

Iowa Section of the American Association for Dental Research



# 65th Annual Meeting













E. Dale Abel, MD, PhD is the Chair and Department Executive Officer of the Department of Internal Medicine, Director of the Division of Endocrinology & Metabolism in the Department of Internal Medicine, and Director of the Fraternal Order of Eagles

#### E. Dale Abel, MD, PhD

Francois M. Abboud Chair in Internal Medicine John B. Stokes III Chair in Diabetes Research Chair and Department Executive Officer, Department of Internal Medicine Director: Fraternal Order of Eagles Diabetes Research Center Director: Division of Endocrinology and Metabolism Professor of Medicine, Biochemistry and Biomedical Engineering University of Iowa, Carver College of Medicine



Diabetes Research Center (FOEDRC) at the University of Iowa. He is a Professor of Medicine, of Biochemistry, and of Biomedical Engineering, and holds the John B. Stokes III Chair in Diabetes Research and the François M. Abboud Chair in Internal Medicine.

Dr. Abel has had a distinguished career in endocrine related research. His pioneering work on glucose transport in the heart guides his current research interests: molecular mechanisms responsible for cardiac dysfunction in diabetes. He directs a focused research group examining the molecular mechanisms leading to cardiac dysfunction in diabetes and the regulation of myocardial growth and metabolism by insulin signaling. His studies have elucidated mechanisms responsible for mitochondrial dysfunction displayed by the heart as a result of insulin resistance and insulin action in the heart. These findings provide insight into the pathogenesis of cardiac dysfunction in the diabetic heart.

Dr. Abel is an established investigator of the American Heart Association (AHA) and his research program has been continually funded by the National Institutes of Health since 1995, by the AHA, the American Diabetes Association, and the Juvenile Diabetes Research Foundation. He is an elected member of the American Association of Physicians (AAP), the American Society for Clinical Investigation (ASCI), National Academy of Medicine (NAM), and the American Clinical and Climatological Association (ACCA).

## **Keynote Address:**

Building Interdisciplinary Teams to Advance Research and Clinical Care



Dental research images for the cover were selected from poster submissions for AADR Research Day 2017. Thanks for these images go to Dr. Isabelle Denry, Dr. Piriya Boonsiriphant, Dr. Bruno Cavalcanti, Dr. Kyungsup Shin, Dr. Kan Wongkamhaeng, and Deborah Yu.

# Table of Contents

# Research at our College

How an Anthropologist's Work Enhances Orthodontic Research	.2
Applying Research to Dental Patient Care	.4
Genetics and the Future Direction of Precision Medicine and Dentistry	.5
Using a MicroRNA-based Approach for Bone Regeneration	.6
Developing Novel Biomedical Materials for Bone and Periodontal Regeneration	.8
Research to Improve the Prognosis of Head and Neck Squamous Cell Carcinoma	10

# Research Day 2018

Letter from Dean David Johnsen	12
Letter from Associate Dean for Research, Brad A. Amendt and Director of the Iowa Insitute for Oral Health Research, Kim Brogden	13
Letter from Officers of the Iowa Chapter of the AADR	14
Welcoming our Guests from the Chongqing Medical University School of Stomatology	15
Program	16
Presentation Assignments	17
Abstracts	26
Author/Abstract-Number Index	70
Iowa Section of AADR — Past Presidents	71
Acknowledgments	72



# How an Anthropologist's Work Enhances Orthodontic Research

Dr. Nathan Holton's interests originally included science, drawing and painting, and for a while he considered majoring in art. But when he took an introductory college course in anthropology, Nathan began contemplating a different kind of career. "In part," Nathan says, "it was a fascination with fossils and using them to reconstruct human origins. While I don't work much directly with fossils now, my research is geared toward using information from living humans or experimental animal models to better understand the anatomy we see in fossils."

Nathan's PhD advisor, Dr. Robert Franciscus, was collaborating with College of Dentistry orthodontist Dr. Thomas Southard on a facial growth and development project. Franciscus introduced Southard to Nathan, who realized he'd found a more specialized niche in facial growth and development, which also dovetailed nicely with dentistry. As Dr. Holton explains it, "Most research on facial growth comes from orthodontics."

> Historically, facial growth research at the College of Dentistry derives from the famous lowa Facial Growth Study, a longitudinal research project that began in 1946 with Drs. Howard V. Meredith. Iowa Child Welfare Research Station, and L.B. Higley, Department of Orthodontics. Study subjects had dental models, anterior and profile photographs. and full intraoral radiographs gathered semiannually; posteroanterior and lateral cephalometric radiographs were taken at

Dr. Nathan Holton's collection of skulls and jaws is currently located in his office in the Dental Science Building.



three-month intervals until age 5 and then twice annually after age 5. When the children turned 12, records were made annually until 1960 when they turned 18. Then in 1968, 16 male and 10 female former subjects who were at least 23 years of age were contacted and asked to participate in another examination; in middle adulthood, 16 female and 15 male former participants were contacted again and had follow-up records made.

The Iowa Facial Growth Study research, says Dr. Holton, is beneficial to anthropologists who study growth and development in living and fossil humans. The original research and the continuing research also helps orthodontists better understand how individuals change over their lifetime. Two examples of projects related to jaw growth for residents (thesis projects) and dental students (summer research projects) include

developmental changes in the biomechanics of the jaws and changes in the magnitude of jaw variation during development. "I know the growth study is used for multiple research projects every year," adds Dr. Holton.

Dr. Holton's research includes studying the influential dynamics on facial growth: the effect of bite force on jaw mechanics and growth; functional vs. non-functional influences on skeletal development; and functional and non-functional determinants of malocclusion, including an ongoing collaborative project



looking at how obesity can affect the rate of tooth eruption and jaw growth.

Dr. Holton's work has broader implications for orthodontic treatment and may, for instance, help explain why some patients respond more quickly to treatment while other patients respond much more slowly. His research, understandably, has a symbiotic relationship with Dr. Lina Moreno, a College of Dentistry orthodontic faculty member and researcher.



# Applying Research to Dental Patient Care

Pediatric Dentistry faculty Arwa Owais remembers being interested in the principle of research as a first grader when she was working with gypsum and clay. She wanted more time to manipulate the mixture so she began thinking about how to change its working time. During junior high and high school, Arwa volunteered in a science lab because she enjoyed working with the science teacher. She also became attracted to dentistry because, she says, "It is a profession that needs problem solving, communication skills, hand skills, and a passion for others."

After receiving her BDS from Jordan University of Science and Technology (JUST) in Irbid, Jordan, Dr. Owais also received an MS in dental public health and a certificate in pediatric dentistry from the UI College of Dentistry. For several years, she was an associate professor and vice dean at JUST, and was the first Jordanian dentist who was dual trained in pediatric dentistry and dental public health. In 2013, Dr. Owais joined the College of Dentistry faculty in Pediatric Dentistry.

"I help my patients and their families see both sides of the diverse cultures," [Dr. Owais] says, "and bridge the gap in their knowledge and dental awareness."

Approximately 80 percent of Dr. Owais's patients are Arabicspeaking immigrant children. She provides a cultural bridge between these patients and their families. Traditionally, they may have visited a dentist only when they have had a problem. Services here at the UI College of Dentistry, however, emphasize the importance of regular appointments. "I help my patients and their families see both sides of the diverse cultures," she says, "and bridge the gap in their

knowledge and dental awareness," referring to the importance of oral health care and systemic health, especially with immunocompromised patients and those with special health care needs.

Through her clinical trial and research activities, Dr. Owais also treats local Amish children. Parents are given her cell phone number and if an Amish child has a dental emergency after hours, she and Dr. Mike Kanellis will drive to their farm to provide research-related emergency dental home patient care.

Treating these groups of dental patients reinforces her goal of improving the quality of life for children through research. "I like to do research that can be applied to help people (and mainly children) in a way that is accessible to them, regardless of their geographical location, ability to pay, and their access to dental care." One of her current research projects includes using silver nitrate, which is safe, non-invasive, affordable, and painless to apply, for treating cavities in children.

Continued on page 11 - see 'Dr. Owais' >>

# **Genetics and the Future Direction of Precision Medicine and Dentistry**

Dr. Lina Moreno became interested in orthodontics as a nine-year-old dental patient—she was fascinated by her appliances and wires and the fact that she didn't have any pain during dental appointments.

She received her DDS in 1991 from Instituto de Ciencias de la Salud CES (Medellin, Colombia) and then performed one year of community service for the Colombian government before starting her orthodontics residency training. Dr. Moreno received a certificate in orthodontics from the Universidad de Antioquia (Medellin, Colombia) in 1995. During this time, she studied the genetic aspects of cleft lip and palate in Colombian families.

Dr. Moreno became a PhD student in oral biology at The Ohio State University in 1998 and then transferred to the UI College of Dentistry oral sciences PhD program, to continue her work in Dr. Andrew Lidral's Craniofacial Anomalies Research Center as a graduate research assistant. After receiving her PhD in 2005, she remained in the lab as a postdoctoral fellow. In 2008, Dr. Moreno received an orthodontics certificate from Iowa and that same year, she was hired as an assistant professor in the Department of Orthodontics and the Iowa Institute for Oral and Craniofacial Research.

Dr. Moreno's research interest remains focused on patients with craniofacial cleft lip and palate issues, as well as genome-wide searches for genes that affect the growth of an individual's maxillo-mandibular complex. She is also examining another research area: bite problems, their cause and treatment. (This area can also include cleft patients who have bite problems.)

Specifically, she is performing a genome-wide search for genes that affect growth

Right: Dr. Lina Moreno in her lab at the Dental Science Building.

of the human face using whole genome association methods and the latest technology for facial imaging. She wants to identify genotype-phenotype correlations that contribute to the development of an individual's maxillomandibular complex.

It is in this area of bite dynamics and muscle arrangement and other aspects of facial variation that the view point of an anthropologist like Dr. Nathan Holton is key to studying craniofacial anomalies and orthodontics and his view point is very helpful to Dr. Moreno.

She has also worked with another anthropologist, Dr. Steve Miller, a former postdoctoral research scholar at the College of Dentistry (now an assistant professor at Midwestern University). Dr. Miller provided Dr. Moreno with in-depth extract phenotypes (how genetic and environmental influences affect a person's

Continued on page 11 - see 'Precision Dentistry' >>

# Using a MicroRNA-based Approach for Bone Regeneration

When Dr. Liu Hong began his career as a neurosurgeon in Shanghai, China, he noted that his patients lost bits of bone due to traumatic injuries. This observation was a catalyst for his budding interest in bone regeneration research.

Dr. Hong pursued a PhD in biomedical engineering from Kyoto University (Japan), followed by one year of doing translational research at the university. He wanted to spend one to two years in the U.S. doing research before returning to his neurosurgery career in China. Dr. Hong obtained employment as a postdoctoral research associate at the University of Illinois at Urbana-Champaign in their department of material sciences. When the funding stopped, he found another position at the University of Illinois-Chicago in their orthodontics department.



In 2004, Dr. Hong became a research faculty in bioengineering at the University of Illinois; then in 2009, he also assumed the directorship of the stem cells and craniofacial tissue engineering lab. During this time, Hong realized that while a physician can help patients one by one and see results fairly quickly, successful research can help thousands of people but may take much more time. His experiences as a neurosurgeon, coupled with his PhD in biomedical engineering and his translational training at Kyoto University, confirmed Dr. Hong's decision to continue his research in bone regeneration through tissue engineering and forego his neurosurgery career.

"Hong realized that while a physician can help patients one by one and see results fairly quickly, successful research can help thousands of people but may take much more time."

Traditionally, a bone graft either derives from bone inside a patient's own body (autograft), such as wrist, hips, pelvis, or ribs, or from a cadaver (allograft). There is, however, a high cost factor, and the risk of an immune inflammatory response, rejection, infection.

With bone regeneration through tissue engineering, a person's own stem cells can be used to build a bone graft. The process is less physically invasive, less costly, the bone regenerates well, the results are better, and the patient's quality of life is improved. Like traditional bone grafts, bone regeneration can be used in patients with cleft-palate, periodontal issues, dental implants, knee replacements, spinal disease, or bone fractures.

Dr. Hong and Associate Dean for Research Brad A. Amendt are both co-principal investigators on a five-year, \$1,810,940 NIH grant for their project, "Oral and Craniofacial Bone Regeneration Using MicroRNA Modulation." Drs. Huojun Cao, Iowa Institute for Oral Health Research, and Dr. Aliasger Salem, College of Pharmacy, are co-investigators. They are investigating whether miR-200c combined with PMIS-200a can induce significant bone regeneration in vivo. (MicroRNAs regulate the expression levels of other genes by binding and cleaving mRNAs or inhibiting translation.)

Dr. Hong has two other NIH grants related to stem cell and tissue engineering: one is a three-year, \$417,125 grant for his project, "A MicroRNA-based Approach for Periodontitisassociated Bone Loss." His co-investigators include Dr. Kim Brogden, Iowa Institute for Oral Health Research, and Dr. Brad A. Amendt. They will study the molecular function and potential underlying mechanism/s mediated by a member of the microRNA-200 family on major proinflammatory and bone factors that cause periodontitis-associate bone loss. It will establish a proof of concept in which this specific microRNA can be used to inhibit periodontal bone loss.

His second is a two-year, \$409,697 NIH grant project, "A MicroRNA-based Approach for Bone Regeneration," which will study the function mediated by a member of the microRNA-200 family to enhance osteogenic differentiation of human bone marrow mesenchymal stem cells and bone formation. It will also establish a proof of concept in which this specific microRNA delivered by a non-viral vector can be used to develop a novel therapeutics for bone regeneration. Drs. Aliasger Salem and Brad A. Amendt, are co-investigators.

In 2017, Drs. Hong and Amendt each received the 2016 Inventor Award from the University of Iowa Research Foundation in recognition of their innovations over the years and their work with NaturemiRI, LLC (https://naturemiri.com/ contact-us/).

Dr. Hong says they're currently working on a 3D structure of bone graft using a 3D printer. The next steps in the process will be to seek Food and Drug Administration (FDA) permission, local Institutional Review Board (IRB) approval, and then begin a clinical trial.

"We're very close," says Dr. Hong.

Left: Dr Lui Hong, standing between the research and clinical wings of the Dental Science Building, intends his research to improve clinical outcomes.

# Developing Novel Biomedical Materials for Bone and Periodontal Regeneration

Dr. Satheesh Elangovan's mother, who taught underprivileged children in India for 30+ years until her retirement, inspired him to pursue teaching as a career. "She is a very hard working selfless individual and a great role model for me," he says.

Towards the end of his dental training, in order to better equip himself to be an effective clinician-scholar and an educator, he decided to pursue his research doctorate in oral biology.

After graduating in India, Dr. Elangovan moved to Boston, Massachusetts, to pursue a Doctor of Science research degree in oral biology at Boston University and began working on biomaterials - salivary protein interactions. After graduation, he was accepted into a combined Doctor of Medical Science (DMSc) and Periodontology specialization program at Harvard University. Dr. Elangovan feels fortunate to have pursued his DMSc research at the Forsyth Institute, a leading oral health research organization and an affiliate of Harvard, where he encountered several inspiring researchers and mentors.

## "When [Dr. Elangovan] came to Iowa for a faculty position interview, he was impressed by the available research lab space, the collaborative spirit and everyone's friendliness."

While working on his DMSc as a Harvard Presidential Scholar, his research continued with several "great mentors" at Harvard and Forsyth. Dr. Elangovan's dissertation work focused on using nano calcium phosphate particles to prevent dental erosion. Based on the potential impact of his research project, he received Harvard's James H. Shaw Award for Excellence in Biomedical Research in 2011. At Harvard he also collaborated separately with researchers at Northeastern University (Boston) to develop biomaterials that deliver genes of growth factors to regenerate tooth supporting structures. "This research," he says, "was aimed at developing nano-sized calcium phosphate particles to deliver DNA that encodes for key growth factors that will enhance

periodontal regeneration." The study was supported in part by the American Academy of Periodontology Foundation Tarrson Regeneration Scholarship.

Dr. Elangovan had heard about the UI College of Dentistry from his dental school classmate and good friend, Dr. Veeratrishul Allareddy. When he came to Iowa for a faculty position interview, he was impressed by the available research lab space, the collaborative spirit and everyone's friendliness.

Since joining the Department of Periodontics faculty in 2011, Dr. Elangovan's research has included basic/translational studies focusing on novel tissue regeneration strategies; evidence-based and health outcomes research; and clinical research focusing on periodontitis-systemic disease associations. He has been collaborating extensively both within and outside the College of Dentistry in these research areas.

The major collaborators on developing novel biomaterials based on nanotechnology and molecular therapeutics for bone and periodontal regeneration include Drs. Aliasger Salem, Liu Hong, and Michael Kormann (University of Tübingen, Germany). They hope to develop innovative strategies to deliver DNA and RNA of growth factors for tissue regeneration and later translate these technologies for clinical use. The collaborators have applied for intellectual property (patent) protection from the U.S. Patent & Trademark Office for their first-time demonstration on the use of chemically modified RNA for bone regeneration. Dr. Elangovan says, "I am very fortunate to have great collaborators like Drs. Salem and Hong and several extremely bright doctoral students in Dr. Salem's lab who carry out these studies as part of their doctoral thesis projects."

Additionally, he enjoys working with periodontics residents and pre-doctoral students on clinical research projects that include clinical research on the effect of obesity on peri-implant health or assessing the quality of scientific evidence in different periodontics topics. For some of these projects, Dr. Elangovan has



From left to right: Timothy Acri, Noah (Zack) Laird, Dr. Satheesh Elangovan, Anh-Vu Do, Bednoush Sourkohi Khorsand, and Dr. Aliasger Salem. Colloboration with Dr. Salem's team in the College of Pharmacy represents one of many partnerships between College of Dentistry researchers and other research programs at the University of Iowa.

collaborated extensively with Drs. Gustavo Avila-Ortiz (Periodontics), Kim Brogden (Periodontics), and Deborah Dawson (Pediatric Dentistry).

Dr. Elangovan appreciates the support he received from the previous Periodontics DEO Dr. Georgia Johnson, who has been a consultant for many of Dr. Elangovan's research projects and says he is looking forward to continue working with Dr. Avila-Ortiz in his new role as the DEO. He thanks his department members, collaborators/mentors, Dr. Brad Amendt (Associate Dean for Research), the College of Dentistry administration, the granting agencies, and the students for supporting his research endeavors, which he hopes will one day positively impact and benefit our patients.

# Research to Improve the Prognosis of Head and Neck Squamous Cell Carcinoma

Dr. Emily Lanzel, a visiting assistant professor in the Department of Oral Pathology, Radiology and Medicine (OPRM), enjoys doing research. It wasn't always the case, however, until as a second-year dental student she had some lectures on oral pathology that piqued her interest. "They were my favorite lectures," recalls Dr. Lanzel.

Her area of research became more focused when former OPRM chair, Dr. Steven Vincent, invited her to join him and Dr. Kim Brogden, director of the Iowa Institute for Oral Health Research (IIOHR), on an inflammatory tissue project to study a biomarker, PDL-1. By providing cancer cell samples to Cellworks, a life sciences technology company, it can identify which patients will respond to a specific treatment and design a specific "cocktail" for a patient's unmet treatment needs. Identifying bio-marker signatures can also help patients find the right clinical trials and the most appropriate drugs for their cancer.

Dr. Lanzel is particularly interested in studying head and neck squamous cell carcinoma (HNSCC). This type of cancer derives from squamous cells, which are found in the outer layer of skin and in the moist mucous membranes. The development of HNSCC occurs in the mucous membranes of the mouth, nose and throat.

Worldwide, it is the seventh most common cancer, with 600,000 new cases appearing annually (50,000 in the U.S.). It occurs most often in older men in their 50s or 60s, although there has been an increase in younger people.

## "I hope that my research will help lead to clinically applicable treatment that will improve the prognosis of HNSCC."

The five-year survival rate for this type of cancer (50%) has not changed in five decades, despite advances in surgery, radiotherapy or chemotherapy, because of the difficulty in diagnosing HNSCC early. The lower survival rate results from changes in the structure of cells that may appear later or lesions that may appear benign, but which can be precancerous. The National Cancer Institute's (NCI) statistic for diagnosing HNSCC at an early stage is only 14%.

According to the NCI, tobacco and alcohol use are the most important risk factors for most head and neck cancers. Other factors may include the human papillomaviruses (HPV) or exposure to sun.



Dr. Emily Lanzel

In 2017, the Department of Oral Pathology, Radiology & Medicine examined approximately 4,700 pathological specimens of patients who either visited the College of Dentistry or who had an appointment with dental alumni from elsewhere in Iowa or in other states.

Dr. Lanzel is one of the UI College of Dentistry pathologists who evaluates patient specimens. Her diagnosis is reported to the patient's dentist. If there is cancer, the patient is sent to an oncologist and is also referred to an otolaryn-

#### $\dots$ Dr. Owais, continued from page 4

The use of silver nitrate is an example of medically managing dental caries in pediatric patients. Although silver nitrate does stain teeth, Dr. Owais hopes through research to find a method of eliminating the discoloration, to increase acceptability of this treatment modality.

Dr. Owais is also working as a co-principal investigator on the Biorepository research project to help understand the basic mechanisms of orofacial diseases, such as cleft lip and palate. The project is establishing a fully integrated medical, genetic and dental patient record to improve the quality of patient care, deliver personalized precision medicine and enhance broader quality research at Iowa. The Biorepository is open to all University of Iowa researchers.

The feelings that Dr. Owais has about her commitment to research can be summed up in a philosophical epiphany by Dr. Tom Southard, chair, Department of Orthodontics:

"If I care for a patient, the impact of that care lasts for years. If I teach a student to care for a patient, the impact lasts for a century. But if I make a discovery, no matter how small, the impact lasts for eternity.

-Dr. Tom Southard

"Research is creating new knowledge."

-Neil Armstrong

gologist for staging and treatment.

Because of their profession, dentists and dental hygienists are in an excellent position to routinely provide oral exams during their patients' appointments. Therefore, it isn't surprising that diagnosing HNSCC is now part of the UI College of Dentistry curriculum.

"I hope," says Dr. Lanzel, "that my research will help lead to clinically applicable treatment that will improve the prognosis of HNSCC."

#### ... Precision Dentistry, continued from page 5

physical appearance and behavior) while she provided the genetics component to provide phenotype / genotype correlations.

For a future research project, Drs. Moreno and Holton will seek funding to evaluate 3D images of orthodontic patients to see what additional phenotypes and changes may occur before and after orthodontic treatment. Additionally, they're interested in what role genetics has with patients responding to treatment, as well as how to tailor a patient's treatment by modeling treatment response according to the patient's own phenotype. For Drs. Moreno and Holton, genetics will provide an important future direction in the era of precision medicine and dentistry.



Image depicts a 3D surface scan of the human face. Dr. Moreno use images similar to this one to understand the genetic variation underlying human facial features and dental malocclusion.



Dear Colleagues:

Thank you for your participation in the 65th Anniversary of the University of Iowa College of Dentistry's Local Research Day on February 13, 2018. Research is central to our mission and is important in itself and for the culture of inquiry that it supports. This day is one of the highlights of our life as an academic community. The event's planning committee and research presenters are to be heartily commended for their hard work.

We are honored to host Dr. E. Dale Abel as our keynote speaker. Dr. Abel is the Francois M. Abboud Chair in Internal Medicine, the John B. Stokes III Chair in Diabetes Research, the Director of both the Fraternal Order of Eagles Diabetes Research Center and the Division of Endocrinology and Metabolism at the University of Iowa, Carver College of Medicine. He is the Chair and Department Executive Officer, Department of Internal Medicine at Carver College of Medicine and participates in research with an excellent collaborative group of faculty in the University of Iowa with very strong partnership from faculty at the College of Dentistry.

Our College has been very successful in recruiting very bright and talented faculty in the past few years. This includes faculty with significant interests in tissue engineering, ceramics, genetics, malocclusion, health policy, and translational and clinical research. This infusion of new ideas has brought new avenues of research and mentoring opportunities across the pre-doctoral, clinical post-doctoral, and graduate programs. It is an exciting time for the College's future!

Local Research Day shows the people and the spirit of discovery that have always made possible outstanding education, service, research, and patient care within our College.

Local Research Day and this research abstract book offer many opportunities to learn about fascinating research within our College. Thank you for being a part of this important event.

Best wishes,

David C. Johnsen, DDS, MS Dean



February 13, 2018

Dental Research participants and Iowa Section of the American Association of Dental Research (AADR):

The University of Iowa College of Dentistry and Dental Clinics (CoD) and the Iowa Institute for Oral Health Research (IIOHR) are committed to advancing science in our laboratories and clinics. Our scientific research is focused on several thematic areas, and it involves interdisciplinary collaboration between CoD scientists and other University of Iowa researchers. This work is vital both for improving oral health and patient care in our clinics and for training future dentists and dental researchers.

The Iowa AADR symposium represents our commitment to current research programs at the CoD and all the great research that has been accomplished in the last year. Our students, post-doctoral associates, residents, faculty, and staff have worked together in the discovery of new and novel scientific paradigms, and they have conducted research covering all aspects of basic, clinical, and evidenced-based research studies, often combining multiple disciplines.

The CoD administration, alumni, and sponsors are pleased to support our dental research programs, the AADR, and our annual research day. It is our occasion to honor the talents and commitment of our students, residents, faculty and staff. Together, their contributions, insights, vision, determination, and dedication will shape the future of dentistry.

In the past year, the CoD has developed new concepts and methods fundamental to the evolving disciplines of biotechnology, environmental health, and commercialization, and we have translated basic life sciences, particularly genomics and proteomics, for use in the dental and medical sciences. As a result, this on-going research is changing clinical practices and industry.

This year we are honored to have Dr. E. Dale Abel, MD, PhD as our Keynote speaker. Dr. Abel is the Director of the Fraternal Order of Eagles Diabetes Research Center, and Professor and Chair, Internal Medicine-Endocrinology and Metabolism in the Carver College of Medicine. Dr. Abel's research is focused on elucidating the mechanisms that are responsible for cardiac dysfunction in obesity, diabetes and insulin resistant states. His studies have elucidated mechanisms that are responsible for mitochondrial dysfunction that characterizes the heart in insulin resistant states and has pioneered studies of insulin action and glucose metabolism in the heart. He is a friend of the College of Dentistry and works with multiple faculty members to promote oral health. He has received numerous awards for research, teaching and service and was recently appointed President-Elect of the Endocrine Society.

Warmest Regards,

Brad A. Amendt, PhD Associate Dean for Research

Kim Brogden PhD Director, IIOHR



Dear Colleagues,

On behalf of the Iowa Section of the American Association for Dental Research (AADR), we are very pleased to welcome you to the University of Iowa, College of Dentistry & Dental Clinics Annual Research Day.

This is the 65th edition of the Annual Meeting of the Iowa Section of the AADR, which provides an open form for colleagues and students to present their exciting research findings and accomplishments to members of the larger research community. Findings range from basic, translational, clinical, health policy and services research, and they underscore the breadth of investigations taking place within our college. The annual meeting represents a unique moment each year to observe and invigorate the research conducted at the College of Dentistry.

We are honored to have Dr. E. Dale Abel as the keynote speaker. Dr. Abel is the Chair and Department Executive Officer of the Department of Internal Medicine, Director of the Division of Endocrinology & Metabolism, and Director of the Fraternal Order of Eagles Diabetes Research Center (FOEDRC) at the University of Iowa. His pioneering research on glucose transport in the heart, and his current investigation on molecular mechanism of cardia dysfunction have advanced insight into the pathogenesis of cardiac dysfunction in the diabetic heart. Dr. Abel's keynote address is titled "Building Interdisciplinary Teams to Advance Research and Clinical Care."

Overall, 94 research studies will be presented in various formats at our annual meeting this year. We would like to thank the presenters, mentors, judges, and staff for their participation and support in making this event successful. We also thank our colleagues from Chongqing Medical University for their research collaboration with our College and for participating in the event.

Finally, we would like to sincerely thank all of the sponsors who have generously contributed to the Local AADR Research Day. Their contributions are essential to our success.

Sincerely,

Kyungsup Shin, MS, DMD, PhD, MS President, Iowa Section of the AADR Assistant Professor Department of Orthodontics

narent Seydl

Sharon K. Seydel Secretary/Treasurer, Iowa Section of the AADR Department Administrative Manager Iowa Institute for Oral Health Research

wa ()wais

Arwa Owais, BDS, MS Vice President, Iowa Section of the AADR Associate Professor Department of Pediatric Dentistry

The University of Iowa College of Dentistry and Dental Clinics welcomes our visitors from Chongqing Medical University School of Stomatology in Chongqing, China to the 2018 Research Day of the Iowa Session of the American Association for Dental Research. T

庆

医科

大学

附属

腔医

院

#### **Milestones**

- September 2016: Dr. Ping Ji, Dean of Chongqing Medical University School of Stomatology and other administrators invited faculty from the UI College of Dentistry to visit Chongqing. Both colleges established a Memorandum of Agreement to work collaboratively on oral, craniofacial, and general health for the advancement of oral health research and scholarship.
- May 2017: Dr. David C. Johnsen, Dean of the University of Iowa College of Dentistry invited faculty from Chongqing Medical University School of Stomatology to visit with the faculty at Iowa and discuss research, teaching and training opportunities.
- February 2018: Faculty, staff, and students from Chongqing Medical University School of Stomatology attend the Research Day of the Iowa Session of the American Association for Dental Research, presenting their current research.

We are fortunate to have our colleagues and friends from Chongqing join us for our Research Day. This event is the first of its kind both for the University of Iowa College of Dentistry and for Chongqing Medical University School of Stomatology. This collaborative partnership serves to strengthen each of our commitments to the exchange of ideas, innovative research, and high-quality teaching and training opportunities for all our faculty, staff, and students.



# Program

Iowa Section of the American Association for Dental Research (AADR) 65th Annual Meeting, Tuesday, February 13th, 2018

7:30 a.m.	Reception with Coffee and Rolls (1st Floor)
8:00 a.m.	<b>Welcome Address</b> (Galagan A/B/C) Dr. David Johnsen and Dr. Brad Amendt
	<b>Keynote Speaker Introduction</b> Dr. Kyungsup Shin
8:20 a.m.	<b>Keynote Address</b> Dr. E. Dale Abel " <b>Building Interdisciplinary Teams to Advance Research</b>
	and Clinical Care"
9:20 a.m.	Break
9:30 a.m 11:45 a.m.	<b>Oral Presentations</b> Session One (Galagan A) Session Two (Galagan B) Session Three (Galagan C) Evidence-Based Research Session (Oral-B Classroom N212)
11:45 a.m 12:45 p.m.	<b>Poster &amp; Table Clinic Presentations</b> (Iowa Institute for Oral Health Research, W220 A/B)
5:00 p.m.	Awards Banquet Reception with Cash Bar
	(Radisson Hotel & Conference Center, Coralville)

# **Presentation Assignments**

# **Oral Session 1**

Presenters are **<u>underlined</u>**. Mentors are *italicized*.

9:30 a.m. - 11:45 a.m., Galagan A

- - (a) Max Smith Pre-Doctoral Competition
  - (b) Max Smith Graduate and Post-Doctoral Competition
  - (g) Endodontic Michel Fuller Post-Doctoral Award(j) Operative Dentistry Post-Doctoral Award
  - (n) Orthodontics Post-Doctoral Award
  - (r) Basic Science Post-Doctoral Award
- 1. <sup>a</sup> **Frankie Chyi**, J.J. Warren

Factors Associated With Toothpaste Use Among Low-Income Families

- Arwa Owais, A. Butali, Vs. Allareddy
  COD-Biorepository: Lessons, Opportunities and Challenges
- 3. Azeez Butali, T. Busch, R. Cornell, J.C. Murray

Genome-Wide Association Study Identifies SULT2A1, DACH1, DKK1, ACVR2A and ACVR1 as Novel Nonsyndromic Orofacial Clefts Candidate Genes

4. <sup>b,n</sup> Lina Alsibaie, O. Reyna-Blanco, M.I. Masoud, N. Eckermann, K. Shin, V. Allareddy, *Vs. Allareddy* 

End-of-Treatment, Retention, and Stability: Class II Division I Malocclusions

- 5. <sup>b,r</sup> <u>Amber M. Bates</u>, M.P. Gomez Hernandez, E.A. Lanzel, F. Qian, *K.A. Brogden* MMP and Immunosuppressive Biomarker Profiles of 7 HNSCC Cell Lines
- 6. <sup>b,j</sup> <u>Thomas D. Grubbs</u>, *E.C. Teixeira*, J.L. Kolker, M.A. Vargas Efficacy of Direct Restorative Materials in Proximal Margin Elevation on the Marginal Quality and Fracture Resistance of Molars Restored With CAD/CAM Onlays
- 7. <sup>b,r</sup> <u>Yunchun Kuang</u>, X. Zhang, *J. Song* Inhibitory Effect of Low-Intensity Pulse Ultrasound on the Expression of Lipopolysaccharide-Induced Inflammatory Factors in U937 Cells
- 8. <sup>b,r</sup> <u>Adil Akkouch</u>, M. Romero-Bustillos, S.L. Eliason, B.A. Amendt, *L. Hong* Novel MicroRNA-Based Therapy for Bone Repair and Regeneration
- 9. <sup>b,g,r</sup> <u>Tadkamol Krongbaramee</u>, M. Zhu, F.B. Teixeira, *L. Hong*

Association Between MicroRNAs and Proinflammatory Cytokines in Human DPSCs Under Bacterial Endotoxin Exposure

# **Oral Session 2**

#### 9:30 a.m. - 11:45 a.m., Galagan B

- - (a) Max Smith Pre-Doctoral Competition(b) Max Smith Graduate and Post-Doctoral Competition
  - (i) Iowa Society of Periodontology Post-Doctoral Award
  - (r) Basic Science Post-Doctoral Award
- 10. <sup>a</sup> Nathan T. Goodson-Gregg, X. Chen

Preliminary Assessment of Dental Pain-Related Behaviors in Nonverbal Elderly Patients With Dementia

11. K.V. Krell, Daniel J. Caplan

12-Month Success of Cracked Teeth Treated With Orthograde Root Canal Treatment

12. Xiaonan Zhang

Analysis of Epidemiological Characteristics and Prediction of Early Childhood Caries in Mainland China

13. <sup>b,i,r</sup> **Dize Li**, T. Chen, C. Wang, *P. Ji* 

Promotion of Osseointegration Using Protamine/Alginate/BMP2 Biofunctionalized Composite Coating on Nanopolymorphic Titanium Surfaces

- 14. <sup>b,r</sup> <u>Matthew T. Remy</u>, A. Akkouch, L. He, X. Song, B.A. Amendt, *L. Hong* Incorporation of MicroRNA-200c and Collagen Into 3D Printed Tricalcium Phosphate Scaffolds to Promote Bone Formation
- 15. <sup>b,r</sup> <u>Miguel Romero-Bustillos</u>, W. Yu, S.L. Eliason, H. Cao, *G. Avila Ortiz, B.A. Amendt* Iroquois Homeobox 1 in the Development of Dental Supporting Structures
- 16. <sup>b,r</sup> <u>Mason E. Sweat</u>, W. Yu, S.L. Eliason, Y.Y. Sweat, H. Cao, L. Hong, *B.A. Amendt* New *in vivo* MicroRNA Biotechnology Reveals Specific Roles for the miR-200 Family in Craniofacial Development
- 17. <sup>b,r</sup> <u>Aline L. Petrin</u>, W. Lyu, L. Deroo, P.A. Romitti, M.M. Jenkins, R.G. Munger, J.C. Murray, A.J. Wilcox, G.L. Wehby, *L.M. Moreno Uribe*, N. National Birth Defects Prevention Study

A Population-Based Study of Gene-Alcohol Interactions and Orofacial Cleft Risk

18. <sup>b,r</sup> Clarissa Souza Gomes Da Fontoura, B.A. Amendt, N.E. Holton, S.L. Eliason, *L.M. Moreno Uribe* 

Craniofacial Phenotypic Variation in Twist1 Mutant Mice

# **Oral Session 3**

#### 9:30 a.m. - 11:45 a.m., Galagan C

- (a) Max Smith Pre-Doctoral Competition
- (b) Max Smith Graduate and Post-Doctoral Competition
- (i) Iowa Society of Periodontology Post-Doctoral Award
- (j) Operative Dentistry Post-Doctoral Award
- (p) Preventive and Community Dentistry Post-Doctoral Award
- (r) Basic Science Post-Doctoral Award

### 19. <sup>a</sup> Katherine R. Sislow, S.L. Sousa Melo

Accuracy of Panoramic Radiographs in the Diagnosis of Osseous Changes in the Temporoandibular Joints Using CBCT As Gold-Standard

20. Lan Huang, Y. Wu, J.A. Helms

Mechanoresponsive Properties and Physiochemical Regulation of Periodontal Ligament Homeostasis

21. Jie Li, D. Chen

Quantitative Proteomics Analysis Reveals the Molecular Difference Between Human Dental Follicle Stem Cells and Periodontal Ligament Stem Cells

- 22. **Susan C. McKernan**, J.C. Reynolds, R.A. Kuthy, L. Tuggle, D. Garcia Environmental Scan of Medical-Dental Integration in Public Health Settings: Targeting Cardiovascular Disease
- 23. <sup>b,r</sup> Yan Y. Sweat, M.E. Sweat, M. Mansaray, I. Saadi, A. Butali, *B.A. Amendt* Six2 Regulates Palatogenesis by Promoting Cell Proliferation during Development
- 24. <sup>b,i,r</sup> **Robert D. Swenson**, A.M. Bates, E.A. Lanzel, A. Akkouch, L. Hong, *K.A. Brogden* **The Effects of 3D-Bioprinting Materials on HEPM Cell Cytokine Release**

# 25. <sup>b,j</sup> <u>Tamer G. Theodory</u>, *J.L. Kolker*, M.A. Vargas, R.R. Maia, D.V. Dawson The Esthetic Outcome and the Infiltration Capacity of Three Resin Composite Sealers Compared to ICON (DMG, America)

26.<sup>b,p</sup> Jennifer M. Sukalski, S.C. McKernan, G. Avila Ortiz, M. Cunningham-Ford, P.C. Damiano, F. Qian

Periodontal Treatment Needs in a Medicaid Expansion Population

27. <sup>b,r</sup> <u>Steven L. Eliason</u>, M. Romero-Bustillos, N.E. Holton, M.E. Sweat, *B.A. Amendt* MicroRNA-26b-5p and Lef-1 Act Through Wnt in the Developing Tooth

# **Pre-Doctoral Posters**

11:45 a.m. - 12:45 p.m., Iowa Institute for Oral Health Research, W220 A/B

- (c) James S. Wefel Pediatric Dentistry Pre-Doctoral Competition
  - (d) Procter and Gamble Award
  - (e) ADA Table Clinics Pre-Doctoral Award
  - (h) Iowa Society of Periodontology Pre-Doctoral Award

·····

28. Erika Takanami, J.A. Banas, F. Qian

### Recovery of Acid Tolerant Bacteria From Dental Plaque and Saliva

29. <sup>c,d,e</sup> <u>Leah Barshinger</u>, *A.I. Owais*, T. Mabry, F. Qian, J.J. Warren, *K. Weber-Gasparoni* Factors Associated With Carious Lesions Among Young WIC-Enrolled Children

- 30. <u>Tanner Brolsma</u>, K. Leary, T. Mabry, K. Weber-Gasparoni, M. Tamegnon Is Required Data Obtained in the Electronic Dental Record and Does the Data Indicate Oral Health Status?
- 31. <sup>c,d,e</sup> <u>Alison R. Christensen</u>, *A.I. Owais*, K. Weber-Gasparoni, *D.V. Dawson* Scientific Knowledge Dissemination Through Manuscript Publication: A Dental Studentís Experience
- 32. <sup>d,e</sup> **Shaan Desai**, T. Busch, J.V. Park, D. Anand, C.A. Bello, A.M. Tora—O, C. Lo, M. Mohamed, S. Lachke, *A. Butali*

Discovery of a Novel Variant in RORA in Non-Syndromic Orofacial Clefts in African Populations

- 33. <sup>c,d,e</sup> <u>Peter D. Douglas</u>, *A.I. Owais*, D.R. Blanchette, M. Penticoff, D.V. Dawson Outcomes of Management of Acute Traumatic Dental Injuries in Children
- 34.<sup>d,e</sup> <u>Nile Eckermann</u>, V. Allareddy, R. Nalliah, S. Chandrashekaraiah, S. Rampa, *Vs. Allareddy* Outcomes Associated with Periapical Abscess in Those Undergoing Heart-Valve Replacements
- 35. <sup>d,e</sup> **Bryer E. Fritsch**, *J.L. Kolker*, F. Qian, J. Harless **Pre-workout Supplement Effects on Enamel Erosion**
- 36.<sup>d,e</sup> <u>YuWei Guo</u>, F. Shao, *H. Cao, B.A. Amendt* Activation of Endogenous BMP2 in Human Cell by CRISPR-Cas 9 SAM Based Synthetic Transcription Factor Technology
- 37. <sup>c,d,e</sup> <u>Noah C. Hollinger</u>, *K. Leary*, F. Qian, K. Weber-Gasparoni, A.I. Owais, M.J. Kanellis Outside Referral Patterns to the Pediatric Dental Clinic
- <sup>38. d,e</sup> Joshua D. Hones, S.C. McKernan, R.A. Kuthy
  Associations Between County General Dentist Workforce and Business Establishments

39. <sup>d,e</sup> Nicole Krois, A. Kossioni, P. Barlow, M. Tabrizi, *L. Marchini* 

Validation of a European Instrument to Measure Clinical Learning Environments for Dental Students (DECLEI) in American Dental Schools

40.<sup>c,d,e</sup> <u>Amanda T. Phan</u>, K. Leary, K. Weber-Gasparoni, B. Kleinheksel, A.I. Owais, F. Qian, M.K. Geneser, A. Stier,

Hands-On Experiences and the Impact on Pediatricians' Comfort in Providing Early Preventive Oral Health Care

41. d,e Grant McCaulley, J.A. Banas, A. Welhaven, F. Qian

Testing Aspects of Freezing Preservation on Oral Bacterial Viability

42. d,e Elise Montesinos, J.J. Warren

Caries in American Indian Children Entering the Mixed Dentition—A Follow Up on the OST SMILeS Cohort

- 43.<sup>d,e</sup> <u>Kyle Nicholson</u>, *X. Chen*, L. Rodriguez, M. Tamegnon, F. Qian Cognitive Impairment in Patients Attending University of Iowa Dental Clinics
- 44. <sup>c,d,e</sup> <u>Colby Beck</u>, *A.I. Owais*, D. Pelzer, M.C. Skotowski, M. Tamegnon, T. Mabry, M.K. Geneser, M.J. Kanellis, K. Leary, S. Kelly, D.V. Dawson, G. Gilbaugh, M. Akers, K. Weber-Gasparoni

A Clinical Trial Comparing  $\mbox{Isolite}^{\mbox{\tiny $\$$}}$  Vs Cotton Roll Isolation in the Placement of Dental Sealants

- 45.<sup>d,e</sup> <u>Eduard Doumanian</u>, *A.I. Owais*, H.T. Phan, K. Shin, A.J. Haes The Effect of Potassium Iodide on Silver Diammine Fluoride-Treated Hydroxyapatite
- 46. **James V. Park**, T. Busch, S. Desai, A.M. Tora–O, C.A. Bello, C. Lo, M. Mohamed, *A. Butali* Identifying DACH1 Variants Contributing to Orofacial Clefts in African Populations
- 47. <sup>d,e</sup> <u>Elizabeth Pfohl</u>, C.A. Squier, N.A. Slach, A.E. Welhaven Smoking Rates and Tobacco Control Funding in Iowa 2000-2015
- 48.<sup>d,e</sup> <u>Amanda Piche</u>, *N.E. Holton* Variability in the Lower Facial Skeleton During Development
- 49. <sup>d,e</sup> <u>Taylor R. Postler</u>, D. Lynch, A. Villhauer, W. Liu, D.V. Dawson, J.J. Warren, T.A. Marshall, K.R. Phips, D.E. Starr, *D.R. Drake* Genotypic Diversity of *Streptococcus sobrinus* in an American Indian Population
- 50.<sup>d,e</sup> **Erica N. Recker**, M. Sarmet Smiderle Mendes, D.R. Blanchette, D.V. Dawson, H. Cowen, J. Hartshorn, J.F. Fernandes Dos Santos, L. Notari Chester, D.J. Caplan, *L. Marchini*

Comparison of Systemic Health Characteristics and Xerostomia among Nursing Home Residents in Iowa, US and Sao Paulo, Brazil

51. **Lydia Rodriguez**, K. Nicholson, A. Welhaven, F. Qian, *X. Chen* **Development of a Cognitive Assessment Tool for the General Dentist** 

- 52. <sup>d,e</sup> **Ryan J. Rucker**, P.B. Barlow, J. Hartshorn, L. Kaufman, B. Smith, A. Kossioni, *L. Marchini* **Dual Institution Validation of an Ageism Scale among Dental Students**
- 53. <sup>d,e</sup> **Rebecca A. Schneider**, A. Villhauer, A. Welhaven, *D.R. Drake* **Mutans streptococci in American Indian Mothers**
- 54. **Ryan P. Shaw**, *M.R. McQuistan*, F. Qian First-Year Dental Students' Willingness to Treat Underserved Populations Post-Graduation
- 55. <sup>c,d,e</sup> <u>Ashley M. Spooner</u>, A.I. Owais, *D.R. Blanchette*, D.V. Dawson, K. Weber-Gasparoni, J.J. Warren, M.K. Geneser, *M.J. Kanellis*

Clinical vs. Radiographic Caries Diagnosis in Primary Teeth Approximal Surfaces

- 56. <sup>d,e</sup> <u>Katelyn Stine</u>, P. Scaffa, M. Carrilho, L. Wang, *C. Vidal* MMPs Extraction Assays in Healthy and Carious Dentin
- 57. <sup>d,e,h</sup> <u>Madeline A. Swenson</u>, *G. Avila Ortiz*, M. Romero-Bustillos, *C.A. Barwacz* Peri-Implant Mucosa Dynamics Around Divergent and Concave Abutment Transition Profiles
- 58. <sup>d,e</sup> **Gabrielle. N. Moen**, *E.C. Teixeira*, J.A. Banas, R. Danso, R. Rawls Metabolic Activity of *S. mutans* Biofilm on Different Dental Composites
- 59. <sup>d,e</sup> <u>Michelle Tsai</u>, F. Qian, *J.A. Banas* Selective Toxicity of Silver Diamine Fluoride and Silver Nitrate Against *S. mutans* and *S. sanguinis* In Vitro
- 60.<sup>d,e</sup> Andrew B. Welling, *N.E. Holton*, S.F. Miller Assessing the Relationship between Craniofacial Development and Asymmetries
- 61. <sup>d,e</sup> Flora Y. Yen, F. Qian, *J.A. Banas*, *D.R. Drake*, A. Villhauer Analyzing the Basis for *Streptococcus sobrinus* Prevalence in American Indian Children
- 62. <sup>d,e</sup> Isabella Jasek, K. Dibbern, M. Andrew, A. Welhaven, V. Allareddy, *D. Anderson, K. Shin* Fracture Energy Assessment of the Mandible Computed Using CBCT

## Graduate, Faculty & Staff Posters & Table Clinics

11:45 a.m. - 12:45 p.m., Iowa Institute for Oral Health Research, W220 A/B

- - (d) Procter and Gamble Award(e) ADA Table Clinics Pre-Doctoral Award
  - (f) ADA Table Clinics Pre-Doctoral Award (f) ADA Table Clinics Post-Doctoral Award
  - (g) Endodontic Michel Fuller Post-Doctoral Award
  - (h) Iowa Society of Periodontology Pre-Doctoral Award
  - (j) Operative Dentistry Post-Doctoral Award
  - (k) Oral & Maxillofacial Pathology Post-Doctoral Award
  - (I) Oral & Maxillofacial Radiology Post-Doctoral Award
  - (n) Orthodontics Post-Doctoral Award
  - (o) Pediatric Dentistry Post-Doctoral Award
  - (p) Preventive and Community Dentistry Post-Doctoral Award
  - (r) Basic Science Post-Doctoral Award
- ····**v**
- 63.<sup>f,r</sup> <u>Timothy Acri</u>, S. Geary, *A. Salem, K. Shin* Impact of Calcium Concentration on Transfection Efficiency and Osteogenic Differentiation
- 64.<sup>f,n</sup> <u>Samuel J. Christensen</u>, D. Nesbitt, *F. Qian, V. Allareddy*, T.E. Southard, S. Marshall, *K. Shin* Adolescent Skeletal and Dental Changes With Rapid Maxillary Expansion (RME)
- 65. <sup>f,r</sup> InO Song, D. Seol, *T. Lim, K. Shin*

Three-Dimensional Finite Element Analysis of Temporomandibular Joint for Mandibular Osteotomy

- 66.<sup>f,k</sup> <u>Md Shahidul Ahsan</u>, *H. Ida-Yonemochi, T. Saku* Perlecan and Its Receptors in Oral Epithelial Dysplasia and Squamous Cell Carcinoma
- 67. <sup>f,j</sup> Hamad A. Algamaiah, J.A. Banas, S.R. Armstrong, A. Jain, R. Danso, R. Rawls, *E.C. Teixeira* Fracture Toughness Evaluation of Resin Composites after Environmental Challenge
- 68. <sup>f,j</sup> Arwa A. Alhakami, *R.R. Maia*, *C. Vidal*, *F. Qian*, *T.A. Marshall* Effect of Time and Temperature on Color Stability of Resin-Composite
- 69.<sup>†,1</sup> **Daniah Alhazmi**, V. Allareddy, G. Axt, S. Allareddy, *S.L. Sousa Melo* Fluctuations in Dose Levels Based on Phantom Location and CBCT Scanner Settings
- 70. <sup>f,o</sup> Joan M. Attridge, D.V. Dawson, D.R. Blanchette, J.J. Warren, K.R. Phips, D.E. Starr, T.A. Marshall, T. Mabry, D.R. Drake
  Caries Experience in American Indian Children in the First Year
- 71. <sup>f,p</sup> <u>Alexandra M. Curtis</u>, S.M. Levy, J.E. Cavanaugh, J.J. Warren, T.A. Marshall Permanent Dentition Hypoplasia Predicts Caries Incidence Longitudinally i n Birth Cohort
- 72. <sup>f,g</sup> **Zachary S. Goettsche**, *A.E. Williamson*, *F.B. Teixeira* A Preoperative Evaluation of Retreatments Using CBCT

- 73. <sup>f,g</sup> Jennie Harris, A.E. Williamson, F. Qian Endodontic Practices Following Dental School
- 74. <sup>f,j</sup> <u>Maram E. Jaradat</u>, A.I. Owais, S. Guzman-Armstrong, J.L. Kolker, S.L. Sousa Melo,
  M. Murrell, T.A. Marshall, F. Qian, M.J. Kanellis
  Silver Diammine Fluoride Effectiveness in Arresting Early Approximal Carious Lesions
- 75. <sup>f,k</sup> **Felipe Nor**, K.A. Warner, M. Sant'ana Filho, S. Wang, *J.E. Nor* **Preclinical Evaluation of MDM2 Inhibitors for Treatment of Adenoid Cystic Carcinoma**
- 76. <sup>f,I</sup> Joshua J. Orgill, S. Vijayan, S. Allareddy, S.L. Sousa Melo, V. Allareddy
  The Dental Specialists Cost-Benefit Analysis of Referring a CBCT to an Oral and Maxillofacial Radiologist
- 77. <sup>f,p</sup> <u>Reem Oweis</u>, *S.M. Levy*, J.J. Warren, J.M. Eichenberger Gilmore, T. Burns, P. Saha, E. Letuchy

Associations Between DXA Bone Outcomes at Age 5 and the Presence of Dental Fluorosis at Age 8

- 78. Zach Percival, M.K. Geneser, A.I. Owais
  Radiographic Adaptation of Prefabricated Stainless Steel Crowns A Pilot Study
- 79. <sup>f,o</sup> <u>Megan R. Rohman</u>, *K. Leary*, A.I. Owais, T.A. Marshall, F. Qian Obesity and Dental Decay
- 80.<sup>f,g</sup> **Ryan Teahen**, *A.E. Williamson*, *F. Qian*, *F.B. Teixeira* **Prevalence and Perceived Indications of CBCT in Endodontics**
- 81. <sup>f,I</sup> **Suvendra Vijayan**, S. Allareddy, S.L. Sousa Melo, F.B. Teixeira, *V. Allareddy* **Segmenting Root Canal System Using an Open Source Slicer Software**
- 82.<sup>t,j</sup> **Rawa Alammari**, *D.V. Dawson*, P.W. Wertz, M.A. Vargas, J.A. Banas, S.R. Kwon Effect of Application Protocol of Remineralizing Agent on Erosion Depth
- B3. D. Chen, J. Li, Jinlin Song
  Simvastatin Reverses LPS-Inhibited Osteoblastic Differentiation of Periodontal Ligament Cells Through Autophagy
- Ban Jiang, L. Jiang, P. Ji, Q. Yin, J. Song
  Dental Education in CQMU: Training the Future Dentists for China
- Steven M. Levy, P. Saha, C. Chen, E. Letuchy, J.J. Warren, T. Burns, A.M. Curtis, J.M. Eichenberger Gilmore, K. Janz, J. Torner
  Fluoride Intake and Age 23 Distal Tibial Bone Microarchitectural Measures
- 86. <sup>f,r</sup> **Dongrim Seol**, I. Song, K. Chitphet, A. Salem, *J. Martin, K. Shin* **Endogenous Progenitor Cell-Based Temporomandibular Joint Cartilage Repair**

87. <u>Alissa Villhauer</u>, D. Lynch, T.R. Postler, D.R. Blanchette, D.V. Dawson, J.J. Warren, *D.R. Drake* 

### Exploration of Caries and Microbial Status in American Indian Children

- 88.<sup>f,r</sup> <u>Min Zhu</u>, A. Akkouch, T. Krongbaramee, Q. Qian, L. Yang, J.A. Banas, *L. Hong* MicroRNA Regulation in Obesity-Associated Periodontitis
- 89.<sup>e</sup> <u>Elliott Glenn</u>, *M.M. Hernandez*, M.R. McQuistan, C. Straub-Morarend, D.R. Blanchette, D.V. Dawson

Dental Student Preferences for Patient Education Using Digital Media

- 90.<sup>e,h</sup> **Blake M. Louscher**, V. Allareddy, *S. Elangovan* Predictors of Citations of Systematic Reviews in Oral Implantology Published in 2010
- 91. <sup>f,o</sup> <u>Nicole Youngers</u>, *A.I. Owais*, A.R. Christensen, K. Pagan-Rivera, D.V. Dawson, K. Weber-Gasparoni

Early Childhood Caries Risk Factors Among Children Aged 0-3 Years

- 92. L.D. Slashcheva, <u>Irene Hilton</u>, *R.A. Kuthy* Dental Payment Innovation: Best Practices of Health Center Dental Clinics in Three States
- 93. <sup>d,e</sup> L.D. Slashcheva, **Phil Ryan**, J. Tate

Improving Healthcare Encounters for Individuals With Intellectual/Developmental Disabilities through Customized Care Communication Cards

94.<sup>f,p</sup> Lyubov D. Slashcheva, J. Coe

Oral Health Integration in Long-Term Care Settings: Lessons From a Virginia Pilot Program

# **Evidence-Based Research Session**

Presentations by D3 students (Moderator: Teresa Marshall) 9:30 a.m. - 11:45 a.m., Oral-B Classroom N212

# Abstracts

# 1. Factors Associated With Toothpaste Use Among Low-Income Families



**Frankie Chyi**<sup>1</sup>, J.J. Warren<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Children from low-income families have a higher risk of having poor oral health. The purpose of this study was to assess factors related to access to toothpaste and toothpaste

use patterns in children from low-income families.

**Methods:** The study was conducted at the WIC Clinics in Iowa City and Des Moines, Iowa. Parents of children 0-5 years of age were recruited in the waiting rooms and asked to complete a questionnaire regarding one of their children. The questionnaire included items regarding frequency of toothbrushing, whether toothpaste was used when their child's teeth was brushed, if they had trouble obtaining toothbrushes or toothpaste because of cost, and knowledge of fluoride. Data from the collected questionnaires were entered into Excel and used to generate descriptive statistics in SPSS. Chi-square tests were done to assess relationships between regular brushing and independent variables.

Results: 212 questionnaires were completed (126 at Iowa City and 86 at Des Moines). Children's age ranged from 8 months-8 years, but most were 4 vears old or vounger. All respondents reported annual family income of \$40,000 or less, with many (65%) having incomes of \$20,000 or less. 38% of the respondents reported that they did not regularly use toothpaste for their child, and 56% of the children brushed their teeth once per day or more. 28% of the participants reported trouble obtaining toothbrushes or toothpaste because of cost. Bivariate analyses found that parents who have time to brush their child's teeth, did not think fluoride was harmful, and thought fluoride was important when buying toothpaste were more likely to have their kids brush once per day or more.

**Conclusion:** Access and use of toothpaste, and lack of regular toothbrushing appears to be significant problems in this population, Infrequent brushing was related to lack of knowledge about toothpaste and fluoride.

Supported by: Dental Student Research Program

## 2. COD-Biorepository: Lessons, Opportunities and Challenges



**<u>Arwa Owais</u><sup>1</sup>, A. Butali<sup>1</sup>,** Vs. Allareddy<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Objectives of this study are to provide an overview of processes to create a dental/medical biorepository, strategies used to obtain support for

creating biorepository, methodological overview of linking up medical and dental records, and updates on subject recruitment.

**Methods:** In preparation for the "Precision Medicine" and "Big Data Analytics" initiatives at our institute, a biorepository was created in July of 2016. Nine different departments within the college of dentistry were invited to participate in the creating of biorepository. The specimen samples collected included: saliva, extracted teeth, and gingival/ periodontal tissues, and bone. The dental records of patients at the college of dentistry were linked up with their medical records using a multi-level/variable matching approach.

**Results:** Within a 15 month period of creating the biorepository, 841 subjects (371 males and 470 females) enrolled in the biorepository. The sample types included DNA (n=539), RNA/microbiome (n=25), extracted teeth (n=267), and tissue/ bone (n=10). Six departments so far participated. Strategies we found to be successful in the creation of biorepository included: multiple periodic presentations given by principal investigators to faculty members and support staff in all departments; preparation and distribution of educational materials to potential subjects; ready availability of study/ research coordinators; and establishment of specimen collection pathways tailored to the specific needs of individual departments and clinics. Close to 200,000 patients who had visited the college of dentistry had their dental and medical records uniquely matched and linked. A combined dental/medical records database was established. This database is updated on a weekly basis and available for investigators to conduct big data analytics. The challenges faced included: unexpected/unforeseen issues in collection pathways, establishing standards of collection and storage protocols, and obtaining support from various stake holders.

**Conclusions:** With support from various stake holders and well defined collection/storage protocols a biorepository can be successfully created for furthering research to improve clinical care in the genomics era.

Supported by: Roy J. Carver Charitable Trust

## 3. Genome-Wide Association Study Identifies SULT2A1, DACH1, DKK1, ACVR2A and ACVR1 as Novel Nonsyndromic Orofacial Clefts Candidate Genes



**<u>Azeez Butali</u>**<sup>1</sup>, T. Busch<sup>1</sup>, R. Cornell<sup>1</sup>, J.C. Murray<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Orofacial clefts (OFCs) are birth defects characterized by openings or splits in the roof of the mouth and/or lip due to improper muscle

development in the soft palate; they have great impacts on speech, hearing, and respiration among other processes. OFCs have a global prevalence of 1 in 700 births, and approximately 70% of all clefts are nonsyndromic, meaning that they are not accompanied by other malformations. We successfully conducted the first GWAS for OFC in Africa and a total of 3,353 participants were genotyped on the pre-release consortium version of Illumina Multi Ethnic Genotyping Array (MEGA). Imputation was done into the 1000 Genomes Phase 3 reference imputation panel using IMPUTE2. The final dataset that passed quality control consisted of 3,178 (1,133 male; 2,045 female) participants enrolled from Ethiopia (30%), Ghana (43%), and Nigeria (27%). They included 814 cases of cleft lip with or without cleft palate (CL/P), 205 cases of isolated cleft palate (CPO), and 2,159 related and unrelated controls. Over 45 million SNPs were imputed including the 2.2 million SNPs in the Multi Ethnic Genotyping Array. Of these SNPs, only 16 million passed our quality control filter and were included in the final analyses. Given the known differences in the developmental and genetic basis of CL/P versus CPO, we conducted two separate GWAS (one for each phenotype). Single-variant association tests were done for imputed dosage data filtered for imputed allelic dosage frequency < 0.01 and info < 0.3using logistic mixed models as implemented in the GMAAT package. The GWAS for CL/P showed that the most significant hits are on chromosomes 8 and 3. The chromosome 8 locus (leading SNP, rs72728755,  $p = 1.52 \times 10^{-6}$ ) is in the 8q.24 region that has been previously reported to be associated with CL/P in Europeans. The GWAS for CPO revealed one genomewide significant locus on chromosome 2 (leading SNP rs140938806, p =  $2.76 \times 10^{-9}$ ), four novel loci that are close to GWAS significant (10<sup>-7</sup>) on Chr2, Chr 7, Chr10 and Chr13. Sub-phenotype analyses also identified a near significant (10<sup>-7</sup>) locus around Chr10 for cleft lip only. Our study has refined the genetic architecture of OFC in Africa, identified new loci and demonstrated genetic heterogeneity for the cleft sub-phenotypes. These findings will provide additional insights into craniofacial development and biology.

Supported by: NIH/NIDCR, Robert Wood Johnson Foundation

# 4. End-of-Treatment, Retention, and Stability: Class II Division I Malocclusions



Lina Alsibaie<sup>1</sup>, O. Reyna-Blanco<sup>10</sup>, M.I. Masoud<sup>10</sup>, N. Eckermann<sup>1</sup>, K. Shin<sup>1</sup>, V. Allareddy<sup>1</sup>, *Vs. Allareddy<sup>1</sup>* <sup>1</sup>University of Iowa, Iowa City, IA; <sup>10</sup>Harvard University, Cambridge, MA

**Objective:** The end of treatment, retention strategies, and long term stability in patients with severe Class II Division I malocclusions who underwent non-surgical orthodontic treatments has not been well characterized. The objective of the present study is to examine these outcomes.

**Methods:** Study subjects were drawn from an Orthodontic Practice Based Research Network (OPBRN) comprised of two orthodontic residency programs and three private practice clinics. Consecutively treated/recalled subjects with Class II Division I malocclusions (overjet>=6 mm and bilateral Class II molar relationship) that were treated non-surgically and aged 13 to 18 years at time of debonding were examined. Pre- and post-treatment cephalometric changes were assessed by paired sample tests. Retention strategies and long term stability were assessed.

Results: 36 subjects participated in the study. Nonsurgical treatment strategies used included premolar extractions (2 or 4 premolars), headgear treatments, functional appliances, and TADs. Significant reductions in overjet (reduction of 4.8 mm, p<0.0001), ANB angle (reduction of 1.9 deg, p<0.0001), proclination of mandibular incisors (2.6 degrees, p=0.04) were observed between start of treatment and at debonding. Hawley appliances with fixed retainers and Hawley appliances in combination with clear retainers were most used retention appliances. 27.8% of patients reported not being compliant with recommended retention protocol. At time of retention check (at least 6 months post-debond), there was an increase in overjet by 0.6 mm (p=0.01). 44% had no mandibular incisor crowding at time of retention check, 6% had mandibular incisor crowding of <0.5 mm, and rest had mandibular incisor crowding of 1 mm or more. Mean facial esthetic and occlusion satisfaction scores were 4.22 and 3.83 respectively.

**Conclusions:** Good end of treatment outcomes can be realized with non-surgical orthodontic treatment approaches in patients with severe Class II Division I malocclusions. However, poor retention compliance can lead to lack of long term stability of occlusion.

## 5. MMP and Immunosuppressive Biomarker Profiles of 7 HNSCC Cell Lines



**Amber M. Bates**<sup>1</sup>, M.P. Gomez Hernandez<sup>1</sup>, E.A. Lanzel<sup>1</sup>, F. Qian<sup>1</sup>, *K.A. Brogden*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Biomarkers like programmed death ligand-1 (PD-L1) have become a

focal point for immunotherapeutic checkpoint inhibition in head and neck squamous cell carcinoma (HNSCC). However, it's only part of the total immunosuppressive biomarker profile of HNSCC cells. Matrix metalloproteinases (MMPs) are enzymes that break down the basement membrane allowing cancer cells to metastasize. MMPs also play an important role in the tumor microenvironment. MMPs can activate certain cytokines, growth factors, and chemokines post-translationally. The objective of this study was to determine MMP and biomarker profiles of seven different HNSCC cell lines. Cell lines were grown in minimal media at 1\*10<sup>6</sup> viable cells/mL and incubated at 37°C. After 24hrs supernatants were collected, and adhering cells were removed with cell lysis buffer. Multiplex immunoassays were used to determine MMP1, MMP7, MMP9, IL-6, VEGFA, IL-1a, TNFa, GM-CSF, IL-1RA, and IL-8 concentrations in supernatants. ELISAs were used to determine PD-L1, CD47, FASL, and IDO concentrations in cell lysates. A one-way ANOVA was fit to examine log-transformed concentrations of biomarkers between seven HNSCC cell lines, and pairwise group comparisons were conducted using post-hoc Tukey's Honest Significant Differences test (alpha=0.05). Significant differences (p<0.05) in both MMP and biomarker concentrations were found between the seven HNSCC cell lines. For example, MMP9 was highest in SCC25 and UM-SCC99, MMP7 was highest in SCC25 and UM-SCC19, and MMP1 was highest in SCC25. This suggests different patients' HNSCC cells can express varying amounts of certain biomarkers and MMPs. These differences could be due to metastatic stage of the cancer, primary tumor site, type of tissue the tumor originated from, or genomic differences between patients. MMP and biomarker expression profiles should be considered when choosing cell lines for future studies. The results support the reason for personalized medicine and the need to further investigate how it can be used to treat HNSCC.

Supported by: NIH/NIDCR T90 DE023520 & R01 DE014390

## 6. Efficacy of Direct Restorative Materials in Proximal Box Elevation on the Margin Quality and Fracture Resistance of Molars Restored With CAD/CAM Onlays



**Thomas D. Grubbs**<sup>1</sup>, *E.C. Teixeira*<sup>1</sup>, J.L. Kolker<sup>1</sup>, M.A. Vargas<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

The purpose of this study was to investigate the effect of four direct restorative materials that can be used in the proximal box elevation (PBE)

technique. Seventy-five molar teeth were randomly assigned to one of five groups (n=15): glass ionomer (GI), resin modified glass ionomer (RMGI), resin based composite (RBC), bulk fill (BF) resin based composite, and a control with no marginal elevation procedure. A resin, nano-ceramic onlay (Lava Ultimate<sup>™</sup>, LAVU) was machined and luted on all specimens with RelyX Ultimate<sup>™</sup>. Margin quality of the tooth-PBE material and PBE material-onlay interface was evaluated with scanning electron microscopy (SEM) using epoxy replicas before and after cyclic loading (100,000 cycles, 1.2 Hz at 65N). In addition to marginal quality, the fracture resistance of each group was measured using a universal testing machine. Fracture pattern was recorded by visual examination. Statistical analysis was performed using one-way ANOVA followed by Least Square Means. For dentin margins, a statistically significant difference was detected between RMGI and control group at baseline (p=0.0442). All other groups GI, RBC, and BF showed no difference to control at baseline (p>0.05). No statistical significance was observed among groups for post-cyclic fatigue (p=0.8735). In terms of change, all materials performed comparable to control except for RMGI group (p=0.0443). For onlay margins, no statistical significance was observed among groups for pre-cyclic fatigue, post-cyclic fatigue, or change (p=0.9713, p=0.528, p= 0.4385 respectively). No statistical significance was observed for the fracture resistance among groups or for the type of break by material used (p=0.1593, p=0.77 respectively). Collective findings suggest that glass-ionomer and resin-modified glass ionomer restoratives might be suitable for proximal box elevation procedures. Nevertheless, clinical caution is recommended with any PBE procedure and further testing of GI materials is needed.

Supported by: 2016 Ralph-Phillips Student Research Award.

## 7. Inhibitory Effect of Low-Intensity Pulse Ultrasound on the Expression of Lipopolysaccharide-Induced Inflammatory Factors in U937 Cells



Yunchun Kuang<sup>101</sup>, X. Zhang<sup>101</sup>, J. Song<sup>101</sup>

<sup>101</sup>Chongqing Medical University, Chongqing, China

**Objectives:** The aim of this study was to investigate the effect of lowintensity pulse US on the expression

of lipopolysaccharide (LPS)-induced inflammatory factors in U937 macrophage cells.

**Methods:** U937 cells were stimulated with different concentrations of LPS and exposed to different intensities of low-intensity pulse US. Cell viability and apoptosis of U937 cells were determined by cell-counting kit assays and flow cytometry. A real-time polymerase chain reaction and an enzyme-linked immunosorbent assay were used to test the expression of inflammatory factors. The expression levels of toll-like receptor 4, p65, p-lkBa and lkBawere assessed by western blots.

**Results:** Tumor necrosis factor  $\alpha$  began to increase in U937 cells on induction with 1µg/mL LPS. Lowintensity pulse US at the intensity of 60 mW/cm2 was more effective in reducing interleukin 8 (IL-8) expressions. Furthermore, LPS inhibited the viability and increased apoptosis of U937 cells, whereas low-intensity pulsed US significantly reversed these effects (P<.05). Low-intensity pulse US reduced the protein expression o fIL-6 and IL-8 at both gene and protein levels in U937 cells. The western blot and immunofluorescence showed that low-intensity pulse US primarily suppressed the degradation and phosphorylation of IkBaand the translocation of p65 into the nuclei.

**Conclusions:** Low-intensity pulse US alleviated the expression of inflammatory factors induced by LPS in U937 cells. This process was modulated by suppressing the toll-like receptor 4–nuclear factor  $\kappa B$  signaling pathway. Therefore, low intensity pulse US might be a potential immunomodulatory therapy for the treatment of periodontitis.

Key Words: Inflammatory factors; lipopolysaccharide; low-intensity pulseultrasound; U937 cells; toll-like receptor 4–nuclear factor κB signaling.

# 8. Novel MicroRNA-Based Therapy for Bone Repair and Regeneration



**Adil Akkouch**<sup>1</sup>, M. Romero-Bustillos<sup>1</sup>, S.L. Eliason<sup>1</sup>, B.A. Amendt<sup>1</sup>, *L. Hong*<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

Defects in oral and craniofacial bones resulting from trauma, congenital abnormalities, or cancer resection are major medical concerns. Gene therapy

approach to bone and periodontal tissue engineering has become one of the most promising therapeutic technologies. We have reported that plasmid DNA encoding miR-200c delivered by polyethylenimine nanoparticles enhanced expression of osteogenic markers in human bone marrow mesenchymal stem cells (hBMSCs). We have further identified miR-200a, which inhibit bone formation when injected at the cranial suture in rat.

**Objectives:** To evaluate the effect of naked plasmid DNA encoding miR-200c or miR-200a inhibitor (PMIS) in promoting osteogenic differentiation of hBMSCs and bone regeneration in critical-size calvarial defects of rats.

**Methods:** We evaluated the expression level of miR-200c and miR-200a, the cell viability, and proliferation of hBMSCs after pDNA transfection. The biomarkers of osteogenic differentiation in the hBMSCs were quantitated using qPCR and ELISA up to 28 days. In addition, we implanted collagen matrix incorporating plasmid DNA encoding miR-200c or PMIS-200a (10  $\mu$ g/implant) into calvarial defects (8 mm-in-diameter) of rats. Bone regeneration was analyzed using microCT and histology after 6 weeks implantation.

**Results:** miR-200c expression was significantly increased in hBMSCs transfected with miR-200c in a dose-dependent manner. The mRNA of RUNX-2, ALP, and OCN were up-regulated in the hBMSCs with miR-200c overexpression and miR-200a inhibition. Additionally, the *in vivo* delivery of miR-200c and PMIS-200a by the naked plasmid DNA was evidenced by miR-200c overexpression and miR-200a inhibition, respectively, in explants one week post-implantation. The microCT and histology analysis revealed that miR-200c or PMIS-200a-loaded collagen scaffolds had significantly stronger osteogenic capability when compared to controls.

**Conclusion:** pDNA encoding miR-200c and PMIS-200a both promote hBMSCs differentiation towards osteoblastic lineage and bone formation capability. This innovative miRNA-based therapy has potential for the clinical treatment of bone disorders including fracture, periodontitis and impaired osseointegration of bone-implants.

Supported by: NIH/NIDCR 1R01DE026433-01A1; 1R21DE025328; R21 DE024799

## 9. Association Between MicroRNAs and Proinflammatory Cytokines in Human DP-SCs Under Bacterial Endotoxin Exposure



<u>Tadkamol Krongbaramee</u><sup>1</sup>, M. Zhu<sup>1</sup>, F.B. Teixeira<sup>1</sup>, *L. Hong*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Vital pulp therapy is used to preserve pulp vitality in inflamed pulp for keeping pulp tissue alive and tooth survival. However, the success rate of

the therapy in irreversible pulpitis is significantly lower than that of root canal treatment. Previous researches have demonstrated that proinflammatory cytokines, especially IL-6 and IL-8, were up-regulated in pulpal inflammation and the level of IL-6 was significantly higher in peri-apical lesion compared to uninflamed peri-apical tissue. Proinflammatory cytokines, including IL-6 and IL-8, have been demonstrated to regulate miR-17, 21, 146a and 200c, while these miRs might be able to regulate proinflammatory cytokines as well. Although pathogenesis of pulp inflammation has been studied for a long time, gene regulation of the inflamed pulp is still limited. Thus, understanding the role of miRs in both the inflammatory process as well as its response to bacteria is essential in the development of a new therapeutic approach for a better control of pulpal inflammation.

**Objectives:** To determine the association between miR-17, 21, 146a, 200c, and multiple inflammatory cytokines including IL-6 and IL-8 in dental pulp stem cells (DPSCs) under a lipopolysaccharide (LPS) challenge.

**Methods:** Primary human DPSCs seeded at 6-well plates were treated with different concentrations of LPS from *P. gingivalis* (1 and 5  $\mu$ g/mL) up to 24 hours. The real-time PCR was performed to quantitate the transcripts of IL-6, 8, and miR-17, 21, 146a, and 200c.

**Results:** LPS induced up-regulation of IL-6 and IL-8 in human DPSCs was observed after 6 and 24 hours. Also, the transcripts of miR-17, 21, and 146a were up-regulated. However, the level of miR-200c was down-regulated.

**Conclusions:** miRs may serve as biological markers to quantitate the progress of pulp inflammation. The regulation of specific miRs could be used to develop a novel therapeutic approach for irreversible pulpitis.

## 10. Preliminary Assessment of Dental Pain-Related Behaviors in Nonverbal Elderly Patients With Dementia



<sup>1</sup>University of Iowa, Iowa City, IA

Nathan T. Goodson-Gregg<sup>1</sup>, X. Chen<sup>1</sup>

**Objectives/Rationale:** We sought to understand behavior patterns in non-verbal dementia patients with and without dental pain. The number of people experiencing age-related

cognitive decline is increasing. These people are expected to keep their natural teeth longer and are at an increased risk of experiencing dental pain. Currently, several tools exist to assess pain in dementia patients but none are dental pain-specific. We aimed to gather signs of pain from existing studies of nonverbal dementia patients to subsequently develop a screening tool for dental pain in nonverbal nursing home residents.

**Methods:** We searched PubMed with the MeSH terms "dementia" and "pain measurement" and identified 254 papers. Of these, we selected 100 papers and determined tools that indicate pain in non-verbal patients. We assessed the 80 most suitable papers for our study based on patient population characteristics and compiled the most frequent indicators utilized in these tools. This is a modification of categories in the Pain Assessment Checklist for Seniors with Limited Ability (PACSLAC) that we found appropriate.

**Results:** We found that the Pain Assessment in Advanced Dementia Scale (PAINAD) and PACSLAC were the most frequently-used tools in studies examined and that the VAS, MMSE, and Doloplus-2 were used less than the PAINAD and PACSLAC. There was a wide range of variability in social changes observed in the tools. Common indicators of pain can be classified into four categories: facial expressions (e.g. grimacing, frowning, and sad expressions); social interactions (e.g. negative speech quality, decreased speech, and verbal aggressions); body language (e.g. guarding or rigid body) and general indicators (e.g. restlessness).

**Conclusion:** This study reveals that existing pain assessment tools are not specific to dental pain. The information gathered provides a foundation for our future study which aims to develop a tool to assess dentally-related pain for non-verbal persons with dementia.

Supported by: Dental Student Research Program, Iowa Dental Research Grant

## 11. 12-Month Success of Cracked Teeth Treated With Orthograde Root Canal Treatment



#### K.V. Krell<sup>1</sup>, **Daniel J. Caplan**<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Introduction:** Long term studies examining treatment outcomes of "cracked teeth" having orthograde root canal treatment in the United States do not exist. The purpose of the present

study was to examine the distribution and one-year treatment outcomes of cracked teeth receiving orthograde root canal treatment in one private endodontic practice over a 25-year period.

**Methods:** A total of 3038 cracked teeth were initially examined, and data from 2086 unique patients were analyzed. Pulpal and periapical diagnoses, year of treatment, tooth type, restorative material and number of restored surfaces at the time of examination were recorded for all patients. Periodontal probing depths also were recorded. The patients' age and sex were added retrospectively for all patients whose data were available. A total of 380 patients with one-year recall data were analyzed. Univariate frequency distributions for all collected variables were evaluated. Bivariate and multivariable associations were analyzed between explanatory variables and success of root canal therapy.

Results: Of the 2086 cracked teeth observed among unique patients, the most common were mandibular second molars (36%), followed by mandibular first molars (27%) and maxillary first molars (18%). Among the 363 teeth eligible for multivariable regression analysis, 296 (82%) were deemed successes after one year. There were no statistically significant differences in success based on pulpal diagnosis (irreversible pulpitis, 85%; necrosis, 80%; previously treated, 74%), patients' age, sex, year of treatment, tooth type, restorative material or number of restored surfaces at the time of examination. The three factors most significant in bivariate analyses were pocket depth, distal marginal ridge crack, and periapical diagnosis, which were used to generate a prognostic index for success of orthograde root canal therapy in cracked teeth called the Iowa Staging index.

**Conclusion:** Results of this study suggest that cracked teeth provided with root canal treatment can have prognoses at higher success rates than previously reported. The Iowa Staging Index may prove to be useful in clinical treatment decision-making.

## 12. Analysis of Epidemiological Characteristics and Prediction of Early Childhood Caries in Mainland China

Xiaonan Zhang<sup>101</sup>



<sup>101</sup>Chongqing Medical University, Chongqing, China

Early childhood caries (ECC) is the most common chronic disease in young children. Its reportedprevalence varies greatly across China. This systematic

review aimed to explore the epidemiological characteristics of ECC in mainland China from 1987 to 2013. In total, 102 articles were included. The pooled national prevalence and care index (ft/dmft%) for ECC were 65.5% and 3.6%, respectively. The overall ECC prevalence declined from 77.9% during 1987–1994 to 56.4% during 2010-2013. The pooled ECC prevalence for children aged 1-6 years was 0.3%, 17.3%, 40.2%, 54.4%, 66.1%, and 70.7%, respectively. There was no significant difference in prevalence between boys (59.1%) and girls (58.9%);and the care index was also similar (8.1% versus 7.7%). Slightly higher ECC prevalence was observed in rural areas (63.5%) compared with urban areas (59.5%) (RR= 1.08, 95% CI: 1.02-1.14); but a much higher care index was reported in urban children (6.0%) than their rural counterparts (1.6%) (RR= 3.68,95% CI: 2.54-5.35). The 2006-2013 map of ECC prevalence among 5-year-olds showed wide geographic variations across China. Four adjacent provinces, including Sichuan, Chon

Since forecasting techniques have been extensively applied to analyze the occurrences, development, and future trends of diseases, such as tuberculosis, malaria, hepatitis, diabetics and influenza, a reliable predictive model for ECC prevalence is needed in China as a decision supportive tool for planning health resources. So far there is no publication devoted to the prediction of ECC, due to the lack of series data of ECC prevalence by year, specifically on the national level. In this study, we first established the autoregressive integrated moving average (ARIMA) model and grey predictive model (GM) based on the estimated national prevalence of ECC with metaanalysis from the published articles. The pooled data from 1988 to 2010 were used to establish the model, while the data from 2011 to 2013 were used to validate the models. The fitting and prediction accuracy of the two models were evaluated by mean absolute error (MAE) and mean absolute percentage error (MAPE). Then, weforecasted the annual prevalence from 2014 to 2018, which was 55.8%, 53.5%, 54.0%, 52.9%, 51.2% by ARIMA model and 52.8%, 52.0%, 51.2%, 50.4%, 49.6% by GM. The declining trend in ECC prevalence may be attributed to the socioeconomic developments and improved public health service in China. In conclusion, both ARIMAand GM models can be well applied to forecast and analyze the trend of ECC; thefitting and testing errors generated by the ARIMA model were lower than those obtained from GM.

## 13. Promotion of Osseointegration Using Protamine/Alginate/BMP2 Biofunctionalized Composite Coating on Nanopolymorphic Titanium Surfaces



<u>Dize Li</u><sup>101</sup>, T. Chen<sup>101</sup>, C. Wang<sup>101</sup>, *P. Ji*<sup>101</sup>

<sup>101</sup>Chongqing Medical University, Chongqing, China

**Objectives:** A bioactive paradigm is required to promote osseointegration of implant materials. The aim of the study

is to create a protamine/alginate/bone morphogenic protein 2 (BMP2) biofunctionalized composite coating on nanopolymorphic titanium (Ti) surfaces in order to promote theosseointegration of Ti implants.

**Methods:** Alkali and heat (AH) treatment is used on Ti implants (TiAH), then protamine/alginate/ protamine (TiAH-Pro/Alg/Pro) coating and exogenous BMP2 were adsorped on the TiAH surface to create biofunctionalized surfaces (TiAH-Pro/Alg/Pro-BMP2). The cell adhesion, viability, and alkaline phosphatase activity (ALP) *in vitro* were investigated in comparison with the pristine Ti as the control sample. In addition, a rat femur model with bilateral placement of Ti implants was employed to analyze the bones' responses to these different surfaces *in vivo*.

**Results:** The initial burst release of the adsorbed protein was effectively dampened by the TiAH-Pro/ Alg/Pro coating, allowing an even protein distribution and sustainedbiomolecule release. In comparison with the pristine Ti, the three modified substratesshowed good cytocompatibility and promoted cell adhesion in the initial period. And the adherent cells on the TiAH-Pro/Alg/Pro surface and TiAH-Pro/Alg/Pro-BMP2 substrate exhibited distinct shapes compared to cells on the pristine Ti and TiAH surfaces. Moreover, it was TiAH-Pro/Alg/Pro-BMP2 that significantly improved the *in vitro* osteogenic differentiation of MC3T3-E1 and led to enhanced osseointegration in the *in vivo* rat model. Such facilitative effects may be achieved by activating integrin andBMP/Smad signaling pathway.

**Conclusions:** This study highlights the potential of combining the inorganic with organic surface modifications for accelerating the osseointegration of implant applications.

## 14. Incorporation of MicroRNA-200c and Collagen Into 3D Printed Tricalcium Phosphate Scaffolds to Promote Bone Formation



Matthew T. Remy<sup>1</sup>, A. Akkouch<sup>1</sup>, L. He<sup>1</sup>, X. Song<sup>1</sup>, B.A. Amendt<sup>1</sup>, *L. Hong*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Introduction:** Tissue engineering approaches to treating bone defects

involve the incorporation of biological and cellular components with the supporting matrices of biocompatible materials to promote new bone formation. Tricalcium phosphate (TCP) is a ceramic material that can serve as a bone substitute due to its chemical similarity to native bone tissue, biocompatibility, and osteoconductive properties. These scaffolds can be fabricated utilizing 3D printing processes and subsequently seeded with cells, collagen fibers, and microRNAs (miRs) to investigate bone regeneration.

**Objectives:** The goal of this study is to observe how the incorporation of collagen and miR-200c into 3D printed TCP scaffolds can benefit the osteogenic differentiation process and contribute to new bone formation in rats with critical-sized calvarial defects.

Methods: Suspension-Enclosing Projection-Stereolithography (SEPS), which involves the use of a high-yield-stress slurry that is UV cured layer-by-layer, was utilized to generate disc-shaped  $\beta$ -TCP scaffolds. Five conditions were created for this experiment: TCP alone, TCP-Collagen, TCP-Collagen-Empty Vector (EV), TCP-200c, and TCP-Collagen-200c. These conditions were used to determine the relationship between collagen and miR-200c and their ability to promote new bone formation. Collagen and miR-200c were loaded onto scaffolds at concentrations of 3 mg/mL and 10  $\mu$ g/mL, respectfully. The scaffolds were implemented into critical-sized calvarial defect sites in male Sprague Dawley rats. The implants were embedded for four weeks, and then retrieved for histological examination and micro-CT evaluation of new bone formation.

**Results:** Micro-CT evaluation between the  $\beta$ -TCP scaffolds showed that the incorporation of collagen and miR-200c together produced larger amounts of new bone formation compared to  $\beta$ -TCP alone.

**Conclusions:** Through use of 3D printing technology, we were able to produce a biocompatible, osteoconductive scaffolding material that can promote new bone formation when incorporated with collagen fibers and microRNA.

Supported by: NIH/NIDCR 1R01DE026433-01A1; 1R21DE025328; R21 DE024799

## 15. Iroquois Homeobox 1 in the Development of Dental Supporting Structures



**Miguel Romero-Bustillos**<sup>1</sup>, W. Yu<sup>1</sup>, S.L. Eliason<sup>1</sup>, H. Cao<sup>1</sup>, *G. Avila Ortiz*<sup>1</sup>, *B.A. Amendt*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The objective of this study is to characterize the expression of

*Iroquois homeobox 1 (Irx1)* in dental gingiva of two different species, mouse and human. In addition, to evaluate the role of *Irx1* in root and dental supporting structures during development.

**Methods:** Gingival samples from genetically modified mice with a *lacZ* reporter replacing the coding sequence of *lrx1* and healthy human gingival samples were collected to perform immunostaining against lrx1 and E-Cadherin. In addition, the pattern of expression during root development of *lrx1* was studied in mice. The expression of *lrx1* and *Pituitary homeobox 2 (Pitx2)* in cementoblast cell line (OCCM30) was quantified by real-time PCR. Stable *lrx1* knockdown by a short hairpin RNA was performed in the OCCM30 cell line and changes in gene expression were analysed.

**Results:** Iroquois homeobox 1 protein has been found in a collar disposition in the gingiva around dental tissues in mice and humans. Irx1 positive cells are observed in a cluster disposition embedded in the connective tissue at parallel/apical position to the junctional epithelium. In these cell clusters, the immunofluorescence staining against Irx1 is limited to the cell nucleus. Irx1 positive cells show low expression of E-Cad. Irx1 is expressed in Hertwig's Epithelial root sheath and OCCM30. The mRNA knockdown of *Irx1* in OCCM30 regulate genes involved in cementum formation producing a decrease in mineralization *in vivo*. Irx1 plays a role in mineralization and cell differentiation and the expression is regulated by Pitx2.

**Conclusion:** A new cell population has been identified in the dental connective tissue attachment. These cells are identified in clusters, show high expression of Irx1 and low expression of E-Cad. These findings are observed in mice and humans. Irx1 seems to play a role in the development of dental supporting tissues.

Supported by: NIH R90 training grant 5R90DE024296-05

## 16. New in vivo MicroRNA Biotechnology Reveals Specific Roles for the *miR-200* Family in Craniofacial Development



<u>Mason E. Sweat</u><sup>1</sup>, W. Yu<sup>1</sup>, S.L. Eliason<sup>1</sup>, Y.Y. Sweat<sup>1</sup>, H. Cao<sup>1</sup>, L. Hong<sup>1</sup>, *B.A. Amendt*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

The molecular regulators of stem cell differentiation is a hot topic and the

proteins involved in this process have been well studied, but the function of microRNA (miR) remains elusive.

**Objectives:** To investigate the role of the *miR-200* family in the regulation of craniofacial development and dental epithelial stem cells (DESCs). Previously, we found that the *miR-200* family was highly expressed in the differentiated cell types of the lower incisor but was absent from the stem cell niche, suggesting it may contribute towards differentiation.

**Methods:** We constructed a plasmid-based miR inhibitor system (PMIS) and used it to inhibit the *miR-200* family in mice. One inhibitor line specifically targets the seed sequence specific for *miR-200a*, and *-141*, while the other is specific for the seed sequence found in *miR-200b*,*-200c* and *-429*, and crossing the lines allows the functional inhibition of the entire *miR-200* family.

**Results:** Double inhibitor mice are neonatal lethal and have poorly differentiated lower incisors. The teeth are smaller and they lack cells expressing cell differentiation markers (DSP and amelogenin) of mature odontoblasts and ameloblasts. Several transcription factor regulators of stemness which are direct targets of the *miR-200* family, including *Sox2*, are ectopically expressed in normally differentiated cells. A proliferation cell labeling BrdU assay demonstrated that the majority of dental epithelial cells are proliferating in double inhibitor mouse incisors.

**Conclusions:** This study is among the first to use targeted inhibition to study specific miRs and we found that the *miR-200* family is required for the appropriate differentiation of DESCs and the family functions by reducing the expression of transcription factors promoting stemness outside of the stem cell niche compartment of the lower incisor. Overall, craniofacial development is affected due to a lack of cell differentiation.

## 17. A Population-Based Study of Gene-Alcohol Interactions and Orofacial Cleft Risk



Aline L. Petrin<sup>1</sup>, W. Lyu<sup>1</sup>, L. Deroo<sup>108</sup>, P.A. Romitti<sup>1</sup>, M.M. Jenkins<sup>109</sup>, R.G. Munger<sup>111</sup>, J.C. Murray<sup>1</sup>, A.J. Wilcox<sup>112</sup>, G.L. Wehby<sup>1</sup>, *L.M. Moreno Uribe*<sup>1</sup>, N. National Birth Defects Prevention Study<sup>109</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>108</sup>University of Bergen, Bergen, Norway; <sup>109</sup>National Center on Birth Defects and Developmental Disabilities, Atlanta, GA; <sup>111</sup>Utah State University, Logan, UT; <sup>112</sup>National Institute of Environmental Health Sciences/National Institutes of Health, Durham, NC

Prior studies have shown conflicting results for maternal prenatal alcohol consumption and the risk for orofacial clefts (OFCs), possibly hiding significant heterogeneity in risk by maternal and fetal alcohol metabolism genes. We examined interaction effects on isolated OFC risk between first-trimester maternal alcohol use (any alcohol and average drinks/sitting) and 7 alcohol metabolism genes/loci (ADH1B/ADH1C, ADH1C, ALDH1A1, CTBP2, MLLT3, OPRL1, SMC2) in both mothers and children. We combined individuallevel data from 5 population-based studies-lowa Case-Control Study, National Birth Defects Prevention Study, Norway Facial Clefts Study, Norwegian Mother and Child Cohort, and Utah Child and Family Health Study-to create the largest population-based casecontrol sample to date, consisting of 1,330 (1,743) case children (mothers) and 2,549 (3,417) control children (mothers). We evaluated interactions between each alcohol consumption measure and gene/locus using multivariable logistic regression, including fixed effects for study site, maternal age and education at delivery, pre-pregnancy body mass index, and firsttrimester smoking and folic acid/multivitamin use.

We observed significant interaction effects between any maternal first-trimester alcohol consumption and maternal ADH1B/ADH1C (p<0.05) and ALDH1A1 (p<0.01) genotypes. Cleft lip only (CLO) risk doubled for mothers homozygous for the minor allele of ADH1B/ADH1C rs1789891 (adjusted odds ratio (aOR)=2.36, 95% confidence interval (CI)=1.16-4.81), while cleft palate only (CPO) risk increased (aOR=1.54, 95% CI=1.06-2.23) for mothers homozygous for the major allele of ALDH1A1 rs2303317. Similar interactions were observed when mothers reported <5 drinks per sitting. CLO risk was significantly higher when mothers reported repeated =5 drinks per sitting with the minor allele of maternal MLLT3 rs4621895 (aOR=3.86, 95% CI=1.65-9.12) and fetal OPRL1 rs6010718 (aOR=24.05, 95% CI=1.95-298.87); CPO risk also increased with the same fetal variant (aOR=11.47, 95% CI=1.16-112.17). These findings suggest meaningful heterogeneity in the risk of OFC subtypes associated with maternal alcohol consumption by variants in certain alcohol metabolism genes.

Supported by: NIH/NIDCR R01 DE020895, NIEHS Intramural Research Program, CDC cooperative agreements U01DD000492 and U01DD001035 from the Centers for Disease Control and Prevention, Bergen Research Foundation, Norwegian Research Council through Biobank Norway

# 18. Craniofacial Phenotypic Variation in *Twist1* Mutant Mice



Clarissa Souza Gomes Da Fontoura<sup>1</sup>, B.A. Amendt<sup>1</sup>, N.E. Holton<sup>1</sup>, S.L. Eliason<sup>1</sup>, *L.M. Moreno Uribe*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Twist Homolog Drosophila 1 (TWIST1) is a key regulator necessary for craniofacial development. Previous studies in mice indicated that loss of *twist1* causes craniosynostosis and mandibular hypoplasia. In humans, we found that mutations in TWIST1 lead to craniofacial and mandibular phenotypic variations. Due on this phenotypic overlap, we utilized Twist1-flox, Mesp1-Cre mice to delete Twist1 in the anterior mesoderm to dissect commonality between human and mice phenotypes. Microcomputed tomography scans were used to analyze and compare craniofacial morphology between *Twist1* (*Twist1*<sup>flox/+</sup>; *Mesp1*<sup>Cre</sup>) mice and Twist1 (Twist1<sup>flox/+</sup>: Mesp1<sup>Cre/-</sup>) controls at 7.14 and 21 days of age. As observed in our human data. results show that while there is extensive variation in craniofacial phenotypes of the mutant mice, the outcomes have a consistent pattern of craniofacial dysmorphology. At day seven, Twist1<sup>flox/+</sup>; Mesp1<sup>Cre</sup> mice present with normal growth compared to Twist1 wild type mice. Though, as the mice continue to grow, we observe phenotypic variations in the mandible along with shortened anterior-posterior axis of the calvarium giving a slight brachycephalic morphology. Finally, when the mice reach the third week some mutant mice exhibited a major rotation of the snout (facial asymmetry) coherent with unilateral coronal synostosis associated phenotypes. The variability of the outcomes suggests that these alterations observed are due to Twist1 haploinsufficiency during craniofacial development and that variants in TWIST1 have different contributions in human craniofacial anomalies.

Supported by: NIH/NIDCR 5T90DE023520-05, AAOF OFDFA\_2008-2011, National Center for Advancing Translational Sciences, NIH UL1 TR000442-06, T32-DE014678-09
19. Accuracy of Panoramic Radiographs in the Diagnosis of Osseous Changes in the Temporoandibular Joints Using CBCT As Gold-Standard



Katherine R. Sislow<sup>1</sup>, S.L. Sousa Melo<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

As there are a variety of causes of Temporomandibular joint (TMJ) pain, the first course of action is often a radiograph to determine if there is an

osseous source. Panoramic radiographs cause marked distortion of the TMJ, yet, for cost and availability reasons, are often the first prescribed. Cone beam computed tomographic (CBCT) has been found to have a high level of accuracy with low radiation exposure. Prior studies have proven inconsistencies in diagnosis comparing the two methods, but none have looked at level of education of the clinician as a variable. Our aim was to confirm the accuracy of panoramic radiographs in the diagnoses of osseous TMJ changes using CBCT as gold standard, and discover any discrepancies with varying levels of dental education. The null-hypothesis was that there is no difference between CBCT and panoramic radiography accuracy nor difference in interpretation given the level of dental education. Six calibrated observers (four radiology residents, and two faculty) examined radiographs of a convenience sample of 100 subjects which had a panoramic radiograph and CBCT taken within one year. The observers then categorized the TMJ morphology (flat, convex, angled, or round) as well as radiograph findings accepted by the Research Diagnostic Criteria for Temporomandibular Disorders (flattening, resorption, osteophytes, subchondral cysts, and sclerosis). The data are being analyzed to examine sensitivity, specificity and accuracy of diagnosis. We expect to reject both null hypotheses. The accuracy of panoramic radiographs is expected to be considered moderate, and closely related to the level of education of the observer. Future projects may include comparing dental students and different specialists or length of time in practice, and surveys of current dentists (in private practice or universities) in their usage of radiographs when diagnosing TMJ disorders.

Supported by: Dental Student Research Program

#### 20. Mechanoresponsive Properties and Physiochemical Regulation of Periodontal Ligament Homeostasis



Lan Huang<sup>101</sup>, Y. Wu<sup>104</sup>, J.A. Helms<sup>104</sup>

<sup>101</sup>Chongqing Medical University, Chongqing, China; <sup>104</sup>Stanford Univeristy, Stanford, CA

**Objectives:** To characterize the response of the periodontal ligament to a variety of physiologically relevant, yet

distinctly different mechanical environments.

Methods: The periodontal ligament was examined under 1) conditions associated with the eruption of the primary dentition using animals from post-natal days 7, 14, and 21; 2) conditions associated with the adult dentition under normal masticatory load; 3) conditions associated with reduced masticatory loading achieved by feeding the animal either a soft diet or a liquid diet; and 4) conditions associated with experimental tooth movement. Tissues were evaluated using histology coupled with histomorphometry, immunohistochemistry, and scanning electron microscopy. Additionally, finite element (FE) modeling was performed using COMSOL Multiphysics to identify and characterize the distribution of tensile and compressive forces within the mechanically loaded periodontal ligament.

**Results:** These analyses revealed first that the adult molar periodontal ligament is inherently osteogenic and mitotically quiescent. Specifically in an unperturbed, uninjured state, using BrdU incorporation and IHC for cell proliferation markers, the adult molar periodontal ligament shows very little evidence of cell proliferation. Second, changes in masticatory load altered mitotic activity and collagen production in the molar periodontal ligament. For example, at early post-natal time points the periodontal ligament was comprised of a very immature collagen network but as eruption ensued the fibrillar collagen became more organized. To test the potential relationship between functional loading and cell proliferation in the PDL, masticatory forces were altered by changing the animals' diet. These data further demonstrated that reduced mechanical loading of the periodontal ligament altered the density and organization of the collagen fibers. Orthodontic forces were then applied to the first molar crown. FE modeling showed the distribution of tensile and compressive forces and histologic/ histomorphometric analyses demonstrated that collagen fiber density and cell density were increased in response to experimental tooth movement.

**Conclusions:** According to our *in vivo* molecular and cellular analyses, the adult molar PDL is a quiescent tissue. Changes in mechanical loading acted as a stimulus to enhance mitotic activity and increase the amount and orientation of the collagen fibers

in the PDL. Both changes appeared to be adaptive responses since a PDL with denser collagen fibers is capable of bearing a greater load before failing, and tissues with greater proliferation are more capable of repairing after damage. With force and tooth movement, the collagen fibers maintained the density and orientation; the cell proliferation increased actively. With force but without tooth movement, the collagen fibers could maintain the density and orientation, but the cell proliferation decreased. Without masticatory force but with tooth movement, the collagen fibers poorly developed and were immature, but the proliferation increased actively.

Without force and without tooth movement, the collagen fibers poorly developed and were immature, and the cell proliferation decreased markably.

More briefly, force or force changes could make the collagen fibers develop to mature condition and maintain its density and orientation.Tooth movement could promote the cell proliferation and mitotic activity in PDL.

#### 21. Quantitative Proteomics Analysis Reveals the Molecular Difference Between Human Dental Follicle Stem Cells and Periodontal Ligament Stem Cells



Jie Li<sup>101</sup>, D. Chen<sup>101</sup>

<sup>101</sup>Chongqing Medical University, Chongqing, China

**Objectives:** Several types of stem cells have been characterized in tooth, which includes dental pulp stem cells (DPSCs), stem cells from exfoliated deciduous

teeth (SHED), stem cells from apical papilla (SCAP), dental follicle stem cells (DFSCs), and periodontal ligament stem cells (PDLSCs). Stem cells in dental follicle have been reported to differentiate into cementoblasts, periodontal ligament fibroblasts and osteoblasts, these cells form cementum, periodontal ligament and alveolar bone *in vivo*, respectively. While stem cells in dental follicle are a precursor to periodontal ligament cells, the molecular changes that distinguish cultured DFSCs from PDLSCs are still unknown.

**Methods:** In this study, we have compared the immunophenotypic features and cell cycle status of the two cell lines via flow cytometry. Then an isobaric tag for relative and absolute quantitation (iTRAQ) proteomics strategy was employed to reveal the molecular differences between the two cell types. Bioinformatics analysiswereconductedaccordingly. Quantitative PCR (qPCR), western blot, and immunofluorescence staining were performed to validate the differentially expressed proteins in the two cell lines.

**Results:** The results suggest that DFSCs and PDLSCs displayed similar features related to immunophenotype and cell cycle. A total of 2,138 proteins were identified and 39 of these proteins were consistently differentially expressed between DFSCs and PDLSCs. Gene ontology analyses suggested that the protein subsets expressed higher in PDLSCs were related to actin binding, cytoskeletal protein binding, and structural constituent of muscle. Upon validation by quantitative PCR (gPCR), western blot, and immunofluorescence staining. Tropomyosin 1 (TPM1) and caldesmon 1 (CALD1) were expressed higher in PDLSCs than in DSFCs. These results suggested that PDLSCs display stronger actin cytoskeletal dynamics relative to DFSCs while DFSCs may exhibit a more robust antioxidant defense ability relative to PDLSCs.

**Conclusions:** This study expands our knowledge of the cultured DFSCs and PDLSCs proteome and provides new insights into possible mechanisms responsible for the different biological properties of the two cell lines.

#### 22. Environmental Scan of Medical-Dental Integration in Public Health Settings: Targeting Cardiovascular Disease



**<u>Susan C. McKernan</u><sup>1</sup>**, J.C. Reynolds<sup>1</sup>, R.A. Kuthy<sup>1</sup>, L. Tuggle<sup>1</sup>, D. Garcia<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** A U.S. based environmental scan was conducted to close gaps in knowledge regarding public health approaches to foster medical-dental

integration. This presentation will describe study findings related to public health activities targeting cardiovascular disease within the dental setting.

**Methods:** The scan included primary data collection via literature review (peer-reviewed research, state oral health plans, grey literature), stakeholder surveys (state oral health programs, chronic disease programs, community oral health programs), and key informant interviews.

**Results:** Literature review identified 13 interventions in dental settings targeting cardiovascular disease: 10 healthcare system interventions, 2 environmental approaches, and 1 community-clinical linkage. The most common intervention components were provision of information (n=10) and clinical activities (n=8), focused on blood pressure screenings and referrals. Among community oral health program survey respondents (n=30), a majority reported that they implement active referrals of high risk patients to primary care, via medical consults, warm hand-offs, and scheduling assistance.

**Conclusions:** Comprehensive integration interventions typically include formal patient management protocols, standardized training of

dental providers, active referrals, and use of EHR to facilitate and track outcomes. Results of this scan will be available for stakeholders to inform development of future initiatives.

Supported by: CDC Special Interest Project Grant 3U48DP005017. NIH CTSA U54TR001356 supported use of REDCap (Research Electronic Data Capture) to collect and manage data.

#### 23. Six2 Regulates Palatogenesis by Promoting Cell Proliferation during Development



Yan Y. Sweat<sup>1</sup>, M.E. Sweat<sup>1</sup>, M. Mansaray<sup>1</sup>, I. Saadi<sup>52</sup>, A. Butali<sup>1</sup>, *B.A. Amendt*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>52</sup>University of Missouri, Kansas City, MO

Cleft lip with or without cleft palate (CL/P) is the most common congenital craniofacial defect, with a frequency of 1 in 500 to 1 in 2500 live births depending on the population, and lifelong care can cost more than \$100,000. In mice, secondary palate development occurs from E11.5 to E17.5, and consists of outgrowth, elevation, extension and fusion processes. At any stage during palatogenesis, the disruption of these processes could cause cleft palate, and these processes are all regulated in part by palatal mesenchyme.

**Objective:** To examine *Six2*, a transcription factor previously shown to play a role in craniofacial and kidney development, for a role in clefting predicted by the SYSFACE tool.

**Methods:** *Six2* knockout mice were generated and examined for clefting and craniofacial developmental defects at different embryonic stages and PO.

**Results:** We demonstrate that *Six2* contributes to palatogenesis because the ablation of *Six2* results in oral clefting. We have characterized the clefting phenotype in *Six2-/-* embryos, demonstrating that the palate shelves fail to extend to the midline and contain increased ossified tissue compared to wild-type (WT) littermates at E16.5. BrdU staining shows there is a decrease in cell proliferation occurring on palate shelves in *Six2-/-* embryos.

**Conclusions:** Six2 is a regulator of palate development by regulating cell proliferation and it also negatively regulates the ossification of palatal mesenchyme. In Six2-/- mice, less cell proliferation and ectopic ossification prevents the extension of the palate shelves causing cleft.

## 24. The Effects of 3D-Bioprinting Materials on HEPM Cell Cytokine Release



**Robert D. Swenson**<sup>1</sup>, A.M. Bates<sup>1</sup>, E.A. Lanzel<sup>1</sup>, A. Akkouch<sup>1</sup>, L. Hong<sup>1</sup>, *K.A. Brogden*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** 3D-bioprinting is an additive manufacturing process that incorporates viable cells into a three-dimensional

matrix. The objectives of this study are to characterize a novel matrix of collagen and hydroxyapatite and to assess the effects of the 3D-bioprinting process on cytotoxicity, proliferation rate, and cytokine expression of HEPM (Homo sapiens palatal mesenchyme) cells.

**Methods:** We prepared a three-dimensional matrix of collagen and hydroxyapatite without and with cells. We used SEM and histology to characterize the structure and arrangement of the collagen fibers. We then incubated the matrix with known standards of cytokines to measure absorption. Finally, we assessed the cytotoxicity of this matrix for HEPM cells and assessed its effect on the production of chemokines and cytokines. A one-way fixed effect ANOVA was fit to concentrations of cytokines and pairwise group comparisons were conducted using Tukey's Honest Significant Differences test (p<0.05).

**Results:** The matrix was found to contain strands of collagen and some hydroxyapatite crystals that did not absorb cytokines except for CCL3 (p< 0.05). The matrix was found to be non-cytotoxic using an AlamarBlue<sup>®</sup> assay. In the presence of the hydrogel the HEPM cells had similar expression profiles of the cytokines measured (P > 0.05 for GMCSF, IL-6, IL-8, and RANTES).

**Conclusions:** 3D-bioprinting has the potential to be used in dentistry as a novel osteogenic bone grafting material. Here we show that a novel matrix of collagen and hydroxyapatite is non-cytotoxic to HEPM cells and does not induce a proinflammatory response. Supported by: NIH/NIDCR T90 DE023520

#### 25. The Esthetic Outcome and the Infiltration Capacity of Three Resin Composite Sealers Compared to ICON (DMG, America)



<u>Tamer G. Theodory</u><sup>1</sup>, *J.L. Kolker*<sup>1</sup>, M.A. Vargas<sup>1</sup>, R.R. Maia<sup>1</sup>, D.V. Dawson<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** The aim of these studies, including a randomized control in

vitro study and a survey study was to answer the following question: in treating initial caries lesions,

is the esthetic outcome and the infiltration capacity of commercial resin composite sealers similar to that of the gold standard ICON (DMG, America) resin infiltrant.

Methods: A sample of 85 extracted human permanent molars were painted with an acid resistant nail varnish (Revlon, USA) to protect the tooth surface from demineralization leaving only two panels of 1x7 mm of exposed enamel on the buccal and the lingual surfaces of each tooth to be demineralized. Samples were immersed in an acidic gel (500g of Fisher G-8 Gelatin, 275 Bloom, 0.1% thymol, lactic acid, pH 4.20) for 3 months to create artificial initial caries lesions. Seventy-five specimens were randomly assigned to 5 groups: I: ICON (DMG, America), B: BisCover™LV (Bisco Dental), O: Optiguard (Kerr), P: PermaSeal (Ultradent) and C: control group. Only 60 of the 75 specimens were hemi sectioned yielding two halves, each with a panel of 1x7 mm of initial caries lesion. One side was used to assess the esthetic following the application of ICON, BisCover™LV, Optiguard and PermaSeal according to ICON manufacturer instructions. The control group (C) did not receive any treatment and was only included in the esthetic part of this study. Preoperative and postoperative photographs were taken. Two sets of photographs were taken for the control group. The preoperative, postoperative and control group photographs were installed in a PowerPoint presentation and placed side by side on a black background. A total of 17 operative faculties and residents at the department of operative dentistry at the University Of Iowa (UI) participated in the survey. The esthetic improvement was assessed based on a 100-mm visual analogue scale (VAS). A value between 0 and 20 indicated slight esthetic improvement. A value between 20 and 40 indicated mild esthetic improvement. A value between 40 and 60 indicated moderate esthetic improvement. A value between 60 and 80 indicated high esthetic improvement. A value between 80 and 100 indicated outstanding esthetic improvement. A value of 100 indicated full esthetic recovery. Each subject was asked to look at the preoperative and postoperative photographs of a specimen in each slide and place a line on the respective VAS according to her/his opinion of esthetic improvement. The survey was conducted twice in two different sessions to evaluate the inter-rater and intra-rater reliability. For lesions on the opposite side , the resins: ICON, BisCover™LV. Optiguard and PermaSeal were applied according to the indirect fluorescence technique protocol using the red fluorophore rhodamine B isothiocyanate (RITC 0.1%; Sigma Aldrich, Steinheim, Germany) and the green sodium fluorescein (NaFl; Sigma Aldrich). Specimens were sectioned in a mesio-distal direction yielding thin sections of 200 µm and were visualized under the Confocal Laser Scanning Microscope (CLSM, Leica TCS NT; Leica, Heidelberg, Germany, 10X objective, dual fluorescence mode) to assess the maximum infiltration depth percentage (ID<sup>Max</sup>%) and the infiltration area percentage (IA%) following the application of the different resins. Inter-and intra-rater reliability was assessed using intraclass correlation coefficients. Paired t-test was used to assess whether there was a systematic difference between the two days on which ratings were taken. All pairwise comparisons of the five treatments were made using an overall significance level of 0.05. The Tukey approach was used to adjust for the performance of the 10 pairwise comparisons among the five treatments. The comparison between treatments was made using the one-way ANOVA.

**Results/Conclusion:** To be determined later on.

### 26. Periodontal Treatment Needs in a Medicaid Expansion Population



Jennifer M. Sukalski<sup>1</sup>, S.C. McKernan<sup>1</sup>, G. Avila Ortiz<sup>1</sup>, M. Cunningham-Ford<sup>1</sup>, P.C. Damiano<sup>1</sup>, F. Qian<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Investigate and determine periodontal treatment needs with use of the Community Periodontal Index of Treatment Needs (CPITN) of a Medicaid expansion population in Iowa (DWP) in comparison with patients insured by the traditional Medicaid State Plan, patients with private dental insurance, and self-pay patients, while evaluating systemic health conditions and sociobehavioral factors.

**Methods:** A retrospective analysis of electronic health records (EHRs) of new patients at the UI COD between 2014-2016 was performed. The primary outcome of interest was CPITN score indicating need for scaling and root planing (SRP). Logistic regression models analyzed associations between selected predictors and treatment need by source of financing.

**Results:** EHR data for 1876 patients were reviewed. SRP was indicated for 59% of DWP members. After controlling for systemic health and socio-behavioral factors, there was no significant difference in periodontal treatment need based on source of financing. Significant predictors of need for SRP in the full model included: age, gender, diabetes, smoking status, and not receiving regular dental exams.

**Discussion:** Associations between periodontitis and predictors are consistent with previous studies. Interestingly, source of financing was not significantly associated with treatment needs. However, high need for SRP among all payment sources was noted.

**Conclusions:** Previous studies found that DWP members had lower oral health than Medicaid adults. DWP's earned benefits structure delays periodontal treatment, potentially leading to deteriorating periodontal health for nearly 60% of the population. Further assessment of periodontal burden at different stages of treatment within DWP should be conducted for a potential program modification.

#### 27. *MicroRNA-26b-5p* and *Lef-1* Act Through Wnt in the Developing Tooth



**Steven L. Eliason**<sup>1</sup>, M. Romero-Bustillos<sup>1</sup>, N.E. Holton<sup>1</sup>, M.E. Sweat<sup>1</sup>, *B.A. Amendt*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

To help characterize the role of Lef1 in craniofacial and tooth development, we used a conditional overexpression *Lef1* allele and

this mouse was crossed to the oral epithelial-specific *Pitx2-cre* mouse to study overexpression (OE) of *Lef1* in the oral epithelium. To study the role of a *microRNA-26b-5p* (*miR-26b*), of which Lef1 is a known target, in craniofacial and tooth development, a *miR-26b* OE mouse was generated.

**Objectives:** To understand the role of *Lef1* and *miR-26b* in craniofacial and tooth development.

**Methods:** We generated an oral epithelial specific *Lef1* OE mouse by creating a Lef1 allele driven by the CAAG promoter and controlled by a stop codon flanked by loxP sites. Activation of this allele was created by crossing this mouse to our *Pitx2-cre* mouse. We also generated a *miR-26b* overexpression mouse by cloning the *miR-26b* gene in front of the *ELF1a* promoter. H&E staining, immunohistochemistry, uCT, qPCR and Array analysis were performed.

**Results:** The OE of *Lef1* causes an incisor overgrowth phenotype and showed an increase in proliferation and alterations in amelogenin expression, while *miR-26b* over expression mice have craniofacial defects including a lack of incisors, molars and hair. We show that activity of *Lef1*, a known transcriptional activator, can be inhibited by interactions with *Sox2 in vitro*. *Lef1* expression levels affect Wnt signaling and Wnt target genes and other cell proliferation mechanisms-enhanced Lef1 expression leads to enhanced Wnt signaling and OE of *miR-26b* reduced the levels of Wnt target genes. The *miR-26b* transgenic mouse can rescue the incisor overgrowth phenotype of the oral epithelial-specific overexpression of *Lef1*.

**Conclusions:** These finding clearly demonstrate that the levels of *Lef1* protein are critical during tooth development by regulating Wnt signaling pathways and further establishes a role for *miR-26b* in the regulation of tooth and craniofacial development by regulating *Lef1 in vivo*.

#### 28. Recovery of Acid Tolerant Bacteria From Dental Plaque and Saliva



<u>Erika Takanami</u><sup>1</sup>, *J.A. Banas*<sup>1</sup>, F. Qian<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The Ecological Plaque Hypothesis posits that dental caries are the result of an imbalance of strong acidogenic bacterial species. In a recent investigation of low pH streptococci the recovery of bacteria on pH 5.5 media failed to correlate with the caries state of the site from which the sample was obtained. This study sought to investigate whether pre-incubation in a low pH buffer can induce an acid tolerance response that improves the recovery of acid tolerant oral bacteria on solid media of pH 5 and pH 5.5.

**Methods:** Dental plaque and saliva samples were collected, placed into phosphate buffered saline at pH 7.0, 6.5 or 6.25 at 37°C for 30 minutes, and plated on solid media of pH 5.0, 5.5 or 7.0. Plates were incubated for 48 hours anaerobically and colony forming units (CFU) were counted. The data were analyzed using the one-way ANOVA with repeated measures.

**Results:** There were no significant differences in the CFUs of acid tolerant bacteria from dental plaque among the three different pH pre-incubation regimens when plated on media of pH 7.0 (p=0.9592), pH 5.5 (p=0.9059), or pH 5.0 (p=0.3475). Similarly, there were no significant differences in CFUs of acid tolerant bacteria from saliva among the three different pre-incubation regimens when plated on media at pH 7.0 (p=0.5160), pH 5.5 (p=0.2312), or pH 5.0 (p=0.9316).

**Conclusion:** The result of this study indicated that pre-incubation at pH 6.5 or 6.25 did not improve the recovery of acid tolerant bacteria from dental plaque or saliva.

Supported by: Dental Student Research Program

#### 29. Factors Associated With Carious Lesions Among Young WIC-Enrolled Children



Leah Barshinger<sup>1</sup>, A.I. Owais<sup>1</sup>, T. Mabry<sup>1</sup>, F. Qian<sup>1</sup>, J.J. Warren<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Early childhood caries (ECC) is a pandemic disease observed

in very young children of low-income and minority groups in the United States. National epidemiological studies indicate that ECC is increasing in poor and near-poor preschoolers. The primary goal of this study was to evaluate risk factors associated with non-cavitated and/or cavitated lesions among children aged 12-48 months enrolled at the University of Iowa's Infant Oral Health Program (IOHP) at local WIC clinic.

**Methods:** The charts of children aged 12-48 months enrolled at the UI IOHP were reviewed for a casecontrolled cross-sectional study. A convenience sample of 394 subjects comprising of 197 children with non-cavitated and/or cavitated lesions (ECC Group) and 197 caries-free (Caries-Free Group), who were matched by age (±1 month) and number of teeth (±1), was included. Statistical analysis consisted of descriptive statistics and bivariate analysis.

Results: Children (47.8% female, 75.4% non-Caucasian) had an average age of 28±10.8 months and averaged 18.0±3.6 teeth. Bivariate analysis revealed that when compared to the Caries-Free Group, ECC Group subjects were more likely to be non-Caucasian (p=0.001), have parents with language barrier (p=0.0032), have mothers with low dental health literacy (p=0.0648), be breast-fed to sleep (p=0.0302) and throughout the night (p=0.0056), as well as consume cariogenic drinks/foods at nighttime (p=0.0002) and eat sweets more than twice daily (p=0.0085). Moreover, ECC group subjects were more likely to be classified as high caries risk at their first IOHP appointment (p<0.0001), have inadequate fluoride exposure (p=0.0062), enamel defects (p=0.0032), and visible plaque on the maxillary incisors (p<0.0001).

**Conclusions:** Risk factors associated with noncavitated and/or cavitated lesions among young children from low-income families include race, parental language barrier, low maternal dental literacy, dietary habits, poor oral hygiene, inadequate fluoride exposure, enamel defects, and visible plaque on maxillary incisors. Logistic regression analysis is ongoing to identify predictor variables for caries experience.

Supported by: Delta Dental of Iowa Foundation Grant, Dental Student Research Program

#### 30. Is Required Data Obtained in the Electronic Dental Record and Does the Data Indicate Oral Health Status?



Tanner Brolsma<sup>1</sup>, K. Leary<sup>1</sup>, T. Mabry<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>, M. Tamegnon<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** The objective of this study was two-fold: (1) determine how consistently data regarding height, weight, blood pressure, and smoking

status of patients treated at University of Iowa Pediatric Dental Clinic (UIPDC) are obtained by dental students and residents and recorded in the Electronic Dental Record (EDR); (2) determine if these parameters predict caries status.

**Methods:** Data were collected from 1334 new patient EDR's from July 1, 2016 to May 31, 2017 and categorized as either resident or student clinics. Patient data included: sex, age, height, weight, blood pressure, and number of teeth with decay or fillings. BMI was calculated when both height and weight were present. Statistical analyses consisted of descriptive statistics, chi-square tests, and spearman correlation coefficient (alpha=.05).

**Results:** Residents saw 48% of the patients and 51% of patients identified as male. For patients 3 years and older, students obtained BMI data for 80% of new

patients while residents obtained this data for 2% of patients. For patients 13 years and older, students recorded smoking status and blood pressure 80% and 58% of the time, respectively, compared to residents 50% and 0% of the time, respectively. A significant difference in obtaining values for height, weight, BMI, blood pressure, and smoking status existed between residents and dental students (p<0.0001). No significant difference in dft/DFT existed for patients whose blood pressure or smoking status was recorded versus those not recorded (p=0.8675, p=0.1093). DFT/dft counts were not significantly correlated with BMI (p=0.7848) or blood pressure (p=0.8538). A statistically significant difference in ages of patients seen existed with residents seeing younger children (p<0.0001).

**Conclusions:** Dental students obtained BMI and blood pressure for identified individuals more regularly than pediatric dentistry residents. Neither groups obtained smoking status on a regular basis. The results did not show significant correlation between DFT/dft, BMI, and blood pressure in the study sample.

#### 31. Scientific Knowledge Dissemination Through Manuscript Publication: A Dental Studentís Experience



Alison R. Christensen<sup>1</sup>, A.I. Owais<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>, D.V. Dawson<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Purpose:** Discuss a dental student's experience in two pediatric dentistry research projects, the creation of a pediatric oral health information

database and its ongoing use.

**Methods:** The first project investigated the relationship between premature birth and early childhood caries risk-factors among children aged 0-3 years. Significant positive associations (p<0.5) between prematurity and bottle-feeding (OR: 0.68, 95% CI:1.03,3.76) and consumption of cariogenic beverages (OR:2.05, 95% CIL 1.10,3.85) were found.

The second project investigated deciduous tooth emergence timing between children born premature vs full-term among children aged 0-3 years. Number of teeth present was highly correlated with age (Spearman rank correlation r=0.89, p<0.0001). Logistic regression analysis revealed no significant association for premature birth, sex or race/ethnicity.

These two projects had an integrated nature due to using the same sample population of 885 children and data set. Data were managed using REDCap (Research Electronic Data Capture) electronic data capture tools hosted at The University of Iowa (UI) Institute for Clinical and Translational Science. REDCap is a secure, web-based application designed to support data capture for research studies, providing 1) an intuitive interface for validated data entry; 2) audit trails for tracking data manipulation and export procedures; 3) automated export procedures for seamless data downloads to common statistical packages; and 4) procedures for importing data from external sources. Statistical analyses were performed by the UI Biostatistics Division.

**Results:** Findings of these projects were presented at local and national AADR and AAPD meetings. Through mentorship, a dental student completed two projects, from developing research questions to submission of manuscripts for publication. The REDCap database created has been used for three other undergraduate and graduate dental students' research projects and will continue to be used for ongoing projects.

**Conclusions:** These projects will continue to benefit future researchers through the creation of the pediatric oral health database.

Supported by: Dental Student Research Program, Delta Dental of Iowa Large Mini Grant, University of Iowa Department of Pediatric Dentistry, NIH National Center for Advancing Translational Sciences U54TR001356

# 32. Discovery of a Novel Variant in *RORA* in Non-Syndromic Orofacial Clefts in African Populations



Shaan Desai<sup>1</sup>, T. Busch<sup>1</sup>, J.V. Park<sup>1</sup>, D. Anand<sup>117</sup>, C.A. Bello<sup>60</sup>, A.M. Tora-O<sup>60</sup>, C. Lo<sup>1</sup>, M. Mohamed<sup>1</sup>, S. Lachke<sup>117</sup>, *A. Butali*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>60</sup>University of Puerto Rico, San Juan, PR; <sup>117</sup>University of Delaware, Newark, DE

Orofacial clefts (OFCs) are the most common birth defects of the craniofacial region with a prevalence of approximately 1 in 700 live births. Multiple genes and environmental factors influence the risk of OFCs. Our objectives include identifying variants in the retinoid-related orphan receptor alpha gene (RORA) in non-syndromic clefts and testing variant function in silico. A recent genome-wide association metaanalysis reported a significant locus near chr15q22 for non-syndromic OFCs, and analysis using the SYSFACE bioinformatics tool identified RORA as the top candidate gene. RORA is an orphan nuclear receptor associated with many cellular activities, including cancer. Two hundred eighty-eight saliva samples, obtained as part of a larger study of OFCs, from non-syndromic OFC populations from Ghana, Ethiopia, and Nigeria were used. We designed primers for all 12 exons of RORA and amplified the DNA samples via polymerase chain reaction. Samples were sent to Functional Biosciences for Sanger sequencing. We compared sequences to reference sequences

to identify variants using UCSC BLAT (blast-like alignment tool) and Consed, a sequencing graphical editor. Any variants discovered were tested in silico with PolyPhen (Polymorphism Phenotyping) and SIFT (Sorting Intolerant From Tolerant) to determine their predicted degree of damage. A novel missense mutation was discovered in exon 1 of a Ghanaian. A guanine nucleotide was substituted for thymine. The affected individual is heterozygous at this locus: chr15:60,627,364. The affected codon changed from GGG to GTG. The resulting amino acid mutation was p.Gly4Val. The bioinformatics tool PolyPhen predicted the variant to be benign, whereas SIFT predicted it to be damaging. We discovered a novel variant in one individual with non-syndromic cleft lip and palate. The variant is larger and more hydrophilic than the wild-type residue glycine, the most flexible amino acid. This flexibility may be necessary for the protein's function; the mutation to valine may inhibit this function. This variant segregated in the family and was found in an unaffected sibling. Additional research to determine the functional role of this variant is required. Ultimately, we also hope to contribute to a more thorough understanding of the diverse etiology of OFCs.

Supported by: Dental Student Research Program

#### 33. Outcomes of Management of Acute Traumatic Dental Injuries in Children



Peter D. Douglas<sup>1</sup>, A.I. Owais<sup>1</sup>, D.R. Blanchette<sup>1</sup>, M. Penticoff<sup>1</sup>, D.V. Dawson<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** To assess the outcomes of treated acute traumatic dental injuries

to young permanent teeth (TDI) within the College of Dentistry (COD) Pediatric Dentistry Clinics.

**Methods:** The records of 193 children presenting to the Pediatric Dentistry Department for TDI management were reviewed (2008-2015). The analysis data set (193 subjects) composed of independent observations (193 teeth) was established by randomly selecting one tooth per subject. **Statistical methods:** The descriptive analyses were conducted, focusing on children's sex, age, trauma history, clinical/radiographic examination, and treatment. A specific analysis was performed in relation to the pulp status at the last follow up visits and the related factors to the pulp prognosis. The Fisher's exact tests were employed to assess possible associations for categorical variables ( $\alpha$ =0.05).

**Results:** Average child age was 10.8±2.8 years and 120 (62.2%) of the 193 were boys. The most common age for injury was 9-11 years. One hundred and fifty-five children (80.3%) presented for follow-up visits. The outcome of the management of the TDI was recorded as survival and necrosis of the pulp tissue.

Pulp status was categorized as pulp survival and necrosis. Pulp survival was reported in 144 (92.9%) teeth and pulp necrosis was documented in 11 (7.1%) cases. There was a statistically significant association between pulp status and type of injury (p=0.0083). The outcome of enamel-dentin fractures was survival in Seventy-five (98.68%) cases. Whereas, luxation and avulsion injuries resulted in survival in 15 (75%) and 13 (86.67%) of the cases.

#### **Conclusions:**

- The most common age for dental trauma was between 9-11 years.
- The most common type of injury was enamel-dentin fracture
- The most common causes of injury were sport injuries and collisions.
- Overall, pulp necrosis was mostly associated with time elapsed between injury and 1st dental visit, as well as type of injury.

Supported by: Iowa Institute for Oral Health Research, Dental Student Research Program, University of Iowa Department of Pediatric Dentistry

# 34. Outcomes Associated with Periapical Abscess in Those Undergoing Heart-Valve Replacements



<u>Nile Eckermann</u><sup>1</sup>, V. Allareddy<sup>1</sup>, R. Nalliah<sup>49</sup>, S. Chandrashekaran<sup>40</sup>, S. Rampa<sup>54</sup>, *Vs. Allareddy*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>49</sup>University of Michigan, Ann Arbor, MI; <sup>54</sup>University of Nebraska, Lincoln, NE; <sup>40</sup>University of Colorado, Denver, CO

**Objective:** The objective of this study is to quantify the impact of having periapical abscess on hospital length of stay in a cohort of patients undergoing heart valve replacement surgeries in the USA. This study tests the hypothesis that presence of an active periapical abscess lesion is associated with excess hospitalization stay in those undergoing heart valve replacement surgeries.

**Methods:** The Nationwide Inpatient Sample for the year 2012 to 2014 was used. All patients aged 19 to 59 years undergoing heart valve replacements were selected. Presence of a periapical abscess at the time of hospitalization for the valve replacement surgical procedure was the primary independent variable of interest. The outcome was hospital length of stay (LOS). Since LOS was skewed, it was log transformed. The association between presence of a periapical abscess and LOS was examined by multivariable linear regression model. The effects of several confounders such as age, sex, race, insurance status, type of admission, co-morbid burden, and geographic region were adjusted in the regression model.

**Results:** During the study period, a total of 68,290 patients aged 19 to 59 years underwent heart valve replacements. Of these, 0.6% had a periapical abscess at the time of hospitalization. The mean LOS in those with a periapical abscess was 21.7 days (compared to 11.8 days in those without periapical abscess). Following adjustment for confounders, those with a periapical abscess were associated with significantly longer LOS (Regression Estimate=0.283, 32.7% excess LOS over mean, 11.9 days excess LOS over mean, p<0.0001). Those covered by Medicaid (OR=1.94, p=0.04) and Uninsured (OR=3.57, p<0.001) were associated with higher odds for having periapical abscess compared to those covered by Private Insurance.

**Conclusions:** Periapical abscess is present unfrequently in those undergoing heart valve replacements. When it occurs, it is associated with excess hospitalization days.

### 35. Pre-Workout Supplement Effects on Enamel Erosion



Bryer E. Fritsch<sup>1</sup>, J.L. Kolker<sup>1</sup>, F. Qian<sup>1</sup>, J. Harless<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Athletic pre-workout supplements may be erosive to dental enamel.

**Objective:** To evaluate *in vitro* erosive effect on enamel of three brands of pre-workout (Cellucor<sup>®</sup> (C4<sup>®</sup>), BSN<sup>®</sup> (N.O.-Xplode<sup>®</sup>), MusclePharm<sup>®</sup> (Assault Sport<sup>™</sup>)), and two flavors (blue raspberry (BR) and green apple (GA)).

**Methods:** Titratable acidities ([KOH] to neutralize products), pH, and erosion depths in enamel of each supplement were determined. The pH was measured immediately after preparing products with de-ionized water as well as after 5-, 10-, and 24 hours. Thirty extracted, caries-free molars (n=5/ group) were exposed to each flavor of the pre-workout supplements for 5 days. The teeth were sectioned, and enamel erosion was measured using polarized light. A Pearson correlation test assessed the relationship between erosion depths, pH, and titratable acidities. One- and two-way ANOVA with post-hoc Tukey's HSD test and two-sample t-test were used to detect differences between products and flavors (alpha=0.05).

**Results:** Titratable acidities ranged from 1.93-6.46 milliliters of KOH. There was significant positive correlation between erosion and titratable acidity (r=0.82; p=0.045). Initial pH ranged from 3.7 to 4.65. There was a negative correlation between lesion depths and initial pH (r=-0.93; p=0.0078) and subsequent pH's. A significant interaction was observed between the brands and flavors on erosion (F(2, 24)=11.10; p=0.0004). Mean lesion

depth for BR was significantly greater than for GA with N.O.-Xplode® (209.20 $\pm$ 36.47 vs. 77.02 $\pm$ 19.79; p<0.0001). For BR, the mean erosion depth for C4® was significantly greater than for N.O.-Xplode® and Assault Sport<sup>™</sup>. For GA, the lesion depth of C4® was significantly greater than that of Assault Sport<sup>™</sup>, which was significantly greater than N.O.-Xplode®.

**Conclusion:** Dental erosion varies between preworkout supplement brands and flavors.

Supported by: Dental Student Research Program

#### 36. Activation of Endogenous BMP2 in Human Cell by CRISPR-Cas 9 SAM Based Synthetic Transcription Factor Technology



<u>YuWei Guo</u><sup>1</sup>, F. Shao<sup>1</sup>, *H. Cao*<sup>1</sup>, *B.A. Amendt*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Determine whether CRISPR-Cas9 SAM based synthetic transcription factor technology can be used to active endogenous BMP2 in human cell.

BMP2 is the only kind of protein approved for bone regeneration. However, because of its short half-life, excessive amount of protein has to be applied to be achieve therapeutic effects. Therefor this will exert major side effects. This experiment is to determine whether CRISPR-Cas9 SAM based synthetic transcription factor technology could active the expression of endogenous BMP2.

**Methods:** Opti-MEM | Reduced-Serum Medium was added into both dilute DNA plasmids and dilute polyethylenimine. The DNA plasmids mixture contain sgRNA plasmids, which were loaded with single or different combination doses. The mixture was added to human 293T cells and incubated for 48 hours. The transfection results were evaluated by using microscope observation of EGFP. RNA was extracted and used to create complementary DNA. Gene expression of BMP2 was qualitatively by Real Time PCR.

**Results:** All of three single sgRNA and combinations of sgRNA active the BMP2 in human 293 T cell.

**Conclusion:** CRISPR-Cas9 SAM based synthetic transcription factor technology can active endogenous BMP2 in human 293T cells. In the future this technology might be useful to reduce side effects caused by excessive amount of BMP2 protein.

Supported by: College of Dentistry, University of Iowa

#### 37. Outside Referral Patterns to the Pediatric Dental Clinic



Noah C. Hollinger<sup>1</sup>, K. Leary<sup>1</sup>, F. Qian<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>, A.I. Owais<sup>1</sup>, M.J. Kanellis<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The literature is limited regarding the characteristics of patients

referred to pediatric dental clinics. The main objective of this study is to evaluate factors associated with referred and non-referred patients at the University of Iowa's Pediatric Dental Clinic (UIPDC).

**Methods:** Data were collected from 723 charts (340 referred and 383 non-referred) of new patients to the UIPDC from July 1, 2015 to May 31, 2016. Patient information included: age, driving distance from the patient's hometown to the UIPDC, size of the patient's hometown, method of payment, number of decayed teeth, presence of special health care needs, and treatment needs. Statistical analyses consisted of descriptive statistics, bivariate analysis and multivariable logistic regression (alpha=0.05).

**Results:** Referred and non-referred patient populations were similarly represented in age distribution (referred: 1-5 years = 39%; non-referred: 1-5 years = 38%) and percentage of patients with Medicaid insurance (referred = 71%: non-referred = 68%). Compared to non-referred patients, logistic regression analysis revealed that referred patients were more likely to live 60+ miles away from UIPDC (OR=16.25; p<0.0001), live in a town with a population of 75,000+ (OR=10.60; p<0.0001), have special health care needs (OR=6.04; p<0.0001), have caries (OR=3.52; p<0.0001), need endodontic treatment (OR=5.20; p<0.0001) and extractions (OR=2.19; p=0.0104), and present with a greater number of decayed teeth (OR=1.17; p<0.0001). Referred patients were less likely to need space maintaining/ orthodontic treatment (OR=3.89; p=0.0002) and less likely to remain patients of UIPDC (OR=2.74; p<0.0001). Outside referrals to UIPDC were not significantly associated with the age of subject or method of payment.

**Conclusion:** Important similarities and differences were found between referred and non-referred patient populations. Patients not referred were from a closer proximity, needed orthodontic care, and remained patients at UIPDC. Patients were similar in age and method of payment.

Supported by: Dental Student Research Program

## 38. Associations Between County General Dentist Workforce and Business Establishments



Joshua D. Hones<sup>1</sup>, S.C. McKernan<sup>1</sup>, R.A. Kuthy<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Recruiting dentists to practice in rural areas has proven difficult. Previous research has examined loan repayment, size of

the community where dentist grew up, family factors, dental school attended, age and gender as factors impacting community choice. Little research has examined attraction of certain business establishments for dentists.

**Objective:** The objective of this project was to evaluate whether various business establishment sectors demonstrated significant associations with general dentist-to-population ratios at the county level (N=99) in Iowa.

**Methods:** Two data sets from 2015 were drawn from for this study: county business establishment data from the Iowa State Data Center and general dentist workforce data from the Iowa Dentist Tracking System. For this analysis, we considered business sectors if they were present in all counties and would be meaningful for dentists when choosing a community. Descriptive statistics were calculated at the state and county levels, with choropleth maps created to display results. Chi-square tests and Kendall's tau-b correlation coefficients were used for bivariate comparisons. Significance levels of p<.05 were used for all hypothesis testing.

**Results:** In 2015, there were 1205 general dentists in lowa. Of the 10 business sectors examined, the most common industries in lowa were retail trade (21% of business establishments), other services (16%), and health care and social assistance (15%). Across all sectors, total establishments per county ranged from 113-12,294 (median = 411). Bivariate correlations found that professional, scientific & technical services and accommodations & food services sectors were the most strongly associated with dentist supply.

**Conclusions:** In Iowa, the presence of business establishments from several sectors was associated with dentist-to-population ratios at the county level. Future studies can use this information to survey dentists about preferences for community choice.

Supported by: Dental Student Research Program

#### 39. Validation of a European Instrument to Measure Clinical Learning Environments for Dental Students (DECLEI) in American Dental Schools



<u>Nicole Krois</u><sup>1</sup>, A. Kossioni<sup>98</sup>, P. Barlow<sup>1</sup>, M. Tabrizi<sup>64</sup>, *L. Marchini*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>64</sup>University of Texas Health Science Center at Houston, Houston, TX; <sup>98</sup>National and Kapodistrian University, Athens, Greece

This presentation reports expanded validity evidence for DECLEI in U.S. dental schools. After a preliminary validation in a small sample last year showed encouraging results, DECLEI was now distributed to 286 students (D3 n=153 and D4 n=133) in two U.S. dental schools (University of Iowa and University of Texas Health Science Center at Houston). Two alternative methods for validation were applied. In the first approach, all 24-items were regressed onto the total composite score using forward conditional method. For this method, the computer chose the most significant item, entered it, looked for the second-most important item, entered it, repeating this process for all items. This approach produced a 9-item scale accounting for 90% of the variance in total score and a Cronbach's  $\alpha$  coefficient of 0.79. In the second approach, the item-total correlation for the full scale was calculated and then eliminated items with relatively poor coefficients. A cutoff of 0.30 or less was used. This process produced a larger scale (20 items), as well as a higher Cronbach's  $\alpha$  coefficient (0.89). Data presented here showed that DECLEI has the potential to be used as a reliable instrument to measure clinical learning environments for U.S. dental students using either a smaller, concise scale or by using a larger, more thorough scale. The choice between the two scales would be dictated by what are the items the user would like to assess.

Supported by: Richard L. and Nancy M. Christiansen Professorship in International Oral Health Education and Research (University of Iowa, College of Dentistry), Finkelstein Centennial Teaching Professorship, Dental Student Research Program

#### 40. Hands-On Experiences and the Impact on Pediatricians' Comfort in Providing Early Preventive Oral Health Care



Amanda T. Phan<sup>1</sup>, K. Leary<sup>1</sup>,

*K. Weber-Gasparoni*<sup>1</sup>, B. Kleinheksel<sup>1</sup>, A.I. Owais<sup>1</sup>, F. Qian<sup>1</sup>, M.K. Geneser<sup>1</sup>, A. Stier<sup>1</sup>,

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Lack of oral health

knowledge is one of the most significant barriers for medical professionals to provide oral health-related services. Research shows that incorporation of infant oral health education in medical residency programs can improve oral health knowledge, confidence and behavior of residents. To increase future pediatricians' knowledge and comfort levels regarding infant oral health, the University of Iowa Departments of Pediatric Dentistry and Pediatric Medicine established a rotation for first year Pediatric Medicine Residents at the University of Iowa Infant Oral Health Program (IOHP) located at the Women, Infant, and Children (WIC) Clinic in Iowa City, IA. The purpose of this study is to assess the changes in knowledge, comfort, and behaviors before and after the IOHP rotation.

**Methods:** Current first-year residents will complete a series of surveys before their IOHP rotation, immediately following their rotation, at the end of each academic year throughout their residency, and once a year for two years following graduation.

**Results:** Pre- and immediate post-rotation surveys' data collection and analysis are currently undertaking. Each year about 13 individuals begin the residency program and 10 rotate through the IOHP. Descriptive statistics will be presented, and changes between before and after the IOHP rotations will be explored using Wilcoxon signed-rank test, McNemar's test, and Bowker's test (alpha=0. 05) when the year is completed.

**Conclusions:** This is a mid-term review of a long-term study. Final conclusions will be drawn at the end of the study; however, preliminary data demonstrates that residents believe they have the ability to identify caries, but lack knowledge of anticipatory guidance on oral health issues.

Supported by: Dental Student Research Program

#### 41. Testing Aspects of Freezing Preservation on Oral Bacterial Viability



<u>Grant McCaulley</u><sup>1</sup>, J.A. Banas<sup>1</sup>, A. Welhaven<sup>1</sup>, F. Qian<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** A cryoprotectant (storage media) is used to improve retention of viability in frozen bacteria. The purpose

of this study was to determine if storage media type affects bacteria viability. In addition, the effects of repeated freezing/thawing on bacteria viability were examined.

**Methods:** The bacteria used were a pure culture of *Streptococcus mutans* (SM) and a dental plaque (DP) sample. Six media were used; trypticase-soy broth with yeast extract (TSB-YE) and 0.1% L-cysteine plus the following: glycerol at concentrations of 10%, 15%, 20%, or 25%, skim milk at 10%, or combined 10% glycerol and 10% skim milk. SM and DP samples were quantified initially and after each freeze/thaw cycle. Additional SM samples preserved in media with 10% glycerol were quantified at 5 freeze/thaw time points.

**Results:** Fluctuations in the viable counts were seen from time point to time point for each different media used. Overall, retention of viability appeared to be optimal in 10% glycerol and averaged 102% for SM and 87% for dental plaque after 5 freeze/thaw cycles each. For SM stored in 10% glycerol there was a significant decrease in viability from time 0 to 1 (p=0.0108), followed by a significant increase from 1 to 5 (p=0.0051), showing an overall increase in viability from time 0 to time 5. Similar initial decreases and subsequent increases in viability were seen with repeated freezing/thawing of DP in all media used.

**Conclusions:** The lack of a major difference in viability using different media suggest that other factors, such as time and freezing/thawing protocols, may have a larger impact on retention of viability than the media used. The fluctuations in viability measurements from time point to time point, especially apparent increases in viability, may reflect increased fragility of bacterial chains or clusters upon freezing/thawing.

Supported by: Dental Student Research Program

#### 42. Caries in American Indian Children Entering the Mixed Dentition—A Follow Up on the OST SMILeS Cohort



Elise Montesinos<sup>1</sup>, J.J. Warren<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** It is unclear why early childhood caries remains rampart among American Indian and Alaska Native children. The main objectives of this study was to continue the OST

SMILeSa longitudinal study that related of caries experience in a group of American Indian children at age 7 years..

**Methods:** Oral exams were conducted on 117 members of the OST SMILeS Study cohort, who had previously been followed from birth to age. These children and their caregivers were members of a Northern Plains tribal community. The same protocols were followed as in the original study, and caries data were obtained using the dmfs/ DMFS criteria by the same calibrated examiner who had conducted the earlier exams. These data were recorded on paper forms, entered on a spreadsheet and converted into statistical software format (SAS and SPSS). Reported here are summary findings of caries prevalence and dmfs/dmft and DMFS/DMFT for the primary canines and molars, and permanent first molars, respectively.

**Results:** For the primary dentition, the prevalence of caries was 95%, the mean dmfs was 29.2, and the mean dmft was 7.1. Unlike previous findings, much (76%) of the caries was filled, and over 78% of the children had one or more stainless steel crowns (mean number of crowns =4.5). For the permanent first molars, the prevalence of caries experience was 39%, the mean DMFS was 1.3, and mean DMFT was 0.8. One or more sealants were detected in 45% of the children and the mean number of sealant surfaces was 1.1 per child.

**Conclusion:** Dental caries is very prevalent in this population of American Indian children, and while much of the decay in the primary dentition was treated, prevalence was also found to be high in the permanent dentition, suggesting that additional efforts are needed to prevent and control this disease.

Supported by: Delta Dental Foundations of Iowa, South Dakota and Wisconsin

#### 43. Cognitive Impairment in Patients Attending University of Iowa Dental Clinics



<u>Kyle Nicholson</u><sup>1</sup>, X. Chen<sup>1</sup>, L. Rodriguez<sup>1</sup>, M. Tamegnon<sup>1</sup>, F. Qian<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Cognitive impairment is highly prevalent in the elderly population. It can affect oral self-care function, change oral care behaviors

and increase the risk of dental caries and other oral disease.

**Objective:** The objectives of this project were to understand the cognitive status and dentally-related function among patients aged 65 and older attending the University of Iowa College of Dentistry and Dental Clinics.

**Methods:** Sixty-nine patients aged 65 and older who attended the University of Iowa College of Dentistry and Dental Clinics in August 2017 were recruited for the research study. All the participants were English-speaking and reported having no dementia, deafness, blindness or sever functional disability. The Montreal Cognitive Assessment (MOCA) and the Dental Activities Test (DAT) were administered by two trained and calibrated dental students to assess the cognitive status and dentally-related function of the study participants respectively. Descriptive analysis was conducted to describe the cognitive and dentally-related function of the participants.

**Results:** The mean age of the participants was 73.7. Of these sixty-nine participants, 46 (63.3%) met the criteria of early mild cognitive impairment (MCI, MOCA score <26) and 8 (11.6%) met the criteria of late MCI (MOCA score <17). There was no significant difference between cognitively impaired and non-impaired patients in terms of oral hygiene practice, dental care utilization and oral self-care functions (p>0.2 in all instances). Thirteen (19.4%) out of sixty-seven who completed the DAT had impaired dentally-related function (DAT score <9).

**Conclusion:** Among 69 elderly patients attending the University of Iowa College of Dentistry and Dental Clinics, more than 60% were found to have a cognitive impairment, and nearly 20% showed impairment in oral self-care and other oral health related activities. These findings suggest a need to incorporate an assessment of cognitive and dentally-related function in geriatric dental care.

Supported by: Dental Student Research Program.

#### 44. A Clinical Trial Comparing Isolite<sup>®</sup> Vs Cotton Roll Isolation in the Placement of Dental Sealants



<u>Colby Beck</u><sup>1</sup>, A.I. Owais<sup>1</sup>, D. Pelzer<sup>1</sup>, M.C. Skotowski<sup>1</sup>, M. Tamegnon<sup>1</sup>, T. Mabry<sup>1</sup>, M.K. Geneser<sup>1</sup>, M.J. Kanellis<sup>1</sup>, K. Leary<sup>1</sup>, S. Kelly<sup>1</sup>, D.V. Dawson<sup>1</sup>, G. Gilbaugh<sup>1</sup>, M. Akers<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Purpose:** The purpose of the study was to evaluate retention of dental sealants as well as patient and operator acceptability and satisfaction after the placement of dental sealants using Isolite<sup>®</sup> vs. cotton roll isolation in sealant placement.

**Methods:** This study was a split-mouth randomized clinical trial (ClinicalTrials.gov #NCT02668874) where at least two non-carious premolar and/or permanent molar teeth across the same arch were in need of first time sealant placement. The teeth pairs received sealants using one of the two isolation techniques. Prior to sealant placement, teeth were evaluated for fissure depth, staining and caries. After placement of the sealant, the child and operator completed two different satisfaction questionnaires. At the 6-month and 12-month recall, retention of each sealant was blindly evaluated along with marginal adaptation and caries development.

**Results:** 104 patients (age of 10.57 years  $\pm$  2.99 years) were enrolled. The total number of teeth with sealants placed was 254 (127 pairs). There was no statistically significant difference in retention rates across the two isolation techniques at 6 months (p =0.7273) or at 12 months (p = 0.3865). Moreover, there was no significant difference in marginal adaption between the two techniques (p = 0.6072 at 6 months and p = 0.2376 at 12 months). No caries were detected at

6-months and caries was negligible at 12-months with no difference between the two techniques (p=1.00). Sixty-five percent (65%) of patients preferred cotton roll, while 87% of operators preferred Isolite® if they were to do the procedure again. Procedural time was longer with cotton roll isolation (average time difference was 0.8 minutes).

**Conclusions:** Results suggest no significant difference between isolation techniques in terms of retention, marginal adaptation or caries. Patients preferred cotton roll technique while providers preferred the Isolite<sup>®</sup>. Procedural time was significantly shorter under the Isolite<sup>®</sup> technique.

Supported by: Dental Student Research Program, Delta Dental of Iowa Foundation

#### 45. The Effect of Potassium lodide on Silver Diammine Fluoride-Treated Hydroxyapatite



Eduard Doumanian<sup>1</sup>, A.I. Owais<sup>1</sup>, H.T. Phan<sup>1</sup>, K. Shin<sup>1</sup>, A.J. Haes<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The aim of this study is to evaluate the effect(s) of adding potassium iodide (KI) following silver diammine fluoride (SDF) reaction with

hydroxyapatite (HAP) aqueous solution.

The null hypothesis is that the application of KI following the reaction between SDF and HAP will not alter the formation of silver phosphate (Ag3PO4), and therefore, will not interfere with the caries-arresting mechanism of SDF.

**Background and Significance:** The dental literature has proposed that KI application may overcome the blackening of SDF-treated tooth structure. This study tests if KI addition would shift the chemical reaction between SDF and HAP in any way that would compromise the caries-arresting effect of SDF on tooth structure.

**Methods:** HAP solutions were prepared by mixing 2.4mg (4.78µmol) HAP powder (Sigma Aldrich) in 993.9µL deionized water (Barnstead) in glass vials. After equilibration, 6.1µL of 2.36M SDF (38% w/v Advantage arrest) was added to each vial. SDF-treated HAP specimens were allowed to equilibrate before KI (Fisher Scientific) addition. Four different groups were analyzed based on the quantities of a 3.0M KI solution (0, 1.6, 3.2, 4.8 µL) added to the vials. Control studies were performed with Ag3PO4 standards and equivalent quantities of KI. Raman spectroscopy (532 nm) was used to detect the reaction products. The reaction products analyzed were Ag3PO4, fluorapatite (FAP), and calcium fluoride (CaF2).

**Results:** Adding KI to the SDF-treated HAP interfered with Ag3PO4 and FAP formation. Adding KI to Ag3PO4 standards exhibited a greater (negative)

impact on Ag3PO4 vs. that formed from SDF-treated HAP. The initial pH of the HAP-H2O solutions was 7. It increased to 10 after the addition of SDF and did not change following KI application.

**Conclusions:** The desired products (Ag3PO4 and FAP) as caries-arresting agents are impacted by KI addition. Increasing the concentration leads to removal of both of these products.

Supported by: Dental Student Research Program, University of Iowa Department of Chemistry, University of Iowa Department of Pediatric Dentistry

#### 46. Identifying DACH1 Variants Contributing to Orofacial Clefts in African Populations



James V. Park<sup>1</sup>, T. Busch<sup>1</sup>, S. Desai<sup>1</sup>, A.M. Tora—O<sup>60</sup>, C.A. Bello<sup>60</sup>, C. Lo<sup>1</sup>, M. Mohamed<sup>1</sup>, *A. Butali*<sup>1</sup>

University of Iowa, Iowa City, IA; <sup>60</sup>University of Puerto Rico, San Juan, PR

Orofacial clefts are the most common craniofacial malformation in humans, occurring in about 1 out of every 700 births worldwide. The causes of orofacial clefts are complex, with race, ethnicity, geographic locations, environment factors, and socioeconomic status all contribute to the incidence of this disease. The goal of this project was to identify variants in the Dachshund Family Transcription Factor 1(DACH1) that could contribute to the development of nonsyndromic orofacial clefts. The DACH1 gene was recently identified through the first African Clefts Genome-Wide Association Study (GWAS) as highly associated with individuals with nonsyndromic orofacial clefts. We preformed Sanger sequencing of the DACH1 gene in 288 individuals from Ghana, Nigeria, or Ethiopia with nonsydromic cleft lip and palate and found 1 novel missense variation (p.Gly739Ser) in 2 individuals from Ghana and Nigeria. It was predicted as tolerated (low confidence) and benign by SIFT and PolyPhen bioinformatic tools, respectively. This missense variation changes the protein sequence of the DACH1 gene and, according to HOPE bioinformatic tool, could change the folding and function of the protein by exchanging the smaller amino acid Glycine with the larger Serine. We have identified a novel variant, but have not yet fully explained the biology of that variant, which requires further research. We hope that our finding will lead us to a more complete understanding of the complex etiology of orofacial clefts and give us the tools to reduce the negative psycho-social impact of orofacial clefts on individuals affected and their families.

Supported by: Dental Student Research Program

#### 47. Smoking Rates and Tobacco Control Funding in Iowa 2000-2015



Elizabeth Pfohl<sup>1</sup>, C.A. Squier<sup>1</sup>, N.A. Slach<sup>1</sup>, A.E. Welhaven<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

There has been a steady decrease in US smoking rates from 1965 facilitated by tobacco control policies and funding. Iowa has mirrored the national trend

until 2012, when rates increased above the US rate. This followed a 43% cut in State funding of tobacco control where funding went from its highest level of \$12 million per year to its current level of \$5.2 million. This study examines the relationship between State funding and smoking rates.

Smoking rates for Iowa adults and high school seniors and for US adults were obtained from the CDC Behavioral Risk Factor Surveillance System (BRFSS) surveys for the years 2000-2015. Federal and State tobacco control funding for the State Division of Tobacco Use Prevention and Control were obtained from the Division for the years 2000-2015. Data was plotted using Excel and the relationship between the trends for funding and smoking rates examined by visually comparing the data from year to year. A series of scatterplots were used to further characterize the relationship between tobacco prevention funding and cigarette smoking rates. To determine if a particular variable comes before another in a time series, the Granger test was used. All analyses were completed using R 3.4.0 (Vienna, Austria) at the 5% level of significance.

Decreases in adult smoking in Iowa approximately paralleled that of the nation between 2000 and 2009, when it decreased below the national rate, until 2012, when it rose above it. Funding for tobacco control increased steadily between 2003 and 2009, when it was cut from \$11.2 million to \$9.6 million, a 14% decrease. None of the tests showed that funding changes influenced changes in cigarette smoking rate for any of the groups (all p-values > 0.15).

While funding for tobacco control is an important contributor to controlling smoking rates, it is likely that other major policy decisions, such as the rate of tobacco tax and smokefree legislation exert a greater effect.

Supported by: Dental Student Research Program

#### 48. Variability in the Lower Facial Skeleton During Development



<u>Amanda Piche<sup>1</sup></u>, *N.E. Holton*<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The lower facial skeleton is a highly variable region of the craniofacial complex. Considerable attention has been given to lower facial skeletal morphology with regard

to growth patterns, the influence of masticatory function, and the relationship between vertical facial dimensions and the development of skeletal and dental discrepancies. Despite this, little is known about the ontogenetic trends with regard to the magnitude of variability of the lower facial skeleton. Using the longitudinal lowa Facial Growth Study, the present study examines whether the magnitude of lower facial variation is established early in development or exhibits significant changes during ontogeny.

**Methods:** We collected coordinate landmarks from lateral cephalograms of n=63 subjects at ages 4yrs, 11yrs, and adulthood. Landmarks were aligned using Procrustes superimposition separately for each age group. To control for the increasing effects of sexual dimorphism on skeletal shape variables, we removed allometric variation within each age group using multivariate regression. Using size-adjusted residuals, we tested for significant differences in the magnitude of shape variation using a test of morphological disparity (i.e., testing for significant differences in the trace of variance-covariance matrices). We then analyzed patterns of shape variation within age groups using principal components analysis.

**Results:** There was no significant difference in the magnitude of variation between the 4yr and 11yr age groups (P=0.965). However, variation significantly increased between 11yrs and adulthood (P<0.001). Patterns of shape variation along the first principal component generally distinguished between longer and shorter anterior vertical dimensions. The range of shape variation was relatively reduced in the 4yr and 11yr groups and became more exaggerated in adulthood.

**Conclusions:** The magnitude and pattern of lower facial variation is stable from 4yrs-11yrs in our sample. Between 11yrs-adulthood, the lower facial skeleton significantly increased in variation independent of the effects of sexual dimorphism.

Supported by: Dental Student Research Program

### 49. Genotypic Diversity of *Streptococcus sobrinus* in an American Indian Population



Taylor R. Postler<sup>1</sup>, D. Lynch<sup>1</sup>, A. Villhauer<sup>1</sup>, W. Liu<sup>1</sup>, D.V. Dawson<sup>1</sup>, J.J. Warren<sup>1</sup>, T.A. Marshall<sup>1</sup>, K.R. Phips<sup>76</sup>, D.E. Starr<sup>73</sup>, D.R. Drake<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>73</sup>Area Regional Dental Prevention/Research Director, Pine Ridge, SD; <sup>76</sup>Oral Health

Consultant, Morro Bay, CA

**Objectives:** American Indian children suffer from high rates of severe early childhood caries (S-ECC). The primary etiological agents of S-ECC are *Streptococcus mutans* (SM) and *Streptococcus sobrinus* (SS). Although SM is more commonly associated with caries, SS is often associated with more severe caries. The objective of this project was to expand upon a growing genotype library of SS isolates from 40 mother-child pairs in a community of Northern Plains American Indians in order to reveal the colonization patterns and genotypic stability of SS within this high-risk population.

**Methods:** Plaque samples were collected from children and their mothers from the time of the child's birth to 36 months of age. Samples were cultured on MSKB selective agar. SS isolates (identified by PCR) were genotyped using AP- PCR. Gel images were analyzed and compared with GelCompar®IIv6.5 software. Exact Wilcoxon rank sum tests were used to compare the distribution of dmfs/DMFS scores between subgroups based upon presence/absence of SM and SS.

**Results:** Preliminary data from 40 families identified 12 unique genotypes after community-wide comparison, and 92% of children shared at least one SS genotype with their mother. SS positive individuals hosted a range of 1-3 SS genotypes with families exhibiting a spectrum of 1-5 genotypes. The most common genotype was found in 45% of individuals. Children harboring both SM and SS exhibited significantly higher dmfs scores than children harboring only SM.

**Conclusions:** Our data continue to show SS genotype commonalities exist both within and across families in our sample population. This supports our hypothesis that SS exhibits some vertical transmission from mother to child. These data also suggest co-colonization with both SM and SS during childhood results in higher caries experience. Continued analysis will reveal the level of SS genotypic stability within these children over time.

Supported by: AADR Student Research Fellowship, NIH RO1 DE017736-01A5

#### 50. Comparison of Systemic Health Characteristics and Xerostomia among Nursing Home Residents in Iowa, US and Sao Paulo, Brazil



**Erica N. Recker**<sup>1</sup>, M. Sarmet Smiderle Mendes<sup>99</sup>, D.R. Blanchette<sup>1</sup>, D.V. Dawson<sup>1</sup>, H. Cowen<sup>1</sup>, J. Hartshorn<sup>1</sup>, J.F. Fernandes Dos Santos<sup>100</sup>, L. Notari Chester<sup>100</sup>, D.J. Caplan<sup>1</sup>, *L. Marchini*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>99</sup>University of Sao Paulo, Sao Paulo State, Brazil; <sup>100</sup>University of Taubate, Sao Paulo State, Brazil

**Objective:** To describe and compare potential differences in systemic health characteristics and xerostomia among residents in American and Brazilian nursing facilities (NF).

**Methods:** This secondary data analysis used data from a study in NF located in Iowa (US) and Sao Paulo (Brazil). Recorded data included demographics, medications, comorbid conditions, and xerostomia. Descriptive statistics, graphics, and all analyses were conducted using SAS 9.4.

Results: The US group (N=81) had a mean age of 82.1 years (SD=12.9 years), 60.5% were females, and 100% were white, whereas the Brazilian group (N=119) had a mean age of 76.4 years (SD=8.7 years), 47.9% were females, and participants identified as white (42.0%), more than one race (45.4%), African (7.6%), native Indian (3.4%), and unknown (1.7%). The median number of comorbid conditions and medications in the US were 9 (min 1, max 31) and 12 (min 1, max 24), respectively, as compared to 2 (min 0, max 5) and 6 (min 1, max 16) in Brazil. The most common comorbidities in the US were hypertension, dementia, depression, gastro-esophageal reflux, constipation, and type 2 diabetes. In Brazil, they were hypertension, unspecified diabetes, Parkinson, depression, peripheral vascular disease, and hypothyroidism. The most common prescription medications in the US were acetaminophen, acetylsalicylic acid, magnesium hydroxide, polyethylene glycol, docusate, and furosemide. In Brazil, they were omeprazole, acetylsalicylic acid, losartan, simvastatin, metformin, and captopril. Xerostomia was reported by 32.10% (US) and 59.66% (Brazil) of the participants.

**Conclusions:** Iowans presented with higher numbers of comorbidities and prescription medications. Conversely, xerostomia was reported in a greater percentage of Brazilians. Both groups present with co-morbidities and prescribed medications that could have an impact on dental disease and treatment.

Supported by: Delta Dental of Iowa Foundation, Dental Student Research Program, FAFESP-Sao Paulo Research Foundation 2015/1222-2

### 51. Development of a Cognitive Assessment Tool for the General Dentist



**Lydia Rodriguez**<sup>1</sup>, K. Nicholson<sup>1</sup>, A. Welhaven<sup>1</sup>, F. Qian<sup>1</sup>, *X. Chen*<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Cognitive impairment rapidly increases after the age of 65 and is associated with poor oral health. It is important for general dentists to

recognize patients with cognitive impairment and modify treatment plans accordingly. Current cognitive assessment tools are not tailored for a dental setting and are typically not used by dentists.

**Objective:** To develop a cognitive screening tool to be used in dental environments using items from the Dental Activities Test (DAT).

**Methods:** Sixty-nine patients aged 65 and older who attended the University of Iowa College of Dentistry and Dental Clinics in August 2017 were recruited for the research study. All the participants were English-speaking and reported having no dementia, deafness, blindness or severe functional disability. The Montreal Cognitive Assessment (MoCA) and the DAT were administered by two trained and calibrated dental students to assess the cognitive status and dentally-related function of the study participants, respectively. Different combinations of the DAT items were tested against the MoCA to assess their performance as a cognitive screening tool.

**Results:** The mean age of the participants was 73.7. 15 (21.8%) participants were cognitively-impaired and 13 (19.4%) had dentally-related functional deficits. As a whole, the DAT yields a sensitivity of 0.88 and a specificity of 0.24 at a threshold score of 9. When used as a cognitive screening tool, the sensitivity of Item 1 (medication schedule) was 0.4 and the specificity was 0.96. Items 1 and 4 combined or items 1 and 8 combined produced similar results in predicting cognitive impairment.

**Conclusions:** Due to the lack of variation in dentallyrelated function among the study sample, whether the DAT or a subset of its items can serve as a cognitive screening tool remains unclear and requires further investigation.

Supported by: Dental Student Research Program

## 52. Dual Institution Validation of an Ageism Scale among Dental Students



**Ryan J. Rucker**<sup>1</sup>, P.B. Barlow<sup>1</sup>, J. Hartshorn<sup>1</sup>, L. Kaufman<sup>3</sup>, B. Smith<sup>52</sup>, A. Kossioni<sup>98</sup>, *L. Marchini*<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA; <sup>3</sup>Boston University, Boston, MA; <sup>52</sup>University of Missouri, Kansas City, MO; <sup>98</sup>National and Kapodistrian University, Athens, Greece

**Background:** Ageism (age discrimination) is pervasive, and has a negative impact in elderly health care. This paper reports on a validation study of a novel scale assessing ageism specifically among dental students. A scale tailored for dental students can provide information that helps address potential biases or attitudes when treating an older population. This data helps when creating or modifying existing dental courses to address these biases.

**Methods:** A novel 27-question scale was generated by geriatric dentistry faculty, previously pilot tested (n=144), and now applied to a larger sample (n=315) of dental students from 2 US dental schools. All five faculty members revised the scale until achieving consensus to establish content validity. Principal Component Analysis was used to assess internal structure of the measure. Questions whose deletion increased the overall a loading on more than one factor or those unexpectedly grouped in another factor were thoroughly examined.

**Results:** The 27-item scale resulted in 5 statements (grouped in 2 domains) that explained more (63%) of the overall variance and had a substantially higher reliability value than other solutions. The five statements are "Elderly people do not take good care of their teeth" (0.62), "Elderly patients do not usually comply with dental advice" (0.93), "The Elderly patient does not live long enough to make it worthwhile to invest time and effort in complex dental treatment" (0.81), "The elderly patient does not live long enough to make it worthwhile to invest time and effort in complex dental treatment" (0.81), "The elderly patient does not live long enough to make it worthwhile to invest money in expensive dental treatment" (0.95), "Dental treatment of elderly patients is too time-consuming" (0.57).

**Conclusions:** This analysis pointed to five statements achieving high reliability (0.76) towards the validity of this scale.

Supported by: Dental Student Research Program, University of Iowa Department of Preventive and Community Dentistry, Richard L. and Nancy M. Christiansen Professorship in International Oral Health Education and Research

### 53. *Mutans streptococci* in American Indian Mothers



**<u>Rebecca A. Schneider</u><sup>1</sup>**, A. Villhauer<sup>1</sup>, A. Welhaven<sup>1</sup>, *D.R. Drake*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Title: Mutans streptococci in American Indian Mothers

**Objective:** *Mutans streptococci* (MS), especially *Streptococcus mutans* (SM) and *Streptococcus sobrinus* (SS), are contributing factors in the development of severe early childhood caries (S-ECC). These two cariogenic bacterial species are often transmitted from mother to child, increasing the caries risk in the primary dentition of their children. S-ECC is 6 times more likely to affect Native American children than Caucasian children. We are currently investigating the presence of SM and SS in plaque samples collected from American Indian (AI) mothers (n=59) in a Northern Plains Tribal Community. We report here on maternal MS levels and composition and the impact on dental health of their children at 36 months of age.

**Methods:** Whole mouth plaque samples were collected from AI mothers and children. Samples were spiral plated onto MSKB agar for MS counts and SB-20M agar to determine which species of MS (SM, SS, or both) were present. The spearman rank correlation was used to test for association between child dmfs and maternal MS counts. The Kruskal-Wallis test was used to explore differences in child dmfs when SM and SS were present/absent in maternal plaque samples. Analyses were performed using SAS 9.4 (Cary, NC)

**Results:** Of the 59 mothers examined, 44 had SM and SS, 10 had SM only, and 5 had no MS present. Statistical analyses indicated no association with child dmfs and maternal MS bacterial counts. Species of MS present in maternal plaque significantly impacted child dmfs. Children with the highest dmfs scores had mothers with only SM present.

**Conclusions:** We observed significant differences in disease burden in children based on the mother's MS status, but no association with maternal MS count. These results are intriguing and we continue to evaluate additional mother-child pairs in this cohort to expand upon our knowledge of S-ECC in this high-risk population.

Supported by: Dental Student Research Program

#### 54. First-Year Dental Students' Willingness to Treat Underserved Populations Post-Graduation



**<u>Ryan P. Shaw</u>**<sup>1</sup>, *M.R. McQuistan*<sup>1</sup>, F. Qian<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** To assess whether changes have occurred over a 9-year period pertaining to first year (D1) dental students' willingness to treat 14

underserved populations.

**Methods:** A 21-item questionnaire was developed and distributed to all D1 students at the beginning of each academic year from 2008-2016. Participants indicated their anticipated willingness to treat the populations 5-years post-graduation. Responses were re-categorized as "yes" vs. "yes, but a limited number of patients, unsure, or no." Bivariate analyses were conducted to assess changes in willingness to treat and D1s' characteristics over time (alpha=0.05)

**Results:** 98% of D1s (n=705) participated in the study. Respondents exhibited changes in their willingness to treat patients with HIV/AIDS (p=0.02) and jail inmates (p=0.005); however, their willingness was not progressively more positive or negative. For example, in 2008, 55% of respondents indicated a willingness to treat patients with HIV/AIDS, while only 46% reported the same in 2009. In contrast, >65% of respondents were willing to treat patients with HIV/ AIDS in 2010, 2015 and 2016. Significant changes were not observed among the other populations. Respondents were consistently willing to treat the frail elderly, populations from other ethnic groups, children <3 years of age, and patients who identify as LGBTQ. They were least willing to treat homeless patients, known drug users, and jail inmates.

**Conclusions:** D1s' willingness to treat underserved populations 5-years post-graduation did not change for the majority of the populations. This suggests that some populations may continue to remain underserved. To address access issues, dental schools could examine whether changing admissions requirements of incoming students is associated with an increased willingness to treat underserved populations. Additionally, findings of this study can be used to develop curricula to provide dental students with the knowledge and skills to treat the populations with whom D1s exhibited the least willingness to treat.

Supported by: Dental Student Research Program

#### 55. Clinical vs. Radiographic Caries Diagnosis in Primary Teeth Approximal Surfaces



Ashley M. Spooner<sup>1</sup>, A.I. Owais<sup>1</sup>, D.R. Blanchette<sup>1</sup>, D.V. Dawson<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>, J.J. Warren<sup>1</sup>, M.K. Geneser<sup>1</sup>, M.J. Kanellis<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The objective of this project was to compare approximal carious lesions in dentin diagnosed by clinical examination to those diagnosed radiographically in high caries-risk children.

**Methods:** Eighty-four children were evaluated by a calibrated examiner using the Early Childhood Caries Collaborative Centers (EC4) criteria. Bitewing radiographs were also made for each child. Occlusal radiographs were made for children when approximal surfaces could not be confirmed to be caries-free clinically. Teeth were eligible to be part of the study if they had at least one surface with caries into dentin (open or closed lesions). The approximal carious surfaces diagnosed by clinical exam were compared to those diagnosed radiographically. Counts were tabulated to determine the number of approximal lesions overlooked by clinical examination alone.

**Results:** A total of 62 anterior teeth and 206 posterior teeth were analyzed. The most commonly affected anterior tooth was F (17 eligible, 27.4%) and the most commonly affected posterior tooth was L (38 eligible, 18.4%).

Anterior: clinical examination identified 40 mesial (M) and 21 distal (D) surfaces, while radiographic identified 45 mesial and 27 distal surfaces. Out of the 45 mesial surfaces of teeth that were diagnosed radiographically, 11.1% were missed by clinical exam alone. Out of the 27 distal surfaces of teeth that were diagnosed radiographically, 22.2% were missed by clinical exam alone.

Posterior: clinical examination identified 45 mesial and 56 distal surfaces, while radiographic identified 84 mesial and 145 distal surfaces. Out of the 84 mesial surfaces of teeth that were diagnosed radiographically, 46.4% were missed by clinical exam alone. Out of the 145 distal surfaces of teeth that were diagnosed radiographically, 61.4% were missed by clinical exam alone.

**Conclusions:** Overall, radiographic examination found an additional 11 (5M, 6D) anterior surfaces and an additional 128 (39M, 89D) posterior surfaces and should be used in clinical trials assessing caries incidence.

Supported by: Delta Dental of Iowa Foundation, Dental Student Research Program

### 56. MMPs Extraction Assays in Healthy and Carious Dentin



<u>Katelyn Stine</u><sup>1</sup>, P. Scaffa<sup>99</sup>, M. Carrilho<sup>116</sup>, L. Wang<sup>99</sup>, *C. Vidal*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>99</sup>University of Sao Paulo, Sao Paulo State, Brazil; <sup>22</sup>Midwestern University, Downers Grove, IL

**Objectives:** Degradation of dentin extracellular matrix (ECM) and caries lesion progression has been attributed to increased activity of endogenous enzymes like matrix metalloproteases (MMPs). The validation and standardization of reproducible protein extraction protocols will stimulate further research to better understand the roles of MMPs in specific mechanisms of ECM degradation. This study compared and optimized *in vitro* extraction protocols for MMPs and investigated the proteolytic profiles of healthy and carious dentin.

Methods: Dentin powder obtained from human healthy and carious molar teeth underwent protein extraction via three different protocols that included incubations with: 4 M Guanidine-hydrochloride (HCl) followed by 0.5M EDTA and a second incubation with guanidine-HCl pH 7.4 (protocol G-EDTA); 1% phosphoric acid demineralization and incubation with buffer containing 50 mM Tris-HCl, 5 mM CaCl<sub>a</sub>, 100 mM NaCl, 0.1% Triton™ X-100, 0.1% nonionic detergent P-40, 0.1 mM ZnCl, and 0.02% NaN, pH 6.0 (protocol PA); or 50 mM Tris-HCI (pH 7.5) containing 4M guanidine-HCl and 0.5 M EDTA pH 7.4 (protocol E). Experiments were run in triplicate. The amount of total protein extracted and the gelatinolytic activity was compared among the protocols and in healthy versus caries dentin. The dentin MMP-2 and -9 activities were quantified using ImageJ and expressed in arbitrary units according to the activity of recombinant MMPs.

**Results:** The total protein content extracted from healthy dentin was higher for G-EDTA protocol, followed by E and PA. However, protocols G-EDTA and PA were more effective in extracting active gelatinases. Initial results have shown increased gelatinolytic activity/ $\mu$ g of total protein extracted with guanidine incubation and PA. Preliminary findings have shown higher levels of gelatinolytic activity in carious versus healthy dentin.

**Conclusions:** Dentinal active MMPs are efficiently extracted using G-EDTA and PA protocols. Increased activity of MMPs in carious than healthy tissue supports the role of MMPs in caries progression.

Supported by: Dental Student Research Program

## 57. Peri-Implant Mucosa Dynamics Around Divergent and Concave Abutment Transition Profiles



<u>Madeline A. Swenson</u><sup>1</sup>, G. Avila Ortiz<sup>1</sup>, M. Romero-Bustillos<sup>1</sup>, C.A. Barwacz<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Implant abutment morphology has the potential to

influence peri-implant mucosal architecture and perceived esthetics. The objective of this randomized clinical trial was to evaluate the effects of two facial abutment transition zone profiles on peri-implant soft tissue outcomes one year after abutment connection.

Methods: The IRB approved the study protocol (HawkIRB #201302798). Subjects needing singletooth replacement in the anterior maxilla were randomized to receive a "divergent" or "concave" abutment transition profile design for their screw-retained implant-supported restoration. A standardized digital stereotactic photography device that orients the patient in a repeatable position was used to record mid-facial zenith position at abutment delivery, and 1, 3, 6, and 12 months thereafter. One calibrated, blinded examiner measured changes in the apico-coronal dimension of the mucosal zenith on clinical photographs. Potential correlations between mid-facial mucosal height, keratinized mucosa width, tissue thickness, and phenotype as functions of abutment morphology were evaluated. Intra-class correlation was used to assess intra-rater reliability. Signed Rank, Wilcoxon-Mann-Whitney, Kruskal-Wallis, and Pearson analyses were performed.

**Results:** 29 patients who completed one-year follow-up were analyzed. There were significant increases in mid-facial mucosal height in both concave (mean=0.32mm; p=0.0067) and divergent (mean=0.34mm; p=0.0085) abutment groups. The difference between groups was not statistically significant (p=0.71). Tissue phenotype did not seem to influence variations in mid-facial mucosal height between subgroups (p>0.50). There was no statistically significant correlation between midfacial mucosal height and keratinized mucosa width or tissue thickness in either the concave (p>0.37) or divergent (p>0.60) groups.

**Conclusion:** A significant gain in the apico-coronal dimension of the mid-facial peri-implant mucosa was observed in both groups, with no statistically significant difference between them at one year postfunctional loading. It appears that facial abutment transition morphology does not play a crucial role in the position of the buccal gingival zenith within the confines of this study cohort.

Supported by: DENTSPLY-Sirona Implants, Dental Student Research Program

## 58. Metabolic Activity of *S. mutans* Biofilm on Different Dental Composites



<u>Gabrielle. N. Moen</u><sup>1</sup>, *E.C. Teixeira*<sup>1</sup>, J.A. Banas<sup>1</sup>, R. Danso<sup>1</sup>, R. Rawls<sup>105</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>105</sup>University of Texas Health Science Center at San Antonio

**Purpose:** This study evaluated the response of a *Streptococcus mutans* 

biofilm after being grown on three different dental composites, including an experimental hydrophobic composite developed with oxirane/acrylate functionality (Oasys).

Methods: Eighteen bars of each composite (Filtek Supreme, Admira VOCO, and Oasys) were formed in a mold and light-cured. Bars were incubated in 6-well plates with 106 bacteria in Brain Heart Infusion media with 0.5% sucrose for the first 24 hours. Media (BHI without sucrose) was changed every 24 h at the same time without disturbingto propagate the biofilm adhered to the bars. Lactate production, metabolic activity, and viable cell counts after incubation with S. mutans biofilm were measured at 4 hours, 24 hours, and 15 days for each material. To test metabolic activity and colony-forming units, bars were transferred to sterile PBS and sonicated at 6V for 10 seconds. Lactate production of the biofilm was tested by sampling the media before the bars were removed for sonication. Lactate was measured with a BioVision kit with absorbance at 570 nm. The MTT (Vybrant® MTT Cell Proliferation Assay Kit) assay was performed only at 24 hours and 15 days, due to insufficient bacterial growth timethe times for which there was sufficient biofilm biomass. MTT was measured using the shortened protocol with 2h of incubation and measured at 540 nm.

**Results:** Two-way ANOVA was carried out (p=0.05). No statically significant differences were noted among the composites for any of the tests. The number of colony-forming units increased linearly over the time points, being statistically higher at 15 days when compared to 4h and 24hrs. The same was observed for the lactate production of the biofilm. No significant difference was observed for the metabolic activity at 24hours and 15days.

**Conclusions:** Although the composites tested have different chemistry and composition, there was no significant difference among them in terms of changing affecting properties of the biofilms that coated them.

Supported by: NIH/NIDCR U01DE023778, Dental Student Research Program

#### 59. Selective Toxicity of Silver Diamine Fluoride and Silver Nitrate Against *S. mutans* and *S. sanguinis* In Vitro



**Michelle Tsai**<sup>1</sup>, F. Qian<sup>1</sup>, *J.A. Banas*<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Certain bacteria commonly present in oral plaque, in particular *S. mutans*, have been linked to an increased risk of dental caries. Others such as *S. sanguinis* have been

associated with healthy oral microbiota. Treatment strategies that target cariogenic strains may have the potential to disrupt the dental decay process and may encompass the greatest capacity for longterm reduction of caries risk. Silver nitrate and silver diamine fluoride both have decades long history of use as topical anti-caries agents. This study sought to investigate the selective toxicity of silver nitrate (SN) and silver diamine fluoride (SDF) against *S. mutans* and *S. sanguinis*.

**Methods:** SN (25%) and SDF (38%) were tested at three different concentrations—1/10 dilution and 1/100 dilution concentration against *S. mutans* and *S. sanguinis* grown individually as biofilms in 24-well plates. SDF was also tested at 1% concentration. Statistical analysis consisted of descriptive statistics and a paired-sample t-test (alpha=0.1).

**Results:** Mean biofilm viability reductions observed for *S. mutans* treated with 1/100 SDF was marginally significantly greater than that observed for *S. sanguinis* treated with 1/100 SDF (1.05±0.38 log10 CFU/cm2 vs. 0.43±0.13 log10 CFU/cm2; p=0.0738). Mean biofilm viability reductions observed for *S. mutans* treated with 1/100 SN was significantly greater than that observed for *S. mutans* treated with 1/100 SDF (1.78±0.58 log10 CFU/cm2 vs. 1.05±0.38 log10 CFU/cm2; p=0.0360), while there were no significant differences in biofilm viability reductions for any other treatments (p>0.10 for all instances).

**Conclusion:** The data showed that under certain defined conditions the cariogenic species *S. mutans* was more sensitive to SDF and SN than the health-related species *S. sanguinis*. The possibility remains that SDF and SN could have a positive effect on changing the long-term ecology of dental plaque.

Supported by: Dental Student Research Program

### 60. Assessing the Relationship between Craniofacial Development and Asymmetries



Andrew B. Welling<sup>1</sup>, N.E. Holton<sup>1</sup>, S.F. Miller<sup>22</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>22</sup>Midwestern University, Downers Grove, IL

**Objectives:** Fluctuating asymmetry (FA) in the human craniofacial skeleton

is the result of random unilateral perturbations during normal and abnormal developmental processes. Due to protracted growth of the human craniofacial skeleton, there is the potential for the accumulation of asymmetries resulting from different developmental and environmental factors throughout ontogeny. Previous studies of FA have relied on adult samples and have been unable to address ontogenetic changes in craniofacial asymmetries. A detailed understanding of the ontogeny of FA is important for pinpointing underlying causal determinants (early vs. late developmental influences). To address this, we examined ontogenetic variation in the magnitude and pattern of craniofacial FA using the Iowa Facial Growth Study.

**Materials and Methods:** We collected k=14 coordinate landmarks from posterior-anterior cephalograms of n=55 subjects at 4yrs, 12yrs, and adulthood. Using a Procrustes-based approach, we conducted landmark superimpositions separately for each age group and used the asymmetric component of variation for analysis. Ontogenetic changes in the magnitude of FA were assessed using Procrustes distance values, which measure asymmetry relative to the mean asymmetry. The pattern of FA within each age group was assessed using principal components analysis (PCA).

**Results:** There was no difference in the magnitude of asymmetry across age groups (4yrs vs. adulthood, P=0.3655; 12yrs vs. adulthood, P=0.3402). PCA results reveal a posterior-anterior gradient of correlated FA (i.e., posterior cranial base-posterior facial skeleton vs. anterior cranial base-anterior facial skeleton) that is present in the 4yr sample and maintained into adulthood.

**Conclusion:** We were unable to document an ontogenetic increase in the magnitude of FA in our sample. Rather, the magnitude of FA was established by 4yrs and maintained through adulthood. Similarly, the pattern of FA was maintained through development. While an increase in FA may exist before 4yrs, our results suggest that FA is constant during most of postnatal development.

Supported by: Dental Student Research Program

## 61. Analyzing the Basis for *Streptococcus sobrinus* Prevalence in American Indian Children



**<u>Flora Y. Yen</u>**<sup>1</sup>, F. Qian<sup>1</sup>, *J.A. Banas*<sup>1</sup>, *D.R. Drake*<sup>1</sup>, A. Villhauer<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Severe-early childhood caries (SECC) is a highly prevalent infectious disease in American Indian (AI) children. *Streptococcus mutans* 

(SM) and *Streptococcus sobrinus* (SS) are key etiological agents of dental caries. Studies suggest that SS could be more cariogenic than SM, however, its prevalence is usually low in the oral cavity. The objective of this project was to evaluate the correlation between acid tolerance and sensitivity to oxidative stress in SM and SS strains isolated from a Northern Plains American Indian population with high levels of SS.

**Methods:** Unique genotypes of SM (n=20) and SS (n=9) isolated from whole mouth plaque samples collected from AI subjects were selected for testing. Each genotype was tested for its reaction to selected concentrations of acid or hydrogen peroxide medium treatment. Following exposure, species were plated side by side on BHI agar using 10-fold serial dilutions and incubated for 48 hours. Number of colonies were counted for data collection. Spearman rank correlation test was performed to assess the relationships between acid tolerance and oxidative stress to prevalence, susceptibility, and inhibition profiles collected from the previous year (alpha=0.05).

**Results:** There was a significant negative correlation between Acid Sensitivity/Survival Rate and Prevalence Profile in SM (r=-0.57; p=0.0081), while a significant negative correlation was found between Oxidative Sensitivity/Survival Rate and Susceptibility Profile in SM (r=-0.49; p=0.0280). Moreover, there was a significant positive correlation between Acid Sensitivity/Survival Rate and Inhibition Profile in SS (r=0.71; p=0.0310).

**Conclusions:** More acid tolerant SS genotypes were likely to have higher inhibitory characteristics towards SM. The more prevalent SM strains seems to exhibit lower tolerance to acidic treatments. In addition, the more susceptible SM strains to SS seem to also be insensitive to oxidative stress. Future analysis of additional SS genotypes and exploration of the mechanism of adherence will help us understand the relationship between SM and SS in this population and the higher prevalence of SS.

Supported by: Dental Student Research Program, NIH 1-R01 DE017736-01A5

### 62. Fracture Energy Assessment of the Mandible Computed Using CBCT



**Isabella Jasek**<sup>1</sup>, K. Dibbern<sup>1</sup>, M. Andrew<sup>1</sup>, A. Welhaven<sup>1</sup>, V. Allareddy<sup>1</sup>, *D. Anderson<sup>1</sup>*, *K. Shin<sup>1</sup>* 

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Fracture energy has been previously assessed for determining

fracture severity in the lower extremities, whose fracture energy was computed using a standard CT scan. However, most fractures on the mandible are scanned utilizing a Cone Beam CT (CBCT) system, which acquires scans in a fundamentally different manner not obtaining the same uniform image reconstructions. The objective of this study is to determine if an objective fracture energy can be computed using CBCT scans, and to obtain their fracture energy scores. **Materials & Methods:** This study was approved by the IRB at the University of Iowa. Unidentified 37 CBCT scans and 2 standard CT scans with mandibular fractures were selected from the data base at the College of Dentistry, University of Iowa. All fractures were grouped by 5 anatomical regions of the mandible. Fracture energies were computed for all the scans, and the fracture energy values were then compared between cases for which standard and CBCT scans were acquired. Additionally, as the interfragmentary surface area is independent of the CT scanner, the average fracture energy release rates for the standard and CBCT scans were directly compared.

**Results:** The 37 subjects with 53 fractures were characterized as follows: 17 fractures of the condylar process, 3 fractures of the coronoid process, 12 fractures of the angle, 14 fractures of the body, and 7 fractures of the symphysis. Average fracture energy of all the fractures was 2.1 Joules (J) with standard deviation of 1.66 J. Maximum fracture energy was 7.7 and minimum was 0.3 J. A comparison between the 5 regions of the mandible was made by Wilcoxon rank-sum test.

**Conclusions:** Fracture energy scores can be computed for mandibular fractures using CBCT. This suggests the possibility of implementing an objective scale for fracture severity of mandibular fractures.

Supported by: Dental Student Research Program

#### 63. Impact of Calcium Concentration on Transfection Efficiency and Osteogenic Differentiation



<u>Timothy Acri</u><sup>1</sup>, S. Geary<sup>1</sup>, A. Salem<sup>1</sup>, K. Shin<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** With the rising use of bone marrow stromal cells (BMSCs) embedded in calcium-containing scaffolds, understanding the role

extracellular calcium plays at the cellular level is paramount for the continued optimization of bone tissue regeneration. Previous studies have demonstrated that changes in extracellular calcium concentration affects both cell viability and differentiation. However, the range of calcium concentrations explored was limited and transfection efficiency was not examined. The objective of this study is to determine how the extracellular calcium level affects cell viability, transfection, and differentiation of the BMSCs.

**Methods:** Cell viability of the BMSCs was determined using MTS assay at 24, 48, and 72 hours post transfection Polyethyleneimine (PEI) complexed with enhanced green fluorescent protein (eGFP) plasmid were used to transfect the BMSCs, and expression of eGFP was quantified using flow cytometry. Osteogenic differentiation was qualitatively assessed after 14 days using alizarin red staining, and the presence of osteogenic markers was quantified using RT-PCR for osteocalcin and alkaline phosphatase after 7 days. To further understand the mechanism in which calcium improves transfection efficiency, confocal images were taken at 1, 2 and 4 hours to visualize uptake of the PEI and disassociation of the DNA from the complexes.

**Results:** The variation of calcium concentration present resulted in increased protection against the cytotoxic effects of the PEI, whilst significantly increasing the transfection efficiency of the complexes. Based on the confocal images, PEI is endocytosed at a faster rate leading to enhanced DNA released in the cells.

**Conclusions:** Our results indicate BMSCs are heavily influenced by the presence of extracellular calcium ions. We have successfully characterized the effect of calcium has on cell viability, transfection, and differentiation.

Supported by: American Association of Orthodontists Foundation Martin "Bud" Schulman Postdoctoral Fellowship Award

#### 64. Adolescent Skeletal and Dental Changes With Rapid Maxillary Expansion (RME)



<u>Samuel J. Christensen</u><sup>1</sup>, D. Nesbitt<sup>1</sup>, *F. Qian*<sup>1</sup>, *V. Allareddy*<sup>1</sup>, T.E. Southard<sup>1</sup>, S. Marshall<sup>1</sup>, *K. Shin*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** A constricted maxilla can be associated with a unilateral or

bilateral posterior cross bite, CR-CO shift, maxillary or mandibular growth asymmetry, and dental crowding. Correction of adolescent maxillary constriction typically includes RME. However, maxillary skeletal expansion becomes more difficult with age due to increasing facial, and mid-palatal, skeletal resistance. The purpose of this study is to evaluate the age and maturation at which a successful split of the maxillary midpalatal suture (MPS) can be achieved. A secondary aim is to assess the skeletal vs. dental changes that are associated with a MPS split or no split.

**Methods:** In this retrospective study, 39 (13 M, 26 F) consecutively treated subjects exhibiting maxillary skeletal constriction underwent RME to alleviate unilateral or bilateral posterior cross bites. Subjects were divided into pre-pubertal and post-pubertal groups based on maturation. Evidence of a MPS split was confirmed by development of a diastema between upper central incisors and using a maxillary occlusal radiograph. Measurements were made on initial and post-expansion maxillary models to assess dental.

**Results:** Average age of pre-pubertal and postpubertal subjects was  $11.9 \pm 1.1$  years (n=13) and 14.6  $\pm$  1.4 years (n=26) respectively. A MPS split occurred for 100% of pre-pubertal group compared with 65% of the post-pubertal group (p < 0.05). No significant differences were seen in dental movements between the pre-pubertal and post-pubertal groups while significant differences were seen for arch perimeter, crowding, intercanine width, and intermolar width in the split and no-split groups. There was a significantly strong negative correlation between age and percent ability to get a MPS split.

**Conclusions:** These results demonstrate that MPS separation is more likely to occur pre-pubertally than post-pubertally but that MPS separation after puberty is still possible. This finding supports the importance of appropriate timing in the use of rapid maxillary expanders.

#### 65. Three-Dimensional Finite Element Analysis of Temporomandibular Joint for Mandibular Osteotomy



InO Song<sup>1</sup>, D. Seol<sup>1</sup>, *T. Lim*<sup>1</sup>, *K. Shin*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Although mandibular osteotomies for advancement or setback are widely used to manage patient's malocclusions with skeletal apical base discrepancies, the effect

of stress redistribution on the temporomandibular joint (TMJ) after surgery is still equivocal. Therefore, comprehensive understanding and prediction of the effect of mandibular osteotomy is essential to improve its safety and efficiency. We have developed the three-dimensional finite element model, which provides the prediction of stress/strain distribution of human TMJ.

**Materials & Methods:** The geometry of mandible, maxilla, and temporal bone was obtained by using cone beam computed tomography (CBCT) images. Articular cartilage and disc was created manually. The surface model was developed by using ITK-SNAP and Autodesk Meshmixer. Then, volume mesh of the deformable structure was developed by using MIMICS (Materialise, Leuven, Belgium). ABAQUS was used for finite element analysis. One-half of volume about midsagittal plane was consisted of tetrahedral elements (C3D4), and the other half was produced by using symmetry condition.

**Results:** Material properties and jaw closer muscles (masseter, temporalis, and medial pterygoid) associated with the normal mastication were included. The friction between mandible and disc was obtained from the mechanical property of synovial fluid. Force and moment equilibrium of entire system including muscle forces and the joint reaction forces/moments between condyle and articular disc were satisfied. In normal condition, maximum stress between ramus and condyle was 33.4 MPa while maximum displacement was 0.3 mm.

**Conclusions:** We established a computational analysis model that can provide stress/strain values in variation of muscle forces. Model validation was obtained by comparing Von-mises stress distribution and deformation with applied muscle forces to previous studies. For future work, variation of stress/ strain by repositioning of mandible segments with associated muscle condition would be suggested, which may imply the prediction of post-surgical outcome of mandibular osteotomy.

#### 66. Perlecan and Its Receptors in Oral Epithelial Dysplasia and Squamous Cell Carcinoma



#### <u>Md Shahidul Ahsan<sup>1</sup>,</u>

*H. Ida-Yonemochi*<sup>113</sup>, *T. Saku*<sup>113</sup> <sup>1</sup>University of Iowa, Iowa City, IA; <sup>113</sup>Niigata University, Niigata, Japan.

**Objectives:** One of the histopathological characteristics of cancerous or pre-cancerous

oral mucosa is reduction in cellular cohesion or enlargement of the intercellular space, due to deposition of perlecan, a heparan sulfate proteoglycan of the basement membrane. However, the significance of perlecan in neoplastic transformation still remains unknown. Since  $\alpha$ -dystroglycan and integrin  $\beta$ 1 have been identified as perlecan receptors, we wanted to determine their differential distributions in comparison to perlecan and Ki-67, a proliferation marker.

**Methods:** Eighty surgical tissue specimens of oral cancerous and pre-cancerous lesions were examined by immunohistochemistry for perlecan,  $\alpha$ -dystroglycan, integrin  $\beta$ 1, and Ki-67. In addition,  $\alpha$ -dystroglycan mRNA signals were localized by in situ hybridization.

**Results:** In normal epithelia,  $\alpha$ -dystroglycan and integrin  $\beta$ 1 were localized to basal cells, while perlecan was identified within the intercellular spaces of parabasal cells. In epithelial dysplasia or carcinoma in-situ,  $\alpha$ -dystroglycan and perlecan were well colocalized in the parabasal to prickle cell layer, and the co-localization tendency is very specific in proliferative areas identified by Ki-67 positivity. After invasion, perlecan shifted to the stromal space, while integrin  $\beta$ 1 and Ki-67 were localized in the periphery of the tumor nests.

**Conclusions:** The findings may suggest that dystroglycan acts as a receptor for perlecan in oral epithelial lesions before invasion. Also, the colocalization tendencies with Ki-67 suggest a possible role for perlecan in tumor cell proliferation and malignant transformation. Thus, careful examination of extracellular matrix molecules and their receptors is important prior to targeting their signaling pathways for tumor suppression strategies.

Supported by: Japan Society for the Promotion of Science (JSPS) Grant

#### 67. Fracture Toughness Evaluation of Resin Composites after Environmental Challenge



Hamad A. Algamaiah<sup>1</sup>, J.A. Banas<sup>1</sup>, S.R. Armstrong<sup>1</sup>, A. Jain<sup>1</sup>, R. Danso<sup>105</sup>, R. Rawls<sup>105</sup>, *E.C. Teixeira*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>105</sup>University of Texas Health Science Center at San Antonio

**Objective:** To determine the fracture toughness of an experimental composite containing oxirane and acrylate functionality (OASys), an Ormocer composite (Admira), and a dimethacrylate resin composite (Filtek Supreme) at baseline, after a 15 days biofilm challenge, and 30 days in water. Also, to determine whether 15 days of biofilm challenge will provide an accelerated model of aging different composite materials when compared to a 30 days of water challenge.

Methods: A stainless-steel mold of (25 x 5 x 2.8 mm) was used, following ASTM standards [E399-90], with 2.5 mm single edge notch at the center of the mold to fabricate 135 specimens (n=15) based on the composite materials. For the baseline group, specimens were fabricated and then tested after 24 hours storage in water. For the biofilm challenge, specimens were randomly placed in a six well tissue culture plate and kept at 37°C with bacterial growth media (Brain Heart Infusion; Streptococcus mutans) changed daily for 15 days. BHI media was supplemented with 0.5% sucrose to promote the establishment of a biofilm for the initial 24 hours. For the water storage challenge, specimens were kept for 30 days in 5 ml of deionized distilled autoclaved water at 37°C. Fracture toughness (KIc) testing was carried out using a universal test with a load cell capacity of 500 N using three-point bending with 20mm spam at a cross-head speed of 0.5 mm/min.

**Results:** Two-way ANOVA showed statistically significant differences for the interaction between materials and challenges (p<0.05). Subsequent analysis showed that the Filtek and Admira mean baseline toughness was significantly higher than that observed for water and biofilm challenges. Oasys mean toughness values in water were significantly higher than that of baseline. Toughness values for Oasys in biofilm were not statistically different when compared to either water or baseline.

**Conclusion:** The fracture toughness of the commercially available composites was negatively affected by the environmental challenges of a 15 days biofilm and by 30 days water storage. In contrast, the experimental composite did not demonstrate this degradation. Both 15 days biofilm and 30 days water storage showed similar effect on the composites with a faster biofilm method.

Supported by: NIH/NIDCR U01DE023778, GPSG

## 68. Effect of Time and Temperature on Color Stability of Resin-Composite



### Arwa A. Alhakami<sup>1</sup>, R.R. Maia<sup>1</sup>, C. Vidal<sup>1</sup>, F. Qian<sup>1</sup>, T.A. Marshall<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Abstract

**Objective:** To evaluate the effect of different exposure time and coffee temperatures on the color stability of three types of resin-composites.

**Methods:** Three types of resin-composites were used to prepare 54 discs (n=18/per-composite): microfilled, microhybrid, and nanofilled (shade A2). Discs were 2mm in thickness and diameter. After light curing (using an LED curing light), the discs were finished and polished using sand paper under water irrigation. Samples were stored in an incubator in distilled water for 24-hours at 37C. Each composite-resin group was randomly further divided to 6 subgroups (n=3): hot coffee 65°C, 37°C coffee, cold coffee 4°C, hot distilled water 4°C (control group). All samples were placed in an incubator at the group-specific temperature.

Baseline color measurements were conducted using a spectrophotometer. The color changes ( $\Delta E^*$ ) were recorded after 24-hours, 3.5-days, and 7-days.

Descriptive statistics and a two-way repeated measures ANOVA, with the post-hoc contrast test were conducted to detect the difference in color stability ( $\Delta E^*$ ) between the three temperatures for each composite over the three time periods (alpha=0.05).

**Results:** Exposure time and interaction between temperature and time were non-significant for the three resin-composite groups. However, the data revealed a significant effect for the temperature on  $\Delta E^*$  for the three resin-composites (p<0.05 in each instance). Moreover, for each of the three resin-composites, the mean  $\Delta E^*$  obtained at 65°C temperature was significantly greater than that observed at 4°C and 37°C, while no significant difference was found between 4°C and 37°C.

**Conclusion:** Within the limitations of this study, the results indicated that higher temperature affects the color stability of resin-composite more than lower temperatures.

#### 69. Fluctuations in Dose Levels Based on Phantom Location and CBCT Scanner Settings



Daniah Alhazmi<sup>1</sup>, V. Allareddy<sup>1</sup>, G. Axt<sup>1</sup>, S. Allareddy<sup>1</sup>, *S.L. Sousa Melo*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Cone beam computed tomography (CBCT) has been

widely used in dental imaging and became an essential imaging modality for many specialties such as periodontology, oral surgery, oral diagnosis, orthodontics, and endodontics. It has been reported that CBCT provides a low radiation exposure compared to MDCT; however, the advanced CBCT units have a variety of scan settings that have to be considered regarding patient exposure.

**Objectives:** The aim of this study was to assess the dosimetry levels in a CBCT device (i-CAT FLX, Imaging Sciences, Hatfield, PA) when operating on various scan protocols (e.g. voxel sizes and fields of view (FOV)).

**Materials and Methods:** Exposure doses resulting from all combinations of scan protocols available on the CBCT machine were recorded with a Radcal MDH 1015, using a 10x5-3CT pencil ionization chamber and a 16cm cylindrical polymethylmethacrylate phantom. Measurements performed on different field sizes and scan settings at different phantom locations were used in the study. The phantom was exposed three times at the same location to calculate a reliable measurement of the radiation by the ionization chamber. Doses were read by an oral and maxillofacial radiology resident. Two-way ANOVA and Tukey test were performed to identify any significant differences at an alpha value of 0.05.

**Results:** The dosimeter reading values increased as the size of FOV increased. Quick scan+ protocol presented the lesser exposure doses among all scan protocols. There were no statistically significant differences among voxel sizes at the same scan settings.

**Discussion/Conclusions:** The exposure doses from the studied scanner are substantially dependent on the selected scan protocol and location within the phantom. The reduction of the dose with acceptable clinical image quality should be obtained by a proper selection of the scan settings in the CBCT machine.

#### 70. Caries Experience in American Indian Children in the First Year



Joan M. Attridge<sup>1</sup>, D.V. Dawson<sup>1</sup>, D.R. Blanchette<sup>1</sup>, J.J. Warren<sup>1</sup>, K.R. Phips<sup>76</sup>, D.E. Starr<sup>1</sup>, T.A. Marshall<sup>1</sup>, T. Mabry<sup>1</sup>, D.R. Drake<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA; <sup>76</sup>Oral Health Consultant, Morro Bay, CA

**Objectives:** To describe the longitudinal course of caries experience during the first year of life in an American Indian population at high risk for early childhood caries, and to characterize the relationships between caries burden and associated risk factors at 12 months.

**Methods:** Data obtained at approximately one, 4, 8 and 12 months of age were drawn from a longitudinal study of 239 American Indian mother-child dyads. Extent and location of tooth emergence and caries experience were characterized. Bivariate analyses to assess covariate relationships utilized chisquare analysis, Kruskal-Wallis tests, and Spearman rank correlations. Potential risk factors included sociodemographic, dietary, microbial and oral hygiene variables. A 5% level of significance was specified.

**Results:** Cavitated lesions were first observed at the 8 month visit in 5 of 233 children (2.1%), increasing to 15.0% at 12 months, with 120 of 7,306 erupted surfaces affected. The dmfs had mean of 0.51 (standard deviation 2.58), and ranged from 0 to 35 at 12 months. The majority (83.5%) of affected teeth were maxillary incisors. All affected surfaces were decayed; none was missing or restored. White spot lesions were observed in all children with cavitated lesions as well as an additional 24.9% of children. *Mutans streptococci* counts and *Lactobacilli* counts tended to be greater in children with one or more cavitated lesions than those without them (p<0.001 in both instances).

**Conclusions:** Caries prevalence in this population had reached 15% by 12 months of age, and was associated with higher microbial burden.

Supported by: NIH RO1-DE017736

#### 71. Permanent Dentition Hypoplasia Predicts Caries Incidence Longitudinally in Birth Cohort



Alexandra M. Curtis<sup>1</sup>, S.M. Levy<sup>1</sup>, J.E. Cavanaugh<sup>1</sup>, J.J. Warren<sup>1</sup>, T.A. Marshall<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Determine whether enamel hypoplasia in the permanent incisors

and 1<sup>st</sup> molars is associated with caries incidence in these teeth longitudinally at the subject level, using data from the Iowa Fluoride Study. **Methods:** Tooth-level hypoplasia status and surfacelevel decayed or filled surface (DFS) status were determined during dental exams at approximate ages 9, 13, and 17. Daily toothbrushing frequency and sugar-sweetened beverage (SSB) intake were reported by subjects' parents via questionnaires sent semi-annually. Daily ingested fluoride intake was estimated using these questionnaires. Subject-level generalized linear models and generalized linear mixed models were used to quantify the effects of enamel hypoplasia at age 9 on the level of caries assessed cross-sectionally (DFS counts) at ages 9, 13, and 17 and longitudinally (adjusted DFS increments (ADJCI)) from 5-9, 9-13, and 13-17 years.

**Results:** Subject-level prevalence of hypoplasia was very low in this sample (4.9%). In cross-sectional models, lower numbers of hypoplastic teeth were significantly associated with lower expected DFS rates and the effect size of this association was smaller for later time points (expected DFS rate increases of 109.2%, 77.4%, and 47.6%, at ages 9, 13, and 17 before covariate adjustment). In the longitudinal models, the association was also significant (97.1% expected ADJCI rate increase over all time points, unadjusted). These results generally held after adjustment for covariates, except the effect of hypoplasia in the age 17 cross-sectional model was no longer significant. Although this association tends to weaken over time, the differences in effect of hypoplasia on DFS rate at the three exams are not significant.

**Conclusion:** Even after adjustment for factors known to be associated with caries, enamel hypoplasia in the permanent dentition at the subject-level is associated with more caries throughout adolescence. Even in populations with low prevalence, enamel hypoplasia could provide a useful predictor of caries in the permanent dentition.

Supported by: NIH R03-DE023784, R01-DE12101, R01-DE009551, UL1-RR024979, UL1-TR000442, UL1-TR001013, M01- RR000059, Roy J. Carver Charitable Trust, Delta Dental of Iowa Foundation

#### 72. A Preoperative Evaluation of Retreatments Using CBCT



#### Zachary S. Goettsche<sup>1</sup>,

A.E. Williamson<sup>1</sup>, F.B. Teixeira<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Cone beam computed tomography (CBCT) has allowed for a more accurate assessment of the periapical tissues following endodontic

treatment. The aim of this study was to identify presenting factors and etiologies for failure of initial endodontic treatment using CBCT.

**Methods:** A record search identified all endodontic retreatments completed at the University of Iowa College of Dentistry Department of Endodontics from 2012 to present in which a CBCT was made prior to

initiation of the retreatment. Twenty-five variables were recorded by assessing the patient's record and preoperative CBCT images. Descriptive and bivariate analyses were conducted to explore the factors associated with symptomatic patients and lesion sizes using chi-square test, Fisher's exact test, and Wilcoxon rank-sum test (alpha=0.05).

**Results:** One-hundred and fifty-nine patients (57.2% females) were identified from the record search. Of the patients, 56.6% were symptomatic and 38.4% had a missed canal at the retreatment evaluation appointment. Symptomatic patients had more flare-ups after retreatment compared to asymptomatic patients (6.7% vs. 0%, p=0.0364). Patients who responded positively to percussion tests had larger lesions (mean±SD=6.49±4.10mm vs. 5.04±4.12mm, p=0.0268), and more cortical plates were destroyed with larger lesions (mean±SD=8.52±3.75 vs. 4.37±3.63; p<0.0001). Moreover, patients with a diagnosis of CAA or AAA had larger lesion sizes (p<0.05).

**Conclusions:** The use of CBCT has allowed for more accurate assessment of preoperative conditions that may influence success rates of endodontic retreatments. Future research is needed to determine how preoperative assessment of retreatment cases using CBCT influences decision making and outcomes.

### 73. Endodontic Practices Following Dental School



**Jennie Harris**<sup>1</sup>, A.E. Williamson<sup>1</sup>, F. Qian<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Introduction:** The purpose of this survey was to determine if what is taught in dental school with respect to endodontics is utilized in practice. or

are general dentists seeking continuing education in endodontic treatment?

**Methods:** A survey was emailed to past graduates of the University of Iowa College of Dentistry with 254 surveys being returned with an 11% response rate. Questions included year graduated, their current practice status, types of endodontic procedures they routinely complete and how much endodontic continuing education they have completed in the past 10 years.

**Results:** Two hundred fifty-four subjects (72.1% males, 57.5% 40+ years old) were included in the study. Comparing subjects in 20-30, 31-40 and 41-50 year age groups, the subjects who were in 51-60 and 60+ year age groups were more likely to perform root canals through crowns (61.7% & 73.6% vs. 46.3% & 55.2% & 53.7%; p=0.0066), retreatments (38.3% & 39.6% vs. 14.6% & 28.8% & 38.3%; p=0.0072), and apical surgery (14.9% & 26.4% vs. 9.8% & 10.6% & 10%; p=0.0132).

Comparing subjects who completed 0-6 hours of endodontic CE in the past year to the subjects who

completed more than 7 hours of endodontic CE, 7+ hours of CE were more likely to perform root canals through crowns (95.1% vs. 52%; p<0.0001), retreatments (68.3% vs. 24.1%; p<0.0001), and apical surgery (51.2% .vs. 7.7%; p<0.0001).

**Conclusion:** Practitioners who perform more endodontic procedures completed more continuing education after dental school. Older practitioners perform more endodontic procedures than their younger counterparts.

#### 74. Silver Diammine Fluoride Effectiveness in Arresting Early Approximal Carious Lesions



Maram E. Jaradat<sup>1</sup>, *A.I. Owais*<sup>1</sup>, S. Guzman-Armstrong<sup>1</sup>, J.L. Kolker<sup>1</sup>, S.L. Sousa Melo<sup>1</sup>, M. Murrell<sup>1</sup>, T.A. Marshall<sup>1</sup>, F. Qian<sup>1</sup>, M.J. Kanellis<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

Title: Silver Diammine Fluoride Effectiveness in Arresting Early Approximal Carious Lesions

**Objectives:** The aim of this study is to evaluate the effectiveness of Silver Diammine Fluoride (SDF) in arresting initial non-cavitated approximal carious lesion in adults utilizing subtraction radiography techniques.

**Methods:** This study is a randomized, double blinded, placebo-controlled clinical trial (*ClinicalTrials. gov identifier-NCT02591147*). The study population consists of adults aged 21-64 years old seeking care at the University of Iowa College of Dentistry. Eligible for the study included having at least one initial non-cavitated approximal posterior carious lesion (Radiologic scores RA1, RA2, or RA3 using the International Caries Classification and Management System (ICCMS) scoring system) (Figure 1) that is in contact with adjacent non-restored tooth surface.

Participants were randomly assigned to one of the two treatment groups and one randomly selected lesion received the following treatment: Group 1: conventional fluoride varnish application along with SDF every 6 month; Group 2: conventional fluoride varnish along with Placebo (water). Participants were prescribed Prevident® toothpaste. Participants completed a baseline diet and caries risk questionnaires.

The selected lesion will be followed up for 24 months every 6 months. Radiographic lesion progression is monitored by digital subtraction radiography.

Baseline measures and outcome data were assessed through direct reporting, clinical examination including blinded subtraction radiographic assessment, diet and caries risk questionnaires, and participant acceptability of the treatment

**Results:** Results reported are from the ongoing two-year clinical trial still in enrollment. To date, 21

subjects have been enrolled. Fourteen were assigned to one group while seven were assigned to the other group. 16 subjects were females (64%). Mean age was 38.71±12.07 years. Mean Decayed, Missing, Filled Teeth (DMFT) was 15.33±1.52. No complaints were reported by the subjects so far.

**Conclusions:** Preliminary findings suggest that SDF is a reasonable option to treat initial approximal lesions. Future results will provide quantitative information on the progression of the lesions when SDF is used.

#### 75. Preclinical Evaluation of MDM2 Inhibitors for Treatment of Adenoid Cystic Carcinoma



**Felipe Nor**<sup>1</sup>, K.A. Warner<sup>49</sup>, M. Sant'ana Filho<sup>115</sup>, S. Wang<sup>49</sup>, *J.E. Nor*<sup>49</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>49</sup>University of Michigan, Ann Arbor, MI; <sup>115</sup>Federal University of Rio Grande do Sul, Porto Alegre, Brazil

Adenoid cystic carcinoma (AdCC) is one of the most common salivary gland malignancies. To date there are no FDA approved chemotherapeutic agents for management of advanced cases. Murine double minute 2 (MDM2), a potent inhibitor of tumor suppressor p53, was found to be overexpressed in solid cancers (including AdCC), and its expression was associated with poor prognosis. Novel anticancer drugs, targeting MDM2, have been developed; here, we present the results of preclinical studies treating AdCC with two such agents. 3 patient-derived xenograft (PDX) models of AdCC and 5 primary human AdCC cells were exposed to MI-773, a small molecule inhibitor of the MDM2-p53 interaction. The combination of MI-773 with Cisplatin was also tested. Expression of MDM2, p53 and downstream-related proteins (i.e. p21, PUMA, BAX, Bcl-2, and Bcl-xL) was assessed by western blot assay. Flow cytometry was carried out to determine the proportion of cancer stem cells (CSC). Additionally, we exposed AdCC cells to AA-115, a second-generation MDM2-p53 inhibitor. MI-773 caused tumor regression in all AdCC PDX models, associated with a significant increase in p53positive cells (p<0.001) and apoptotic cells (p=0.015). Combination of MI-773 with Cisplatin was more effective than single-agent therapy without showing tumor rebound upon treatment cessation. MI-773, as well as AA-115, potently induced the expression of p53 and its downstream targets MDM2/p21. MI-773 also regulated the expression of apoptosis-related proteins PUMA, BAX, Bcl-2, and Bcl-xL. The proportion of CSC was significantly reduced upon treatment with MI-773 as both a single-agent or when combined with Cisplatin (p<0.05). Remarkably, mice treated with a neoadjuvant regimen of MI-773 prior to surgery had no recurrence for over 300 days of follow-up. Taken together, data suggest that inhibition of the MDM2-p53 interaction might represent a promising therapeutic option for patients with adenoid cystic

carcinoma. Further evaluation of MI-773 in clinical trials is warranted.

Supported by: National Council for Scientific and Technological Development (CNPq) (FN); Adenoid Cystic Carcinoma Research Foundation (AACRF); University of Michigan Head and Neck SPORE P50-CA97248 from the NIH/ NCI; NIH/NIDCR R01-DE23220, R01-DE21139 (JEN).

#### 76. The Dental Specialists Cost-Benefit Analysis of Referring a CBCT to an Oral and Maxillofacial Radiologist



Joshua J. Orgill<sup>1</sup>, S. Vijayan<sup>1</sup>, S. Allareddy<sup>1</sup>, S.L. Sousa Melo<sup>1</sup>, *V. Allareddy*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Cone beam computed tomography (CBCT) is well-established

as a useful diagnostic and treatment planning tool in dentistry. Much attention has been given to selection principles for use of CBCT and who should be interpreting the CBCT scans in the past 10 years with an emphasis focused on incidental findings. This study, instead, looks at the specialty-specific costbenefit advantages referring CBCT scans to an Oral and Maxillofacial Radiologist (OMR).

**Objective:** To determine the cost-benefit advantage of each dental specialty when referring to an OMR versus self - interpreting CBCT scans.

**Materials and Methods:** Data for annual gross billing and annual hours worked were obtained for dental specialists. The average fee for private practice OMRs and the time spent on an average interpretation was obtained through a phone survey/online fees from website of 15 OMRs.

**Results:** The average hourly gross billing for each specialty is as follows: OMS is \$826.92; Endodontists is \$489.72; Orthodontists is \$534.39; Periodontists is \$564.90; Prosthodontists is \$533.31. The savings for each specialty is as follows: OMS \$571.92; Endodontists \$234.72; Orthodontists \$279.39; Periodontists \$309.90; Prosthodontists \$278.31.

**Discussion:** Referring CBCT scans for interpretation to an OMR reduces losses to each of the dental specialists, most of all for the OMS. The dollar amount saved for each of the dental specialists on an assumption that 24 CBCT scans are made per month is as follows: OMS \$4,575.36/month and \$54,904.32/year; Endodontists \$1,877.76/month and \$22,533.12/year; Orthodontists \$2,235.12/month and \$26,821.44/year; Periodontists \$2,479.20/month and \$29,750.40/year; Prosthodontists \$2,226.48/month and \$26,717.76/year. The total dollar amount saved combined with the reduced liability makes referring to an OMR for each dental specialist an effective and cost-effective means of interpretation of CBCT scans.

#### 77. Associations Between DXA Bone Outcomes at Age 5 and the Presence of Dental Fluorosis at Age 8



**<u>Reem Oweis</u>**<sup>1</sup>, *S.M. Levy*<sup>1</sup>, J.J. Warren<sup>1</sup>, J.M. Eichenberger Gilmore<sup>1</sup>, T. Burns<sup>1</sup>, P. Saha<sup>1</sup>, E. Letuchy<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** Explore the associations between dental fluorosis at age 8 and DXA bone outcomes at age 5.

Methods: Participants have been in the Iowa Bone Development Study (IBDS) that grew out of the Iowa Fluoride Study (IFS), a longitudinal investigation of dietary and non-dietary fluoride exposures, dental fluorosis and dental caries. IFS participants were recruited during 1992-95 from 8 lowa hospital postpartum wards, and detailed guestionnaires were sent every 1.5-6 months. Data on combined fluoride intakes from water, other beverages, selected foods, dietary fluoride supplements and dentifrice were collected with the questionnaires. DXA bone assessments of the whole body, proximal femur (hip), and lumbar spine were performed at the University of Iowa Clinical Research Center (with Hologic QDR-2000 DXA). Each person's dental fluorosis score was defined as the proportion of zones with definitive or severe fluorosis.

**Results:** The mean daily fluoride intake estimated by area-under-the-curve (AUC) from birth to 5 years was 0.64mg(SD=0.24) for females and 0.68mg(SD=0.30) for males. The mean fluorosis score (mostly mild) was 0.11 (SD=0.19). In unadjusted associations between bone outcomes and dental fluorosis scores, no significant associations were detected for females(p>0.05). For males, a significant negative association was found only between hip BMD and dental fluorosis scores. Sex-specific partial correlation coefficients were estimated between DXA-derived bone outcomes and dental fluorosis scores adjusted for height, weight, physical activity, and calcium and fluoride intake. No significant associations were found for females. For males, a significant negative association was found only between hip BMD and dental fluorosis scores.

**Conclusion:** The findings show little association between the presence of mild dental fluorosis and bone measures. Given that the study participants generally had been receiving modest-moderate fluoride intakes from the different sources, results provide additional evidence of the safety of fluoride intakes that most children in the U.S Midwest are consuming.

Supported by: NIH R01-DE09551, R01-DE12101, M01-RR00059, UL1-RR024979; Wright-Bush-Shreves Endowed Professor Fund (Levy); University of Iowa

#### 78. Radiographic Adaptation of Prefabricated Stainless Steel Crowns — A Pilot Study



**Zach Percival**<sup>1</sup>, *M.K.* Geneser<sup>1</sup>, *A.I.* Owais<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** The purpose of this study was to evaluate whether the radiographic appearance of stainless steel crowns on posterior primary teeth

differs between those seated with the Hall technique compared to those seated using the traditional technique in the opinion of pediatric dentists of varying experience levels.

**Methods:** Bitewing radiographs of Hall technique stainless steel crowns were randomly selected and evaluated for participation based on inclusion criteria. Ten crowns were selected and matched to traditional technique crowns based on tooth number and patient age at treatment. The twenty selected bitewing radiographs of stainless steel crowns were randomly ordered in a PowerPoint presentation. Pediatric dental residents and faculty at the University of Iowa evaluated the fit and adaptation of each crown in terms of clinical acceptability.

Results: In progress.

**Conclusions:** To date, perception of Hall vs. traditional stainless steel crowns is controversial. The results of this study will provide preliminary results on the perception and acceptability of Hall vs traditional stainless steel crowns among practitioners.

#### 79. Obesity and Dental Decay



<u>Megan R. Rohman</u><sup>1</sup>, *K. Leary*<sup>1</sup>, A.I. Owais<sup>1</sup>, T.A. Marshall<sup>1</sup>, F. Qian<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Purpose:** The purpose of this study was to investigate the relationship between obesity and dental caries among children visiting The University of Iowa tal Clinic (URDC)

Pediatric Dental Clinic (UIPDC).

**Methods:** Data was collected from 237 charts of children (ages 3-16) at the UIPDC <from 02/05/2017-06/30/2017. Patient demographic information was obtained including age, date of exam, sex, race, primary language, social-economic status, height, weight, medications, total number of teeth, number of decayed or filled teeth (dft/DFT), frequency of sugars, and exposure to fluoride toothpaste. Body Mass Index (BMI) was calculated by the Center for Disease Control and Prevention BMI percentile calculator. Weight was categorized as underweight, normal or healthy weight, overweight, and obese using ageadjusted CDC guidelines. Data analysis was completed with the standard chi-square test, Fisher's exact test, nonparametric Wilcoxon rank-sum test and Kruskal-Wallis test, and Spearman's rank correlation test, as appropriate, were used to explore the association of levels of BMI with each of variables of interest in the study.

**Results:** The mean age of patients was 9.1 years (SD 3.6) and 52.3% females. It was found that 9.7% of patients were underweight, 57.4% were healthy weight, 15.2% were overweight, 17.7% were obese, and 59.5% of patients had a dft/DFT of one or greater. The results showed marginally significant ( $.05 \le P < .10$ ) association between BMI and sex (P = .0531) and age (P = .0531). There were no significant or marginally significant associations of levels of BMI with types of insurance, race, medications, snacks, beverages, inadequate fluoride, tooth brushing, DFT, and high or low risk (P > .10 for each instance).

**Conclusions:** No relationship was found between obesity and dental caries among children visiting the third year dental student clinic at the UIPDC.

### 80. Prevalence and Perceived Indications of CBCT in Endodontics



**Ryan Teahen**<sup>1</sup>, *A.E. Williamson*<sup>1</sup>, *F. Qian*<sup>1</sup>, *F.B. Teixeira*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objective:** To understand implications of the 2016 American Association of Endodontists (AAE) and American Academy of Oral and Maxillofacial

Radiology Joint Position Statement on the use of cone beam computed tomography (CBCT) on endodontic practice. An assessment of the current prevalence and perceived indications of this technology was undertaken.

**Methods:** A 16-item survey was emailed to all active members of the AAE in March of 2017 inquiring about their use of CBCT. The data were collected and analyzed through descriptive and bivariate analyses using SAS 9.4 for Windows (alpha=0.05).

**Results:** There were 1,175 respondents with a response rate of 23%. 79.9% (n=935) practice in the US, 28.7% (n=334) are Diplomates with the American Board of Endodontics, and 85.5% (n=1004) use CBCT in their practice. The mean time since graduation for those who use CBCT was significantly lower than those who don't (17.1±11.9 vs. 22.9±12.2 years; p<0.0001). 46.6% consult with radiologists, at least occasionally, for interpretation of CBCT images. 85.7% use small field of view imaging. CBCT is used most commonly for endodontic surgeries, followed by nonsurgical retreatments, followed by nonsurgical treatment and is rarely used for recalls. Of those that use CBCT, 83.5% believe their total treatment time was at least occasionally expedited while 80.6% believe that they

were at least occasionally offering superior treatment.

**Conclusion:** CBCT imaging is common amongst endodontists, in particular those that are recent graduates and are board certified. Endodontists that use CBCT tend to believe it allows for expedited and superior treatment.

Supported by: AAE Foundation for Endodontics

### 81. Segmenting Root Canal System Using an Open Source Slicer Software



<u>Suvendra Vijayan</u><sup>1</sup>, S. Allareddy<sup>1</sup>, S.L. Sousa Melo<sup>1</sup>, F.B. Teixeira<sup>1</sup>, *V. Allareddy*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** The development of 3D imaging provides exciting opportunities

for oral and maxillofacial radiology and endodontics, specifically in regenerative endodontic therapies. The aim of this study was to explore the feasibility of creating a virtual 3D model of a molar root canal system using  $\mu$ CT images in order to produce scaffolds with similar shapes.

**Objectives:** The aim of this study was to explore the feasibility of creating a virtual 3D model of a molar root canal using  $\mu$ CT images on an open source slicer software.

Materials and Methods: An extracted molar tooth was scanned using the Bruker Skyscan  $\mu$ CT (Kontich, Belgium) at 10  $\mu$ m resolution, 16 bits depth, and 360 $\infty$ rotation using a step and shoot detector motion at 80 kv. The images were reconstructed using NRecon software and initially stored as .tiff format files (or tiff format) and later converted to DICOM. The converted DICOM files were imported into the 3D slicer software. There were difficulties with segmenting these images as the file size was in excess of 1 GB and the computer was not responsive. The segmentation was done using 3D slicer software by selecting the region of interest (ROI) and then using the threshold tool to segment the root canal. All 3D models were stored as .stl files. For these kinds of files it is recommended to use extremely fast computers with a minimum RAM of 32GB for the images to even be displayed.

**Preliminary Results:** Preliminary results indicate that root canal system can be segmented accurately from  $\mu$ CT scans using segmentation software.

**Future Directions:** In the future, research will be expanded to validate these finding by measuring and comparing scans with sectioned teeth and 3D printed models of root canals.

#### 82. Effect of Application Protocol of Remineralizing Agent on Erosion Depth of Enamel



**Rawa Alammari**<sup>1</sup>, *D.V. Dawson*<sup>1</sup>, P.W. Wertz<sup>1</sup>, M.A. Vargas<sup>1</sup>, J.A. Banas<sup>1</sup>, S.R. Kwon<sup>15</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>15</sup>Loma Linda University, Loma Linda, CA

**Objective:** The aim of the current study is to evaluate the effect of the application protocol of 1.1% sodium fluoride gel (NaF)(Prevident®Brush-on gel), and Casein Phosphopeptide-Amorphous Calcium Phosphate (ACP)(MI Paste<sup>™</sup>) on the erosion depth of enamel associated with 1% Citric Acid (pH=3.6) using polarized light microscopy.

**Methods:** Extracted human molar teeth (N=24) were collected and used for the preparation of enamel blocks. The buccal surface was flattened and protected with acid-resistant nail-varnish leaving a 1.0mm unprotected stripe down the center of the flat surface.

Specimens were randomly assigned to one of 8 treatment groups (n=3):

- 1. Application of ACP before 1% Citric Acid (B-ACP),
- 2. Application of ACP after 1% Citric Acid (A-ACP),
- 3. Application of ACP before and after 1% Citric Acid (BA-ACP),
- 4. Application of NaF before 1% Citric Acid (B-NaF),
- 5. Application of NaF after 1% Citric Acid (A-NaF),
- 6. Application of NaF before and after 1% Citric Acid (BA-NaF)
- 7. 1% Citric Acid only (with no remineralization agent) (NoRem).
- 8. Negative control exposed to Grade 3 deionized water (NC).

After treatment, specimens were sectioned and examined under a polarized light microscope and the average erosion depth for each specimen was determined based on triplicate measurements of each sample.

#### 83. Simvastatin Reverses LPS-Inhibited Osteoblastic Differentiation of Periodontal Ligament Cells Through Autophagy



D. Chen<sup>101</sup>, J. Li<sup>101</sup>, **Jinlin Song**<sup>101</sup> <sup>101</sup>Chongqing Medical University, Chongqing, China

**Objectives:** Periodontitis leads to progressive destruction of the supporting tissues of the teeth, and has been the major cause of tooth

loss. Simvastatin was first developed as a lipid-

lowering drug and found to be able to promote bone formation for decades. The objectives of this study were i) to explore the efficiency of simvastatin on osteoblastic differentiation and ii) determine the role of autophagy played in the regulation of simvastatin on osteogenesis.

**Methods:** Human periodontal ligament cells (hPDLCs) were isolated from orthodontic teeth, which were extracted from five healthy individuals (11 to 19 years of age) in Stomatological Hospital of Chongqing Medical University. Concentration-dependent cell growth and osteogenic effect of simvastatin was evaluated via CCK-8 and Alizarin Red Staining, respectively. Then three groups were divided: LPS group, LPS + Simvastatin group, and control group. After 21-day osteogenic induction, cells were stained with Alizarin Red to evaluated mineralized nodules formation. Protein and mRNA were collected for western blot and gPCR analysis. To further explore the role of autophagy in simvastatin regulation, an autophagy inhibitor BafA1 was then used to pretreat these cells, and protein samples were collected on scheduled time points for western blot analysis.

**Results:** Autophagy-related MAP1LC3B was upregulated at both mRNA and protein level and reached maximum expression on day 7 and day 10, respectively. Alizarin Red Staining suggested that 0.1 µM simvastatin significantly increased the mineralized nodules formation. LPS  $(1 \mu g/ml)$ inhibited osteogenesis compared with control group. In contrast to LPS group, LPS + Simvastatin group showed more mineralized nodules. By pretreating with BafA1, Beclin1 was upregulated on protein level and reached maximum expression on day 3 but decreased from day 7. On day 3, LPS + Simvastatin group significantly increased Beclin1 expression level in comparison to LPS group. BafA1 pre-treatment decreased Beclin1 expression, while simvastatin restored the expression level.

**Conclusions:** Simvastatin reversed LPS-inhibited osteoblastic differentiation in PDLCs. Autophagy was involved in this reversion process. These results suggested that simvastatin might provide a new strategy to periodontal regeneration.

### 84. Dental Education in CQMU: Training the Future Dentists for China



Dan Jiang<sup>101</sup>, L. Jiang<sup>101</sup>, P. Ji<sup>101</sup>, Q. Yin<sup>101</sup>, J. Song<sup>101</sup>

<sup>101</sup>Chongqing Medical University, Chongqing, China

Abstract: There are about 1.4 billion people in China, and almost 100 million people go to see dentist every year.

According to the data published by National Health and Family Planning Commission (NHFPC) in 2012, only 116,000 are registered dentists (including dental assistants) in China. There are more than 3 million

patients visiting dentists every year in Chongging, which is the youngest municipality. To meet with the growing demands for oral treatments, training qualified dentists has become an urgent affair in China. The School of Stomatology of Chongqing Medical University (CQMUSOS) was founded in 2006, and now is equipped with 469 dental units and has more than 850 faculties. The hospital receives more than 1 million patients every year. As the only Stomatological school in Chongging, CQMUSOS recruits about 120 undergraduates (80 for stomatology, 40 for dental technology) every year. The 5-year competency-based education program for stomatology undergraduates is now being implemented. In order to achieve teaching objectives, specific curriculum is designed: 1) Emphasis is placed on the basic sciences and introduction to stomatology in the first and second year. 2) The third year is spent on learning medical lessons and basic stomatology courses. Students will provide non-treatment dental care for patients as voluntary dental assistants. 4) Oral clinical courses and artificial simulator practices will be done in the fourth year, and students will do some preclinical skill training and be preparing for the next internship. 5) Clinical practice in fifth year is designed to improve undergraduates' clinical skills and community dental care skills. Students are trained in all dental specialties, including endodontics, periodontics, prosthodontics, maxillofacial surgery, oral mucous, pediatric dentistry, preventive dentistry, oral radiology, etc.. After completing all credit hours and passing examination of clinical skills, students will be awarded bachelor's degree in stomatology. Furthermore, the School of Stomatology also offers some postgraduate programs in all dental specialties, including residents training and study toward the MS or PhD degrees. Besides, as a developing Stomatological school, and having a short time in dental education, CQMUSOS is making efforts to improve educational level, and searching for improvements about teaching methods. Coorperation with some high-level dental schools in recent years is benefit for CQMUSOS which is aiming to train future dentists with qualified skills and competences, and also with international perspectives.

### 85. Fluoride Intake and Age 23 Distal Tibial Bone Microarchitectural Measures



**Steven M. Levy**<sup>1</sup>, P. Saha<sup>1</sup>, C. Chen<sup>1</sup>, E. Letuchy<sup>1</sup>, J.J. Warren<sup>1</sup>, T. Burns<sup>1</sup>, A.M. Curtis<sup>1</sup>, J.M. Eichenberger Gilmore<sup>1</sup>, K. Janz<sup>1</sup>, J. Torner<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Introduction:** Fluoride intake affects tooth and bone mineralization. Few studies have comprehensively assessed fluoride intake and childhood/young adult bone development.

**Purpose:** To assess associations of fluoride intake from birth to age 23 with age 23 volumetric trabecular

and cortical bone mineral density and microarchitectural measures at the distal tibia using Multirow Detector Computed Tomography (MDCT).

**Methods:** In this prospective birth cohort study. participants were a subset (n=186, 102 female) from the longitudinal Iowa Bone Development Study (IBDS). Parents and participants provided detailed questionnaire data 2-5 times yearly (birth to age 23) concerning fluoride intake from water, beverages, selected foods, dentifrice, and supplements. Individual water sources and major beverages were assayed for fluoride. Cumulative fluoride intakes (area-underthe-curve, AUC) for different periods (0-5, 5-12, 12-18, and 18-23 years) were examined for their association with trabecular bone outcomes over 4-6% and cortical bone outcomes over 14-16% of the distal tibia obtained from MDCT imaging (Siemens SOMATOM Force Scanner) using advanced algorithms for quantitative digital topology, geometry, and tensor scale, designed and developed at the University of Iowa. Partial correlations adjusted for a)sex, weight, and height (n=177), and b) these variables plus calcium intake and physical activity scores (n=155) were determined for 11 bone measures (9 trabecular, 2 cortical).

**Results:** Mean combined daily fluoride AUC intakes were 0.67, 0.72, 0.8, and 1.05 mg/day for the 4 time periods, respectively. In both levels of these adjusted analyses, greater fluoride intakes during all of the intake periods were not associated significantly (all p> 0.05) with any of the 9 trabecular or 2 cortical bone measures at age 23.

**Conclusions:** Results suggest that childhood, adolescent, and early adult fluoride intakes in the range of this study do not have adverse effects on trabecular or cortical bone micro-architecture at age 23.

Supported by: NIH R01-DE09551, R01-DE12101, R56-DE12101, UL1-TR000442; Carver Charitable Trust; Delta Dental of Iowa Foundation.

#### 86. Endogenous Progenitor Cell-Based Temporomandibular Joint Cartilage Repair



Dong Rim Seol<sup>1</sup>, I. Song<sup>1</sup>, K. Chitphet<sup>1</sup>, A. Salem<sup>1</sup>, *J. Martin*<sup>1</sup>, *K. Shin*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** Degeneration of cartilage surfaces in temporomandibular joint

(TMJ) disorders cause pain and disability and seldom resolve spontaneously; thus, there is a need to develop regenerative therapies. In previous studies, we showed that endogenous progenitor cells have a promising potential for the regeneration of TMJ cartilage. The objective of this study was to determine the optimal conditions of WBC lysates and hydrogel for migration of progenitor cells, and to develop sustained delivery of N-[N-(3,5-Difluorophenacetyl)- L-alanyl]-S-phenylglycine t-butyl ester (DAPT) from PLGA microspheres.

**Methods:** Progenitor cells from bovine TMJ cartilage were isolated and processed for cell migration assay using 8 µm-pore Transwell® plates with various concentrations of WBC lysates (0, 0.8, 2.5, 8.3 and 16.7 million cells/ml). The lysates were obtained by freeze/thaw method and measured for high mobility group box1 (HMGB1), a chemotactic agent. Full-thickness cartilage defects (4 mm-diameter) were implanted with different concentrations of fibrinogen (12.5, 15 and 20 mg/ml) and thrombin (5 and 10 U/ml) of fibrin/hyaluronic acid (HA) hydrogel. After 2-week of culture, wet weight and DNA content were measured from the hydrogel. Additionally, releasing kinetics of DAPT-encapsulated PLGA microspheres were tested.

**Results:** HMGB1 was detected in WBC lysates and the migration of progenitor cells was dramatically enhanced at higher than 8.3 million cells/ml. Hydrogel stability and cell migration were more effective in 20 mg/ml fibrinogen and 10 U/ml thrombin hydrogel but there were no significant differences. DAPT release profile of PLGA microspheres demonstrated an initial burst release (40%) in first 24 hours, followed by a sustained release until 2 months.

**Conclusion:** Progenitor cell migration can be enhanced by optimizing WBC lysates concentration and composition of fibrin/HA gels. For chondrogenic differentiating of migrated cells, we need to modify PLGA microspheres to protect initial burst of DAPT in future work.

### 87. Exploration of Caries and Microbial Status in American Indian Children



<u>Alissa Villhauer</u><sup>1</sup>, D. Lynch<sup>1</sup>, T.R. Postler<sup>1</sup>, D.R. Blanchette<sup>1</sup>, D.V. Dawson<sup>1</sup>, J.J. Warren<sup>1</sup>, *D.R. Drake*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Objectives:** *Streptococcus mutans* (SM), *Streptococcus sobrinus* (SS), and

Lactobacillus (LB) species have been shown to play a role in the development of dental caries. Children from low socioeconomic families have a greater incidence and prevalence of early childhood caries. Our current study is looking at mutans streptococci (SM and SS) colonization and transmission and prevalence of Lactobacilli in a Northern Plains American Indian Tribe. We report here on SM, SS, and LB and species colonization profiles and detection frequency in a subset of children from this population (n=64) and the relationship to caries status (cariesfree/caries-active).

**Methods:** Whole mouth plaque samples were collected 8 times between the child's birth and 36 months of age. Samples were spiral plated onto

MSKB (Mitis salivarius-Kanamycin-Bacitracin) agar for mutans streptococci (MS) counts and isolation and Rogosa agar for LB counts. MS isolates were identified as SM or SS by sugar fermentation profiles and PCR. Scores based on the number of visits each species was detected (detection frequency) along with a three species colonization profile were recorded for each subject. Detection frequencies were compared using the Wilcoxon rank sum test. The distribution of colonization profiles were compared using Fisher's Exact test. Analyses were performed using SAS 9.4 (Cary, NC).

**Results:** Statistically significant differences were seen in species detection frequency between groups for SM (p=0.0025), SS (p=0.0004), and LB (p<0.001). The colonization profiles observed were different for both groups. (p<0.0001).

**Conclusions:** We observed differences in SM, SS, and LB colonization profiles and detection frequency of each species in caries-free versus caries-active children. Ongoing investigation includes genotyping of SM, SS, and LB isolates from this subject set by arbitrarily primed PCR to further explore the link between these microbial species and the rampant caries observed in this population.

Supported by: NIH 1-R01 DE017736-01A5.

### 88. MicroRNA Regulation in Obesity-Associated Periodontitis



Min Zhu<sup>1</sup>, A. Akkouch<sup>1</sup>, T. Krongbaramee<sup>1</sup>, Q. Qian<sup>1</sup>, L. Yang<sup>1</sup>, J.A. Banas<sup>1</sup>, *L. Hong*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Obesity exacerbates the prevalence and severity of periodontitis

while the mechanistic basis is yet unknown. microRNAs (miR) are involved in periodontitis, obesity and chronical inflammation and specific miRs have significant roles in their pathophysiology. We have previously shown that miR-200c possess antiinflammation by targeting IL-6 and IL-8.

**Aim:** To better understand the role of miR-200c in the interaction of periodontitis and obesity.

**Materials and Methods:** Mice on a high fat diet (obese mice) and a regular diet (lean mice) were injected with LPS 10µg/injection in the palatal gingiva of upper molars to induce experimental periodontitis. Periodontal bone loss was detected by µCT and levels of miR-200c, IL-6, and IL-8 at the gingival tissue, white adipose tissue (WAT), liver and blood were assayed after two weeks. In addition, oral swabs were taken from control mice for the quantification of Gram-positive, Gram-negative, and total bacteria.

**Results:**  $\mu$ CT showed periodontal bone loss after LPS challenge in both obese and lean mice after 2 weeks.

IL-6 and IL-8 increased at LPS dose-dependent in the gingiva, WAT, blood, and liver of obese and lean mice after LPS challenge. All miR-200c decreased in these tissues at LPS dose-dependent after LPS challenge. Interestingly, although the control obese mice have lower miR-200c expression than control lean mice, the decrease was greater in obese mice than in lean mice. In addition, higher concentrations of total bacteria, especially Gram-negative bacteria, were recovered from the oral cavities of obese mice compared to lean mice.

**Conclusion:** The results indicated that periodontitis negatively affected miR-200c expression not only in gingiva but also in WAT, liver and blood. Obesity also negatively affected miR-200c expression similarly. The obese mice had more LPS-producing bacteria (Gram-negative) than lean mice in the oral cavity, probably causing the lower miR-200c in obese mice. Knowledge gained from this study may guide further study on treatment of periodontitis and obesity.

Supported by: NIH/NIDCR R21DE025328, R21DE024799, R01DE026433

### 89. Dental Student Preferences for Patient Education Using Digital Media



<u>Elliott Glenn</u><sup>1</sup>, *M.M. Hernandez*<sup>1</sup>, M.R. McQuistan<sup>1</sup>, C. Straub-Morarend<sup>1</sup>, D.R. Blanchette<sup>1</sup>, D.V. Dawson<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Background:** Digital media devices (tablets) are becoming more common in the medical and dental patient education setting. They are advantageous due to their portability, interactive nature, and ease of use. Tablets have been used in the 4th year dental clinic for several years, but the students' usage habits and preferences are unknown. There were three applications used: DDS GP, 3D4 Medical and a library of past student cases.

**Objective:** The goal of this descriptive study was to better understand how the tablets are used in the 4th year students for patient education and treatment plan presentation.

**Methods:** At the beginning of the year, a lecture was given to the fourth year dental class explaining how to use the tablets for patient education purposes. The tablets were used by the students in clinic for 6 months. A survey was administered using the Qualtrics web-based platform.

**Results:** The survey was sent to 80 students and 52 responded (28 females and 24 males). All participants stated that they plan to use a form of digital media device as a part of their practices after graduation and that they felt it facilitated patient education. 84% of students felt that use of the tablet increased patient

acceptance of proposed treatment plans. Half of the students used the tablets with patients on a weekly basis. The most used application was DDS GP, and it was preferred by 66% of students.

**Conclusions:** Participants were positive about the usage of digital media in a clinical setting. They felt the use of the tablets improved patient education and understanding of their treatment plan. Expansion of the use of tablets to the other clinics at the College of Dentistry may be beneficial to facilitate patient education, motivation and improve understanding of treatment plans.

Supported by: Dental Student Research Program

#### 90. Predictors of Citations of Systematic Reviews in Oral Implantology Published in 2010



Blake M. Louscher<sup>1</sup>, V. Allareddy<sup>1</sup>, S. Elangovan<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Introduction:** Systematic reviews (SRs) combine available evidence systematically to provide a clinically applicable evidence summary and

therefore contribute heavily to evidence based health care. Citation count is one of the metrics used to measure the impact of articles and evidence dissemination. Our assessment is aimed at identifying the variables at the SR level, including its quality of reporting, in oral implantology that influence its citation counts.

Method: Using a well-defined selection criterion, a thorough search was conducted in PubMed, Web of Science, and Cochrane Database by two investigators to identify SRs in the field of oral implantology published in 2010. This was followed by extraction, by two investigators, of variables (number of authors, number of institutions, number of references, journal impact factor, AMSTAR score, presence or absence of meta-analysis, and total citations in 2016). We separately evaluated the quality of reporting of SRs using the AMSTAR checklist. Bivariate associations between the extracted variables and SR citation count were examined by Pearson correlations and Spearman rank correlations. The simultaneous effect of all extracted variables and SR citation count were examined by a multivariable linear regression model fit by the Ordinary Least Squares method.

**Results:** Our search resulted in 26 SRs. Number of authors ranged from 1 to 8 and number of institutions ranged from 1 to 5. The mean JIF was 3.22 (±1.81) and the mean AMSTAR score was 6.04 (±2.84). The AMSTAR score ranged from 2 to 10, indicating variability in reporting quality. The total citations for selected SRs ranged from 0 to 123 (Web of Science) and 1 to 245 (Google Scholar). Close to 42% of the

studies had international collaboration and metaanalysis was performed in 10 SRs. Our correlation analysis revealed lack of significant (p>0.05) correlation between the examined variables listed in the methods and 2015 citation counts.

**Conclusion:** Within the limitations of our study, we did not identify any variable which could act as a predictor of citation count of SRs in oral implantology published in 2010. Of particular interest is the lack of significant correlation between the quality of reporting of SRs and the total citation counts. This underscores the importance of careful appraisal of SRs by authors before incorporating its findings into clinical practice.

Supported by: Dental Student Research Program

#### 91. Early Childhood Caries Risk Factors Among Children Aged 0-3 Years



Nicole Youngers<sup>1</sup>, A.I. Owais<sup>1</sup>, A.R. Christensen<sup>1</sup>, K. Pagan-Rivera<sup>1</sup>, D.V. Dawson<sup>1</sup>, K. Weber-Gasparoni<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA

**Purpose:** Study the child and family influences on caries in WIC-enrolled

children aged 0-3 years beyond the biological infectious disease model.

**Methods:** Data were collected from records of children attending the University of Iowa's Infant Oral Health Program (IOHP) located at a local WIC program. Mothers completed questionnaires regarding their prenatal history and their child's demographics, neonatal history, oral hygiene and dietary habits. Clinical evidence of visible plaque, enamel defects, and caries were obtained. Odds ratios (ORs) were calculated for significant associations detected by Chi-square tests or Fisher's exact tests; the significance level was set at *P*=.05.

**Results:** Analyses were based on information from 851 subjects with caries status data. The average age for this group was  $19 \pm 7$  months. Increased risk of caries was associated with older age (P<.0001), increased number of siblings in the house (P=.0060), race/ethnicity (P=.0070) presence of parent's language barrier (P<.0001), the child being breastfed to bed (P=.0241) and decreased caregiver's knowledge of baby-bottle-tooth-decay (P=.0069). Several other variables were also found to be associated with greater likelihood of caries including low dental health literacy of the caregiver (P=.0089), daytime consumption of cariogenic beverages (P<.0001), nighttime consumption of cariogenic drinks/foods (P=.0072), visible plaque on incisors/ poor oral hygiene (P<.0001) and enamel defects (P=.0010).

Conclusion: The study showed an association

between the presence of caries and several important ECC risks which should be focused on to improve caries preventive measures.

#### 92. Dental Payment Innovation: Best Practices of Health Center Dental Clinics in Three States



#### L.D. Slashcheva<sup>1</sup>, <u>Irene Hilton</u><sup>118</sup>, *R.A. Kuthy*<sup>1</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>118</sup>Department of Health, San Francisco City, CA

Medicaid expansion with the implementation of the Patient

Protection and Affordable Care Act of 2010 has encouraged health innovation within state level insurance marketplaces. In addition to expansion of the influence of managed, accountable, or coordinated care organizations as a broad-level innovation in healthcare payment, individual enhanced benefits, such as a dental benefit, has also provided opportunity for innovation through various methods. In recent years, safety net dental providers have absorbed a large proportion of newly-insured dental patients. The National Network for Oral Health Access provides technical assistance on best practices to HRSA health center grantee dental programs. In early 2017. NNOHA interviewed providers, administrators. Primary Care Association staff, and dental payer level from four states regarding the nature of dental payment innovation in their respective state. This formative investigation specifically targeted the best practices for adapting clinical care in health center dental clinics to provide care most effectively under the given payment innovation incentives, penalties, and protocols. Key themes that inform a NNOHA Technical Assistance Fact Sheet include clinical workflow adaptation to adjust for payer incentives, engagement of care coordination to improve compliance with recall schedules, and utilization of required metrics for overall health center evaluation of outcomes. As dental care reimbursement follows the trends of healthcare overall towards value-based reimbursement, lessons from pioneers in dental payment innovation will inform effective health center clinical guidelines that will both strengthen the dental safety network and improve the oral health of the communities they serve.

#### 93. Improving Healthcare Encounters for Individuals With Intellectual/Developmental Disabilities through Customized Care Communication Cards



L.D. Slashcheva<sup>1</sup>, **Phil Ryan**<sup>1</sup>, J. Tate<sup>1</sup> <sup>1</sup>University of Iowa, Iowa City, IA

A shift from the institutional medical model of care for individuals with intellectual and developmental disabilities (IDD) towards a communitybased social model of integrated living

and care has occurred. However, healthcare systems and providers are not prepared to accommodate the complex communication/behavioral needs of individuals with IDD, resulting in poorer access and lower quality of healthcare service-provision and health outcomes. Recognizing that effective communication via Direct Support Professionals (DSPs) is the lynchpin to coordinating high quality and effective care for individuals with IDD, a work group was convened to develop a quality improvement intervention to address the challenges discussed above. Healthcare providers at the University of Iowa Hospitals and Clinics partnered with administration and staff of a local agency that has been providing community-based supports to individuals with IDD for over 45 years. We identified key problems during healthcare encounters and ways to avoid them through improved DSP-provider communication. Customized Care Communication Cards were developed to offer patient-specific strategies for optimizing a health encounter, orienting providers to communication styles-including words or actions that may trigger or prevent adverse behaviors-and environmental considerations-such as specific mobility or cognitive limitations that may require accommodation. Additionally, Care Cards serve as a communication tool between providers and support staff that interact with a patient daily. Specialized sections about oral/medical/vision homecare may improve continuity of care that individuals with IDD receive from a network of community-based healthcare providers. This tool has potential for improving the quality of communitybased care for individuals with IDD.

#### 94. Oral Health Integration in Long-Term Care Settings: Lessons From a Virginia Pilot Program



#### Lyubov D. Slashcheva<sup>1</sup>, J. Coe<sup>70</sup>

<sup>1</sup>University of Iowa, Iowa City, IA; <sup>70</sup>Virginia Commonwealth University, Richmond, VA

Meeting oral health needs of older adults in Long-Term Care (LTC) settings means addressing unique challenges

and disparities for this population. The Virginia Dental Association (VDA) LTC Access to Care Work Group facilitated a one-year pilot program integrating oral healthcare professionals into two public LTC facilities to demonstrate cost-effectiveness and benefits of ensuring preventive and referral oral health services into the LTC setting. A Registered Dental Hygienist and a Dental Assistant staffed the pilot program, providing training to direct support staff on oral disease/hygiene and recording oral health status, treatment indicated and rendered, and oral healthassociated hospitalizations throughout the pilot program in order to raise the value placed on oral health in LTC settings, improve oral health of LTC residents, and demonstrate reduced morbidity and cost of oral health-related ailments/hospitalizations. To qualitatively assess the pilot program and inform the broader discussion on best practices for integrating oral health programs into LTC settings, VDA LTC Access to Care Work Group members and pilot program staff were interviewed. Key challenges and opportunities for integrating oral health services into LTC settings exist both on the direct care provision and administrative level. The novel Community Dental Health Coordinator (CDHC) may be a suitable catalyst to address recommendations emerging from pilot program. Continued collaboration between oral healthcare and LTC professionals as exhibited in this pilot program will strengthen and improve the LTC infrastructure in valuing and improving oral health for older adults.

### Author/Abstract-Number Index

Acri, T	<u>63</u>
Ahsan, M.S	<u>66</u>
Akers, M.	.44
Akkouch, A	. <u>8</u> , 14, 24, 88
Alammari, R	<u>82</u>
Algamaiah, H.A	<u>67</u>
Alhakami, A.A	<u>68</u>
Alhazmi, D	<u>69</u>
Allareddy, S	69, 76, 81
Allareddy, V.	4, 34, 62, 64,
-	69, 76, 81, 90
Allareddy, Vs.	2, 4, 34
Alsibaie, L	4
Amendt. B.A	8. 14. <i>15. 16</i> . 18. <i>23</i> .
	27.36
Anand. D	32
Anderson, D	62
Andrew M	62
Armstrong S P	67
Attridge LM	70
Attriage, J.M.	<u>70</u> 15 00 57
Avila Ortiz, G	15, 26, 57
Axt, G	.69
Banas, J.A	28, 41, 58, 59, 61,
	. 67, 82, 88
Barlow, P.	39, 52
Barshinger, L.	29
Barwacz, C.A.	57
Bates A.M.	5.24
Beck C	44
Bello C A	32 16
Planchatta D.P.	77 50 55 70
Bianchette, D.R.	33, 50, 55, 70,
Due of the LCA	.87,89
Brogden, K.A	5, 24
Brolsma, T	<u>30</u>
Burns, T	77, 85
Busch, T	3, 32, 46
Butali, A	2, <u>3</u> , 23, <i>32</i> , 46
Сао, Н	15, 16, <i>3</i> 6
Caplan, D.J.	11, 50
Carrilho M	56
Cavanaugh J F	71
Chandrashekarajah S	3/
Chan C	05
Chen D	01 07
Chen, D	21, 83
Cnen, 1	13,
Chen, X	10, 43, 51
Chitphet, K	.86
Christensen, A.R.	. <u>31</u> , 91
Christensen, S.J	<u>64</u>
Chyi, F.Y.	. <u>1</u>
Coe, J.	.94
Cornell, R	3
Cowen, H.	50
Cunningham-Ford, M	26
Curtis A M	71 85
da Fontoura CS	18
Damiano PC	26
Danso P	59 67
Dalliso, R	DE 71 77 44 40
	23, 31, 33, 44, 49,
	50, 55, 70, 82, 87,
	89, 91
Deroo, L.	.17
Desai, S	. <u><b>32</b></u> , 46
Dibbern, K	62
Develop DD	
Douglas, P.D	. <u>33</u>

Drake, D.R	. 49, 53, 61,	L
	70, 87	L
Eckermann, N.	4, <u><b>34</b></u>	ſ
Elchenberger Glimore, J	.M. 77, 85	r
Elangovan, S	90 0 15 16 10 <b>27</b>	I N
Elidson, S.L.	8, 15, 10, 18, <u><b>21</b></u>	I N
Fernancies Dos Santos, J	J.F. 50 ZE	I N
Garcia D	<u>35</u> 22	'
Geary S	63	
Geneser M.K.	. 40. 55. 78	Ň
Gilbaugh, G		Ň
Glenn, E	. 89	١
Goettsche, Z.S		١
Gomez Hernandez, M.P	5,	١
Goodson-Gregg, N.T	. <u>10</u>	١
Grubbs, T.D	<u>6</u>	١
Guo, Y.W	. <u>36</u>	١
Guzman-Armstrong, S	. 74	١
Haes, A.J	. 45	١
Harless, J	35	١
Harris, J	. <u>73</u>	١
Hartshorn, J	50, 52	1
He, L	14	ſ
Helms, J.A.	20	ſ
Hernandez, M.M.	89	r N
Hilton, I.	. <u>92</u> 77	r N
Hollinger, N.C.	<u>3/</u> 19 27 49 60	1
Honos ID	. 10, 27, 40, 00 <b>70</b>	
Hong I	<u>30</u> 8 9 <i>11</i> 16	`
11011g, L	24 88	
Huang I		0
Ida-Yonemochi, H	66	F
Jain. A	67	F
Janz, K	. 85	F
Jaradat, M.E	. 74	F
Jasek, I	. 62	F
Jenkins, M.M	. 17	F
Ji, P	. 13, 84	F
Jiang, D	. <u>84</u>	F
Jiang, L	84	F
Kanellis, M.J.	. 37, 44, 55, 74	F
Kaufman, L	52	F
Kelly, S	44	ŀ
Kielnneksel, B	40	(
Kolker, J.L.	6, 25, 35, 74 70 E2	•
Kossioni, A	39, 32 11	•
Krois N	<b>70</b>	•
Krongbaramee T	9.88	0
Kuang Y	7	F
Kuthy, R.A.	. 22. 38. 92	Ē
Kwon, S.R.	82	F
Lachke, S	32	F
Lanzel, E.A.	. 5, 24	F
Leary, K	. 30, 37, 40,	F
	. 44, 39	F
Letuchy, E	. 77, 85	F
Levy, S.M	. 71, <i>77</i> , <u><b>85</b></u>	F
Li, D	. <u>13</u>	F
Li, J	. <u>21</u> , 83	F
Lim, T	65	F
Liu, W	49	S
Lo, C	32, 46	5
Louscher, B.M		S

#### Presenters are **<u>underlined</u>**. Mentors are *italicized*.

Lynch D	19 87
	. <del>- 3</del> , 07
Lyu, W	.17
Mabry, T	. 29, 30, 44, 70
Maia, R.R.	. 25. 68
Mansaray M	27
	.23
Marchini, L	. 39, 50, 52
Marshall, S	. 64
Marshall, T.A.	. 49, 68, 70, 71,
	74 79
Martin	.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,
	.00
Masoud, M.I	. 4
McCaulley, G	. <u>41</u>
McKernan, S.C.	. 22. 26. 38
McOuistan M.P.	51 80
	. 54, 05
Miller, S.F.	.60
Moen, G.N	. <u>58</u>
Mohamed, M	. 32, 46
Montesinos, E	. 42
Moreno Uribe I M	17 18
	. 17, 10
Munger, R.G.	. 1/
Murray, J.C	. 3, 17
Murrell, M	. 74
Nalliah R	.34
Nachitt D	61
	.04
Nicholson, K	. <b>43</b> , 51
Nor, F	. <u>75</u>
NorIE	75
Notari Chastar I	.70 EO
Notari Criester, L	. 50
Orgill, J.J	. <u>76</u>
Owais, A.I.	. 2, 29, 31, 33, 37,
·	40 44 45 55
	7/ 70 70 01
••••••	. 74, 70, 79, 91
O LA LA D	
Oweis, R	. <u>77</u>
Oweis, R Pagan-Rivera, K	. <b>77</b> . 91
Oweis, R Pagan-Rivera, K Park. J.V	. <u>77</u> . 91 . 32. <b>46</b>
Oweis, R Pagan-Rivera, K Park, J.V.	. <b>77</b> .91 . 32, <b><u>46</u> 44</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D	. <u>77</u> .91 .32, <u>46</u> .44
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M.	. <u>77</u> .91 .32, <u>46</u> .44 .33
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z Petrin, A.L.	. <u>77</u> .91 .32, <u>46</u> .44 .33 . <u>78</u> . <u>17</u>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z Petrin, A.L. Pfohl, E.	. <u>77</u> .91 . 32, <u>46</u> . 44 . 33 . <u>78</u> .1 <u>7</u> .47
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M Percival, Z Petrin, A.L. Pfohl, E Phan, A.T.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>40</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z Petrin, A.L. Pfohl, E Phan, A.T. Phan, H.T.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>40</b> .45
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z Petrin, A.L. Pfohl, E Phan, A.T. Phan, H.T. Phips, K.R.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z Petrin, A.L. Pfohl, E Phan, A.T. Phan, H.T. Phips, K.R. Piche, A.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .45 .45 .49, 70 . <b>48</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .45 .49, 70 . <b>48</b> <b>49</b> , 87
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Postler, T.R. Oian E	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>9</b> , 70 . <b>48</b> .49, 70 . <b>48</b> .49, 87 .5 26 28 35
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D Penticoff, M Percival, Z Petrin, A.L. Pfohl, E Phan, A.T. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35,
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43,
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 . <b>5</b> , 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61,
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> . <b>37</b> .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74,
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>49</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, 79, 80
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z Ptohl, E. Phan, A.T. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .47 .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, <i>68</i> , 73, 74, .79, 80
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, Q. Rampa, S.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .47 .47 .49, 70 .48 .49, 70 . <b>48</b> .49, 70 . <b>48</b> . <b>37</b> , 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, Q. Rampa, S. Rawls, R.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z Phan, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, C. Rampa, S. Rawls, R. Pecker, F.N	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>5</b> .49, 70 .4 <b>8</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, <i>68</i> , 73, 74, .79, 80 .88 .34 .58, 67 <b>50</b>
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, S. Rampa, S. Rawls, R. Recker, E.N. Denwi, M.T.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, G. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Pagene Dispersion	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .4 <b>1</b> .4 <b>3</b> .5 <b>1</b> .5 <b>4</b> .5 <b>9</b> .6 <b>1</b> .6 <b>4</b> .6 <b>8</b> .7 <b>3</b> .7 <b>4</b> .5 <b>8</b> .6 <b>7</b> .5 <b>6</b> .5 <b>4</b> .5 <b>8</b> .6 <b>7</b> .5 <b>6</b> .5 <b>4</b> .5 <b>4</b> .5 <b>4</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, C. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> .49, 70 . <b>48</b> .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, G. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, F. Rampa, S. Rawls, R. Rewy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> .45 .49, 70 . <b>48</b> .49, 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> .1 <b>4</b> .4 .22 .43, <b>51</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, G. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L Rohman, M.R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 .5 <b>0</b> .1 <b>4</b> .4 .22 .43, <b>51</b> .7 <b>9</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, F. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L. Rohman, M.R. Pomparo, Purtillog, M.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4 .22 .43, <b>51</b> .4 <b>9</b> .22 .43, <b>51</b> .22 .25 .27, 57
Oweis, R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4 .22 .43, <b>51</b> . <b>79</b> .8, <b>15</b> , 27, 57
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phan, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, F. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L. Rohman, M.R. Romero-Bustillos, M Romitti, P.A.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> .49, 70 . <b>48</b> .49, 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4 .22 .43, <b>51</b> . <b>79</b> .8, <b>15</b> , 27, 57 .17
Oweis, R Pagan-Rivera, K Park, J.V. Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, F. Qian, G. Rampa, S. Rawls, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L. Rohman, M.R. Romero-Bustillos, M. Romitti, P.A. Rucker, R.J.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> .49, 70 . <b>48</b> .49, 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 .58, 67 .5 <b>0</b> .1 <b>4</b> .4 .22 .43, <b>51</b> .7 <b>9</b> .8, <b>15</b> , 27, 57 .17 . <b>52</b>
Oweis, R Pagan-Rivera, K Park, J.V Pelzer, D. Penticoff, M. Percival, Z. Petrin, A.L. Pfohl, E. Phan, A.T. Phan, H.T. Phips, K.R. Piche, A. Postler, T.R. Qian, F. Qian, F. Qian, F. Qian, R. Recker, E.N. Remy, M.T. Reyna-Blanco, O. Reynolds, J.C. Rodriguez, L. Rohman, M.R. Romero-Bustillos, M Romitti, P.A. Rucker, R.J. Ryan, P.	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .4 <b>7</b> .4 <b>7</b> .5 <b>7</b> .2 <b>6</b> , 28, 35, .37, 40, 41, 43, .5 <b>1</b> , 54, 59, 61, .64, <i>68</i> , 73, 74, .79, 80 .88 .34 .58, 67 .5 <b>0</b> .1 <b>4</b> .4 .22 .43, <b>51</b> .7 <b>9</b> .8, <b>15</b> , 27, 57 .17 .5 <b>2</b> . <b>93</b>
Oweis, R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> . <b>49</b> , 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4 .22 .43, <b>51</b> . <b>4</b> . <b>2</b> . <b>3</b> . <b>5</b> . <b>5</b> . <b>7</b> . <b>9</b> . <b>3</b> . <b>1</b> . <b>1</b> . <b>1</b> . <b>1</b> . <b>1</b> . <b>1</b> . <b>1</b> . <b>1</b>
Oweis, R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> . <b>47</b> .45 .49, 70 . <b>48</b> .49, 70 . <b>48</b> .49, 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 . <b>50</b> . <b>14</b> .4 .22 .43, <b>51</b> . <b>79</b> .8, <b>15</b> , 27, 57 .17 . <b>52</b> .23 .23
Oweis, R	. <b>77</b> .91 .32, <b>46</b> .44 .33 . <b>78</b> . <b>17</b> . <b>47</b> .4 <b>7</b> .4 <b>9</b> .45 .49, 70 . <b>48</b> .49, 70 . <b>48</b> .49, 87 .5, 26, 28, 35, .37, 40, 41, 43, .51, 54, 59, 61, .64, 68, 73, 74, .79, 80 .88 .34 .58, 67 .5 <b>0</b> .8 <b>1</b> .4 .22 .43, <b>51</b> .7 <b>9</b> .8, <b>15</b> , 27, 57 .17 . <b>52</b> .9 <b>3</b> .23 .77, 85
Salem, A..... 63, 86 Sant'ana Filho, M......75 Sarmet Smiderle Mendes, M. Scaffa, P. ..... 56 Schneider, R.A. ..... 53 Sislow, K.R.....19 Slach, N.A...... 47 Smith, B..... 52 Song, X.....14 Sousa Melo, S.L. ..... 18, 27, 48, 60 Southard, T.E.....64 

Stier, A	. 40
Stine, K	. <u>56</u>
Straub-Morarend, C	. 89
Sukalski, J.M.	. <u>26</u>
Sweat, M.E	. <u>16</u> , 23, 27
Sweat, Y.Y	. 16, <u><b>23</b></u>
Swenson, M.A.	. <u>57</u>
Swenson, R.D.	. <u>24</u>
Tabrizi, M	. 39
Takanami, E	. <u>28</u>
Tamegnon, M	. 30, 43, 44
Teahen, R	. <u>80</u>
Teixeira, E.C	. 6, 58, 67
Teixeira, F.B	. 9, 72, 80, 81
Theodory, T.G	. <u>25</u>
Tora-O, A.M	. 32, 46
Torner, J	. 85
Tsai, M	. <u>59</u>
Tuggle, L	. 22
Vargas, M.A	. 6, 25, 82
Vidal, C	. 56, 68
Vijayan, S	. 76, <u><b>81</b></u>
Villhauer, A	. 49, 53, 61, <u><b>87</b></u>
Wang, C	. 13

Wang, L	. 56
Wang, S.	.75
Warner, K.A	.75
Warren 11	1 29 42 49
	55 70 71 78
	85 87
Wabar-Gasparani K	20 $70$ $71$ $77$
Weber-Gasparolli, K	129, 30, 31, 37, 100, 100, 100, 100, 100, 100, 100, 10
	.40, 44, 55, 91
Wenby, G.L.	
Welhaven, A	. 41, 47, 51,
	. 53, 62
Welling, A.B.	. <u>60</u>
Wertz, P.W.	. 82
Wilcox, A.J.	. 17
Williamson, A.E.	. 72, 73, 80,
Wu, Y	.20
Yang, L	. 88
Yen, F.Y	. 61
Yin, Q	.84
Youngers, N.	. 91
Yu. W	. 15, 16
Zhang, X	. 7. <b>12</b>
Zhu. M	. 9. 88
,	

# **Iowa Section of AADR - Presidents**

1967-68	James Searls	1992-93	Jed Hand
1968-69	C. Robert Kremenak	1993-94	Lisa Wilcox
1969-70	N.N. Soni	1994-95	Ana Diaz-Arnold
1970-71	Leslie Higa	1995-96	William Rubright
1971-72	Clayton Shalla	1996-97	Karen Baker
1972-73	Mohamed Khowassah	1997-98	David Drake
1973-74	Carl Svare	1998-99	Clark Stanford
1974-75	Charles Sabiston	1999-2000	Janet Guthmiller
1975-76	Steven Wei	2000-01	Kaaren Vargas
1976-77	William Grigsby	2001-02	Rebecca Slayton
1977-78	Jimmy Pinkham	2002-03	John Warren
1978-79	Christopher Squier	2003-04	Teresa Marshall
1979-80	Dorothy Rowe	2004-05	Galen Schneider
1980-81	Brian Clarkson	2005-06	Kim Brogden
1981-82	James Wefel	2006-07	Zoya Kurago
1982-83	Murray Hill	2007-08	Karin Weber-Gasparoni
1983-84	James Beck	2008-09	Jeffrey Banas
1984-85	Daniel Boyer	2009-10	Marcela Hernandez
1985-86	Mark Jensen	2010-12	Justine Kolker
1986-87	Rick Walton	2012-13	Sherry Timmons
1987-88	John Reinhardt	2013-14	Gustavo Avila Ortiz
1988-89	Richard Walton	2014-15	Christopher Barwacz
1989-90	Steven Vincent	2015-17	Veerasathpurush Allareddy
1990-91	John Keller	2017-18	Kyungsup Shin
1991-92	Ronald Ettinger		

## Acknowledgments

# We extend our grateful acknowledgment to the following members of our College of Dentistry family:

#### **College of Dentistry Administration**

David Johnsen	Brad Amendt	Scott Arneson
Ron Elvers	Lily Garcia	Michael Kanellis
Penni Ryan	Galen Schneider	Sherry Timmons
Jan Swartzendruber	Deborah Abbott	

#### **College of Dentistry DEOs**

Steven Armstrong (Dept. of Operative Dentistry) Gustavo Avila Ortiz (Dept. of Periodontics) Daniel Caplan (Dept. of Preventive & Community Dentistry) Kirk Fridrich (Dept. of Oral & Maxillofacial Surgery) John Hellstein (Dept. of Oral Pathology, Radiology & Medicine) Julie Holloway (Dept. of Prosthodontics) David Holmes (Dept. of Family Dentistry) Fabricio Teixeira (Dept. of Endodontics) Thomas Southard (Dept. of Orthodontics) Karen Weber-Gasparoni (Dept. of Pediatric Dentistry)

#### Iowa Section of AADR

Kyungsup Shin

Arwa Owais

Sharon Seydel

#### Judges Local AADR 2018

Madaratara 2010		
Kyle Stein	Erica Teixeira	John Warren
Natalia Restrepo-Kennedy	Marcia Sampaio Campos	Saulo Sousa Melo
Leonardo Marchini	Susan McKernan	Michelle McQuistan
Justine L. Kolker	Kecia Leary	Tad Mabry
Brian Howe	Aditi Jain	David Jones
Nidhi Handoo	Nathan Holton	Liu Hong
Matthew Geneser	Manueal Ricardo Pedro Gomez	Sandra Guzman-Armstrong
Daniel Caplan	Bruno Das Neves Cavalcanti	Hanan Elgendy
Christopher Barwacz	Kim Brogden	Huojun Cao
Abdullah Mohammed D Alshehri	Steven R. Armstrong	Jeff Banas
Adil Akkouch	Sindhura Allareddy	Veerasathpurush Allareddy

#### Moderators 2018

Kasey Befeler

Karen Kluesner

Amber Marolf

#### **Councilor Iowa Section of AADR 2018**

Veerasathpurush Allareddy

#### Iowa Institute for Oral Health Research

Brad A. Amendt	Jeff Banas	Kim Brogden
Sharon Seydel Jennifer Peak	Christopher Squier	J. Michael Tilley

#### Student Research

Teresa Marshall	Satheesh Elangovan	Justine Kolker
Lynn Schaul		

## **Technology & Media Services**

Chuck McBrearty	Kasey Befeler	Pat Conrad
Hao Geng	Sean Kelley	Margaret Ruddy
Rich Tack		

## **Dental Facilities Services**

Justin Bringman	Jim Christison	Bob Day
Richard Madden	Sherri O'Rourke	Bob Watson

### **Division of Biostatistics & Research Design**

Xian Jin Xie	Derek Blanchette	Deborah Dawson
Fang Qian	Anne Welhaven	Monelle Tamegnon

# We extend our grateful acknowledgment to the following sponsors:

Procter and Gamble Oral Care, Crest & Oral-B Desi Nuckolls





**American Dental Association (ADA)** 



**Delta Dental of Iowa Foundation** 



**Omicron Kappa Upsilon (OKU) National Dental Honor Society** 



Iowa Association of Endodontists - Sponsoring the Michel Fuller Postdoctoral Award

Iowa Society of Periodontology - Sponsoring pre-doctoral and post-doctoral awards







