preparation of the journal. I would also like to thank the William Jarvie Research Society executive board for their continued support and hard work. This year's President, Madeleine Daily, and Vice President, Rachel Cubilla, have helped guide the editorial team tremendously and worked hard to make this year's virtual Birnberg Day as interactive and meaningful as possible.

Last but not least, I would like to thank all the members of the William Jarvie Society. The number of students interested and committed to dental research continues to grow and we are very fortunate to be at Columbia during a time of such academic growth and intellectual curiosity.

Congratulations to all those who have published abstracts in this journal. I hope their work will inspire future students to pursue research.

Sincerely,

Glenna Lee
Editor-in-Chief *2020-2021*
William Jarvie Research Society

April 2, 2021

Dear Members of the Jarvie Society and CDM Community,

Research is the vehicle through which we advance the benefits of dentistry, allowing us to branch into new territories with new ideas. It is through research that we as individuals and as a school will continue to integrate dentistry into personalized healthcare and interdisciplinary medicine, and the results will reverberate locally and worldwide.

Virtual Birnberg 2021 is an important opportunity for us to affirm and demonstrate our commitment to the merits of scholarship and research. I am very proud of your initiative taking to advance your knowledge and your profession, and for helping to make the College of Dental Medicine an institution that is shaping the future of dental medicine and oral health.

The quality and breadth of the student research presented here, as well as the opportunity to witness the cooperative relationship between students and faculty mentors, make the Virtual Birnberg 2021 an inspiring event for me. I am grateful to you for all you do on behalf of the school and our community in these very challenging times, and I congratulate you on your very hard work.

Sincerely,

Christian S. Stohler, DMD, DrMedDent
Professor and Dean, College of Dental Medicine
Senior Vice President, CUIMC

April 1, 2021

Dear William Jarvie Research Society Members,

The spirit of inquiry among CDM students is strong and thankfully has not been dampened by the COVID-19 pandemic. Student research enriches the educational experience and promotes a culture of discovery and innovation. We take great pride in the degree to which students and residents at CDM engage in research and scholarly activity. Showcasing that research in the Jarvie Journal and during Birnberg Day is one of our most time-honored traditions. I am delighted that although we can't be together physically, we will be recognizing student research during Virtual Birnberg 2021.

The faculty and administration at CDM applaud your hard work and hope you will continue to develop your interest in scientific inquiry.

Congratulations on your research achievements!

Warm Regards,

Dana L. Wolf, DMD, MS
Senior Associate Dean for Predoctoral Academic and Student Affairs

April 1, 2021

Dear William Jarvie Research Society Members

All great institutions have great traditions. I am delighted that despite the challenges we faced this past year during the pandemic, that you remained true to CDM's mission reaffirming our commitment to scholarship, research, education, and patient care. I am equally delighted that the research tradition remains strong in the Columbia student body as evidence by the mix of basic research and clinical studies.

Research and scholarship are at the core of Columbia University values. The student publication and presentation of their research on Birnberg Day, are part of the College of Dental Medicine's mission of producing leaders in the field of oral health care.

Congratulations to all participating in Birnberg Research Day. We look forward to your future research endeavors and professional accomplishments.

Sincerely,

James B. Fine, DMD
Senior Associate Dean, Graduate Education

COLUMBIA UNIVERSITY
College of Dental Medicine

CAROL KUNZEL, PhD
PROFESSOR OF FOUNDATIONAL
SCIENCES AND SOCIOMEDICAL
SCIENCES AT COLUMBIA UNIVERSITY
IRVING MEDICAL CENTER
DIRECTOR OF RESEARCH
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March 31, 2021

Dear Members of the CDM Research Community:

It is always a pleasure to have the opportunity to review the pre-doctoral and post-doctoral research abstracts presented at the annual College of Dental Medicine's Birnberg Research Program. Once again the Jarvie Journal is an excellent compendium of the student research conducted at CDM. The projects represented here reflect the depth and breadth of commitment to research excellence and discovery present in the CDM student body, and the mentors who guide them.

Research has long been a proud part of the College of Dental Medicine's mission. Over the years, faculty and students have understood the significance of research to maintain and grow the profession. As you and your peers prepare to assume leadership roles in the profession, the need to engage with research and its empirical findings, becomes ever more and more evident.

The projects presented here are multi-disciplinary, diverse, and multi-faceted in terms of the questions they ask and the methods they employ. They contribute insights on many levels to the prevention of oral and systemic disease and the delivery of integrated, personalized care. Together they portray an outstanding year of student research accomplishment at the College of Dental Medicine, even in the face of the challenges of the COVID-19 pandemic.

A large debt of gratitude is owed to the research mentors who have supervised and supported the students presenting today. Congratulations to each and every student and their mentor(s) on the extraordinary display of scholarship presented at this year's 2021 Birnberg event.

Sincerely,

Carol Kunzel, PhD
Director of Research
College of Dental Medicine

COLUMBIA UNIVERSITY IRVING MEDICAL CENTER

History of the William Jarvie Society*

The William Jarvie Society for Dental Research was organized on December 16, 1920. At the invitation of Dr. William J. Gies, all the undergraduate students of dentistry at Columbia University conferred with him for the purpose of considering the desirability of organizing a society of students, teachers, and benefactors for the promotion of the spirit of research in the School of Dentistry.

After general discussion, it was unanimously voted to proceed with the proposed organization and Joseph Schroff, MD** was elected temporary chairman. Because of the important relation which Dr. William Jarvie bore to the establishment of the School of Dentistry, and because of high interest in the promotion of dental research, it was unanimously voted that the society be named the William Jarvie Society for Dental Research and that Dr. William Jarvie be elected an honorary member. Dr. Schroff served ably as president during 1922. Dr. Monasch officiated during 1923, and in 1924, because of the amalgamation of the College of Dental and Oral Surgery with the School of Dentistry of Columbia University, interest in the organization diminished and the society ceased its activities in 1925. On February 7, 1929, the society resumed activity and elected officers. Interest revived, and the organization was again brought into prominent place in the extracurricular life of the school.

During 1932-33, several members of the faculty who had contributed greatly to research in dentistry and allied fields addressed the members of the society and their guests. Dr. Charles C. Bodecker, Professor of Oral Histology and Embryology, spoke on "Dental Caries and Allied Subjects" and illustrated his talk with a liberal number of lantern slides. Dr. Bodecker spoke of the various theories and the classification of dental caries and also explained the caries index for recording the extent of caries. He also briefly outlined the work done by various investigators in this field.

Dr. Byron Stookey, Associate Professor of Neurological Surgery, addressed the next open meeting, which was held as a feature of the alumni day activities. His topic was, "The Interpretation and Treatment of Painful Affections of the Trigeminal Nerve." In a most interesting and instructive lecture, Dr. Stookey showed the relationship of diseases of this nerve to dental diagnosis. He explained the past work done in this field and the newer methods of surgical treatment, illustrating his talk with many lantern slides. He also presented several patients to demonstrate the effectiveness of his surgical treatment of this disease.

The Jarvie Society recorded another year of activity and accomplishment. Student interest in the organization was never greater, and a long and vigorous future for the society seems assured. The future of dentistry lies in its research into the problems that beset it, and the Jarvie Society has done its share in stimulating interest in this long-neglected phase of our work.

An excerpt from the Dental Columbian, 1933.

*** Editor's Note: Dr. Joseph Schroff, MD, one of the first two students admitted to the dental school through the Columbia admissions process, became the first student to receive the Columbia DDS degree in 1922. Dr. Schroff subsequently joined the SDOS faculty, teaching Oral Surgery to generations of students until his retirement as head of Oral and Maxillofacial Surgery in the early 1950s.*

Birnberg Research Award

The Birnberg Research Medal Award of the Dental Alumni of Columbia University was established by the Alumni Association of the Columbia University School of Dental and Oral Surgery in the early 1950s to encourage dental research of excellence and to help stimulate public interest in support of dental research. The award is named in honor of Dr. Frederick Birnberg (1893-1968), class of 1915, who helped to establish a research fund.

The College of Dental Medicine faculty research committee, in conjunction with the school's Alumni Association, considers individuals who have made important contributions to dentistry through both research and mentoring for selection as Birnberg Lecturer and recipient of the Birnberg Research Medal Award of the Dental Alumni of CU. Sixty-two outstanding scientists and teachers have been honored as the Birnberg Lecturer since the first Birnberg Research Medal Award was presented in 1954.

Birnberg Lecturer and Award Recipients

1954 Dr. Charles F. Bodecker	1979 Dr. Berge Hampar	2001 Dr. David T. W. Wong
1955 Dr. Joseph Appleton	1981 Dr. Ronald Dubner	2002 Dr. Henning Birkedal-Hansen
1956 Dr. Isaac Schour	1982 Dr. Martin A. Taubman	2003 Dr. Barbara Dale-Boyan
1957 Dr. Ralph Phillips	1983 Dr. Louis T. Grossman	2004 Dr. Paul B. Robertson
1958 Dr. Reider F. Soqnnaes	1984 Dr. Solon A. Ellison	2005 Dr. Bruce L. Pihlstrom
1959 Dr. John Knuston	1985 Dr. Norton S. Taichman	2006 Dr. Jeffrey D. Hillman
1960 Dr. Maxwell Karshan	1986 Dr. Ronald J. Gibbons	2007 Dr. Ralph V. Katz
1961 Dr. George Paffenbarger	1987 Dr. Robert J. Gorlin	2008 Dr. Robert J. Genco
1962 Dr. Eli Goldsmith	1988 Dr. Enid A. Neidle	2009 Dr. Deborah Greenspan
1963 Dr. Edward V. Zegarelli	1989 Dr. David H. Pashley	2010 Dr. Sally J. Marshall
1964 Dr. Francis A. Arnold	1990 Dr. William H. Bowen	2011 Dr. Michael Longaker
1965 Dr. Seymour Kreshover	1991 Dr. Harold C. Slavkin	2012 Dr. R. Bruce Donoff
1966 Dr. Paul Goldhaber	1992 Dr. George R. Martin	2013 Dr. Peter J. Polverini
1968 Dr. Sholom Peariman	1993 Dr. Richard Skalak	2014 Dr. Henry Ginsberg
1970 Dr. Melvin Moss	1994 Dr. Ze'ev Davidovitch	2015 Dr. Laurie K. McCauley
1971 Dr. Irwin Mandel	1995 Dr. Ivar Mjor	2016 Dr. Rena D'Souza
1973 Dr. Lester Chan	1996 Dr. Lorne M. Golub	2017 Dr. George Hripcsak
1975 Dr. Russell Ross	1997 Dr. Bruce J. Baum	2018 Dr. Jeanette M. Wing
1976 Dr. Jerome Schweitzer	1998 Dr. Kenneth Anusavice	2019 Dr. Gordana Vunjak-Novakov
1977 Dr. George Green	1999 Dr. James D. Bader	2020 Anil K. Rustgi*
1978 Dr. David Scott	2000 Dr. Lars Hammerström	2021 Anil K. Rustgi

Rescheduled due to COVID-19

2021 Birnberg Speaker and Research Awardee:
Anil K. Rustgi, MD

Anil K. Rustgi is the Director of the Herbert Irving Comprehensive Cancer Center at NewYork-Presbyterian/Columbia University Irving Medical Center. Dr. Rustgi is a world-renowned leader in the field of gastrointestinal oncology. His interdisciplinary research focuses on tumor initiation, the tumor microenvironment and tumor metastasis in the context of gastrointestinal cancers, including cancer of the esophagus, pancreas, and colon. Dr. Rustg's lab works to translate their discoveries into improving molecular diagnostics and finding new experimental therapeutics for patients, and is funded through several grants including an NCI P01 (program project on esophageal cancer), an NCI U54 on Barrett's esophagus, two NIH R01 grants (for pancreatic cancer and colon cancer) and an American Cancer Society Research Professorship.

He has more than 300 publications and his work has appeared in high-impact journals such as Nature, Nature Genetics, Nature Medicine, Cancer Cell, Genes and Development, Gastroenterology, Journal of Clinical Investigation, PNAS and New England Journal of Medicine.

He has been elected to the American Society of Clinical Investigation and the Association of American Physicians and is a Fellow of the American Association for the Advancement of Science. Previously, he was president of the American Gastroenterological Association (17,000 members), editor-in-chief of Gastroenterology, and president of the International Society of Gastroenterological Carcinogenesis. Dr. Rustgi will serve as president of the American Pancreatic Association.

He has been recognized for his contributions with numerous awards, including the AGA Julius Friedenwald Lifetime Achievement in Gastroenterology Medal (2017), AGA Distinguished Mentor Award (2016), the Ruth C. Brufsky Award for Excellence in Research in Pancreatic Cancer (2013), the Distinguished Achievement Award from the South Asian American Society for Cancer Research (2012), and an American Cancer Society Research Professorship. In addition he received the top mentorship awards (Arthur Asbury for faculty and one from the postdoctoral fellow program) from his tenure at the University of Pennsylvania.

Dr. Rustgi graduated summa cum laude from Yale College with a bachelor's degree in molecular biophysics and biochemistry (departmental honors) and earned his medical degree at Duke University School of Medicine, where he was elected to Alpha Omega Alpha, the national medical honorary society. He completed an internal medicine residency at Beth Israel Hospital and a GI fellowship at Massachusetts General Hospital (MGH), both of which are affiliates of Harvard Medical School. He also rose to associate professor of medicine at MGH before joining the University of Pennsylvania in 1998, where he served as Chief of Gastroenterology and directed two Centers and NIH T32 training grants until 2018.

Birnberg Research Program

Wednesday, April 7, 2020
Schedule of Events

Birnberg Research Program Lecture – College of Dental Medicine

Speaker and Birnberg Research Awardee:
Anil K. Rustgi, MD
Director, Herbert Irving Comprehensive Cancer Center
Professor of Medicine
Interim Executive VP and Dean of the Faculties of Health Sciences and Medicine
Columbia University Vagelos College of Physicians & Surgeons

Virtual Student Table Clinic and Research Poster Session

12:00PM – 1:00PM   Virtual Poster Viewing*
Link available on April 7

1:00PM – 2:00PM   Birnberg Lecture – Dr. Anil Rustgi

2:00PM – 3:00PM   Panel Discussion – Head and Neck Cancer Research: Visions and Collaborative Efforts – Moderator: Dr. Flora Momen-Heravi

3:00PM – 5:00PM   Virtual Poster Judging

Note: Viewing of posters will be available to all from Wednesday, 4/7 through Friday, 4/9

A Message from the President of the William Jarvie Research Society

Over the past year, we have faced numerous challenges in light of the global pandemic. With remote learning and limited in person gatherings, the Jarvie Society had to find ways to adapt our programming to fit within these new constraints. Yet the resilience of our research community is impressive; through virtual and socially distanced means, our student researchers have accomplished a great deal this year. I am very proud of our student engagement in research and of the College of Dental Medicine's commitment to shaping the future of dental medicine and oral health. The William Jarvie Research Society is pleased to present the 64th edition of the Journal of the William Jarvie Research Society and celebrate student research during Birnberg Research Day.
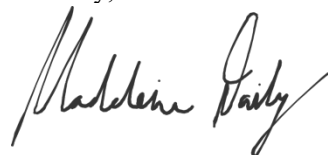
The William Jarvie Research Society (WJRS) is the Columbia University chapter of the American Association of Dental Research National Student Research Group (NSRG.) Our goal as a society is to encourage every interested student to have a productive research experience at the College of Dental Medicine, and to expose our members to a variety of research opportunities at CUIMC and beyond. Each year, the WJRS organizes a number of activities that support student research and emphasize the role of research in the development and practice of modern dentistry. We were excited to welcome over 40 new members from the class of 2024 this year!

Throughout the year, the Jarvie Society held numerous events aimed at encouraging student interest and participation in research. We presented our Research Opportunities Information Series virtually this year. This event series, geared especially towards first year students, provided practical advice on how to find and apply to research fellowships. We also continued our Lunch and Learn Series virtually, at which prominent faculty members were invited to give lectures about their current research projects. Under the direction of our Newsletter Editor, Kira Chen, we released our Fall 2020 issue of the Jarvie Newsletter, in which we presented original articles on a range of topics in dental research written by our members. We were excited to expand our advocacy efforts this spring, when our Advocacy Chair, Ali Lemkuil, brought together a group of 10 Jarvie members to participate in the AADR's Virtual Hill Day.

Each year, we look forward to Birnberg Research Day as a chance to celebrate the breadth of research conducted by CDM students and faculty. This year we received abstract submissions covering a huge range of research topics, from basic sciences to behavioral health. Congratulations to all predoctoral and postdoctoral students participating in this year's Birnberg Research Day!

On behalf of the Jarvie Society, I would like to thank Dr. Carol Kunzel and Ms. Kelli Johnson for their guidance and support throughout the year, and especially for their dedication to the organization of Birnberg Research Day. Additionally, I would like to thank Dean Christian Stohler for his continued enthusiasm and commitment to student involvement in research. This edition of the Jarvie Journal would not have been possible without the impressive efforts of our Editor-in-Chief, Glenna Lee, and our assistant editors, Emily Horowitz, Heather Kim, and Kira Chen. It has been an honor to serve as President of the Jarvie Society this year alongside our Vice President, Rachel Cubilla, and our executive board members, Julian Bensadoun, Amanda Segal, Ali Lemkuil, and Maura Lynch. Thank you to our board members, class representatives, and all of our Jarvie members for an amazing year.

Sincerely,

Madeleine Daily
Class of 2022

2020-2021 William Jarvie Society Membership

Officers:	**President:**	Madeleine Daily '22	
	Vice President:	Rachel Cubilla '22	
	Editor-in-Chief:	Glenna Lee '22	
	Assistant Editors:	Emily Horowitz '22	
		Heather (Hyesung) Kim '22	
		Kira Chen '23	
	Secretary:	Maura Lynch '23	
	Treasurer:	Julian Bensadoun '23	
	Communications		
	Coordinator:	Amanda Segel '23	
	Advocacy Representative:	Alison Lemkuil '22	
	Columbia Research		
	Committee D3 Member:	Samuel Fleisher '22	
	Columbia Research		
	Committee D2 Member:	Ashley Kahen '23	
	Columbia Research		
	D1 Representative:	Lexi Catalano '24	
	Columbia Research		
	Committee Advance		
	Standing Representative:	Princy Bhardwaj '22	

Advisors: **Dr. Carol Kunzel**
CDM Director of Research

Ms. Kelli Johnson
Student Affairs Administrator

Members:

Caroline Aronin	Alec Donelian	Simon Luu	Houston Rhodes
Chaya Beniawski	Isaac Donkor	Maura Lynch	Marissa Rifkin
Julian Bensadoun	Ian Edelman	Vinay Maddula	Sami Schnall
Princy Bhardwaj	Samantha Eyen	Chelsea Markus	Amanda Segel
Alexis Catalano	Samuel Fleisher	Catherine Martini	Abrar Shamim
Erica Chang	Rose Harooni	Tyler Moore	Nick Shleiwet
Kira Chen	Emily Horowitz	Kenna Nguyen	Austin Talis
Jack Cherny	Sharon Hsueh	Sunny (Suh Yeon) Oh	Dharmesh Thakkar
Rachel Cubilla	Jessica Hwang	Rodolfo Olivares	Rachel Utomo
Madeleine Daily	Ashley Kahen	Nicole Pallas	Goldi Weiser
Gabby Dean	Heather (Hyesung) Kim	Shannon Park	Leelah Weitz
Nechama Dembitzer	Glenna Lee	Anirudh Pidugu	Rebecca Weitz Fenster
Erika Denour	Ali Lemkuil	Nikta Radfar	Asli Yilmaz
Johanna Diaz	Rebecca Li	Zacharie Rahhal	Yuedi Yu

Pre-Doctoral Student Abstracts:

Molecular, Cellular, Tissue, System, Regenerative Medicine, & Organism Biology and Physiology

1 "Extracellular vesicles as liquid biopsy for cancer immunotherapy"

Caroline Aronin[1], Sunil Dubey[1], Mathew Matthen[2,3], Fatemeh Momen-Heravi[1,3]

[1]Division of Periodontics, Section of Oral and Diagnostic Sciences, College of Dental Medicine, Columbia University, New York, NY, USA, [2]Division of Hematology and Oncology at New York Presbyterian Hospital/Columbia University, Columbia University Medical Center, New York, NY, USA, [3]Herbert Irving Comprehensive Cancer Center, Columbia University Medical Center, Columbia University, New York, NY, USA

Background: Tumors of the head and neck and lung remain extremely heterogenous, and their response to immunotherapy is difficult to predict. Extracellular vesicles (EVs), including exosomes and microvesicles, are membrane-bound vesicles secreted by most cell types during both physiologic conditions as well in response to cellular stress. EVs play an important role in intercellular communication and are emerging as key players in tumor immunology and disease-associated biomarkers.

Objectives: The objective of this study was to identify the diagnostic utility of EVs' proteome in patients who underwent cancer immunotherapy in head and neck cancer and lung cancer.

Methods: We have performed as spectrometry-based label-free quantitative proteomics of patients with head and neck cancer tumors and circulating EVs before and after immunotherapy – attempting to make connections between the microenvironment and the treatment outcomes. We used Tumor Cancer Genome Atlas (TCGA) data to generate survival curves, extract immune infiltrate data, and search associated mutations with markers identified as differentially expressed in immunotherapy responders and non-responders.

Results and Conclusions: We found significantly higher levels of KRT6A and B2M in EVs isolated from circulation of immunotherapy non-responders. FN1, APOA4, and AGT were enriched in EVs of non-responders after immunotherapy. Interestingly, THBS1 and PF4 were lower in EVs isolated from treatment non-responders before and after immunotherapy compared to treatment responders. CD14 levels were higher in EVs of non-responders before immunotherapy and lower in non-responders after immunotherapy. In TCGA data, EV markers which were enriched in treatment non-responders, were negative prognostic indicators of different subtypes of head and neck cancer and lung squamous cancers. Our group is currently working on confirming these markers in an independent cohort to develop liquid biopsy assays.

Discussion: EVs have the potential to be a promising biomarker and therapeutic tool for cancer treatment planning and monitoring in the era of precision medicine. Qualitative and quantitative findings of specific EV molecular signatures are necessary in applying EV-based tumor diagnosis and monitoring.

2 "Tethering Lubricin/PRG4 to Improve Regenerative Healing of Fibrocartilaginous Tissues"

Julian I. Bensadoun[1,2,+], Jeffrey T. Felix[1,2,+], Solaiman Tarafder[2], Chang H. Lee[1,2]*

[1]College of Dental Medicine, Columbia University, New York, New York, [2]Center for Dental and Craniofacial Regeneration, New York, New York, [+]Co-first authors, *Faculty mentor

Background: Lubricin/PRG4, an abundant protein in synovial fluids and on articular surfaces, enables frictionless joint movement. However, an exposure of injured tissues to lubricin may disrupt healing by preventing cell/tissue adhesion. Lubricin is also responsible for inefficiencies in the delivery of previous developed connective tissue growth factor-loaded bioadhesives which aid in endogenous stem cell recruitment to the avascular layers of torn menisci.

Objectives: We investigated the mechanism of lubricin/PRG4 retention on the injured surface of intra-synovial tissues. Furthermore, by tethering the lubricin/PRG4 to CD44, we explored strategies to facilitate healing of fibrocartilaginous TMJ disc and knee meniscus tissues.

Materials and Methods: Immunofluorescence was performed for lubricin/PRG4, Hyaluronic acid (HA), and Collagen-II (COL-II) on injured/unrepaired menisci. Meniscus explants were pre-coated with HA or COL-II, incubated in bovine synovial fluid, and lubricin/PRG4 surface expression was observed. CD44 was selected as a tethering agent given its strong binding affinity both to lubricin/PRG4 and HA. Binding of CD44 to lubricin/PRG4 was tested by coating lubricin/PRG4 on a polystyrene plate, followed by CD44 application. CD44 binding to the articular surfaces of menisci expressing lubricin/PRG4 was also evaluated. CD44-bound bioadhesives were applied to our meniscus explant healing model through controlled delivery of bioactive cues.

Results and Conclusions: The torn surface of injured/unrepaired menisci showed that lubricin/PRG4 deposition co-localized with HA. HA pre-coating on the meniscus surface showed abundant lubricin/PRG4 expression compared to the un-coated controls ($p<.0001$). On culture plates, CD44 binding was consistently localized on the area with lubricin/PRG4 pre-coating. Similarly, CD44 showed binding on the articular surface of menisci with strong lubricin/PRG4 surface expression in contrast to samples when lubricin/PRG4 was degraded by NaCl. Fluorophore-labeled CD44 showed an even distribution in CD44 bound bioadhesive which led to improved healing of injured menisci by tethering pre-coated lubricin/PRG4.

Discussion: Our data suggest that HA plays an important role in allowing the surface binding of lubricin/PRG4. To tether the surface pre-coated lubricin, we developed CD44-bound bioadhesives. Finally, modification of bioadhesives with CD44 may improve their ability to support healing of clinically relevant meniscus tears by endogenous stem cell recruitment.

3 "Evaluation of Periodontal Disease and Alveolar Bone Loss in Women with HIV"

A. Besmer[2], K. Kister[2], J. Shah[1], S. Noh[2], A. Cantos[1], I. L. Chesnoiu Matei[2], C. Silva[2], Y. O'Neal[2], C. Ramón[1], J. T. Grbic[2], T. Hu[3], R. Demmer[3], S. Wadhwa[2]*, M. T. Yin[1]

[1]Columbia University Irving Medical Center, New York, New York, [2]Columbia University College of Dental Medicine, New York, New York, [3]Division of Epidemiology and Community Health, University of Minnesota, Minneapolis, Minnesota, *Faculty mentor

Objectives: In the pre-combination antiretroviral therapy (cART) era, periodontal disease was common among people living with HIV. With the widespread use of cART, prevalence of periodontal disease in HIV has decreased; however, there is a higher risk of lower bone mineral density. We examined prevalence of periodontal disease, alveolar crestal height (ACH) and number of teeth present in women with HIV, living in the United States.

Methods: In total, 138 HIV+ (n=97) and HIV- (n=41) women with mean age 53.8 ± 7.7 (HIV+ = 54.4 ± 6.6; HIV- = 52.4 ± 9.7; p=0.24) were enrolled. Women with HIV were on cART with virological suppression. Each participant received a full mouth (3rd molars excluded) periodontal examination. Clinical attachment level (CAL), bleeding on probing (BOP) and probing depth (PD) were determined at 6 sites per tooth. Periodontitis was classified according to the Centers for Disease Control and Prevention/American Academy of Periodontology definitions as none/mild, moderate or severe. Alveolar crestal height (ACH) was determined from dental radiographs by measuring the distance from the Cemento-enamel junction to level of crestal bone at the mesial and distal site of all teeth (except 3rd molars and canines) and averaged for every single participant.

Results: Women with and without HIV did not differ with regards to periodontitis prevalence (46% vs. 45%, p=0.92), mean CAL (3.45 ± 0.12 vs. 3.62 ± 0.22mm, p= 0.45), mean PD ($3.10 + 0.09$ vs. $3.33 + 0.19$mm, p=0.24), or the percentage of sites with BOP (33 ± 3 % vs. 30 ± 4 %, p=0.45). ACH was greater (3.18 ± 0.13 mm vs 2.54 ± 0.17mm, p=0.006) and number of teeth present was less in HIV + than HIV – women ($22.87 + 6.65$ vs $18.94 + 7.49$, p=0.005). After adjusting for age, race/ethnicity, diabetes and smoking, the trend remained for ACH (p=0.06) and number of teeth (p=0.08).

Conclusions: Despite similar clinical periodontal disease parameters, HIV+ women have radiological evidence of greater alveolar bone loss, and tooth loss, compared to HIV- women.

4 "Analysis of clinical patterns of immune-related-adverse-events in patients with immune checkpoint inhibitors"

M. Choi[1], A. Mor[1], S. Bukhari[1]

[1]*Columbia Center for Translational Immunology, Columbia University, New York, New York*

Background: Immune checkpoint inhibitors that target programmed death 1 [PD-1], programmed cell death ligand [PD-L1] as well as the cytotoxic T-lymphocyte-associated protein 4 [CTLA-4] have been increasingly used in cancer therapy. Currently, 2 PD-1 inhibitors (nivolumab, and pembrolizumab) and 3 PD-L1 inhibitors (atezolizumab, avelumab, and durvalumab) have been approved by US Food and Drug Administration for usage. While effective, these drugs reactivate T-cell mediated immunity and, in the process, cause autoimmune-like disorders, or Immune-related-adverse-events (irAE). IrAE can cause serious damage to patient's bodies and can deter patients from continuing their immune check point inhibitor therapy. Despite their severity, however, there remains much knowledge gap regarding the clinical variables that may impact onset, and severity of irAE.

Objectives: Investigate the association between irAEs reported during anti–PD-1 therapy/PD-L1/CTLA-4 by comparing patient data of irAEs (type, stage, time until onset (TUO) across multiple cancer types, stage, medication, and PD-1 levels).

Materials and Methods: 39 patients, who have either gone through, or is in the process of receiving on-going treatment with immune check inhibitors were identified through an irAE database. Descriptive statistics were calculated to assess the frequency of irAE: Odds Ratio (OR) and Line of Linear Regression (LOLR) were derived for cancer types, cancer stage, chemotherapy/ other immune therapies, and PD-1 levels.

Result and Conclusions: Those with tumor type NSCLC and Cancer stage 4 had the highest OR. Additionally, those with cancer stage 4 had the highest risk for developing irAE and had the longest average TUO. Patients treated with Pembrolizumab, Atezolizumab, Durvalumab, Combination therapy, and those treated with different immunotherapy than immune checkpoint inhibitors, had high risks of developing irAE. Patterns of average TUO seemed sporadic and analysis lead to inconclusive results, and no information regarding irAE type or stage or PD-1 levels could be found.

Discussion: Small sample size of the study limits conclusions drawn from the study. In addition, several assumptions were made in the study due to lack of data: If no information regarding irAEs were available, they did not have an irAE, and onset was determined as when the symptoms were first reported in the data. In future studies, we need to increase sample size, and conduct multivariable analysis to understand these complex biological/clinical associations.

5 "The Effect of Tooth Movement and Relapse in Bone Marrow Gene Expression"
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Introduction: Orthodontic tooth movement has traditionally been thought to be mediated by periodontal ligament cells and alveolar bone. It is known that during orthodontic tooth movement, bone marrow resident osteoclasts resorb the alveolar bone causing a direct connection between the periodontal ligament and the bone marrow, in a process termed undermining resorption. However, the role of the bone marrow has hardly been investigated in the biology of tooth movement.

Objectives: The goal of this study was to examine the changes in bone marrow expressed genes during orthodontic tooth movement and relapse by RNA sequencing.

Materials and Methods: Eight 8-week-old CD-1 male mice were divided into three groups. 1) Control (n=3). 2) Tooth movement for 11 days (n=3) 3) Relapse-Tooth movement for 8 days followed by 3 days of removal of orthodontic forces (N=2). In order to achieve tooth movement- a 25 grams Dentsply Sentalloy Ni-Ti open coil was engaged from the first molar to incisor. The first molar was extracted for all of the mice and the PDL tissue was carefully scraped from the extracted molars and corresponding alveolar bone. RNA was isolated using a Qiagen RNeasy Minikit and RNA quantity and quality was analyzed using a Nanodrop and Bioanalyzer. RNA Integrity numbers were greater than 6.0 and sequenced by Columbia Genome Center core facility. 353 genes that are known to be expressed in bone marrow from the (https://www/proteinatlas.org/humanproteome/tissue/bone+marrow) were examined. Genes that had a greater or lesser than log 2 change of 1 expression for Tooth movement/control and relapse/control were examined.

Results: For tooth movement, 8/353=2% of the genes known to be expressed in the bone marrow had greater than 1 log 2-fold induction, while 331/353= 94% had less than -1 log 2-fold induction compared to non-tooth movement controls. For relapse, 21/353= 6% of genes known to be expressed in the bone marrow had greater than 1 log 2-fold induction, while 31/353 =9% had less than -1 log 2-fold induction, compared to non-tooth movement controls.

Conclusion: Orthodontic tooth movement causes a reduction of bone marrow genes that return to control levels during relapse. Greater understanding on the role of the bone marrow in mediating orthodontic tooth movement and relapse are needed in order to expedite tooth movement and prevent relapse.

6 "Neurodevelopmental Phenotypes in Individuals with Pathogenic Variants in *CHAMP1*"

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Background: Neurodevelopmental disorders (NDD) such as intellectual disability (ID) and autism spectrum disorder (ASD) are both genetically and phenotypically heterogeneous. Due to the pleiotropic nature and genetic heterogeneity of these conditions, exome sequencing (ES) is a first-tier diagnostic approach for individuals with NDD. *De novo* pathogenic variants in chromosome alignment maintaining phosphoprotein 1 (*CHAMP1*), encodes kinetochore-microtubule associated protein (CAMP) on 13q34, causing a rare neurodevelopmental disorder.

Objectives: The goal of this study was to refine the phenotype associated with *de novo* pathogenic/likely-pathogenic variants in *CHAMP1* in 10 previously unreported individuals enrolled in Simons VIP/Searchlight by providing data on clinical features and standardized neurobehavioral measures.

Methods: We enrolled 12 individuals with pathogenic variants in *CHAMP1* that were documented by exome sequencing or gene panel sequencing. Medical history interviews, seizure surveys, Vineland Adapted Behavior Scales Second Edition, and other behavioral surveys were completed by primary care givers of 12 participants.

Results and Conclusions: We report on clinical features of twelve individuals (ages 2-26) with *de novo* predicted loss of function variants in *CHAMP1* and compare them with previously reported cases. Common phenotypes include intellectual disability/developmental delay, language impairment, congenital and acquired microcephaly, behavioral problems including autism spectrum disorder, seizures, hypotonia, gastrointestinal issues of reflux and constipation, and ophthalmologic issues. Other rarely observed phenotypes include leukemia, failure to thrive and high pain tolerance. Pathogenic variants in *CHAMP1* are associated with a clinical phenotype of developmental delay/intellectual disability and seizures.

Discussion: *CHAMP1* defects affect kinetochores-microtubule attachment resulting in abnormal chromosome alignment along the metaphase plate, impairing chromosomal segregation and leading to apoptosis or cytokinesis failure. The condition is associated with intellectual disability, speech and language impairment, microcephaly, seizures, hypotonia, ophthalmologic issues, constipation/gastroesophageal reflux, and behavioral problems including ASD. We report a single case of pediatric onset leukemia associated with cytogenic abnormalities. We believe that the dysfunctional connectivity between CAMP and the complex microtubule/kinetochore protein networks contribute to the genomic instability required to predispose one to cancer. We should continue to monitor for future reports of leukemia and other cancers in individuals with *CHAMP1* variants.

7 "Role of Extracellular Vesicles in Tumor Microenvironment and Systemic Effects of Tumors in Head and Neck Cancer"

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Background: Extracellular vesicles (EVs) are essential mediators of tumor microenvironments and systemic effects of cancer. These membrane-bound vesicles are emerging as a popular means for early detection of malignant tumors, intracellular signaling, and cellular homeostasis. However, little is known regarding EVs' proteomic profile and their functional role in modulating tumor microenvironments and systemic effects of cancer in head and neck cancer (HNSCC).

Objectives: This study aimed to examine the role of the proteomic cargo of EVs in HNSCC pathogenesis and tumor microenvironment.

Materials & Methods: The proteomic cargo of EVs was isolated from plasma of HNSCC patients and then functional and genomic studies were carried out to elucidate their role and diagnostic utilities in HNSCC. Our analysis included the cancer genome atlas (TCGA) pan-cancer atlas dataset. Genes that correlated with hemostasis-related genes and genes enriched in EVs were analyzed by the GSEA pre-ranked algorithm. Ex-vivo studies were carried out to identify mechanistic roles of HNSCC EVs.

Results and Conclusions: Proteomic analysis showed that many enriched proteins in HNSCC-derived EVs belonged to hemostasis and coagulation pathways. Functional studies demonstrated the role of HNSCC EVs in promoting blood coagulation and platelet activation. Bioinformatic analysis in the TCGA confirmed genomic alteration in the form of gain, amplification, and high mRNA levels in hemostasis-related genes in HNSCC tumors. Enrichment of coagulation and hemostasis-related genes in HNSCC and other solid tumors was prevalent and associated with high tumor mutation burden. Tumors with genomic alterations of hemostasis-related genes showed enrichment in epithelial-mesenchymal signature and suppression of interferon-gamma signaling. Interestingly, patients with high gain, amplification, and high mRNA of the dysregulated hemostasis genes showed significant co-occurrence of those genomic events. The presence of genomic alterations and high expression of hemostasis and coagulation-related genes was associated with lower survival outcomes in HNSCC and pan-cancer studies.

Discussion: Our results indicate that specific proteomic changes could be detected in EVs in HNSCC cancer. Those changes correlate with tumor-specific genomic alterations in hemostasis- and inflammation-related genes. Our findings indicate the functional role of tumor EVs in coagulation and their diagnostic utility as disease associated-biomarkers.

8 "Hypoglossal Nerve Stimulation for Obstructive Sleep Apnea Clinical Outcomes"

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Background: Obstructive Sleep Apnea (OSA) is a chronic disorder characterized by paroxysmal upper-airway collapse during sleep. These episodes frequently lead to hypercapnia, hypoxemia and daytime somnolence. Other symptoms include snoring, cognitive impairment, and cardiovascular complications. Continuous positive airway pressure (CPAP) is the standard treatment and has proven beneficial; however, it is known to have poor long-term adherence, typically due to patient discomfort. In search of a more efficacious treatment, various surgical interventions have been explored. Among the most promising of these procedures is hypoglossal nerve stimulation (HNS). HNS has shown positive outcomes despite being performed on patients with moderate-to-severe OSA who previously failed CPAP therapy. Previous analyses of HNS and OSA were limited in their study type (case reports and series) and the number of included patients.

Objectives: To perform an updated meta-analysis and systematic review of quantifiable OSA patient outcomes before and after HNS. Outcomes will be separated by time post-HNS to explore if and when an improvement in OSA is expected to begin and whether improvements are stable over time.

Materials & Methods: Two reviewers independently conducted a comprehensive literature search to identify prospective studies in PubMed, Embase, and Cochrane Library databases, using keywords "hypoglossal nerve stimulation, HNS, obstructive sleep apnea, OSA, upper airway stimulation, UAS." The last search was performed on November 17, 2020. There was no disagreement between the two reviewers.

Results and Conclusions: Statistically significant reductions were found between baseline and experimental apnea-hypopnea index (AHI), oxygen desaturation index (OD), and scores on the Epworth Sleepiness Scale (ESS) across all groups. A significant heterogeneity was found across the 6-month group for all three outcomes. No significant variability was found across the 3-month and 12 month groups for any of the three outcomes.

Discussion: Our results suggest that hypoglossal nerve stimulation alone leads to statistically significant improvements in AHI, ODI and ESS scores compared to baseline scores in patients with moderate-to-severe OSA as soon as 3-months post-operation. These improvements appear to be robust, remaining statistically significant for as long as currently measured (60 months). Further research should be conducted to examine whether or not these same improvements can be seen in patients with more mild OSA. These strong results also suggest that HNS should be investigated as an earlier intervention if patients have difficulty adhering to CPAP regimens. Further studies could also examine HNS outcomes when compared to CPAP adherent patients as well as other surgical interventions (MMA, UPPP) to see which intervention is most efficacious.

9 "Neurodevelopmental Phenotypes Associated with Pathogenic Variants in *SLC6A1*"

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Background: *SLC6A1* encodes GAT-1, a major gamma-aminobutyric acid (GABA) transporter in the brain. GAT-1 maintains neurotransmitter homeostasis by removing excess GABA from the synaptic cleft. Pathogenic variants in *SLC6A1* disrupt the reuptake of GABA and are associated with a neurobehavioral phenotype.

Objectives: We aim to expand knowledge about specific pathogenic variants of *SLC6A1* associated with a neurological phenotype.

Materials & Methods: Medical history interviews, seizure surveys, Vineland Adaptive Behavior Scales Second Edition and other behavioral surveys were completed by primary care givers of participants in Simons Searchlight. All participants underwent clinical whole exome sequencing or gene panel sequencing. Comparable cases from the literature were included in supplemental data for comparison. Patient data was analyzed and summarized into tables and figures that describe the neurological phenotype associated with pathogenic variants of *SLC6A1*.

Results and Conclusions: We identified 28 individuals with largely *de novo* pathogenic/likely pathogenic variants. Twenty-one unique missense (71%) and truncating (29%) variants were identified in the Simons Searchlight cohort. The phenotype of individuals with pathogenic variants in *SLC6A1* includes hypotonia, intellectual disability/developmental delay, language disorder/speech delay, autism spectrum disorder, sleep issues, and seizures.

Discussion: Understanding the genotype-phenotype relationship of *SLC6A1* may provide opportunities to develop new treatments for GABA-related conditions. Clinical features and behavioral scales highlight the importance of focusing on speech, language and communication skills when treating individuals with *SLC6A1* pathogenic variants. Since seizures are common, monitoring for seizures is recommended when the *SLC6A1* genetic diagnosis is made. Future clinical and functional studies of pathogenic variants in *SLC6A1* will further delineate mechanisms of dysfunction to help develop therapies for individuals affected by the condition.

10 "Advancing Osseointegration of Implanted Biomaterials in the Maxilla and Mandible"

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Background: The term osseointegration refers to the immediate contact between biological bone, discussed here in the maxilla or mandible, and the surface of an implanted biomaterial. Effective osseointegration is a requirement for the ultimate success of an implanted biomaterial. In order for implanted biomaterials, like metallic dental implants, to anchor and offer load-bearing capability, there must be sufficient bone growth and no fibrous capsule formation at the juncture between the implanted material and the biological bone. This review article discusses osseointegration, the current state of dental implants, and the future of dental implantology. [1, 2, 3, 4, 5]

Objectives: Here, we aim to examine the science of osseointegration, the history of dental implant use, the range of clinical biomaterials, surface modifications that improve osseointegration, and future directions for implanted biomaterials. [1, 2, 3, 4, 5]

Materials & Methods: Review articles, research papers, and released documents from the Food and Drug Administration that specifically discuss osseointegration, dental implants, the history of dental implants, dental implant materials, dental implant surface modifications, or the medical device approval process were included in this review.

Results and Conclusions: In the last few decades, implanted biomaterials have been improved to allow for even lower rates of failure, even fewer infections, and even more rapid and strong levels osseointegration. [2, 6, 42] From the discovery of titanium as a bioinert substance to the established efficacy of textured surfaces in promoting osseointegration, implanted biomaterials have improved significantly since the introduction of dental implants in the 1970s. [9, 6] The future of implanted biomaterials will build on the rich history of innovation in dentistry with advancements in implant fixture texture with nanoscale topography, bioactive coatings, and the introduction of therapeutic agents via hydroxyapatite coatings. [6, 44, 42]

Discussion: There is still much to be uncovered about the efficacy of these features and unlimited opportunity in exploring the combinations at the intersection of texture, coatings, and therapeutic agents. It is at this juncture where the future gold standard of dental implantation lies.

11 "Epigenetic Editing of Endogenous Periodontal Transcription Factors by CRISPR Activation"

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Background: Periodontitis is the eleventh most prevalent medical condition worldwide affecting 20-50% of the global population. Current clinical treatments facilitate the attachment of long junctional epithelium to root surfaces rather than generate new connective periodontal tissues, leading to recurrence of periodontitis. To overcome these limitations, stem cell-based regenerative therapies have been investigated, however, precise cellular programming for these tissues has remained elusive and may require a network of transcriptional gene regulation. Scleraxis (Scx) and Mohawk (Mkx) are two transcription factors upregulated and crucial for the development and maintenance of the periodontal ligament. We aim to co-regulate and endogenously activate these master regulators using dCas9-VPR CRISPR activation (CRISPRa) in translationally relevant cells, including human periodontal ligament stem cells and dental pulp stem cells.

Objectives: We hypothesize that simultaneous upregulation of key transcriptional factors, Scx and Mkx, will activate downstream lineage pathways toward periodontal differentiation and stimulate periodontal ligament regeneration

Materials & Methods: CRISPRa components included Sp-dCas9 fused with transcriptional activator VPR and four guide RNAs (gRNA) per gene. Transfection efficiency and gene upregulation was tested with HEK-293T cells, human periodontal ligament (PDLSCs) and dental pulp (DPSCs) stem/progenitor cells. Samples were harvested at 48 hours and total RNA isolated. Scx and Mkx expression was evaluated with qPCR using GAPDH as the endogenous control. Cells were transfected using Lipofectamine 2000 and suspended in a collagen hydrogel for 24 hours.

Results and Conclusions: Previous screening results in HEK-293T cells identified the best performing gRNAs for Scx and Mkx, producing greater than 100- and 4-fold increase respectively. In the biologically relevant cell line, PDLSCs, electroporation was the most efficient transfection method, demonstrating >60% transfection efficiency with 500ng of pMaxGFP fluorescent reporter after 24 hours compared to <20% seen with lipid-based transfection methods. Electroporation was used to transfect 100ng of dCas9 with 100ng of Scx or Mkx guide RNAs. Transcriptional analysis by quantitative PCR demonstrated significant induction of Scx expression in DPSCs, however no induction of Mkx expression. To simulate an in vivo microenvironment, we performed successful transfections of DPSCs within a 3D collagen hydrogel.

Discussion: Genome engineering of key periodontal ligament transcription factors, Scleraxis and Mohawk were endogenously activated using the CRISPRa dCas9-VPR system. Future improvements include multiplexing of Mkx and Scx in biologically relevant periodontal or dental pulp stem cells, leading to the beginning of multi-transcriptional network regulation. These strategies may be necessary for enhanced stem cell-based periodontal regeneration and therapeutics.

12 "Therapeutic Approach to Angelman Syndrome Using CRISPR Cas13d/CasRx Programmable Targeting"

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Background: Angelman Syndrome is a rare neurogenetic disorder characterized by severe intellectual disability, lack of speech, autistic tendencies, seizures, ataxia, muscle hypotonia and overall happy dispositions. Patients frequently display craniofacial malformations such as prognathism, bruxism and widely spaced teeth. Angelmans is a monogenic disorder caused by loss of function of the UBE3A gene on the maternally inherited allele, while the paternal allele is intact but epigenetically imprinted by a long non-coding RNA. We propose a novel genome engineering approach by un-silencing UBE3A using CRISPR Cas13d/CasRx RNA targeting.

Objectives: Design and construct CRISPR Cas13d/CasRx components and multiple guide RNAs to precisely target and degrade the antisense non-coding RNA responsible for epigenetically silencing UBE3A.

Materials and Methods: Human gRNAs targeting regions of long non-coding RNA SNHG14 (UBE3A-ATS) were designed using the NY Genome Center Cas13d targeting algorithm. Guide RNAs were ranked for specificity and off target activity. gRNAs were purposely targeted towards the distal area of UBE3A-ATS as not to interfere with critical Prader Willi genes, a related disorder sharing the same genetic locus. Target regions were mapped onto the human chromosome 15 using Ensembl. Cas13d/CasRx plasmids and guide RNAs will be molecularly cloned into a pLenti vector backbone (Addgene #138147) using Gibson cloning.

Results and Conclusions: A rigorous literature and bioinformatics search honing in on the target region of RNA UBE3A-ATS was performed. We targeted the distal region as to not disturb critical Prader Willi genes on the paternal allele. Approximately 18 guide RNAs were designed to tile our region of interest for knockdown. An additional 6 were designed including a non-targeting region, positive controls, and a GFP spike-in. Cas13d/CasRx components were properly streaked, inoculated and isolated yielding >300 µg. Molecular cloning of all designed guide RNAs into the Cas13d/CasRx vector backbone is ongoing.

Discussion: We successfully located a reasonable targeting region within the distal portion of UBE3A-ATS, the non-coding RNA responsible for epigenetically silencing UBE3A. We next designed multiple guide RNAs tiling this region for the purpose of degrading UBE3A-ATS RNA. Previously reported UBE3A-ATS inhibitors can be toxic, have multiple off target effects or stimulate deleterious DNA repair mechanisms. The recently discovered CRISPR Cas13d enzyme does not bind or cut underlying DNA, instead targeting RNA. This may be a safer therapeutic approach than permanently altering the genome. If paternal UBE3A in Angelman Syndrome is successfully unsilenced, it would provide an innovative treatment for patients suffering from this disorder.

13 "Molecular Subtypes of Head and Neck Cancer in Patients with African Ancestry"

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Background: Head and neck cancer (HNC) accounts for more than 300,000 deaths annually and is the seventh most common cancer worldwide. Epidemiological data identifies disparities in black patients for HNC screening, detection, treatment, and survival. Although socioeconomic and environmental factors play a role in the existing racial disparities, HNC incidence and survival rates in the black population cannot be attributed to these factors alone. This study does not aim to debut the existing epidemiological research; instead, it aims to uncover the biological basis that may complementing the documented disparities in head and neck cancer.

Objectives: To investigate the role genomic race plays in head and neck cancer.

Materials & Methods: We examined HNC samples from 95 black and 1004 white patients from seven studies piloted from five institutions: The Cancer Genome Atlas (TCGA), Memorial Sloan Kettering Cancer Center (MSKCC), Broad Institute, MD Anderson Cancer Center, and John Hopkins University. We used an unbiased estimate of identifying the relation of race on HNC molecular features by using racial admixture, rather than self-reported race. We then characterized the extent to which genomic alterations in black patients impact their clinical outcomes and correlate with disease-defining molecular alterations.

Results and Conclusions: The mean age at diagnosis for black and white patients was 58 ± 8 and 61 ± 12 years old, respectively (p=0.0293). Black patients showed a greater percentage of the laryngeal (p=5.93E-04) and tongue (p=5.931e-4) tumor sites. Black tumor samples showed more advanced neoplasm disease stage (Stage III and IV) (p=1.97e-7) and higher rates of metastasis (p=8.47e-3) compared to white. Black patients showed higher percentage of positive lymph node stages (p=2.21e-4) and were more likely to show a positive disease of surgical margin (p=8.09e-3). White patients were more likely to be HPV-positive compared to black (p=2.19e-3). Black patients had a worse overall survival (median of 25.94 months for blacks and 60.43 months for whites, p=4.229e-4). Differential mutation frequencies and copy number alterations of a large set of genes, including COL11A1, SYNE1, DNAH5, NOTCH, PIK3CA, FAT1, MUC16, CSMD3 FGF21, PPARD and TP53, were identified. Black patients showed more chromosomal 6q and 3p loses. Differential protein and mRNA expression of over 100 genes was identified. Blacks had increased mRNA expression of genes GSTM1, CYPA45, CNNM1, SLC5A12, AGR2 and GSTT2 and decreased mRNA expression of RHEX, CTSW, USP32P1, LRRC7A2, RIMS3, NOX5, PXDNL, and CFHR3. Lastly, we found differential methylation of certain genes involved in TP53 regulation, PUMA activation, megakaryocyte development, platelet production and mitophagy. In conclusion, we discovered unique molecular alterations in the black tumor samples that may have promising clinical use in HNC screening, diagnoses, monitoring and treatment.

Discussion: In an era of personalized medicine, genomic profiling based on race defined from a molecular method is needed to drive the changing practice of diagnostic and treatment modalities on a case to case basis. Historically, cancer biomarkers and molecular signatures have been largely identified from white patients. Here, we illustrate an urgent need to continue updating and advancing the documented molecular data from different racial populations in order to improve the overall health and care of all patients.

14 "The Signaling Pathway of Sigma-1 Receptor Agonist PPBP Maleate (4-PPBP)"

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Background: Pharmacokinetic small molecules Oxotremorine M (Oxo-M) and PPBP maleate (4-PPBP) induce differentiation of CD146$^+$ stem/progenitor cells extracted from tendon and periodontal ligament (PDL) tissue. We have recently shown that Oxo-M acts via acetylcholine receptor signaling. The 4-PPBP signaling mechanism remains unknown, despite the potential role of the sigma-1 receptor (s1R) in other types of cells.

Objectives: This study sought to confirm 4-PPBP as a s1R agonist and to identify the intracellular signaling molecules that elicit tendon and PDL regeneration following 4-PPBP treatment.

Materials & Methods: CD146$^+$ rat tendon stem cells (rTSC) and CD146$^+$ human PDL stem cells (hPDLSC), were treated with s1R agonist (50 mM 4-PPBP), selective s1R antagonist (200 mM BD1047), and their combinations. Following treatment, western blot and qRT-PCR were performed to assess signaling protein activity and gene expression induced by 4-PPBP.

Results & Conclusions: 4-PPBP increased p-ERK1/2 in rTSC, while BD1047 significantly attenuated the expression. Src, a downstream signaling mediator of s1R was decreased in the BD1047-treated rTSC. hPDLSC showed a similar pattern of pERK and Src attenuation with notable difference in sensitivity to BD1047.

Discussion: These findings suggest that ERK1/2 and Src signaling are involved in the s1R-activated intracellular cascade, which is potentially linked with improved regeneration of tendon and PDL tissue by Oxo-M and 4-PPBP. In contrast to uniform rat tissue, human tissue donors' genetic variation, age, and medical history may affect cellular activity and protein expression. COVID-19 limited hPDLSC collection; therefore, future studies will include hPDLSC from a variety of donors in order to establish universal patterns. Follow-up studies will measure expression of additional signaling molecules and determine the chronological order of the cascade. Clinical use of this treatment has potential to accelerate healing following tendon injury, dental trauma, orthodontic tooth movement, and advanced periodontal disease.

15 "In Vitro Study on Accuracy of Complete-Arch Intraoral Scans: The Contribution of Translocation Errors to Overall Surface Inaccuracy"

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Introduction: Digital impressions derived from intraoral optical scanning (IOS) reveal increasing deviations in trueness as the scanned area expands. This error is generally recognized, but there is a lack of evidence to characterize the nature of such inaccuracy. Moreover, scanning of edentulous areas has shown to be especially unreliable due to a lack of landmark structure, which is otherwise naturally provided by teeth.

Objectives: This study aims to 1) investigate the extent to which deviations in position, scale, and shape contribute to overall surface deviation in complete-arch digital impressions, and 2) verify whether the application of artificial markers improves edentulous scan accuracy.

Materials & Methods: An edentulous stone model was scanned on a laboratory scanner as a reference scan (RSC), and with an IOS as test scans (TSC1). Five artificial markers were positioned on the model and scanned again with laboratory scanner (RSC2) and IOS (TSC2). Test scans were repeated 45 times. All scans were processed to generate a standard tessellation language (STL) mesh. TSC1 and TSC2 were aligned to RSC1 and RSC2, respectively, utilizing iterative closest point (ICP) algorithm with a 3-D metrology software. The surface accuracy was evaluated in this initial alignment. Six regions of interest (ROI) were segmented from each test scan with a 3-D modeling software. Each ROI was translated and rotated to find its own best-fit position in accordance with RSC. The translocation error was defined as the combined translational and angular discrepancy of each segment to reach its best-fit position. Surface deviation was visualized with a heatmap and numerically reported as mean and standard deviation of pre- and post-correction root mean square error (RMSE) for individual segments.

Results: ΔRMSE for TSC1 was 70.3±17.2% (p=.000) with a pre-correction RMSE absolute value (AV) of 80.7±58.0μm and post-correction RMSE (AV) of 16.7±5.5μm. ΔRMSE for TSC2 was 81.8±13.4% (p=.000) with a pre-correction RMSE (AV) of 113.6±71.6μm and post-correction RMSE (AV) of 14.7±12.0μm. Assessment of each ROI indicated a gradual increase of inaccuracy from anterior to posterior segments.

Conclusion: The present study suggests translocation as a prominent source of inaccuracy in complete arch digital impressions via IOS. Comparison between scans with and without artificial markers indicated their use failed to aid in improved accuracy. Trueness and precision were sub-optimal for both test scans. Error distribution pattern analysis revealed increased inaccuracy in posterior segments compared to anterior segments.

16 "Does decompression of odontogenic keratocysts prior to enucleation reduce the rate of recurrence?"

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Background: The odontogenic keratocyst (OKC) was first described by Philipsen in 1956 and is one of the most commonly diagnosed odontogenic jaw cysts. A variety of treatment modalities have been proposed for OKC management, and there is currently ongoing debate regarding the ideal treatment strategy. While conservative treatment modalities are associated with several advantages, such as the preservation of anatomical structures, it is not established whether decompression prior to conservative surgery reduces the risk of recurrence.

Objectives: The purpose of this study was to determine if OKC decompression prior to conservative surgery reduced the rate of recurrence compared to single-stage conservative surgery for OKCs.

Materials & Methods: This was a pooled cohort study composed of both patients retrospectively identified at our institution and cases reported in the literature. Single-stage surgery (control) was defined as either enucleation, enucleation and curettage, or enucleation with peripheral ostectomy. Two-stage surgery (experimental) was defined as decompression followed by enucleation, enucleation and curettage, or enucleation with peripheral ostectomy. The primary predictor variable was the treatment modality. The primary outcome variable was the recurrence rate as assessed at last known follow-up. Descriptive statistics were calculated for all study variables. Patient and cyst characteristics were compared by the treatment modality using chi-squared and independent sample tests.

Results: A total of 684 patient cases were included in the final pooled sample. The mean age was 39.80 years (range: 7-80 years). The mandible (76.8%) was the most common site, with the rest of the cysts manifesting in the maxilla (23.0%). 58.1% of the cysts were unilocular while the remaining 41.9% were multi-locular. Two-stage conservative treatment demonstrated a lower recurrence rate (14.5 vs 22.1%; p=0.029).

Discussion: It is well established that decompressing OKC prior to enucleation carries a myriad of benefits, particularly reduced size/volume of the OKC prior to enucleation, induced bone formation, histologic modulation of the cystic epithelium to non-keratocyst, and even complete resolution of the OKC as a whole. Our study revealed that decompressing the cysts is also beneficial in terms of reduced risk of recurrence.

Conclusion: Our comprehensive analysis of both internal and external cases reported in the literature exhibited the efficacy of decompression. Decompressing the cysts prior to enucleation yielded a significantly lower risk of recurrence relative to enucleating the cysts alone.

17 "Protective effect of LNA-anti-miR-132 therapy on liver fibrosis in mice"

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Background: MicroRNAs (miRs) are small regulatory RNAs that are frequently deregulated in liver disease. Extracellular vesicles (EVs) are shed from almost all types of cells into biofluids. Both circulating EVs and miRs have potential for biomarker discovery and treatment monitoring. Liver fibrosis is characterized by excessive scarring caused by chronic inflammatory processes.

Objectives: In this study, we sought to determine the functional role of miR-132 using a lock nucleic acid (LNA)-anti-miR approach and identify the therapeutic effects of miR-132 inhibition in a liver fibrosis mouse model.

Materials & Methods: A mouse model of liver fibrosis was developed through administration of scheduled doses of carbon tetrachloride (CCl_4). Mice were then given injections of either LNA-anti-miR-132 or LNA scrambled oligonucleotides (control). Blood and tissue samples were collected for analysis. Human liver samples of both fibrotic/cirrhotic as well as control tissues were obtained from the NIH Liver Tissue Cell Distribution System. Population data was collected from the Tumor Cancer Genome Atlas (TCGA) database.

Results: A significant induction in miR-132 levels was found in both mice treated with CCl_4 and patients with fibrosis/cirrhosis. Inhibition of miR-132 in mice given LNA-anti-miR-132 caused a decrease in CCl_4-induced collagen deposition and α smooth muscle actin, an increase in the anti-fibrotic macrophage metalloelastase 12, and a decrease in caspase 3 (pro-fibrogenic) activity as compared with the control. Further, CCl_4 treatment elicited induction of EVs in control and not in LNA-anti-miR-132 treated mice. Using TCGA data, we found increased miR-132 in hepatocellular carcinoma (HCC) as compared to the control tissue as well as a significant correlation between miR-132 and higher tumor stage and grade and unfavorable survival in HCC patients.

Discussion: MiRs play a complex role within the regulatory frameworks that govern physiology and pathology. A broader understanding of the effects of the presence or absence of miRs as well as their origin, localization, and transport will revolutionize disease treatment and prevention at the subcellular level. Therapeutic inhibition of miR-132 may be employed as a novel approach to alleviate liver fibrosis, and treatment efficacy can be monitored by analyzing EV shedding.

18 "The Genetic Implications of Esophageal Atresia"

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Introduction: Esophageal atresia is a congenital defect involving an improper development of the esophagus. While it can be found as an isolated defect, it is often associated with other congenital anomalies. A majority of the cases are associated with a tracheoesophageal fistula, leading to potential complications in both eating and breathing. Unfortunately, the etiologies of esophageal atresia are not completely understood. Current studies have suggested the likelihood of genetic causes; however, a wide variety of genetic anomalies have been observed in patients, leading to the difficulty in pinpointing a specific associated source.

Objectives: We proposed to perform a comprehensive analysis of the genetic mutations in patients diagnosed with esophageal atresia reported in the literature.

Materials & Methods: A thorough literary review was performed searching keywords on PubMed and Google Scholar to compile all reported data on potential pathogenic genetic anomalies found in patients diagnosed with esophageal atresia. The data was then organized into tables to differentiate and highlight relevant clinical information associated with the chromosomal anomalies, copy number variants and syndromes reported in the current literature. A chromosomal map was constructed to give a visual overview of the genetic mutations and copy number variants observed in these patients. We then wrote a review article on the genetic implications of esophageal atresia.

Results and Conclusions: Through an exhaustive literary analysis, 65 potentially pathogenic copy number variants and 35 genetic syndromes were identified in patients diagnosed with esophageal atresia. Chromosomal anomalies compromised most of the cases of esophageal atresia in which a genetic association was found. Most of the copy number variants observed in these patients are *de novo* or arose from parents with balanced translocations. Specific genes were implicated in some cases, and their molecular mechanisms were analyzed if possible. Recurrent genetic abnormalities were found in some patients; however, others were found in isolated cases.

Discussion: While the etiologies of esophageal atresia is still not completely understood, it is evident based on these findings that it is a genetically heterogenous condition. Esophageal atresia is clearly not associated with one specific genetic irregularity and has inconsistent expressivity. Further research must be done to further implicate the specific genetic etiology of the condition and to gain further insight on its role in causing this congenital defect.

19 "Oral Manifestations of Metastatic and Lymphoid Neoplasms"

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Background: Metastatic and lymphoid neoplasms are amongst varied systemic diseases that can manifest in the oral cavity. Metastatic diseases comprise 1-3% of malignant oral neoplasms. ~25% of patients presenting with oral metastatic disease are unaware of having a primary cancer. **Lymphoid neoplasms** are a heterogenous group diseases including lymphomas, acute/chronic lymphocytic leukemias, and plasma cell neoplasms. The oral tumor may be limited to the oral cavity or a manifestation of widely disseminated disease. Both metastatic diseases and lymphoid neoplasms of the oral cavity have been reported to mimic inflammatory conditions.

Objectives: This studied aimed to document the oral manifestations of metastatic and lymphoid neoplasms seen among the CDM Department of Oral Pathology's patient population. This study sought to investigate/report on patient demographics, clinical presentation, and clinician's clinical diagnosis. For metastatic diseases, the origin of the primary was reported. For lymphoid neoplasms, the disease classification and whether it was localized/disseminated was ascertained. For both groups, we assessed whether the patient had any known history of disease prior to the oral finding.

Materials & Methods: This retrospective analysis involved manually searching the CDM Department of Oral Pathology's biopsy service database from 2015 to 2020 to identify all biopsied oral lesions that were manifestations of metastatic or lymphoid neoplasms. These findings were cross-referenced with patients' electronic medical records in Epic. Recorded data included sex, age at diagnosis, location of biopsy, description of clinical presentation, clinical diagnosis, histologic/biopsy diagnosis and whether the patient had a prior known history of the disease.

Results and Conclusions: From a search of 17,500 cases, 29 cases were identified. 8 cases involved manifestations of metastatic diseases, including colon, lung, prostate, and renal primary origin. 21 cases involved manifestations of lymphoid neoplasms, including B-cell, T-cell, follicular, and MALT lymphoma; plasmacytoma; and multiple myeloma. 17 cases presented as initial manifestations within the oral cavity without prior known history of disease. 3 metastatic lesions presented in bone and 5 in soft tissue. 7 lymphoid lesions presented in bone and 14 in soft tissue. In 27.6% of cases, the clinical diagnosis was correct. In 20.7% of cases, a benign or infectious diagnosis was suspected.

Discussion: Although rare, metastatic and lymphoid neoplasms can present in various ways in the oral cavity. In a portion of patients, the oral lesion is the initial manifestation of the systemic disease. Hopefully, recognition of the clinical presentation of these diseases will allow for earlier intervention and better prognosis.

Pre-Doctoral Student Abstracts:

Social and Behavioral Sciences, Education, Health Services, and Global Oral Health

20 "WHO Reclassification of Diagnostic System for Oral Dysplasia"

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Background: The grading system regarding oral epithelial dysplasia suffers from high degrees of subjectivity, leading to both intraobserver and interobserver variability. Various review articles have demonstrated that the same dysplasia case is often diagnosed with different degrees of dysplasia. In 2017, the World Health Organization (WHO) proposed a transition from the traditionally used three-tier system to a standardized two-tier system for assessing oral epithelial dysplasia.

Objectives: This goal of this study was to compare the intra- and inter-observer variability amongst CDM oral pathologists regarding the diagnosis of oral dysplasia cases. Both the current three-tiered system and the proposed two-tier system were utilized in grading of the oral dysplasia cases in patients treated at Columbia University Medical Center.

Materials & Methods: Histologic slides of 100 oral dysplasia cases were pulled from Columbia University's Department of Pathology archives. The cases were chosen to represent all categories of the 3-tiered system: mild, moderate, and severe. To assess intra- & inter-observer reliability, the cases were de-identified, and given to three CDM oral pathologist for classification utilizing both the three-tier and two-tier system.
Percent agreement was reported, and a Cohen κ-Statistic was used to calculate both the intra- & inter-observer variability.

Results and Conclusions: Utilizing the three-tiered system, Observer 1 obtained a κ-Statistic of 0.49348, indicating moderate agreement [0.41 – 0.60.] Using the two-tiered system, agreement increased from 0.49348 to 0.63928, increasing the degree of agreement from moderate to substantial. Observer 2 obtained a κ-Statistic of 0.47226 when using the three-tiered system, which increased to a κ-Statistic of 0.5 when using the two-tiered system. Observer 3 obtained κ-Statistic of 0.33171 using the three-tiered system, indicating fair agreement [0.21-0.40], which increased to a κ-Statistic of 0.4587 when using the two-tiered system.
The level of agreement between Observer 1 and Observer 2 using the three-tiered system was equal to a κ-Statistic of 0.28251, indicating *fair* agreement [0.21 – 0.40]. The κ-Statistic decreased to 0.26996 during their second attempt. Observer 1 and 2 using the two-tiered system obtained a κ-Statistic of 0.54, indicating *moderate* agreement, which decreased to 0.51. Observer 2 & Observer 3, using the three-tiered system, obtained a κ-Statistic of 0.11224, indicating *slight* agreement, which increased to 0.2551. Observer 2 & Observer 3, using the two-tiered system, obtained a κ-Statistic of 0.2, indicating *slight* agreement, which increased to 0.318. Observer 1 & Observer 3, using the three-tiered system, obtained a κ-Statistic of 0.16 indicating *slight* agreement, which decreased to 0.1314. Using the two-tiered system, they obtained a κ-Statistic of 0.2, which decreased to 0.15, indicating *slight* agreement.

Discussion: The data suggests that the proposed two-tiered system increases inter- & intra-observer agreement. Our findings illustrate a much more drastic increase in inter-observer agreement verses intra-observer agreement. Continuing this research will further illustrate if the proposed two-tiered system truly decreases variability and increases agreement amongst oral pathologists surrounding oral dysplasia grading. Supplementary research and data would require a larger sample size, in addition to a greater number of oral pathologists.

21 "Dentist Attitudes and Orientations Toward Teledentistry During COVID-19"

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Background: In response to the COVID-19 pandemic, the Columbia University College of Dental Medicine established the Urgent Care Clinic (UCC), which provided urgent dental care and teledentistry services to the community. Traditionally, teledentistry has been employed as a way to improve access to dental care especially in rural and remote communities, and is a relatively new concept in a busy, urban, academic dental setting.

Objective: As part of the Lipton Fellowship for Interprofessional Research, this study uses a social work-dental perspective in order to assess provider attitudes about the newly implemented teledentistry phone service in the UCC from March through July, 2020.

Methods: All 26 faculty and resident dentists serving in the UCC were invited to participate via email, yielding a response rate of 69% (n=18). A four-part, 26 item, survey instrument assessed demographic characteristics, attitudes about the teledentistry service, experience providing urgent care during the pandemic, and willingness to provide teledentistry services in the future. Likert-scaled items (1-strongly agree, 4-strongly disagree) are dichotomized as agree, disagree in reporting results.

Results and Conclusions: Overall, 72% of dental providers agreed that telehealth is part of the future of dental care, and 72% expressed a desire to continue providing teledentistry in the future. Providers specifically involved with teledentistry (n=14) had mixed attitudes about the phone screening service. Nearly all respondents agreed it was safe (93%) and efficient (93%); while 57% agreed it was accurate, and 36% agreed it was thorough. In addition, a majority of providers (57%) agreed that patients shared psychosocial or personal matters during the telehealth appointment, and 64% also agreed that they were not comfortable addressing such concerns. Nearly all (93%) agreed the option to refer these patients to social work support staff would be beneficial, and that they would be comfortable (93%) making such a referral. These results convey a need for continued development of teledentistry systems that providers feel confident adopting, particularly regarding accuracy and thoroughness, as well as the ability to address psychosocial needs of patients through collaboration with a Social Work team.

Discussion: Further research evaluating both patient and provider perspectives is warranted to increase understanding for effectively designing evidence-based teledental delivery systems with which both patients and providers feel comfortable. Overall, the knowledge gained from this study has important implications for the future of teledental care and related dental education, and offers suggestions for improving the teledental experience during and following the COVID-19 pandemic.

22 "Integrating Oral Health Promotion in Group Well Child Care"

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Background: Caries, while far reaching, is disproportionately found in pediatric, low socioeconomic status, and ethnic minority populations. Expanding the prevention effort to the medical community, where children are usually seen earlier and more frequently, is necessary, however, pediatricians often struggle with the feasibility of devoting time to perform oral health screenings. Group well child care has been studied for decades and shown to increase the number of well child visits and decrease the amount of advice sought between visits. However, oral health promotion is seldom included in research regarding the group healthcare delivery model.

Objectives: The objective of this study is to pilot a new oral health component in an established group well child care model and to investigate if group well child care is appropriate and effective for oral health promotion in pediatric medicine.

Methods: An interactive PowerPoint about pediatric oral health topics was presented by a dental student to an established group of caregivers (n=4) at a clinic that serves predominantly Hispanic families of low socioeconomic status. The twenty-minute presentation was given at the group's nine- and twelve-month visits. A survey was administered to assess caregiver demographics as well as knowledge, attitudes, and behaviors regarding their child's oral health. The survey was administered on paper pre-intervention at the nine-month visit, post-intervention at the twelve-month visit, and via phone call six months after the twelve-month visit. Data was analyzed for improvement in caregiver knowledge, attitudes, and behaviors.

Results: All participants demonstrated improved oral health behaviors and knowledge from baseline. Participants started with and maintained positive attitudes toward oral health. One of four caregivers was lost to follow-up.

Conclusions: Participants improved oral health behaviors and increased oral health knowledge following the intervention. Participants started with and maintained positive attitudes towards oral health. The pilot was well received and feasible in the setting of a pediatric clinic.

Discussion: Oral health promotion can be feasibly incorporated into the framework of group well child care with positive outcomes. The group's pediatric medical facilitator and the dental student collaborated to address the caregivers' questions and concerns. This side-by-side provider structure allows for a comprehensive and efficient delivery of care. The small sample size and clinic's specific demographic are limitations for generalizability. Moving forward, the study size may be expanded to reach a broader patient pool for more robust effects.

23 "A Survey of Dental Students Regarding Smoking Cessation: A US-Armenia Cross Cultural Comparison"

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Background: Tobacco remains a leading cause of preventable death, especially in lower-middle-income countries like Armenia where smoking prevalence is high. Armenia's government has recently prioritized tobacco control to reduce the burden of preventable disease. Tobacco use also leads specifically to poor oral health outcomes. Dentists are uniquely positioned to counsel patients in smoking cessation, yet few receive adequate training for this role. Dental schools in the US and Armenia have known disparities in how they train students to address their patients regarding tobacco cessation. Notably, Columbia University College of Dental Medicine in New York, USA (CDM) has a required module on smoking cessation counseling; Yerevan State Medical University in Yerevan, Armenia (YSMU) does not.

Objectives: The aim of this study was to cross-culturally compare the knowledge/attitudes/practices of dental students attending CDM and YSMU with regards to tobacco use and cessation. This was done to also explore several variables contributing to differences between the two groups, particularly with a focus on education.

Materials & Methods: A cross-sectional online survey design was used. Questionnaire items were developed through literature review, expert input, face and content validity. The questionnaire was translated into Armenian and pre-tested in both English and Armenian. Prior to implementation, reliability for internal consistency of domain items was analyzed through Cronbach's alpha and question items were revised. An online link to the survey was sent to all enrolled dental students at both schools (CDM=~270, YSMU=638). Data are analyzed through SPSS for frequencies and bi-variate comparisons.

Results and Conclusions: There is a positive correlation between students' year of study and their objective tobacco knowledge at both schools, with the effect stronger at CDM. CDM students are more knowledgeable about tobacco than YSMU students in all domains except the relation between smoking and COVID-19. CDM students and YSMU students differ significantly in attitudes on tobacco cessation and the dentist's role, especially under different methods of analysis. Cigarette use is higher amongst students at YSMU than at CDM, specifically comparing the male populations, while E-cigarette use is lower. The COVID-19 crisis has impacted the smoking habits and attitudes of dental students at both CDM and YSMU. Significantly fewer students at YSMU report receiving coursework in all domains of tobacco health effects and cessation than at CDM.

Discussion: These findings enhance our understanding of the differences and similarities between American and Armenian dental students in these domains and the variables, educational and otherwise, responsible for them; this information may help to evaluate education needs and promote smoking cessation counseling training in both schools.

24 "A Pilot Study to Determine the Adequacy of Dental Education in Preparing Dentists to Manage Dental Anxiety in Patients with Developmental Disabilities"

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Background: One in four adults in the U.S. have disabilities that challenge them on a daily basis. Recently, the National Council on Disability urged the Commission on Dental Accreditation to modify accreditation requirements to include "more robust training" in the care of intellectually and developmentally disabled patients. Comprehensive curricula is early in its development and the effectiveness of it is unknown.

Objectives: The aim of this pilot study was to determine if the adequacy of special needs dental education has had an impact on providers' professional behavior, practice characteristics, attitudes, and confidence when treating these patients and managing their dental anxiety. The study addressed the importance of preparing dentists to treat this population in an effort to improve dental education in this area.

Materials & Methods: The study design was a non-randomized, non-interventional, anonymous survey using Qualtrics. It was administered prospectively to members of one local and one national organization. The sample included all dental specialties.

Results and Conclusions: Of the 107 respondents, 89% reported that they do treat special needs patients. Positive reinforcement (89%), enhancing control (85%), and distraction (85%) were the modalities most used by these participants. Of those surveyed, 74% reported confidence in treating this population, 87% expressed concern about the safety of treating this population, and 82% would like to learn more about treating this population. Level of specific expertise had the strongest influence on a provider's decision to treat or not to treat special needs patients. Participants who do treat this population reported reimbursement level as having the least influence on their decision to treat. Participants who do not treat this population reported information from continuing education courses as having the least influence on their decision not to treat. Participants felt that receiving post-doctoral education better prepared them for managing patients with special needs rather than dental school training, with pediatric dentists reporting the highest rate of preparation. No correlation was found between year of dental school graduation and how well they felt their dental school education prepared them for treating this population.

Discussion: The adequacy of dental education has a significant impact on dentists' knowledge, attitudes, beliefs, and confidence about treating those with developmental disabilities and managing their dental anxiety. Acknowledging that this relationship exists can have a significant impact on addressing the importance of preparing dentists to treat this population. Improvements in dental and post-doctoral education in this area can be made.

25 "Internationalization of Medical Education at Home – Improving Cultural Competency via an International Peer Online Program"

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Background: Student outbound mobility programs have become increasingly popular as well as comprising important portions of the internationalization of medical and global health education. However, this approach is limited, socially unjust, and does not reach all students. Internationalization *at home* is a more novel concept that is intended to provide student with relevant skills and experiences without undergoing exchange travel abroad. To achieve this, online programs seem to be likely solutions, especially in light of the recent lockdown of international travel due to the COVID-19 pandemic, but reports on outcomes of online student exchange programs that focus on acquiring cultural competencies without associated travel are quite limited to date. Internationalization at home can provide all students with skills in cultural competency for future international collaboration and to practice medicine with a global mindset.

Objectives: The goal of this study was to determine the acquisition of learning objectives such as cultural awareness and competency by medical and dental students via an international online program during the COVID-19 pandemic.

Methods: 68 students from 12 international universities participated in a condensed 8-week online program involving international small peer group collaborative work, online networking, and scientific educational enrichment. Perceived improvement of cultural competency using Likert Scale and open-ended questions was used as a measure of success. Furthermore, students' definition of cultural competency and incompetency in the different countries was captured.

Results and Conclusions: The program was well received by students and had improved their perceived cultural competency skills. Data analysis supported statistically significant improvement of the above skills after the program, in comparison to the start of the program. Thus, learning objectives were achieved.

Discussion: Internationalization of medical education can be achieved at home - via structured online peer exchanges - and can provide students with intercultural skills and networking opportunities that are typically achieved via international in-person travel. This program represents a socially just and equitable way to reach all students and can result in improvement of their cultural competency; preparing them for their work in global health, and thereby resulting in improvement of global health.

26 "Dental Residents' Personality Traits and Risk of Developing Post-Traumatic Stress Disorder During COVID-19 Crisis"

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Background: Healthcare workers who care for people affected by pandemics are vulnerable to mental health problems, including post-traumatic stress disorder (PTSD). Additionally, numerous studies have linked the development of PTSD to certain personality traits such as high neuroticism. In contrast, high extraversion and high conscientiousness have been shown to be protective against the development of PTSD. While there is some evidence that some medical professionals, like surgeons, possess more PTSD-protective personality traits than other medical professionals, there is little research on either the personality traits or the mental health of dental providers. Thus, it is essential to assess dental professionals' personality traits and their risk for developing PTSD, especially in traumatic situations like the COVID-19 pandemic.

Objectives: We aim to: 1) document personality traits and current PTSD symptoms among U.S. dental residents enrolled in various specialty programs; 2) assess any correlations between personality traits and PTSD symptoms.

Materials & Methods: A cross-sectional online survey design was used with a convenience sample of U.S. dental specialty programs. Surveys were sent from September 2020 until present to directors of the following programs: General Practice Residency (GPR), Advanced Education in General Dentistry (AEGD), Oral and Maxillofacial Surgery (OMFS), Pediatric Dentistry (Peds), and Dental Anesthesia (DA). The Qualtrics survey included 14 demographics items, the validated 44-item scale Big Five Inventory personality scale, and the 20 item PTSD Checklist for DSM-5. Data was analyzed using Rstudio software. Univariate and Bivariate analyses were performed.

Results and Conclusions: A total of 82 usable surveys were returned. Respondents were mostly female (n=52, 63.4%), white/Caucasian (n=35, 42.7%), young adults (M=30.8 yr, SD=4.61 yr), did not meet clinical criteria for PTSD (n=71, 86.5%), and 76.8% (n=63) were required to see patients during COVID-19 pandemic. Mean(Min, Max, SD) for personality trait scores from highest to lowest, were 35.87(Min=18, Max=44, SD=4.47) for Agreeableness, 34.74(Min=20, Max=45, SD=5.34) for Conscientiousness, 35.48(Min=25, Max=47, SD=4.52) for Openness, 26.26(Min=13, Max=40, SD=5.92) for Extraversion, and 22.67(Min=11, Max=34, SD=5.40) for Neuroticism. Mean(Min, Max, SD) for PTSD scores was 13.7(Min=0, Max=51, SD=12.6) suggesting low symptom severity (data skewed left) but high variability. Gender was positively correlated with neuroticism (r=0.29, p<0.01), with "She/her" pronouns correlated with higher neuroticism. Neuroticism was also positively correlated with PTSD symptom severity (r=0.45, p<0.001).

Discussion: Dental residents displayed high scores in agreeableness, conscientiousness, extraversion, and neuroticism. Female-identifying residents reported higher neuroticism than male-identifying residents, and residents with high neuroticism reported more severe PTSD symptoms. The study continues to engage a larger sample size across all dental programs.

**27 "Feasibility of Retrospective Dental Chart Review
to Assess Caries Risk During Orthodontic Treatment"**

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Introduction: Orthodontic treatments are performed on patients with abnormal alignment of teeth and jaws to optimize masticatory function and esthetics. Despite these benefits, orthodontic treatments have been associated with exacerbation of caries. Currently, dental clearance is the accepted method in orthodontics to ascertain that a patient is free of caries at the start of an orthodontic treatment, but it only provides partial information on a patient's caries risk level.

Objectives: The goal of this study was to assess the feasibility of retrospective dental chart review in predicting caries progression during orthodontic treatment.

Materials & Methods: Dental charts of 71 patients under age 21 years who initiated orthodontic treatment between 2017 and 2020 at the Columbia University College of Dental Medicine were reviewed. According to chart entries, each patient was assigned a caries risk level based on the history of dental utilization and caries risk behaviors following The American Academy of Pediatric Dentistry's guideline for caries-risk assessment (19 low, 21 moderate, 31 high). Kruskal–Wallis test and pairwise two-sided multiple comparison analyses were performed to compare the preventive and restorative dental service utilization during orthodontic treatment between each caries risk group.

Results & Conclusions: Preliminary analyses show that across all risk groups preventive and restorative dental utilization declined during orthodontic treatment from pre-orthodontic treatment levels. Yet low caries risk group's restorative utilization was significantly lower than moderate and high caries risk groups' restorative utilization during orthodontic care ($p < .001$) suggesting that pre-orthodontic caries treatment experience is associated with restorative need during orthodontic care.

Discussion: Assessment of past restorative dental service utilization and caries risk classification is a feasible approach to informing orthodontists' efforts to tailor preventive measures and recall intervals based on the individual patient's risk profile and needs, although further research with larger sample size is needed before applying it to the clinical setting. Future studies can also investigate the general decline in dental service utilization among orthodontic patients.

28 "Primary Caregiver Preferred Language and Dental Caries"

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Background: Previous literature shows that children from households where a language other than English was the primary language experienced disparities in (1) access to care, (2) use of prevention education and anticipatory guidance services, and (3) overall health. There is limited research on the relationship between primary caregiver's acculturation and oral health outcomes.

Objective: The purpose of this preliminary study was to explore primary caregiver's acculturation and the correlation with their child's decayed missing filled teeth (dmft) scores and caries risk factors using preferred language as a proxy for acculturation.

Methods: Reviewed records of 100 child participants, ages 2 to 8 years old, from a community dental clinic within a large academic medical center in Washington Heights. Two groups (n=50 each) were compared; control group of primary caregivers who spoke English and a study group of primary caregivers whose preferred language was non-English. Data included child demographics, dmft score, and caries risk factors. A modified definition of severe early childhood caries (SECC) where the number of cavities was greater than the child's age was utilized as another method for comparison. Multivariable analysis was conducted using Fisher's Exact Test and Kruskal Wallis Test to examine the association of dmft scores and caries risk factors for the two groups. Pearson correlation between continuous age and dmft scores was calculated with 95% confidence interval.

Results: In this preliminary study, age, sex, and insurance status did not differ significantly by language preference. Additionally, on average, fewer children with primary caregivers whose primary language was non-English were classified as having SECC than those with primary caregivers whose primary language was "English" (50% vs 74%, p=0.023). There was a positive correlation between age group and median dmft score (p=0.025) with the group of patients age 4-6 years old having the highest median dmft score and the group of patients ≤3 years old having the lowest median dmft score (Pearson correlation of 0.21, 95% CI: 0.01, 0.39).

Discussion: Although primary caregiver acculturation using 'preferred language' was not associated with caries prevalence in children, it is known that communication positively impacts a healthcare practitioner's ability to care for their patients. Examining primary caregivers requiring interpreters and caries prevalence will be explored next.

29 "Impact of COVID-19 on Dental Care in New York State and Georgia"

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Background: During the onset of the COVID-19 pandemic in 2020, there was an unprecedented, forced closure of dental offices nationwide. The effects of this pause on dental care have not yet been defined.

Objectives: As the states of Georgia and New York differed in COVID-19 case incidence, total COVID-19-related deaths, and state guidance for reopening, an interstate comparison of the COVID-19 pandemic's impact on oral healthcare was conducted. The aim of this study was to better quantitate the withdrawal of services of dental care in New York State and Georgia, two states with major differences in guidance on reopening, during the COVID-19 pandemic, and investigate the impact of COVID-19 exposure fear on patients' seeking of dental care.

Materials & Methods: A 16-question Qualtrics survey was sent to the membership of the New York State Dental Association (NYSDA) and Georgia Dental Association (GDA) by the respective association offices. The survey included demographics of the dentists, appointment cancellation rates during the COVID-19 pandemic and how much cancellation rates were accounted for by COVID-19 exposure fear, reopening times for non-emergent care, and the amount of individual dental procedures provided to patients from March 1 through August 1, 2020, compared to the same 5-month period in 2019.

Results and Conclusions: Despite NYSDA and GDA members having no statistically significant differences in the demographic makeup of respondents in this study, NYSDA members reported significantly larger decreases in performing all types of dental procedures, including prophylaxis, elective care, emergent care, and specialty procedures. Antibiotic prescription was the only dental care service whose change from pre-COVID baseline was not significantly different between New York and Georgia.

Discussion: This study provides data for future investigations of the dental care provided during the COVID-19 dental hiatus to assess the impact and repercussions of the pandemic on oral public health in the near and more distant future.

30 "Effectiveness of online training on first and second year AEGD residents in identifying, referring, and managing patients at-risk for substance use and opioid disorders"

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Background: Dentists contribute greatly to the opioid epidemic, often prescribing opioids in larger than necessary quantities as well as choosing opioids over nonsteroidal anti-inflammatory drugs (NSAIDS). Additionally, dentists are the largest source for first opioid exposures in adolescents and young adults, commonly following third molar extractions. Currently, dental school curricula may be lacking in opioid prescription and substance abuse training, which is essential in curbing the opioid epidemic.

Objectives: The purpose of our study is to determine whether first (PGY1) and second (PGY2) year AEGD residents would benefit from an online module on training on identifying, referring, and managing patients with or at risk for opioid abuse.

Methods: The training was piloted by 44 Columbia AEGD residents who participated in an online course developed by a collaboration of faculty from the Columbia College of Dental Medicine, the Columbia University Department of Psychiatry, and the Columbia Center for Teaching and Learning. The curriculum objectives were aimed to (a) identify, (b) refer, and (c) manage patients with or at risk for substance-use disorder in the dental setting. Residents completed a self-assessment before and after participation in modules with case-based and expert-led video components. Before and after data was collected directly through the online program as well as through a post-training Qualtrics Survey.

Results: Improvement between the pre-test and post-test confidence scores was found in all three domains – Identify, Refer and Manage. Analysis by resident year indicated that PGY1 vs. PGY2 status is a significant predictor of training outcomes. PGY2 residents scored significantly higher on the pre-test than PGY1 residents in all domains. PGY1 residents had significantly higher changes from their pre-test to post-test scores in the Identify and Manage domains. PGY1 residents also had a higher change score in the Refer domain, but this was not significant. Gender is not a significant variable for any domains.

Discussion: Training for substance use disorder is beneficial to AEGD residents. The online program was able to increase overall confidence and narrow the educational gap between PGY1 and PGY2 residents, particularly in the areas of identifying and managing patients at risk of substance use. Evolving evidence suggests that the COVID-19 pandemic has amplified the risk of substance use disorders by increasing hardships and reducing access to screening and support services. This emphasizes the importance of training dentists now more than ever. Finally, the online nature of the program allows for successful, asynchronous education.

31 "Caregivers' Preferred Methods of Receiving Pediatric Oral Health Instruction"

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Introduction: Dental caries is one of the most common chronic diseases among children, and is often preventable with early intervention. Parent oral hygiene education is not routine among prenatal education or early intervention services. Caregivers are typically educated on oral hygiene education for the first time when they bring their child for their first dental visit. Since children often require a caregiver's assistance to practice daily oral hygiene, proper oral health training for caregivers is crucial in preventing oral disease in children.

Objective: This project aims to assess caregivers' preferences of receiving oral health instructions and how preferred strategies compare to their child's level of functioning. The survey data collected in this study will allow a better understanding of preferred methods of oral health instruction among caregivers.

Materials and Methods: A survey was provided to primary caregivers of new patients at the Columbia University Pediatric Dentistry Clinic. The survey asked questions regarding the patient's oral health, barriers to caring for the child's oral health, preferred methods of oral health education, and components of the Vineland Adaptive Behavior Scale to assess the child's level of function. Survey responses were scored and analyzed.

Results and Conclusion: Forty-two caregivers participated. Survey responses showed a need for improvement in caregivers' confidence in caring for their child's oral health. 79% of participants who responded to the question about their confidence in caring for their child's oral health did not feel completely confident doing so. Thirteen participants reported barriers to caring for their child's oral health, with 46% of those participants reporting time as a barrier. When provided options for methods of receiving information on how to care for their child's oral health, the most highly rated was a demonstration from the child's dentist, followed by a cell phone or tablet application with oral health instruction. Additional statistical tests will be conducted for further comparative analysis.

Discussion: The results of the survey show there is a need to improve caregivers' confidence in caring for their child's oral health and identifies methods that would be most helpful in providing caregivers oral health instruction. Future research should involve the impact of various methods of oral health instruction on caregivers' knowledge and confidence in providing oral health care. Three caregivers reported their child having special health care needs. Future research should identify differences in caregivers' preferences of oral hygiene education based on their child's level of function.

Post-Doctoral Student Abstracts

**32 "Efficacy of Horizontal Alveolar Ridge Expansion Through the Ridge Split Procedure –
A Systematic Review"**

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Background: Alterations in alveolar ridge dimensions after teeth extraction frequently occur. Alveolar ridge augmentation strategies are indicated to mitigate ridge width loss that typically follows tooth extraction for implant placement. Various treatment modalities, including guided bone regeneration, and the use of narrow-diameter implants, have been proposed; however, complications and drawbacks exist. Alternatively, the horizontal alveolar ridge split technique is considered minimally invasive which may provide an adequate dimension for proper implant insertion. This technique has introduced the concept of expanding the horizontal ridge dimension via sequential osteotomy preparation, thereby reducing the risk of fracture and dehiscence.

Objectives: The aims of this systematic review are the following: 1- To determine the efficacy of horizontal alveolar ridge split on alveolar ridge horizontal dimensional changes by assessing the volumetric changes of bone and the survival rates of implants; 2- To investigate the influence of various factors on treatment outcome.

Materials & Methods: An electronic and manual literature search was conducted by two reviewers (B.A.H and M.A) for articles written up to Jan 2021. PICO (Problem, Intervention, Comparison, Outcome) was established to address the following two questions: 1-What is the effect of horizontal alveolar ridge splitting on increasing alveolar width and implant survival? 2-What are the factors that influence the efficacy of the horizontal alveolar ridge split?

Results and Conclusions: From a search of 188 articles after removing duplicates, 27 articles were identified based on defined inclusion and exclusion criteria. Studies included were prospective or retrospective, case series with 10 or more human subjects that reported alveolar ridge split outcomes, implant survival and /or failure rate and/ or mean ridge gain, and complication rate. Data from these articles are in the process of being extracted using the data extraction form adopted from the Cochrane Collaboration.

Discussion: Although horizontal ridge split is a widely used technique and could result in adequate horizontal bone gain and minimal intra- and post-operative complications, it remains essential to investigate its efficacy in a more systematic manner. It is also crucial to determine various factors that influence treatment outcome to design a treatment modality with minimal complications and a high implant survival rate.

33 "Disruption of Monocyte and Macrophage Homeostasis in Periodontitis"

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Background: Monocytes and macrophages are major cellular components of the innate immunity that play essential roles in tissue homeostasis. Macrophages can be pro-inflammatory (M1) or anti-inflammatory (M2). M2 macrophages are also involved in tissue repair and resolution of inflammation. The contribution and signaling events of different subsets of monocytes/macrophages in periodontal health and disease remains to be determined.

Objectives: We hypothesized that monocyte/macrophage signaling is perturbed in periodontitis-affected sites versus periodontally-healthy sites.

Materials & Methods: Pairs of gingival tissue samples (each from a periodontally healthy and a periodontitis-affected site from the same patient) were harvested from 21 patients undergoing periodontal surgery. Each sample was processed to form a single-cell suspension and a flow cytometry panel was designed and validated to study monocyte/macrophage phenotypes. In separate experiments, changes associated with a pro-inflammatory phenotype were examined in monocyte/macrophage subsets obtained from peripheral blood of patients with type 2 diabetes mellitus (T2DM, n=8) versus diabetes-free controls (n=6). Monocyte-derived macrophages of T2DM and healthy individuals were also challenged with *Porphyromonas gingivalis lipopolysaccharide (LPS)* and their phagocytic clearance of dying cells (efferocytosis) was quantified by confocal microscopy.

Results and Conclusions: A higher frequency of intermediate monocytes (by 19.4%) and of non-classical monocytes (by 6.8%) was observed in periodontitis-affected tissues compared to healthy tissues (p<0.05 for both). These monocytes overexpressed HLA-DR and PDL1, which suggests an activated inflammatory status. PDL1 increase was specific to intermediate monocytes and M1 macrophages in periodontitis-affected sites. The ratio of M1 to M2 macrophages was also significantly higher in periodontally-affected sites. We identified a subpopulation of M1 macrophages present in periodontally-affected tissues which expressed high levels of CD47, a glycoprotein of the immunoglobulin family that plays a critical role in self-recognition and impairment of phagocytosis. Challenge with *P. gingivalis LPS* inhibited efferocytosis in peripheral blood-derived macrophages. Further, macrophages of T2DM individuals showed decreased intrinsic ability of efferocytosis compared to macrophages derived from diabetes-free subjects.

Discussion: Our data provide novel insights into the disruption of myeloid-derived cell homeostasis in periodontitis and highlight a potentially significant role of these cell types in its pathogenesis. Modulating macrophage and monocyte signaling pathways to affect the development, progression and treatment responses in periodontitis should be further evaluated.

34 "A Survey of Postdoctoral Residents in Evaluating the Oropharyngeal Airway"

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Background: Procedural sedation is an approach to dental treatment for children unable to cope with treatment due to acute anxiety/stress reaction and pain. To ensure patient safety and welfare, airway patency must be assessed as part of a ballast on patient assessment and rescue, without which we place patients at risk. The most accepted method, the Brodsky classification of tonsil size, visually estimates and grades the percentage of oropharyngeal airway occupied by the tonsil and is endorsed by national specialty organizations. Yet there remains a great deal of individual interpretation as guidelines on the assessment of the oropharyngeal airway remain ambiguous.

Purpose: The purpose of this preliminary study was to assess the differences in classification grade and interpretation of the oropharyngeal airway amongst varying dental specialty practitioners compared to a grade determined by imaging software.

Methods: Postdoctoral year one residents in pediatric dentistry, orthodontics, endodontics, and general dentistry were asked to view and evaluate a single clinical photo of an oropharyngeal airway utilizing the Brodsky rating scale for tonsillar measurement. This clinical photo demonstrated a clear view of an oropharyngeal airway without any patient identifiers. These Brodsky grades submitted by the residents who responded to the survey with varying specialty training were compared to the true airway classification which was made by measuring the airway utilizing imaging software. The data was analyzed using Fischer's exact test to test the association between dental specialty and scoring variability.

Results and Conclusion: In this preliminary survey of 41 postdoctoral year one residents at Columbia University College of Dental Medicine, 15 (37%) were returned. From the returned surveys, 5 (33%) were specializing in pediatric dentistry, 4 (27%) orthodontics, 3 (20%) endodontics, and 3 (20%) were continuing advanced education in general dentistry. There was no association between dental specialty and scoring variability.

Discussion: Previous work, found no significant difference between the practitioner's experiences and airway assessment and found inconsistencies in grading suggesting little standardization. This preliminary study, with its limited number of subjects, did not show correlations between dental specialty and scoring. Further study to evaluate additional variables such as sex, location of postdoctoral residency training completed, practitioner need of corrective lenses, clinical setting, etc., is required.

35 "Comparison of Marginal Fit Accuracy of Milled Versus 3D printed Provisionals"

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Background: Provisional restorations are used as a transitional phase to analyze the adequate mastication function, to evaluate esthetics and to provide temporary teeth for patients. With the ongoing development of dental technology and effort to fabricate accurate provisional and final restorations, computer-aided design/computer aided manufacturing (CAD/CAM) is increasingly being used in dentistry to fabricate dental prostheses. Dental restorations are digitally fabricated with various methods including resin-based additive manufacturing techniques; stereolithography and or digital light processing (SLA/DLP) and CAD/CAM milling technology.

Objectives: The aim of this study was to evaluate and compare the marginal adaptation of full coverage provisional restorations which were either milled or 3-D printed using three different provisional materials.

Materials & Methods: Two typodont plastic teeth (Columbia Dentoform, Lancaster, PA, USA) corresponding to the maxillary right central incisor were prepared using diamond burs (Brasseler, Savannah, GA, USA) for a full coverage all ceramic crown with two different finish lines: chamfer and shoulder.
The prepared plastic teeth were digitally scanned using a digital scanner (Emerald S scanner, Planmeca, Hoffman Estates, IL). A provisional crown was designed for each one of the prepared tooth using a digital design software (Exocad, Germany)
Three different materials and manufacturing methods were tested with 5 sample crowns fabricated for each different tooth preparation. (total 10 per group- 5 chamfer, 5 shoulder)
The study groups were:
- Group1: Temporary resin for 3D printer (CB resin, Formlabs Inc, Somerville, MA) was used using a 3D stereolithographic printer (Form 3b, Formlabs Inc, Somerville, MA).
- Group 2: Using a 3D printer provisional resin (NextDent, Netherlands) with digital light processing printer (Photon, Commerce, CA, USA).
- Group 3: Provisional crowns were fabricated using a polymethylmethacrylate (PMMA) block (Telio CAD/CAM, Ivoclar Vivadent, Schaan, Liechtenstein) using milling machine (Planmill, Planmeca, Hoffman Estates, IL).

For each group, 5 sample of provisional crowns were prepared to test consistency of the reproduction of the provisional crowns, and to test the marginal adaptation. The prepared provisional crown was seated without cementation to test the marginal adaptation. The marginal discrepancy was analyzed using a micro-CT (Quantum FX, PerkinElmer, Hopkinton, MA, USA). The marginal discrepancy between different marginal finish lines were compared between groups.

Results and Conclusions: Data regarding the marginal fit of the provisional crowns using the different materials and manufacturing techniques will be presented.

36 "Mallampati Scale and Sleep-disordered Breathing"

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Background: Sleep-disordered breathing (SDB) is relatively common, affecting 0.7% - 13.0% of the population with a peak incidence, in children, between 2 and 8 years of age. Delays in diagnosis of SDB can lead to significant morbidity in children including deficits in neurocognitive ability, cardiovascular impairments, lack of proper growth and development, behavioral issues and school performance challenges (Ross et al., 2006). Although recent research has reported increased body mass index (BMI), adenotonsillar hypertrophy, and craniofacial and/or airway abnormalities to increase SDB-risk, the impact of Mallampati scale (classification), which assesses pharyngeal muscles common in SDB, has not. Ninety percent of people who suffer from SDB are thought to remain undiagnosed (American Osteopathic Association).

Objective: The purpose of this preliminary study is to evaluate associations between Mallampati scale (classification) and SDB-risk.

Materials & Methods: This cross-sectional study recruited well-children 24 months-11 years and their parent from a community dental clinic for children within a large academic medical center. The Mallampati scale was used by a single trained practitioner, using the Samsoon and Young (1987) technique, to classify patients' oropharynx. The parent then completed a 22-item sleep questionnaire (PSQ), previously validated, to identify children at risk for obstructive sleep-related breathing disorders. Associations between Mallampati scale classification, Brodsky classification of tonsil size, BMI percentile, snoring, dry mouth, and attention span and SDB-risk was determined by chi-square, Fisher's exact test, Kruskal-Wallis test, and simple logistic regression models.

Results: Of the 150 children included (average age 5.9 years), 76 (51%) were female, 107 (71%) identified as Latino/Hispanic, 82 (55%) had Mallampati class I/II, and 68 (45%) had class III/IV. Patients with Mallampati class III/IV, collectively, had a 5-fold increase in SDB-risk by PSQ compared to patients with class I/II. Patients with a Brodsky grade 3+/4+, collectively, had a 3-fold increase in SDB-risk by PSQ. Elevated BMI percentile (P=.011), nighttime snoring/heavy or loud breathing (P≤.0001), difficulty waking in the morning (P=.0002), and daytime inattentive or hyperactive behavior (P≤.0001) were associated with increased SDB-risk with Mallampati class III/IV. The Mallampati scale may be used as a rapid, easy, non-invasive screening tool as part of a comprehensive oral examination to identify SDB-risk.

Discussion: There is an association between Mallampati scale classification and SDB-risk by PSQ highlighting the critical role of dental practitioners in performing a high-level oral examination as early recognition/anticipatory guidance, referral for early diagnosis, and age-appropriate early intervention is of importance.

37 "Exploring Family Characteristics and Dental Treatment under General Anesthesia"

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Background: Criteria for dental treatment under general anesthesia (GA) remain vague and dependent upon individual practitioner's interpretation of, for example, the behavior of the child and their ability to cope in an outpatient-setting, extent and severity of dental treatment required, child temperament, and others. Social factors, e.g., family dynamics, play a crucial role in the development of behavioral characteristics and the maturation of a child, thus warranting an exploration of associations between these factors and the necessity of dental treatment under GA.

Objectives: The purpose of this preliminary study was to assess variables related to family dynamics; and identify correlations between those variables and the necessity for dental treatment under GA.

Materials & Methods: This study included a retrospective chart review from a community dental clinic (August 1, 2019-2020) of children 2-7 years old (ASA I/II) without a history of previous dental treatment. Fifty case-control subjects (25 waitlisted for GA or GA treated; 25 not requiring GA) were matched by age, sex, and date of comprehensive oral examination. Following verbal consent, an English/Spanish 24-item questionnaire was verbally administered to parents assessing family and household characteristics (e.g., birth order, caregivers, siblings, home type, etc.) and familial dental anxiety using Corah's 5-point dental anxiety scale. These data were analyzed descriptively, and associations explored using Kruskal-Wallis and Fisher's exact tests.

Results and Conclusions: Most subjects (n=40, 80%) were under 5 years (M=3.8, SD=1.07), Hispanic/Latino (n=31, 62%), male (n=26, 52%), and had at least one sibling (n=44, 88%; M=1.92, SD=1.44). Most control subjects (n=10; 40%) lived in a household composed of mother, father, and two children, while only 12.5% (n=3) of subjects in the GA group lived in a household with the same composition. Five (20.8%) subjects requiring GA lived in a household consisting of the mother and two children, while only one (4%) of the control subjects lived in a similar household. Parents of children requiring GA reported higher dental anxiety scale scores (M=1.92, SD=0.93), than control subject parents (M=1.36, SD=0.64).

Discussion: This study suggests that household makeup, specifically children living in single mother households, and parental dental anxiety may be associated with children who may benefit from dental treatment under GA. Screening parents for self-reported dental anxiety and household composition may be additional factors used to assess the necessity and benefits of dental treatment under GA. Further research is warranted with a larger, more diverse sample to fully explore these associations and the need for dental treatment under GA.

38 "Evaluation of Accuracy of Scan Alignment in the Dual Scan Protocol Using Distinct Number of Radiographic Markers"

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Background: Cone Beam Computed Tomography (CBCT) scans and optical scans of data are commonly aligned as a treatment planning and diagnostic tool. Accuracy of scans and alignment software can prevent suboptimal treatment, reduce chair time, costs, and can improve patient satisfaction. Dual Scan Protocol (DSP) suggests the usage of fiducial markers to align the scan of a desired prosthesis to a scan of a patient's anatomy. In the absence of hard tissue landmarks, these radiographic markers serve as points of reference for the alignment. Proper number of markers is necessary for the alignment of scans. However, greater number of markers can lead into accumulation of artifacts, affecting accuracy of CBCT and surface data.

Objectives: The aim of the study is to evaluate the effect on scan data alignment when distinct number of fiducial markers are utilized in a DSP and to provide clinical recommendations.

Materials & Methods: A processed complete denture (CD) from an edentulous typodont was prepared with multiple number of radiographic markers (Suremark, Suremark, Simi Valley, CA). CD was placed on an eight-inch diameter Styrofoam with 3 dental stone blocks (Labstone Type III Blue, Dentsply Sirona, York, PA) as reference markers (RM) positioned outside the CD.
CBCT scan (Kavo OP3D™, Kavo, Biberach, Germany) of the CD without any markers were merged utilizing stone RM as a baseline. Scan of the Denture with 3, 5, 6, 8, and 10 radiographic markers were taken at the recommended setting for adult patients. First scan simulated a patient wearing CD, showing markers only. The Second scan was taken at the recommended setting for DSP to pick up detail of CD and markers. RM were present in both scans.
DICOM file was converted to a stereolithography (STL) file, and later the RM were segmentalized. Denture STL file was aligned with DICOM file of the first scan, and RM were reintroduced based on the denture position. RM from both scans were exported for evaluation.
Alignment of the DICOM and STL files were repeated 10 times and exported to a 3D processing software (CloudCompare, Telecom ParisTech, Paris, France) to evaluate their discrepancy. Software provided angular and linear discrepancies in x, y and z axes via a 4x4 transformation matrix. A student *t*-test was completed for evaluating percent agreement between the different scans for each group in comparison to the baseline scan's angular and linear deviations. ANOVA analysis was completed to evaluate the difference among the scan with different number of radiographic markers.

Results and Conclusion: Angular discrepancies between groups and reference points presented variations particularly in x, Tx and Ty. All groups presented significant differences in angular variation. Angular discrepancy average was below 0.6º. The 6 markers group presented the greatest level of misalignment. The 6 markers were placed buccal to the CD and continue at similar plane. The 3 markers group presented the least discrepancy when compared to the reference.
Within the limitations of the present *in vitro* study, we conclude that different number of markers could lead into alignment discrepancies. Discrepancies, although statistically significant, were minimal and could be considered not clinically significant (<1º). The usage of 3 markers showed great level of accuracy and less variations from the reference points. Further investigation of factors such as marker shape, size, and distribution are suggested to quantify discrepancies associated with digital file superimposition in DSP.

39 "Adhesion of Epithelial Cells to 3D Printed and Milled Provisional Restorations"
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Background: With the continued development of digital dentistry, provisional restorations are being digitally designed and manufactured using 3D printed or milled technologies. The seal formed by the epithelial cell attachment to the provisional surface can ensure a successful esthetic result by maintaining a stable and healthy soft tissue position. There is limited data of epithelial cell response with these materials used for digital manufacturing. Therefore, it is critical to test the adhesion of epithelial cells to the newly available provisional materials.

Objectives: This study seeks to establish a quantitative measure of adhesion of epithelial cells to various provisional materials. Provisionals fabricated by means of two different 3D printing technologies along with those that are conventionally milled will be studied. The effects of various mechanical surface treatments will also be included. This study was designed to establish a protocol and recommendations as to what provisional resin protocol best allows for adequate surface adhesion of epithelial cells.

Materials & Methods: Sample disks were digitally designed using a software (Alibre Software) with a dimension of 20 mm diameter and 1 mm thick.
Three different groups of 40 disks each were tested. The groups consisted on:
- **Group 1:** Stereolithography (SLA) 3D printer (Formlabs 3b -Low Force Stereolithography (LFS)™. The provisional resin used was the one recommended by the manufacturer (Temporary CB photopolymer resin for Form 2 and 3).
- **Group 2:** Digital light processing (DLP) 3D printer (ANYCUBIC Photon UV LCD DLP 3D Printer) was used together with a temporary crown resin (NextDentTM C&B MFH C&B Micro Filled Hybrid) which is a biocompatible Class IIa material developed for crowns and bridges.
- **Group 3:** Milling machine (Planmill 40 S milling) used to mill specimens from Polymethyl-methacrylate (PMMA) (Teliocad LT Shade A2 Polymethyl Methacrylate blocks.)

Each group of disks were divided in subgroups depending on the mechanical agent used to treat them as follows:
- **Subgroup A:** Remove supports, pumiced starting with coarse, medium, and fine laboratory pumice only (Henry Schein; Melville, NY) using a wet rag wheel (Muslin Wheel; Kerr, Orange, CA), no sandblasting was done, no high polish was done.
- **Subgroup B:** Remove supports, pumiced starting with coarse, medium, and fine laboratory pumice using wet rag wheel, high polish (Acrilustre; Buffalo Dental, Syosset, NY), no sandblasting was done.
- **Subgroup C:** Remove supports, sandblast medium grit (Henry Schein; Melville, NY), pumiced starting with coarse, medium, and fine laboratory pumice using wet rag wheel, no high polish was done.
- **Subgroup D:** Remove supports, sandblast medium grit, high polish, no pumice was done.
- **Subgroup E:** remove supports, sandblast medium grit, pumiced starting with coarse, medium, and fine laboratory pumice using a wet rag wheel, and high polish.

The epithelial cell adhesion was evaluated using primary human epidermal keratinocytes, experiments were performed to test the adhesion or proliferation of cells on the discs with various surface treatments.

Results and Conclusions: Analysis of the adhesion and proliferation of the epithelial cells on the different materials and surface treatments will be reported.

40 "What is the influence of a 0.1 mg/kg decrease in PO midazolam on recovery time?"

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Background: Oral midazolam (POmid) is commonly used for minor dental procedures for children. It has advantageous properties, including a quick onset of action, a relatively short duration, and therapeutic effects such as anxiolysis and anterograde amnesia. Previous literature review different regimens and routes of administration of POmid and compare efficacy. Few studies examine the recovery and discharge times for minor changes in dosing regimens of POmid.

Objectives: The purpose of this quality assurance and performance improvement study was to compare charted recovery times of two regimens as part of continuous hospital-driven quality improvement at a community dental clinic for children located within a large academic medical center.

Methods: This retrospective chart review of patients sedated between 2017-2019 involved a sample of 462 well-children (47% females); 2- to 5-years-old (average age: 3.5 years): 30-50 lbs; ASA I; normal birth history; maximum Brodsky classification of tonsil size grade 2+, who received dental extractions and/or dental restorations with minimum sedation (AAPD guidelines) using a regimen of PO midazolam syrup at 0.4 or 0.5 mg/kg. Post-op, patients were monitored until discharge criteria were met as measured by a modified post-anesthesia recovery score. The data collected included age, sex, recovery time, and procedure effectiveness by a modified sedation rating scale. These data were analyzed, and associations explored via chi-square and t-test.

Results: Two hundred fifty-six (n=256; 55%) patients received a 0.4 mg/kg dose and 206 (45%) patients received a 0.5 mg/kg dose, with an average treatment time of 17.15 and 25.12 minutes, respectively (P<.0001). Mean recovery time for the 0.4 mg/kg dose was shorter than the 0.5 mg/kg dose (108.25 and 131.13 minutes, respectively; P<.0001). Practitioner-rated procedure effectiveness remained comparable by strength, 0.4 mg/kg, 0.5 mg/kg (18%, 18% 'ineffective'; 61%, 68% 'effective'; 20%, 13% 'very effective'; respectively).

Conclusion: A 0.1 mg/kg decrease in POmid may provide comparable levels of clinical efficacy while significantly reducing recovery time and time to safe discharge from Faculty supervision as determined by recognized criteria.

Discussion: This study shows that a 0.1 mg/kg decrease in dosing regimen of POmid has a significant effect on recovery and discharge time. During COVID-2019-related federal, New York state, and institutional recommendations and restrictions for healthcare practitioners on-the-ground and on-site, this small change increases necessary spacing, work- and patient flow while preserving high quality cost-efficient patient care with ballasts that guard the patient's safety and welfare without which we place patients at risk for morbidity.

41 "Replication of Gene Polymorphisms Associated with Periodontitis in an Elderly Cohort: *The WHICAP Ancillary Study of Oral Health*"

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Background: Periodontitis is a chronic inflammatory disease associated with bacterial dysbiosis and results in irreversible loss of connective tissue attachment, alveolar bone loss, and tooth loss. Genome-wide association studies (GWAS) have identified gene polymorphisms associated with periodontitis, but their findings are rather inconsistent across populations.

Objectives: We sought to replicate gene polymorphisms identified in the available-to-date 15 GWAS of periodontitis in a tri-ethnic sample of elderly individuals, participants in the Washington Heights/Inwood Columbia Aging Project (WHICAP) Ancillary Study of Oral Health.

Materials & Methods: The replication sample involved 1,124 individuals, 65-98 years old, with available genome-wide genotypes, obtained through Illumina Omni-1 Quad bead chip sequencing, and clinical phenotypes including edentulism, number of teeth present, CDC/AAP periodontitis classes, % of teeth with pockets ≥4mm, presence/absence of pockets ≥6mm, and % of teeth with clinical attachment loss (CAL) ≥3mm or ≥5 mm. In 912 dentate participants, data on subgingival colonization was assessed through checkerboard DNA-DNA hybridization and next generation sequencing (HOMINGS). Four previously-described microbial traits (high colonization by *Porphyromonas gingivalis*, *Aggregatibacter actinomycetemcomitans*, "red complex" species or "orange complex" species) were analyzed.

Results: 1,980 SNPs were reported to have suggestive associations (p≤5x10^{-6}) with any of the above periodontitis-associated traits, mapping to a total to 92 individual genes. P-values for significant replication were set individually after accounting for multiple comparisons and linkage disequilibrium pruning. The following significant gene-phenotype associations were identified: CLEC19A with edentulism and % of teeth with PD ≥ 4mm; SNTB1, IL37, HPVC1, TRPS1, ABHD12B, LDLRAD4, TGM3 with % teeth with PD≥4mm; DAB2IP with presence of pockets with PD≥6mm; NELL1, RAB28, ROBO2, KIAA1715, LINC01017 and LDLRAD4 with % teeth with CAL≥3 mm; RUNX2 and LAMA2 with % teeth with CAL≥5 mm; and KIAA1715 (LNPK) with high colonization by *A. actinomycetemcomitans*. In addition, hierarchical clustering was carried out to create novel microbial traits based on similarity in bacterial abundance or alpha-diversity. Three genes (CLEC19A, EMR1, IQSEC1) were associated with checkerboard-based bacterial abundance, three (ACTN2, LBP, NCR2) with sequencing-based abundance, and one gene (NCR2) with sequencing-based alpha diversity.

Conclusions: In this study of a tri-ethnic sample of elderly individuals, we could only replicate a limited number of genes previously reported to be associated with various periodontitis-related traits. Only two genes (CLEC19A and NCR2) associated with more than one phenotypes, and no genes associated consistently across multiple traits, further underscoring the difficultly in identifying reliable genetic markers of periodontitis.

42 "Exploration of Associations Between Breastfeeding Behaviors, Plaque Microbiota and Caries"

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Background: The oral microbiota is long recognized for its role in caries etiology. Exposure to breastfeeding may benefit the infant oral microbiome through exposure to microbiota-rich breastmilk and skin contact. Prolonged breastfeeding, greater than 12 months, however has been linked to increased caries risk, particularly among children breastfed nocturnally.

Objectives: To assess oral microbiota characteristics and explore associations with breast feeding duration and dental caries experience among 3-year-old children in a population with disproportionately high caries rates.

Materials and Methods: This substudy of an exploratory feasibility pilot enrolled 24 parent/child dyads (males and females 36-47 months; parents over 18 years), 12 children with caries and 12 caries-free. Children with gastrointestinal disorders, recent antibiotic use, food allergies, dietary restrictions or inability to eat by mouth were excluded. A single study dentist collected supragingival plaque samples during routine dental examinations. A bilingual verbally administered parental questionnaire assessed dietary, physical activity, medical/oral health, socio-environmental, and demographic characteristics. Breastfeeding exposure (none, partial, exclusive), duration, source (breast, bottle, combination) and current status were also assessed. Variables were descriptively analyzed and Fisher's Exact and T-tests explored associations. Plaque samples were analyzed via 16s ribosomal RNA pyrosequencing using V3-V4 sequencing, Illumina MiSeq 2x300 to describe microbial diversity and relative abundance.

Results and Conclusions: Twenty-three dyads (95.8%) completed all measures, including 15 (65.2%) males and 20 (87%) Hispanic children. Two children (8.7%) were never breastfed, 13 (56.5%) exclusively breastfed, and 8 (34.8%) partially. Of those breastfed, 7 (33.3%) were primarily fed by breast, 6 (28.6%) by bottle, and 8 (38.1%) a combination. Prolonged breastfeeding was reported among 7 (30%) children (4 with caries), with 1 (4%) child still breastfeeding. Caries status was not significantly associated with breastfeeding exposure (P=0.66) or duration (P=0.55). All plaque samples were of sufficient quality to extract and sequence DNA, yielding sufficient read counts for analyses, suggesting feasibility of sample collection and processing methods. There were no statistically significant differences in alpha or beta diversity or bacterial relative abundance between children with and without caries. Analyses exploring differences on the basis of prolonged breastfeeding are pending.

Discussion: Given the limited sample, the lack of statistically significant differences between groups is unsurprising. However, the ability to collect plaque biospecimens of sufficient quantity and quality is promising and supports feasibility of study methodology. Research with a larger sample may yield important insight into factors that shape the oral microbiota and influence caries etiology in high-risk populations.

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