THE EXPLORER

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Student Research Group
925 W. 34th Street
Los Angeles, CA 90089
dentistry.usc.edu

THE EXPLORER

Dear Students and Colleagues,

Research Day is always an exciting time for the Ostrow School of Dentistry of USC. The largest such event at USC, Research Day provides a unique opportunity for students and faculty members to share and learn from the immense amount of scientific investigation taking place within the school.

The Ostrow School of Dentistry, Division of Biokinesiology and Physical Therapy, and Division of Occupational Science and Occupational Therapy all have long legacies of scientific success. From continuously publishing high-impact research to translating new findings for the clinic, we've been able to demonstrate how quality science powers our professions.

It's especially important for students at all levels to stay connected to research. Participation in scientific study provides unmatched educational opportunities and readies students for a long career in a dynamic, ever-evolving field. It also opens the door to unique opportunities for mentorship and leadership.

Congratulations to all of our 2014 student and faculty presenters. We are all incredibly proud of your curiosity and hard work!

Avishai Sadan, DMD
Dean
G. Donald and Marian James Montgomery
Professor of Dentistry
Ostrow School of Dentistry of USC

WELCOME!

Dear Colleagues,

It is my pleasure to welcome you to Research Day 2014! Each year, the Ostrow School community looks forward to this celebratory event, which brings us together to learn about the exciting discoveries that our students, staff, and faculty are making. This year is special because we are dedicating our Annual Research Day to the remarkable career accomplishments of Professor Harold Slavkin.

At the Ostrow School of Dentistry, we are proud to be part of the University of Southern California, an elite institution committed to excellence in research endeavors. USC emphasizes the preparation of students to become leaders in fields such as science and health care. Our students and post-docs are among the best in the nation, with research published in top tier journals. We have also seen a positive trend in proposal submissions across the entire Ostrow School. Last year, we ranked #1 in funding from the National Institute for Dental and Craniofacial Research (NIDCR) among all private dental schools in the nation. Our Occupational Science and Occupational Therapy and Biokinesiology and Physical Therapy programs are national leaders in education and research. We take great pride as we celebrate our research accomplishments together and deeply value our interactions and the bond that links the Dentistry, Occupational Science and Occupational Therapy, and Biokinesiology and Physical Therapy programs.

Looking towards the future, we will continue our quest to provide the best possible research opportunities for our students, to equip them with the critical thinking skills, clinical training, and cutting-edge research experience necessary to advance scientific knowledge and shape the future of health care. We must continue to be innovative in our research project development, collaborate with our colleagues to build a stronger research program, and explore diverse funding opportunities for our research projects.

Please join me in congratulating our students on their successes and exploring the many excellent research projects being showcased during our Research Day. Your contributions give us confidence in a bright future for the research program at our school.

Fight on!

Yang Chai, DDS, PhD
Professor
George and MaryLou Boone Chair in Craniofacial Molecular Biology
Associate Dean of Research
Director, Center for Craniofacial Molecular Biology
Ostrow School of Dentistry of the University of Southern California

DR. HAROLD SLAVKIN

Dear Colleagues,

Few people have had as profound an influence on dentistry and craniofacial science at USC—or indeed, on the fields of dental and craniofacial research—as Dr. Harold Slavkin. This June, he will retire after a remarkable career spanning nearly five decades at USC. We therefore take the opportunity provided by Research Day to celebrate his distinguished career and visionary leadership. We dedicate this day to honoring him and his amazing accomplishments.

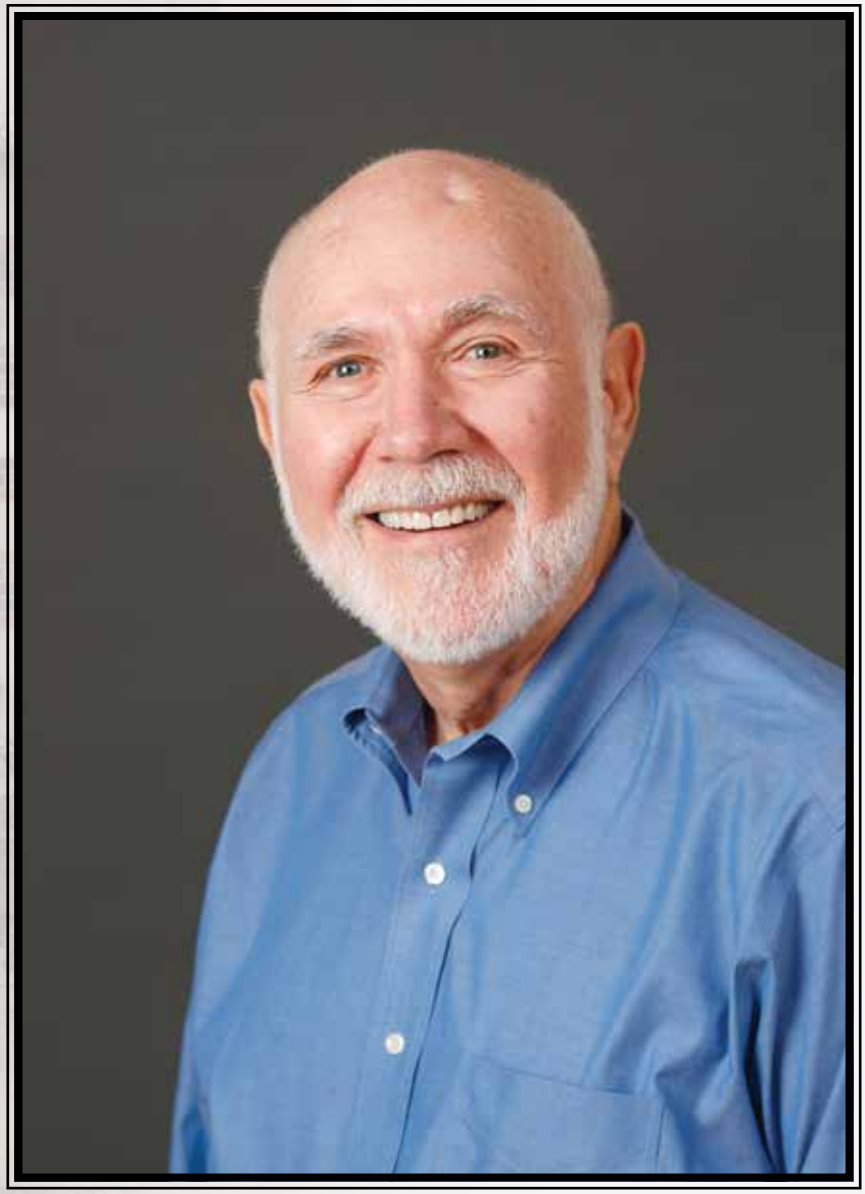
Dr. Slavkin is a Trojan through and through: after serving as a dental technician in the U.S. Army, he completed his undergraduate and D.D.S. degrees at USC. His star was on the rise from the start, and in 1968 he wrapped up his postdoctoral training—begun at UCLA, then continued at USC—earlier than anticipated, as he was appointed Chair of the Department of Biochemistry. Dr. Slavkin cites this unexpected leap into administration as one of the biggest challenges of his career, but also a tremendous opportunity for learning and growth. In 1972, he witnessed the birth of the Laboratory for Developmental Biology, which in 1989 transformed into the Center for Craniofacial Molecular Biology.

Dr. Slavkin's career has coincided with some of the greatest advancements in science and technology of our era. During his time in Washington D.C. during the second half of the 1990's, he witnessed several paradigm shifts that affected dentistry and craniofacial biology directly. As Director of the National Institute for Dental Research (NIDR), he was instrumental in securing a dramatic increase in funding for dental and craniofacial research, and in the NIDR's rebirth as the more fittingly named National Institute for Dental and Craniofacial Research (NIDCR). The National Institutes of Health first jumped on the information superhighway in this period as well, adopting widespread e-mail, intranet, and internet usage. The first draft of the complete human genome was published just after his return to USC, this time as Dean of the School of Dentistry, in 2000.

An important change in the health sciences over the past decades is that "the distinction between clinician and scientist or biologist is getting smaller," Dr. Slavkin noted in a recent interview. In this era of "omics," it is important for the clinician-scientist to learn how to make the best use of informatics resources. Clever searches of the tremendous resources now available at our fingertips can yield important links between phenotypes and genotypes, for example, if one can formulate the right questions. For Dr. Slavkin, addressing health disparities constitutes another area of vital importance. He serves on the boards of several local and national organizations concerned with this issue, and plans to devote more time to this area as he retires from teaching. In addition, he looks forward to planning special trips with each of his eight grandchildren, painting watercolors, sailing, and of course spending time with his beloved wife, Lois.

Each and every one of us at the Ostrow School of Dentistry has benefitted personally from Dr. Slavkin's tremendous dedication, integrity, enthusiasm, scholarship, and leadership. It is in tremendous gratitude for this selfless service that we wish him all the best as he sets sail on this new journey.

Good luck, Hal!



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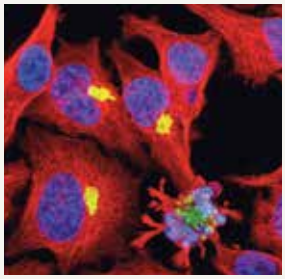





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Research Poster Abstracts

SONGTAO SHI

From Tooth Fairy to Leader in Mesenchymal Stem Cell Research

BY TIFFANY LEE and PAYAL PATEL

In the midst of a November birthday celebration at USC's Center for Craniofacial Molecular Biology, Dr. Songtao Shi finished eating his cake to sit down and share his story with us. The excitement and passion for research poured out of him as he talked about how he got to where he is today and how his research has developed throughout the years.

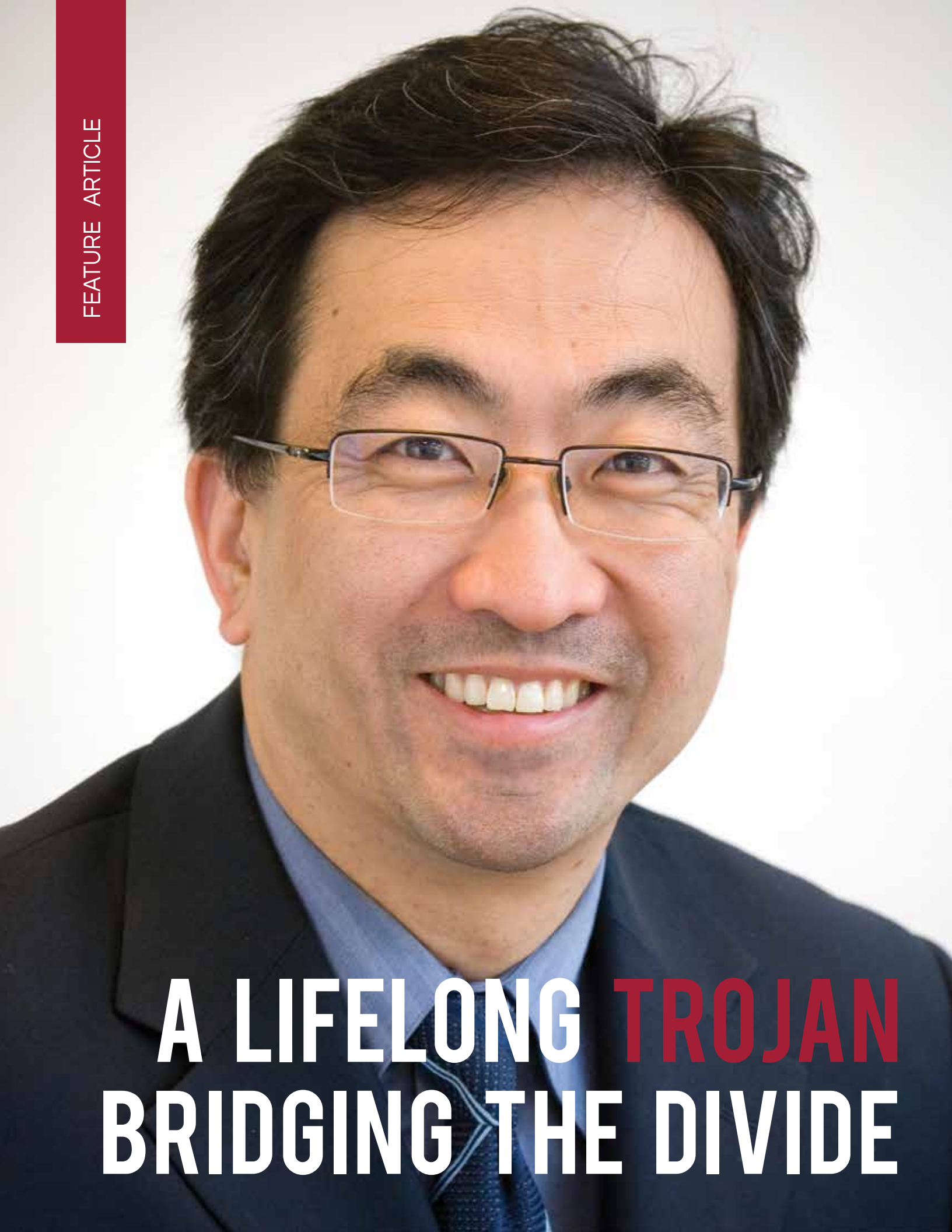
Mesenchymal stem cells have long been of great interest to Dr. Shi and are the focus of his research here at USC. Initially, he explored the use of mesenchymal stem cell therapy in systemic lupus erythematosus (SLE) patients as they were optimal patients for clinical testing. There was a 70-80% survival rate in late stage SLE patients, suggesting that mesenchymal stem cell therapy was a viable treatment option. Since SLE has been linked to orofacial manifestations and because of his background in dentistry, the results of this study influenced Dr. Shi to investigate the effect of mesenchymal stem cell therapy on orofacial problems. Research includes the use of periodontal ligament stem cells in the treatment of periodontitis, the creation of a biological root implant, and the use of stem cells from exfoliated deciduous teeth after dental trauma.

A major milestone in Dr. Shi's research took place when his daughter lost her first primary tooth, leading him to discover the deciduous tooth ("baby tooth") stem cell population. He noticed some residual pulp tissue and cultured it, finding viable stem cells after 3 days. He then repeated this procedure by collecting teeth from his daughter's friends at their birthday

parties. Since he couldn't leave the party right away, he would store the teeth in milk for 1-2 days until he could visit his lab for culturing and found viable stem cells again. The discovery of such a cell population led to further research on the use of stem cell therapy in dental disease. Pre-clinical trials on animals with deciduous tooth stem cells established efficacy and safety. Dr. Shi and his team are currently conducting clinical studies with deciduous tooth stem cells. One such study includes the use of deciduous tooth stem cell therapy in trauma treatment for pediatric patients. This procedure has been implemented in 20 patients so far, using autologous stem cells from an exfoliating deciduous tooth to promote healthy development in a traumatized tooth. The treatment has shown positive effects and improvement in the patients, but observations are still ongoing. Future inquiry will include the application of such therapy using allogenic deciduous tooth stem cells.

Despite making tremendous advances in his research on the different applications of stem cell therapy, Dr. Shi stressed that the greater importance of it all was being able to translate the results of basic science research into solving clinical problems. After a year in private practice after dental school, Dr. Shi decided to pursue a role in academia in order to make a greater impact on patient care. By utilizing his clinical background, Dr. Shi has applied his research towards many common dental issues. Humbled by his opportunities and achievements in his research, he hopes that one day his research will make a profound and significant change in clinical care for the better.

FEATURE ARTICLE



A LIFELONG TROJAN BRIDGING THE DIVIDE

BY SHAWN EBRAHIMPOUR

Dr. Mark Urata is a rare member of society, having highly specialized training in diverse sectors that uniquely qualifies him to carry out the ambitious role he plays in the education, investigation, and treatment of craniofacial anomalies.

In meeting Dr. Urata, I was pleasantly greeted by a jovial individual full of life who immediately lightened the mood with his witty humor. As we dove into conversation about his newest appointed position as the chair of USC's newly created Division of Oral and Maxillofacial Surgery, he remarked that the alliance between this new division and the Division of Plastic and Reconstructive Surgery at the Keck School of Medicine of USC "is a novel expansion, placing two remarkable clinical divisions under one administrative roof, which will give unique access to grow in a way that they independently could not."

In discussing the defining characteristics of the collaboration, he discussed how the joint residency would be much like a family working together cohesively. "Having professionals trained in a different fashion working side by side for the first time will allow both to have access to a different type of information in tackling clinical problems that overlap," he said.

Dr. Urata himself is a case in point of this novel residency merger. He spent his undergraduate '85, DDS '89, Oral and Maxillofacial Surgery '93, MD '97, General Surgery '99, and Plastic and Reconstructive Surgery '02 education at USC, followed by a craniofacial fellowship at UCLA completed in '03. He has seen firsthand the benefits that his education lends to a surgeon tackling complex craniofacial anomalies. This official leap in the field brings great excitement to the field of surgery and to the Ostrow School of Dentistry of USC. Residents will be receiving arguably some of the most diverse training in the nation in the new joint program.

Within his already hectic work schedule, Dr. Urata still finds time to carry out world-class research on TGF-beta signaling in palatogenesis. Dr. Urata collaborates with Dr. Yang Chai, one of the preeminent craniofacial researchers in the entire field, who himself serves as both Director of the Center for Craniofacial Molecular Biology and Associate Dean of Research at Ostrow. He remarked, "We both envisioned in joining a world-class craniofacial team at Children's Hospital with a world-class research institute. That had never been done before," Urata said.

We further discussed the duo's novel approach to answering the complex questions presented by craniofacial anomalies. Drs. Urata and Chai are currently looking into the molecular mechanisms underlying cleft palate and craniosynostosis. "We want to know if there are elements of the two diseases that we can alter at the molecular level in utero, that would prevent us from doing the large surgeries we currently do to correct that," stated Urata. A practicing surgeon, he scrubs in three times a week for six-hour operations poring over the craniofacial apparatus.

"Ultimately we all want to make the biggest difference we can," Urata said. "If we can alleviate children having to undergo surgery to correct congenital defects we would. So if I could put myself out of business as well as Dr. Chai and his team, that would be our dream."

Dr. Urata's dedication to his field is apparent on a daily basis on many levels: while he mends cleft palates in the operating room, through the merging of two schools of surgical teams with similar interests yet different approaches, and through his tireless efforts to bridge the knowledge gaps of craniofacial anomalies in the research arena.

STAN HANES

Battling Odontogenic Keratocysts

BY SAM SAAB and HARRISON FRYBERG

The odontogenic keratocyst (OKC) is a benign but locally aggressive cystic neoplasm that most often affects the posterior mandible. It is also referred to as Keratocystic Odontogenic Tumor (KCOT). Although its incidence in the general population is relatively rare, it is an interesting subject of study due to its particularly high rate of recurrence. Recurrence rates following the surgical excision of an OKC over a 5-year period range from 3% to as high as 60%, which is much higher than that of other odontogenic cysts. Definitive diagnosis of the cyst is obtained from microscopic examination of biopsy samples displaying classic histomorphologic features of the cystic epithelium thought to be associated with the tumor's invasive course and tendency to recur. These features include a uniform 6-8 cell layer thickness with a distinct palisaded pattern of the basal cell layer and a wavy parakeritinized surface. Additionally, the cystic epithelium lacks rete ridges and displays a degree of separation from the basement membrane. Several treatment modalities for this type of tumor exist and opinions over their respective efficacies vary.

Dr. Stan Hanes is a Board Certified Oral and Maxillofacial Surgeon and Assistant Clinical Professor at the Oral and Maxillofacial Surgery division.

A case study of an odontogenic keratocyst (OKC) was done at the Oral and Maxillofacial Surgery clinic. Dr. Stan Hanes and Dr. Fariborz Farnad led the study, along with assistance from Dr. Nasser-Said-Al-Naief, a pathologist from the University of the Pacific. In September of 2011, a 21-year-old Asian female presented to the clinic with a left mandibular cyst around tooth # 17 (Figure 1).

The cyst was large, multilocular, and extended from tooth # 19 to the left ramus of the mandible and superiorly to the sigmoid notch displacing tooth #17 inferiorly to the mandibular angle. Histologic examination revealed a well-defined cystic cavity lined with a layer of keratinocytes with a distinct palisaded pattern of the basal cell layer, and covered by a wavy parakeratinized surface. Additionally, the epithelial connective tissue junction was flat, and lacked rete ridges. Immunohistochemical staining with Bcl-2 (B-cell Lymphoma 2) was positive at the basal layer of the cystic epithelium, indicating the expression of Bcl-2 anti-oncogenic regulatory proteins at that site. These histologic and immunohistochemical examinations were evidence that the cyst was an odontogenic keratocyst (OKC). Due to the large size of the cyst and its location, the doctors decided to treat it with marsupialization and decompression. Their intention in doing so was to avoid endangering any vital structures such as the nerve or producing a pathologic fracture in the already weakened bone. Marsupialization is a surgical technique that converts a closed cavity into an open pouch by excising the overlying mucosa and creating an opening in the overlying bone. This is then followed by placing a catheter into the cystic cavity, and suturing it to the mucosa. This catheter facilitates the decompression of the cyst. Decompression is important because cysts usually expand putting pressure on adjacent structures. This pressure can cause the resorption of bone or lead to the degradation of other tissues. Marsupialization and subsequent decompression release pressure and prevent it from building up in the confined space of the lesion. Additionally, it is important to note that leaving the wound exposed to the oral cavity allows for the development of a persistent inflammatory infiltrate within the body of the cyst. After the marsupialization

was complete, the roof of the cyst was removed and sent for histological examination.

In March 2012, the patient returned to the clinic for additional evaluation. A panoramic radiograph revealed substantial bone regeneration and displayed that tooth #17 had moved mesially and superiorly (Figure 2).

These results were attributed to the proper decompression and marsupialization of the cyst. The cyst was then completely enucleated and tooth #17 was extracted. Histologic examinations revealed that a main portion of the cystic lining showed hyperplastic stratified squamous epithelium with lack of surface parakeratinization. Interestingly, it was discovered that the cystic epithelium had been perfused by a mononuclear inflammatory infiltrate of moderate density, whereas signs of persistent inflammation had been minimal and relegated to the fibrocollagenous border of the cyst before. Immunohistochemistry staining with Bcl-2 determined heavy positive staining throughout the hyperplastic thickened epithelial lining. These findings verified the diagnosis of OKC. Further, they seemed to suggest that the presence of the mononuclear inflammatory infiltrate facilitated by marsupialization and decompression was responsible for altering the histomorphologic features of the cystic lining to a less aggressive form. Five months later, the patient returned to the clinic for examination. A panoramic radiograph showed complete bony healing without signs of recurrence (Figure 3). The patient will be scheduled for long term follow up to be observed for possible recurrence.

Histologic changes in the cystic lining following the decompression and marsupialization of OKCs have been showed by several studies. Eventually, the cystic lining is replaced by normal oral epithelium and healing proceeds to completion. However, more studies must be done on the histochemical markers (including Bcl-2) involved in this process, to provide surgeons with a more predictive index for the potential of recurrence of OKC.

Figure 1. A large multilocular cyst extending from first molar to the area of the ramus and mandibular notch.

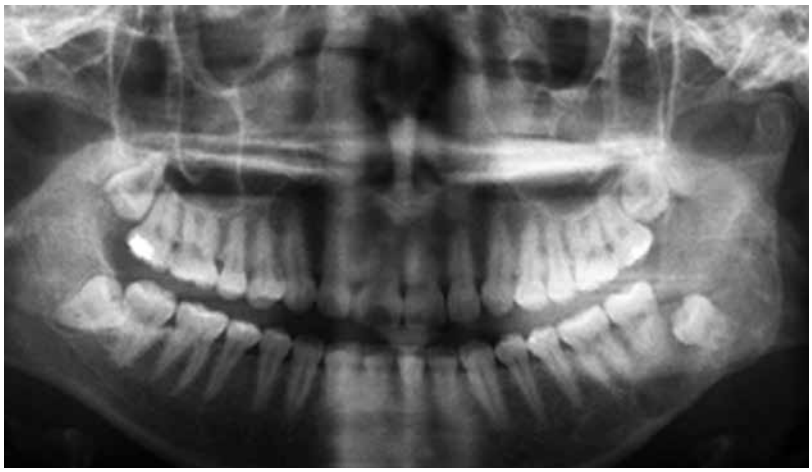


Figure 2. Six months post marsupialization showing significant bone regeneration.

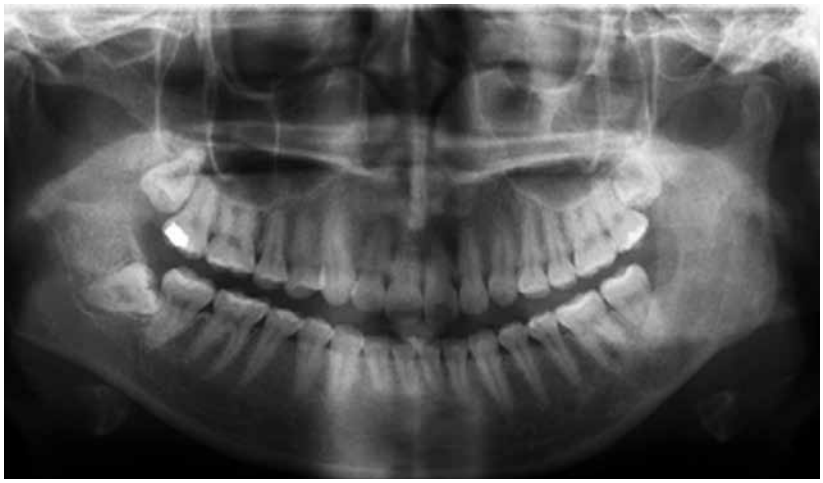


Fig 3. Showing complete bony healing of left ramus and body.

FEATURE ARTICLE

PEDRO SANCHEZ

Shaping the Future of Craniofacial Diagnoses using Molecular Genetics

By Kristine Hong and Tarim Song

Every three minutes a child is born with cleft lip, cleft palate, or both. These conditions adversely affect speech, swallowing, breathing, and appearance. While cleft lip can be repaired in infancy with a single surgery, children with both cleft lip and palate typically require exhausting phases of therapy, multiple surgeries, orthodontics, and implants. With over 7,000 children born with cleft lip and palate in the US each year, there has been an enormous incentive for research and innovation. By understanding the underlying mechanism behind clefting, there is hope to one day have a medical intervention that will help reduce or eliminate the surgical, social and medical burden of this common disorder. Cleft lip and palate is a complex disorder with multifactorial causes including genetic and environmental factors. The majority of cases are isolated, not belonging to a recognizable syndrome, thus making a precise diagnosis difficult.

Dr. Pedro Sanchez-Lara, a pediatrician and medical geneticist, is at the groundbreaking interface of clinical diagnostics and molecular technologies. He is using a series of clinical and research tools to discover the underlying causes of craniofacial defects. He and his colleagues hope to better understand the different causes and forms of cleft palate, which can lead to better individualized treatments and clinical care.

At the Children's Hospital Los Angeles, Dr. Sanchez is the Director of Cytogenomics, Molecular Pathology and Craniofacial Genetics. Using next-generation sequencing technology, Dr. Sanchez is able to sequence a single gene, a panel of genes, or a whole exome, which is all 23,000 coding genes, on a chip smaller than the size of a matchbook. "We can put 3 individuals onto one chip, such as a child and her parents," Sanchez explains. "If the child has a disease that is absent in the parents and siblings, one can overlap the differing sequences and discover the unique changes specifically to the patient." The long-term goal is clear: "in order to work towards helping cure patients with their medical problems, we need to know exactly what they have beyond the basic symptomology."

Dr. Sanchez is involved in evolving the classification of orofacial clefts from a purely clinical and syndromic

diagnosis to a molecular genetic diagnosis. He hopes that research can incorporate individuals who have such subtle findings that they do not require interventions (e.g., a bifid uvula but normal speech). His research has identified several genes that have the predisposition to cleft lip and palate, including MN1 and BMP2. Dr. Sanchez states that "The reality of cleft lip and palate is this: there are over 250 genes known to result in clefts either in humans or animal models. Testing each one individually is expensive and inefficient. Next-generation sequencing technology has allowed us to combine all known causes of clefting into one test." Understanding the underlying mechanism involved can revolutionize future treatment; through identifying the presence of genetic abnormalities, doctors can personalize treatment even before problems arise. Dr. Sanchez also brings a clinical perspective to the animal models as an investigator at the Center for Craniofacial Molecular Biology of the Ostrow School of Dentistry of USC. Using his clinical experience, he has helped select potential therapies that may rescue or prevent the development of cleft palate. In 2012, Dr. Sanchez, Dr. Yang Chai, and colleagues were successful at preventing the development of cleft palate in a conditional knockout mouse model of Loeys-Dietz Syndrome using a common antihypertensive medication that reduces TGF-Beta signaling. As Dr. Sanchez notes, "The next step is knowing the population frequency of patients with mutations in this pathway and seeing if there are any pockets of patients in the world where further trials can be completed."

For over 30 years, international humanitarian efforts have been traveling around the globe surgically correcting orofacial clefts. Dr. Sanchez has partnered with the founders of Operation Smile International (operationsmile.org), which has aided over 180,000 children with clefts. In 2008, Dr. Sanchez helped initiate the Operation Smile International Family Study, which has recruited several thousand families from countries including the Democratic Republic of Congo, Honduras, Peru, the Philippines, and Vietnam. In conjunction with this project, he and investigators at CHLA and USC are studying how genetic and environmental factors interact in orofacial clefting. Dr. Sanchez cautions that there are likely many factors in the environment that we have not been tracking and which therefore have unknown influence on clefting. When the mechanisms and pathways involved are understood, the goal of discovering new treatments and ultimately helping patients can be achieved. Helping families affected by clefting thus requires a very long-term plan.

In 2001, the first human genome was sequenced, after thousands of man-hours and a cost of $3 billion. The result was a sequence of more than 3 billion DNA base pairs. In January 2014, it was announced that because of the rapidly evolution in technology, the price for sequencing a patient's genome has dropped down to $1,000. Dr. Sanchez believes that genetic sequencing will become common practice, and while it is still difficult to interpret, it will become the standard of care in the near future. Given the new genetic discoveries behind cleft lip and palate, there is a heightened need today for dentists and surgeons to be trained to be able to address the problems associated with cleft lip and palate, with the hope that one day genetic data may be used to personalize a treatment plan.

> "In order to work towards helping cure patients, we need to know exactly what they have beyond the basic symptomology... Next-generation sequencing technology has allowed us to combine all known causes of clefting into one test."

NEIMAR SARTORI

Predicting the Clinical Efficacy of Restorative Materials

BY SOO KYUNG LEE and AILEEN NGAN

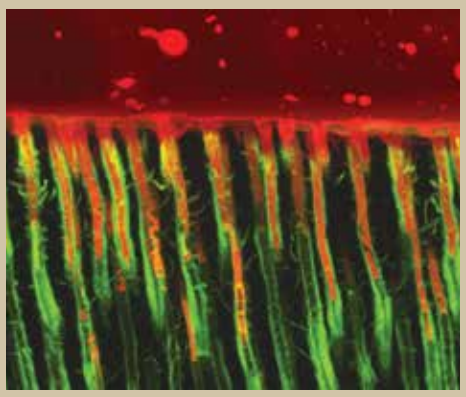
The physiological performance of natural teeth in the oral cavity results from the balanced relationship between biomechanics, function, and esthetics. More specifically, it is the combination of enamel's impressive compressive strength and dentin's flexibility that provides the optimal strength and resilience of an intact tooth. When this perfect harmony between natural enamel and dentin is compromised by dental caries, congenital defects or poorly fabricated restorations, it can lead to undesirable results ranging from altered tooth strength and failed restorations to unrestorable tooth fractures.

One of the main goals of restorative dentistry is the reproduction of this strong enamel-dentin interface when delivering fabricated restorations to the patient's mouth. Dental restorations must mimic the biomechanics of the original tooth to provide a long-lasting bond between the restorative material and the remaining tooth structure. Unfortunately, this goal poses one of the greatest challenges that dentists must face in the present day. The field of restorative dentistry is not merely limited to the "drill-and-fill" approach. While preventing dental caries

and recovering defective teeth to full function, dentists must also address the growing demand for esthetic or metal-free restorations. Moreover, the quickly advancing market of dental products may overwhelm dentists in their selection of the best and latest dental materials. Therefore, it is imperative that dentists are well-informed concerning which restorative adhesive systems have been tested and proven for the most successful and longest-lasting clinical results.

To address the efficacy, success, and longevity of dental materials, Dr. Neimar Sartori and his research group continue to produce groundbreaking research on dental materials and bonded restorations here at the Ostrow School of Dentistry of USC. Born and raised in Brazil, Dr. Sartori attended the Federal University of Santa Catarina School of Dentistry in Florianopolis, Brazil. During the course of his studies, he discovered his passion for esthetic dentistry. He pursued this passion by completing a residency in advanced operative dentistry, a master's degree, and a Ph.D. in restorative dentistry focused on biomaterials. Currently, Dr. Sartori is an Assistant Professor in the Division of Restorative Sciences as well as Assistant Director of the Advanced Program in Operative Dentistry at the Ostrow School of Dentistry.

Apart from teaching in the clinic, Dr. Sartori is an ardent researcher who has published a myriad of papers in peer-reviewed journals as well as book chapters. His main area of research focuses on using advanced microscopy techniques to examine the quality and bonding strength of adhesive interfaces between dental tissues and different restorative materials or bonding approaches. In regards to his research, Dr. Sartori states, "Mostly, I am conducting studies on the bonding between esthetic materials and tooth structure. There are so many materials out in the market and several of them have not been evaluated by an independent research group before their release."



Confocal Laser Scanning Microscopy image showing the degradation of adhesive interface via hydrolysis.

One of Dr. Sartori's latest research projects investigated the clinical performance of a novel one-step self-etch adhesive system in non-carious cervical lesions after 18 months. One-step self-etch adhesives are hydrophilic in nature, allowing water to flow from the dentin up to the adhesive-composite interface even after polymerization. These adhesive systems also do not remove the smear layer to prepare for effective dentin-resin bonding. Thus, this particular adhesive system has shown inferior marginal sealing and bonding strengths to dentin when compared to gold standard adhesive systems. In this study, Dr. Sartori modified the adhesive technique by adding a hydrophobic coat over the all-in-one adhesive system to potentially improve dentin-resin bonding. Dr. Sartori notes, "We can modify adhesive techniques or adhesive systems to try to improve the long-term bonding strength between the restorative material and tooth structure. This is important because the short-term bond strength of most adhesive systems is normally good, however, after a year of function or after artificial aging the results can be completely different."

"What we try to do is research new biomaterials and techniques to apply the best results to the clinic," explains Dr. Sartori, who is hopeful that his research translates into better understanding and predictability of restorative outcomes using different dental materials.

Based on Dr. Sartori's research, we can confirm that the durability and clinical success of bonded esthetic restorations are intimately related to the bond strength of the adhesive materials to the tooth structure. Proper understanding of the principles and limitations of these materials and procedures will ensure successful, long-lasting restorations. Therefore, to uphold the highest standard of care, dental professionals should always verify the predictability and effectiveness of new dental materials through available scientific and clinical literature.

Images Opposite: A conservative approach to a fractured tooth using composite resin

FEATURE ARTICLE

Continuous Quality Improvement: RESEARCH IN PRACTICE

BY CHRIS PATUWO and OMAR KHOLAKI

The familiar crackle of the PA system sounds as the announcement begins, routine to most students and of little note to the patients: "Paging Dr. STAT. Dr. STAT to the first floor east lobby." Perhaps unknowingly to many, this activates the Ostrow School of Dentistry's most sought-after selective group: the IV Sedation Team. Composed of approximately 20 junior and senior dental students, the IV team is an integral component of the school, serving as first responders to all medical emergencies. The IV Team was founded by Dr. Stanley Malamed to mimic a true anesthesia residency and has since graduated over one hundred members, many of whom have gone on to complete training in anesthesia, oral surgery, and pediatrics. All members are well trained in advanced cardiac life support (ACLS), advanced life support (ALS), and pediatric advanced life support (PALS) as preparation for emergency response. Their role as emergency responders, however, is only one aspect of the team's duties. A large part of being on the IV Team is an obligation and opportunity not only to learn and master dental anesthesia techniques, but also to teach them. During the semester, team members help run the local anesthesia course and often volunteer time on weekends to help teach moderate sedation courses for general dentists. Just like a traditional residency, they also have rotations at different surgical centers to gain exposure to the field. As current senior member Andrew Young puts it, "Being on the selective requires a level of commitment that I don't think any other extracurricular activities match."

However, this level of commitment does not go unrewarded, as team members are afforded opportunities that are truly unique in the Ostrow

School. In terms of exposure, simply being immersed in the world of dental anesthesia allows them to accumulate a wealth of knowledge about local anesthesia and sedation. Combined with the constant hands-on learning they do each day and the teaching commitment that accompanies the selective, members have an unparalleled opportunity to develop their skills in sedation. To be specific, at no other time in dental school do students get to start intravenous lines, administer intramuscular ketamine injections, or draw and push medications for general anesthesia. For members like Marco Savittieri, an additional interesting aspect of being on the IV Team is the unique exposure to very different patient populations: whether helping in the operating room, with unruly pediatric patients, or with special needs patients, "we are improving the lives and well being of those who without sedation would otherwise live without adequate oral care."

Cultivating such a mature perspective and sense of responsibility may be difficult to juggle amidst the tribulations of the dental curriculum, but having a good mentor certainly helps. One of the IV Team's own alumni, Dr. James Tom, is currently the faculty leader of the IV team. Dr. Tom graduated as a member of Dr. Malamed's IV Team in 1999 and went on to complete a residency in dental anesthesia at Ohio State University in Columbus. He has since returned to USC as the attending anesthesiologist, spending much of his time in the operating room providing analgesia and anxiolysis to patients who may otherwise experience the outdated "white knuckle" dentistry still performed elsewhere today. Though an active member of the dental anesthesia faculty for many years at USC, he is assuming a larger leadership position in his first year stepping into Dr. Malamed's shoes. Already, the access to dental anesthesia at USC has more than doubled (from 2 days a week to 5 days a week) with the hiring of new faculty. And among various other projects Dr. Tom is spearheading, a mini research project to improve the Dr. STAT emergency response protocol ranks as a top priority. Having been involved in a variety of research in the past, Dr. Tom understands the important role of evidence-based research in providing the most current information for practitioners and also in contributing to the general mindset of what he calls CQI, or continuous quality improvement. Meaning just what it sounds like, continuous quality improvement is a widely-used managerial approach that encourages consistent self-evaluation to address areas that could use adjustments. The crux of such a process is the collection of structured data that can be used to highlight variables, trends, and potential areas of weakness. Employing this theory-based, data-driven management system, Dr. Tom has been using the feedback from the IV Team members and faculty at the Ostrow School to take a fresh look at the quality and efficiency of emergency responses. The IV Team's response was once highly variable and lacked a systematic approach in terms of which personnel and how many of them would respond to routine Dr. STAT calls. To remedy this, Dr. Tom took a cue from the system employed during residency and set up month-long "chief resident" rotation schedules. Each month, a different team member is given the assignment of first responder and is responsible for providing a detailed write-up following each Dr. STAT call. These write-ups are very similar to case presentations many of the members will one day perform in their post-doctoral training and serve, along with the recorded response times, as the primary means of collecting data. Dr. Tom hopes the project will reflect positively on the changes made so far and elucidate more ways to improve.

The Dr. STAT/IV team has evolved into a mini anesthesia residency and will serve to enrich the careers of motivated USC dental students with hands-on experience in anesthesia. The research being conducted by Dr. Tom and data-gathering by all team members will foster the new approach to constant quality improvement. In addition, students will mirror their problem-based education by using case-based, real-life scenarios to explore alternative response approaches.

HONGSHENG TONG

Innovations in Orthodontics: Comprehensive Diagnosis in 3D and Treatment Customization

BY KENNETH SMITH

"I have overcome my own limitations by working together with a team of very talented and committed people with different backgrounds. Working with residents, I have also learned as much from them as they learn from me. That has kept me young and my mind active. I truly enjoy the ride."

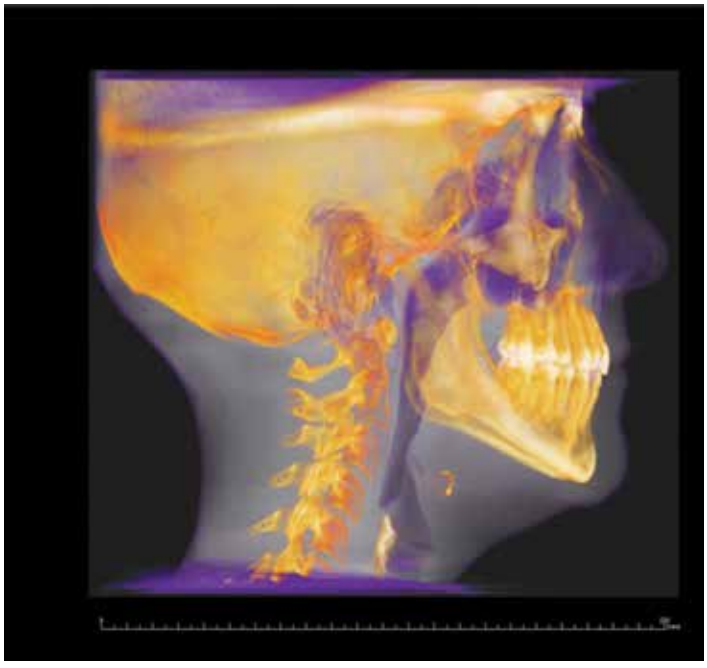
Dr. Tong received his dental degree from Beijing Medical University in China. Upon entering the United States he completed a PhD in Craniofacial Biology at USC and later completed his residency in Orthodontics at the Ostrow School of Dentistry. Since 2007, Dr. Tong has been an assistant clinical professor in the USC graduate orthodontic program. Aside from being a faculty member at USC, he practices orthodontics in two cities in Southern California.

Dr. Tong's most recent publication discussed the monitoring of root movement via crown superimposition of a single cone-beam computed tomography (CBCT) and consecutive iTero scans. This technology allows for tracking root movement at any time during orthodontic treatment in three dimensions without exposing patients to additional radiation. This work will be featured on the cover of this year's March issue of the American Journal of Orthodontics and Dentofacial Orthopedics

In collaboration with USC's Redmond Imaging Laboratory, Dr. Tong led a group of orthodontic residents to identify the proper mesiodistal angulation and faciolingual inclination of each whole tooth, not just the crown, by studying a sample of orthodontic patients who had "near normal" occlusions. He intends to put all this information into use by setting up each and every tooth virtually in 3D space to generate virtual model set-ups. "Properly positioning the roots will provide the patient with the best foundation for their teeth to sit on," stated Tong. In placing the teeth in their correct anatomical positions he hopes patients will have better treatment outcomes and more stable retention.

The current research revolves around the central theme of making a thorough diagnosis through the use of CBCT technologies and allowing the formulation of a comprehensive and customized treatment plan, with a specific treatment goal in mind. In collaboration with Prof. Koshnevis and Prof. Chen from Viterbi School of Engineering of USC, Dr. Tong is developing a new set of orthodontic appliances that will be custom fabricated with orthodontic treatment goals already incorporated into each appliance. These appliances, upon activation will direct specific orthodontic forces to each tooth, in accordance with the prescribed treatment goal. Dr. Tong named this philosophy a "target and shoot" treatment rather than the usual "shoot and target." This will significantly reduce clinical adjustments orthodontists usually have to make through trial and error, and therefore reduce the number and length of appointments and increase treatment efficiency.

Currently, Dr. Tong and his team have completed the first few stages of their product development: blue print design of appliance, prototype development and bench tests by using typodonts. Next, the team will conduct human clinical trials to determine if the custom appliances and treatment plan will in fact enable the appropriate tooth movements. Dr. Tong's research team has been awarded the top prize for the USC Stevens Institute Idea Empowered Program Innovation Grant in 2012 and the USC Coulter Translational Program Grant in 2013. The ultimate goals of these programs are to help translate the successes in scientific research from the laboratories into market-ready products for consumers. Dr. Tong hopes that in the future all orthodontists will benefit from the technologies they are developing and be able to data collect and treatment plan their patients in a more comprehensive manner.



THOMAS TANBONLIONG

Longevity of Class II Composite Restorations in Pediatric Dental Patients

BY STEPHANIE TING and MOSHE EIZDE

With his friendly demeanor and gentle mannerisms, it's easy to see why Dr. Thomas Tanbonliong is such a successful pediatric dentist. Not only is he a skilled clinician, he is also a seasoned clinical researcher and a mentor for the pediatric residents at Ostrow School of Dentistry of USC. Dr. Tanbonliong graduated from University of the Pacific in 1993. It wasn't until he completed a year of GPR in Cleveland, Ohio that he realized his passion for pediatric dentistry. Being able to provide comprehensive care for children from the beginning of their youth fills Dr. Tanbonliong with the utmost satisfaction, particularly when he is able to maintain his patients' oral health into adulthood. Dr. Tanbonliong went on to complete his pediatric dentistry residency at Case Western University School of Dental Medicine in 1996. Finally, he has been teaching in the Pediatric Dentistry department at the Ostrow School of Dentistry of USC since 1997.

One of Dr. Tanbonliong's many roles as clinic director of the USC Graduate Pediatric Dentistry Program is to serve as a research mentor to his residents. Every resident in the program is required to conduct a research project during their residency. As a research mentor, Dr. Tanbonliong helps most residents devise and implement their own research project. Examples of these projects range from examining the relationship between BMI and dental growth and development among Hispanic patients, comparing two different kinds of posterior white Zirconia crowns on primary posterior teeth and evaluating post discharge complications from oral conscious sedation.

Dr. Tanbonliong serves as a research mentor to Dr. Vivian Yee, a second year pediatric dental resident who finished her research on the longevity of posterior Class II resin-based composite restorations in pediatric patients. In her study, she compares the replacement rate of Class II composite restorations that were placed by pediatric dentistry residents under no pharmacological behavior guidance, nitrous oxide, oral conscious sedation, and general anesthesia. The results show that the rate of replacement of the Class II composite restorations were highest in the groups with no pharmacological behavior guidance and decreased with stronger pharmacological behavior guidance. The lowest replacement rate was in the general anesthesia group.

Dr. Tanbonliong hopes to inspire creativity in research. "Nothing is too bizarre," he said when asked if he had any advice for students who are hoping to get involved in clinical research. "Research comes from ideas – if you think of something, you should think about it and do a search in the literature. It may be an idea worth pursuing," he advises. Dr. Tanbonliong encourages his students to stay current on evidence-based literature, which he believes is the primary source of new ideas for research.

FEATURE ARTICLE

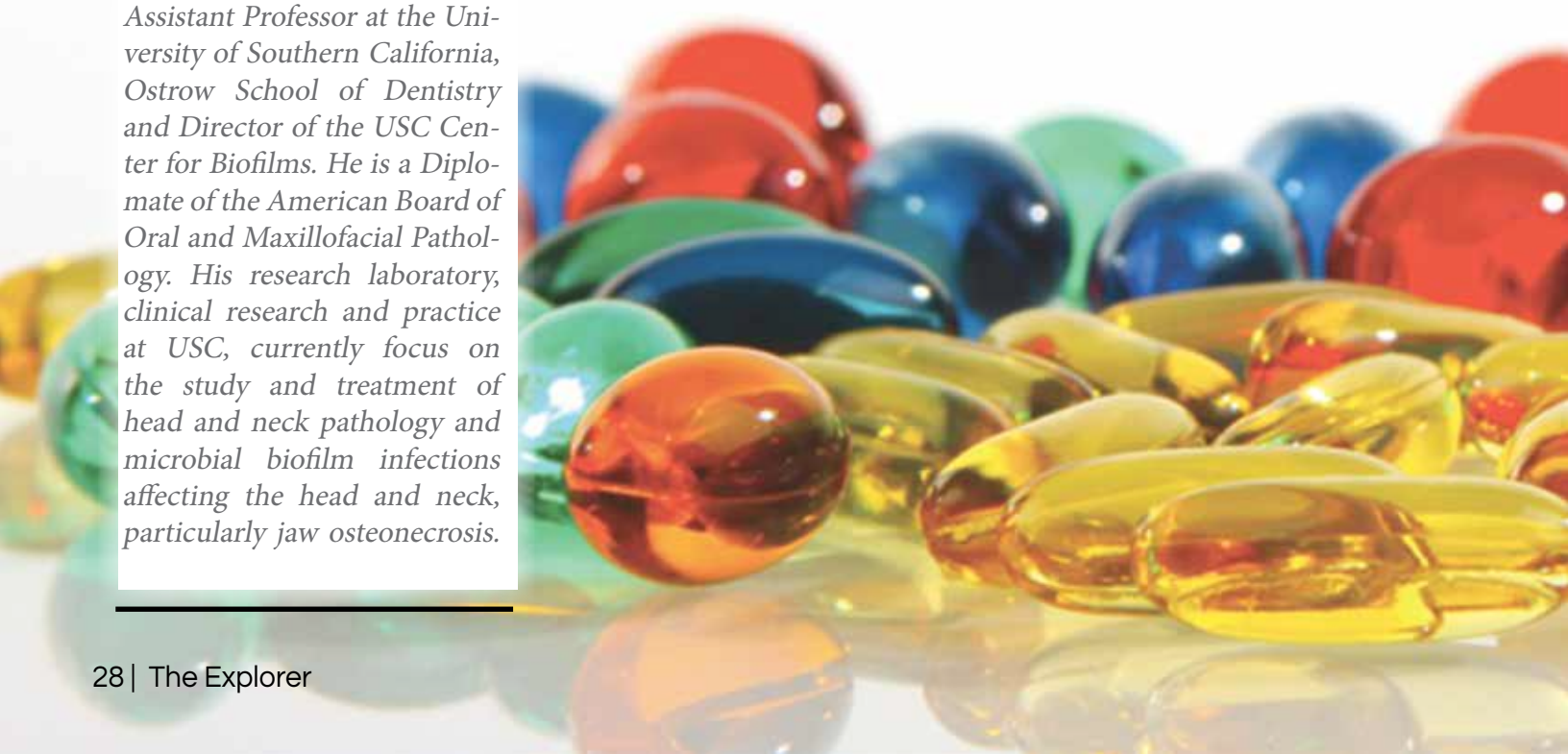
PARISH SEDGHIZADEH

A Pharmacometric Approach to Understanding Drug Therapy Risks

BY EUGENIA CHAN and ISAAC SUN

Dr. Parish P. Sedghizadeh is Assistant Professor at the University of Southern California, Ostrow School of Dentistry and Director of the USC Center for Biofilms. He is a Diplomate of the American Board of Oral and Maxillofacial Pathology. His research laboratory, clinical research and practice at USC, currently focus on the study and treatment of head and neck pathology and microbial biofilm infections affecting the head and neck, particularly jaw osteonecrosis.

Pharmacometrics is the discipline of using statistical models based on pharmacology, physiology, and disease for quantitative analysis of interactions between drugs and patients. Over the past few decades, a new class of drugs known as anti-resorptives has emerged in the pharmaceutical field to battle diseases like cancer and osteoporosis. Bisphosphonate drugs are the most frequently prescribed class of anti-resorptives, and millions of Americans receive these drugs. Yet even commonplace drugs have short-term and long-term side-effects. One serious adverse effect of long-term bisphosphonate therapy is jaw osteonecrosis, commonly called bisphosphonate-related osteonecrosis of the jaw (BRONJ). This condition is characterized clinically by painful and exposed necrotic jawbone in the oral cavity, and it can negatively impact quality of life and the ability to eat and speak. Constantly observing this side-effect in some of his patients inspired Dr. Parish Sedghizadeh's interest in studying bisphosphonate therapy and its effects on the human population.



Dr. Sedghizadeh is pushing the envelope in scientific research regarding orofacial side effects of this relatively new but now commonplace class of drugs. Before becoming Director of the USC Center for Biofilms, Dr. Sedghizadeh earned his DDS degree from USC and went on to specialize in Oral and Maxillofacial Pathology at Ohio State University, attaining a Master of Science degree in Oral Biology and becoming a Fellow of the American Academy of Oral and Maxillofacial Pathology. Currently, he is a Diplomate of the American Board of Oral and Maxillofacial Pathology and he conducts research, publishes, teaches and sees patients as a faculty member of the Ostrow School of Dentistry of USC.

Since bisphosphonates are a relatively new class of drugs, little was initially known about their side-effects and long-term usage. In 2003, findings of osteomyelitis-like lesions in the jaws were reported in patients who were affected by multiple myeloma and metastatic bone disease. The newly found condition was termed BRONJ. The BRONJ lesions were triggered by dental surgery or by ill-fitting dentures.

The pathogenesis of BRONJ is mainly due to defects in normal jawbone physiological remodeling and wound healing processes. Bisphosphonates inhibit osteoclast function and promote apoptosis, which ultimately decreases bone resorption. The normal turnover rate of bone is therefore affected. Since not all patients who receive bisphosphonate therapy acquire BRONJ, it appears that the pathogenesis of BRONJ is multifactorial. Dr. Sedghizadeh's transdisciplinary research group is currently connecting bench-top research with clinical trials to establish a pharmacometric approach for determining why bisphosphonates are associated with osteonecrosis, and why the disease takes hold in some patients but not others.

Pharmacometrics provides a unique approach to such problems, as it applies the potent combination of pharmacokinetics, pharmacodynamics, and pharmacogenomics to the understanding of drug-related conditions. Pharmacokinetics is the study of how a drug moves throughout the body, while pharmacodynamics is the study of how a drug affects the body. Pharmacogenomics is the study of how genes influence the metabolism of drugs in the body. Each attribute of pharmacometrics illustrates the importance of how a specific drug is metabolized through a specific route in the body, and how each person can differ in the way their body deals with a drug, causing differences in how the drug affects their body.

In utilizing pharmacometrics, and specifically mathematically-calculated risk factors pertaining to bisphosphonate therapy, Dr. Sedghizadeh is creating a robust statistical model pinpointing the probable degree of severity, future risks, and other facts the public and practitioners should know about drug-related conditions like BRONJ. His work is providing clinicians with a risk-assessment tool for predicting and ultimately preventing disease in future patients who will receive bisphosphonate medications.

ADVANCEMENTS IN ENDODONTICS

A novel method for root fracture detection

BY MATTHIAS FALLIS and SHANT AHARONIAN

One of the biggest challenges in dentistry is the detection of fractured roots. Dentists need to know if a root fracture is present in order to determine whether the tooth is likely to survive root canal treatment or if it should be extracted instead. Currently, the methods dentists utilize to diagnose root fractures include surgical exploration involving an operative microscope, direct visual examination, illumination (fiber optic), traditional radiographs, periodontal probing, staining, bite tests, cone beam computed tomography, flat panel volume detector computed tomography, and optical coherence tomography. Out of these methods the most accurate ones involve a surgical exploration to visually detect a fracture or an atraumatic extraction with periodontal breakdown. While these methods are more accurate than alternatives, they are highly invasive. However, current research at USC based on recent pioneering work by Dr. Cherilyn Sheets and Professor James Earthman offers some hope for the future of root fracture detection.

Dr. Cherilyn Sheets works at a private practice in Newport Beach. She has received several awards including the 2004 USC School of Dentistry Alumnus of the Year Award and the 2012 Innovation in Research Award for her contributions to dentistry. Dr. Sheets is a member of the USC Ostrow School of Dentistry Board of Counselors and also is a Clinical Professor of Restorative Dentistry at USC, lecturing annually with Dr. Earthman for the bioengineering students who desire a career in dentistry or medicine.

Dr. Sheets and Dr. Earthman have developed a medical device to detect structural instability in dental implants and natural teeth, including root fractures, when used in combination with already existing clinical diagnostic techniques. The Periometer® is an instrument that utilizes a hand held percussion probe that can detect fractured teeth without tissue destruction. The Periometer works

by administering a probe with a predetermined kinetic energy against a solid body, thus producing a stress wave from the impacted surface. Fractured teeth undergoing the percussion of the probe exhibit irregular stress wave response characteristics that are analyzed by a computer in the Periometer system. These irregular characteristics correspond to localized micromovement, such as that produced by a crack. Consequently, the Periometer is capable of providing several pieces of data that can help quantify the severity and even the location of tooth defects,

The Periometer also determines the amount of mechanical stress energy that is dissipated into heat, to give an indication of the overall mobility of the structure called the Mobility Index. A visual graph (Energy Return Graph) is generated from data that are analyzed as mentioned above to provide a Defect Severity Quotient. This new parameter corresponds to the amount of instability in the tooth caused by defects (including fractures). Thus, the Periometer is a new risk assessment tool and presents a unique dimension of diagnosis for dentists.

The pilot study of the Periometer consisted of twenty adult subjects who complained about a specific tooth, which had a poor prognosis. The patients had the option of having the tooth extracted or having no treatment done at all. These patients were excellent candidates for testing the Periometer's capabilities. The subjects were each examined using the Periometer. In addition to the tooth under investigation, six other teeth in the same arch were tested as baseline controls with the Periometer. Some of the patients elected to have their suspicious tooth extracted. Out of the extracted teeth all had vertical fractures or some sort of micro root fractures. The Periometer was successful in confirming the diagnosis for each case.

Overall, the Periometer takes a giant step forward in the field of endodontics. No other method has shown comparable success in detecting tooth fractures without an invasive surgical procedure. Although the results of the pilot study mentioned in this article are promising, like any pilot, the study has some limitations. More studies are needed with larger sample sizes to further test the accuracy of the Periometer in locating vertical root fractures. Peer reviewed publications on this new technology and its other uses in diagnostics for implants and teeth can be found in bioengineering and dental journals.

FACULTY SPOTLIGHT
DR. KIM AUSTIN

BY RAMIN FOROUGHI and CATHERINE TAN

Dr. Kim Austin is known amongst the students of Ostrow School of Dentistry of USC as a hard-hitting, no-nonsense educator, who holds her students to the highest expectations of practice and professionalism. Though she has been here at USC as a faculty member for nearly 20 years, her history in Southern California extends back even further as she is a native Californian who grew up in Compton. She was always interested in the health professions and was drawn to dentistry in particular because it offered the challenge of balancing the intricacies of the oral cavity and head and neck region with the complexities of its integration within the systems of the body.

While attending Howard University College of Dentistry in Washington DC, Dr. Austin discovered that she was most interested in periodontology. Early influence from faculty who made the experience of hands-on surgical opportunities enjoyable inspired her to later pursue periodontics. Upon graduation in 1987, she completed a one-year general practice residency at Montefiore Medical Center in the Bronx, New York and then continued on to work in private practice on the east coast.

In 1991, Dr. Austin returned to Los Angeles, where she ran a dental clinic with Job Corps, an education and training program for at-risk teens and young adults. After working there for a few years, she decided to further her education and joined the Trojan family by entering the postgraduate periodontics program at USC. Following graduation in 1995, Dr. Austin was offered a position as a part-time periodontics faculty member. She was thrilled to have the opportunity to teach as this was something she truly enjoyed doing as a postgraduate. It was refreshing for her to work with students who were filled with enthusiasm for dentistry and more specifically periodontics.

Dr. Austin transitioned into the role of a full-time faculty member in 2003. She is currently an Assistant Professor of Clinical Dentistry and the Module Director for the Sophomore Periodontics Module (SPM) and continues to maintain her private practice. Dr. Austin is also involved with student organizations as a faculty advisor for the Student National Dental Association and Students Professionalism and Ethics Association. She enjoys the balance of educating students and keeping up to date on the latest dental topics in academics as well as treating a diverse patient population in her small office in Los Angeles.

Dr. Austin views periodontics as the hub of all dentistry. She believes that periodontics has a bright future and will never be overshadowed since it is essential to the success of many of the other dental disciplines, especially restorative dentistry. Dr. Austin strives to instill the importance of responsibility and accountability in dental students, as they will become dental professionals whom patients will trust and rely upon. Though some may view Dr. Austin's SPM as a strict "boot camp" for periodontics, it is only with the best interests of her students at heart. It is her hope that with a rigorous course, her students will practice and hone the skills necessary to become organized and efficient 3rd and 4th year dental students, and ultimately graduate as fully competent, responsible, and caring dentists. With an abundance of experience as both an educator and as a clinician, Ostrow School of Dentistry of USC is only strengthened by having Dr. Kim Austin here as faculty.

KORNELIA KULIG

The Biomechanics of Dance

Kornelia Kulig and the graduate students working with her in the Division of Biokinesiology and Physical Therapy are dedicated to improving the health of dancers. Dance requires a unique blend of artistry and athleticism, emphasizing an appreciation of the beauty of human movement. The popularity of dance has increased significantly in recent years, in populations ranging from young children to older adults. Dancers come in all shapes, sizes, and skill levels, and all dancers, whether beginners or professionals, may be at risk for incurring injuries. Especially at an elite level, dance injuries are extremely common and often prove detrimental to the career of a professional dancer. Dance injuries tend to be chronic in nature, and typically involve the back or lower extremities; foot and ankle injuries have an especially high prevalence among dancers. However, little is known about the specific biomechanical factors that may contribute to the high injury rates in various disciplines of dance. Insight regarding factors related to injuries in dancers may inform training and rehabilitation strategies.

A strong interest from both PhD and DPT students in the Division has led to several research projects that aim to explore some of the factors that may contribute to the development of dance-related injuries. Motion analysis and electromyography (EMG) have been used to examine the mechanical demands of common dance movements. An 11-camera motion analysis system combined with two high speed cameras, four force plates, and wireless EMG equipment allows for detailed analysis of different elements of dance technique. Computer software can be used to model the human body and determine the mechanical demands associated with different movements. Ultrasound has also been used to examine bony morphology and tendon properties in dancers. Tendinopathies are common injuries seen in dancers, and research examining jump landings in healthy dancers and dancers with patellar tendon pain was conducted in Dr. Kulig's research laboratory in an effort to determine movement strategies that may contribute to this injury. Another research project looked at trunk and lower ex-

tremity coordination variability in dancers and non-dancers to identify coordination strategies used by elite level dancers.

Danielle Jarvis and K. Michael Rowley, both PhD students in Biokinesiology, are focusing their research efforts on biomechanical factors related to dance. They are joined by third year Doctor of Physical Therapy student Pamela Mikkelsen, who is spending her final semester of the Physical Therapy program in a hybrid research and clinical rotation. Current research efforts focus on specific foot and ankle demands during dance movements, as the foot and ankle are so commonly affected by injuries. A two-segment model of the foot has been developed to gain a more detailed picture of how dancers use different parts of the foot during different types of common dance skills. Another current research project aims to determine the effect of the different types of footwear worn by dancers on the mechanical demands placed on the lower extremity joints during repetitive jumping movements. Students have presented results from dance biomechanics research at both national and international conferences, as USC makes a name for itself in the field of dance medicine and science.

SHARON CERMAK

The Five Senses: Creating the Ideal Office Visit

Research at the USC Division of Occupational Science and Occupational Therapy, ranked the nation's No. 1 occupational therapy graduate educational program by U.S. News & World Report, is designed to systematize knowledge on occupation—those meaningful activities, ranging from the ordinary to the extraordinary, that compose daily human life—and its influence upon health and well-being. Drawing upon interdisciplinary concepts from the biomedical and social sciences, the Division's research program is conceptualized as translational with applications to occupational therapy practice, rehabilitation, education, and public and community health. Faculty members have been successful in acquiring extramural funding, particularly from the National Institutes of Health, as the Division has collectively acquired over $18 million since 2000 to support projects related to occupational science and occupational therapy.

Among these projects is the Sensory Adapted Dental Environments (SADE) research program (1 R34 DE022263-01), led by Principal Investigator Sharon Cermak EdD, OTR/L, FAOTA. Funded by a National Institute of Dental and Craniofacial Research (NIH) R34 clinical trial planning grant, the SADE research project aims to collect information

that will support a clinical trial on the effectiveness of a specially adapted dental environment for children who have difficulty tolerating oral care in the dental clinic. The research is studying two groups of children: children with autism spectrum disorders and children who are typically developing, including those who are over-reactive to sensory stimulation. Commonly, such children exhibit anxiety and negative behavioral reactions when confronted with sensory experiences of dental visits such as fluorescent overhead lighting, touch in or around the mouth, or the texture and scent of oral care products. The research program is piloting a sensory adapted dental environment—including adaptations such as dimmed lighting, exposure to soothing music and application of a vest that provides calming, deep pressure sensations—that has potential to reduce anxiety and behavioral problems among the targeted groups.

Preliminary findings from the pilot study are positive: children in the sensory adapted condition showed decreased anxiety on a physiologic measure of skin conductance and fewer people were needed to restrain the child during an oral prophylaxis, in comparison to the regular dental environment.

Because the research aims to contribute to safer, more efficient and less costly treatment, it has the potential to revolutionize clinic-based dental care for today's growing population of children with autism spectrum disorder, as well as for typically developing children who demonstrate anxieties related to clinical dental care. The potential cost-savings and contributions to child comfort are dramatic, as more than 25 percent of all children may potentially benefit from an adapted dental environment.

Professor Cermak's research team has already generated several articles which have been printed in peer-reviewed publications, including *Pediatric Dentistry*, *Special Care in Dentistry* and the *American Journal of Occupational Therapy*.

The SADE research project is a quintessential example of the interdisciplinary nature of occupational science research. The project's co-investigators include José Polido DDS, chief of the Division of Dentistry and Orthodontics at Children's Hospital Los Angeles; Marian Williams, assistant professor of clinical pediatrics at the Keck School of Medicine of USC; Michael Dawson, professor of psychology at the USC Dornsife College of Letters, Arts and Sciences; and Christianne Lane, assistant professor of research at the Keck School of Medicine of USC. Students Elyse Peterson (Occupational Therapy Doctorate '13), Lauren St. Hilaire (Occupational Therapy Doctorate '13) and Leah Stein (Occupational Science PhD '13) also contributed to the team's efforts.

The SADE research project is also just one instance of how occupational science research at the USC Division of Occupational Science and Occupational Therapy is generating critical knowledge about the impact of everyday occupations on people's health, function and well-being across the lifespan. In a world rapidly shifting from the compartmentalized to the convergent, occupational science is a discipline positioned at the intersection of the biological and social sciences generating relevant, valuable and rigorous research about the ways activities contribute to healthy, satisfying and productive lives. Together, the faculty and students at the USC Division of Occupational Science and Occupational Therapy at the Ostrow School of Dentistry of USC are helping make the future of healthcare a reality today.

RESEARCH DAY

Schedule of Events | March 12, 2014

8:00am - 8:30am	Registration - Presenters and Judges
8:30am - 12:00pm	Poster Judging
11:30am - 12:00pm	General Registration
12:00pm - 12:30pm	Lunch - Founder's Club
12:30pm - 12:45pm	Opening Remarks **Avishai Sadan, DMD** Dean Ostrow School of Dentistry of USC **Yang Chai, DDS, Ph.D** Associate Dean of Research Ostrow School of Dentistry of USC
12:45pm - 1:25pm	**Keynote Address - Dr. Laurie McCauley** "*Parathyroid hormone drives bone regeneration: Maneuvering between cellular and clinical aspects.*"
1:30pm - 2:10pm	**Keynote Address - Dr. Scott Fraser** "*Imaging cellular and molecular dynamics of embryological development."*
2:15pm - 2:55pm	**Keynote Address - Dr. Chris Powers** "*Mechanisms of patellofemoral joint dysfunction: What have we learned over the last 20 years?*"
3:00pm - 3:30pm	Award Presentations
3:30pm - 4:00pm	Group Focused Discussions
3:00pm - 5:00pm	Poster Viewing and Reception

Poster Category Awards

- Advanced Specialty Program Resident
- Biokinesiology and Physical Therapy Student: Exercise Musculoskeletal Biomechanics
- Biokinesiology and Physical Therapy Student: Neural Control and Motor Behavior
- Dental Hygiene Student
- Graduate Post-Doctoral Trainee
- Graduate Pre-Doctoral Candidate
- Occupational Science and Occupational Therapy Student
- DDS Student: Basic Science
- DDS Student: Clinical Science
- Dean's Research Award - Awarded to the overall most outstanding project poster

JA Wilson Dental Library Bioinformatics Award

- Awarded to the best poster/research incorporating bioinformatics resources into the project. Judges will consist of the information specialist from the Wilson Dental Library, a representative of the Bioinformatics Services Program of the Health Services Libraries and a faculty representative of Ostrow School of Dentistry.

ADA/Dentsply Student Clinician Research Program Award

- Awarded to the first place winner of the DDS Student: Clinical Sciences category

USC Stevens Center for Innovation

- Awarded to the poster with the highest likelihood of translating into practical use.

The USC Stevens Center for Innovation (http://stevens.usc.edu/) is a univesity wide resource in the Office of the Provost at the University of Southern California that helps identify, nuture, protect, and transfer to the market the most exciting innovations from USC. It also provides a central connection for industry seeking cutting-edge innovations in which to invest. As part of this role, the USC Stevens Center manages the university's intellectual property portfolio stemming from its $650 million annual research program. Furthermore, the USC Stevens Center develops the innovator as well as innovations, through educational programs, community-building events, and showcase opportunities.

KEYNOTE SPEAKERS

USC Research Day 2014

Laurie McCauley is the William K. and Mary Anne Najjar Professor of Periodontics and Dean of the School of Dentistry at the University of Michigan, and Professor of Pathology in the Medical School.

Professor McCauley earned a B.S., D.D.S., M.S. and Ph.D. (veterinary pathobiology) from The Ohio State University. She was engaged in private practice limited to periodontics in Marysville, Ohio for three years and in 1992 she joined the University of Michigan School of Dentistry faculty as an assistant professor and rose up through the ranks. She served as chair of the Department of Periodontics and Oral Medicine in the School of Dentistry from 2002 to 2012. Over the course of her career, she has held a number of visiting scientist and visiting professor appointments, including a visiting appointment at the École Normale Supérieure de Lyon and the Center for Experimental Therapeutics and Reperfusion Injury, Brigham and Women's Hospital, Harvard Medical School. She also continues a private practice limited to periodontics with the University of Michigan Dental Faculty Associates.

Professor McCauley has more than 130 high quality peer-reviewed publications in the biomedical literature in the areas of hormonal controls of bone remodeling, cancer metastasis to bone, and craniofacial regenerative medicine. She has sustained independent funding as principal investigator from the National Institutes of Health for twenty years. She is a fellow in the American Association for the Advancement of Science, a diplomat of the American Board of Periodontology, and a fellow in both the American College of Dentists and the International College of Dentists. She is the second dentist in the history of the American Society for Bone and Mineral Research (ASBMR) to be elected to its council and also served on the National Institutes of Health (NIH), National Advisory Dental & Craniofacial Research Council. Among the many recognitions of her research are the inaugural Paula Stern Achievement award, an esteemed award of the ASBMR, the William J. Gies Award sponsored by the American Dental Education Association and the American Academy of Periodontology for outstanding contributions to literature and education in periodontology, and a distinguished scientist award from the International Association for Dental Research.

Laurie McCauley, D.D.S., M.S., Ph.D
Dean, University of Michigan School of Dentistry

Scott E. Fraser, Ph.D
Provost Professor of Biological Sciences and Biomedical Engineering

Scott E. Fraser has a long-standing commitment to quantitative biology, applying the tools of chemistry, engineering, and physics to problems in biology and medicine. His personal research centers on imaging and molecular analyses of intact biological systems, with an emphasis on early development, organogenesis, and medical diagnostics.

After training in physics (BS, Harvey Mudd College, 1976) and biophysics (PhD, Johns Hopkins University, 1979), he joined the faculty at UC Irvine, and rose through the ranks to become Chair of the Department of Physiology and Biophysics. In 1990 he moved to Caltech to serve as the Anna L. Rosen Professor of Biology, and the Director of the Biological Imaging Center. He is deeply committed to interdisciplinary training and translational research, having helped found the Caltech Brain Imaging Center and the Kavli Institute of Nanoscience, as well as serving as the Director of the Rosen Center for Biological Engineering.

In Fall 2012, he moved to USC to take a Provost Professorship in the Dornsife College of Letters Arts and Sciences, the Children's Hospital Los Angeles and the Viterbi School of Engineering. He remains active in interdisciplinary research as serves as the Director of Science Initiatives for the USC campuses.

Christopher Powers, Ph.D, PT
Associate Professor, Division of Biokinesiology and Physical Therapy

Christopher Powers is currently the Co-Director of the Musculoskeletal Biomechanics Research Laboratory and the Director of the Program in Biokinesiology at USC. He also has academic privileges in the departments of radiology and orthopaedic surgery at USC's Keck School of Medicine. His primary teaching responsibilities include movement analysis, biomechanics and, specifically, the mechanics of human gait.

Dr. Powers' research and teaching interests relate to the biomechanical aspects of human movement. More specifically, his research focuses on how altered kinematics, kinetics, and muscular actions contribute to lower extremity injury. He is particularly interested in the pathomechanics underlying knee and patellofemoral joint dysfunction. He has published more than 130 peer-reviewed articles and has received several research awards from APTA, including the Rose Excellence in Research Award from the APTA Orthopaedic Section, the Eugene Michels New Investigator Award, the Dorothy Briggs Scientific Inquiry Award, and the Helen J Hislop Award for contributions to the professional literature. He is an active member of APTA, currently serving as president of the California Physical Therapy Association.

Dr. Powers received a bachelor's degree in physical education from the University of California, Santa Barbara in 1984, his master's degree in physical therapy from Columbia University in 1987, and a PhD in biokinesiology in 1996 from USC. He completed his post-doctoral training at the Orthopaedic Biomechanics Laboratory, University of California, Irvine.

RESEARCH DAY POSTER ABSTRACTS

FACULTY

Poster #1
Title: Do Sleep Behaviors Change after an Occupation-based Lifestyle Intervention?
Name: Natalie Leland

Background: Poor sleep is associated with poor health outcomes among older adults. Physical activity and sleep compression interventions are associated with improved sleep quality. Purpose: This study aimed to evaluate the effect of an occupation-based lifestyle intervention program on sleep behaviors in diverse older adults living in urban Los Angeles. Methods: A sample of community-living elders was randomized to an occupational therapy lifestyle redesign group (LR group) or a no-treatment control group for 6 months. The intervention was broad-based and flexible, but contained preplanned content regarding healthy sleep. The current study examined the sub-cohort reporting on sleep behaviors (n=299), including changes in nighttime sleep hours, total time slept in 24 hours, and change in napping behaviors over time (i.e., non-napping, continued napping, no longer napping, and now napping). Results: 210 individuals (117 LR group, 93 controls) had complete sleep information at baseline and 6-month follow-up. Napping behaviors did not significantly differ between the groups, 55% of the LR Group were non-nappers (vs. 52% control); 16.2% continued napping (vs. 20.8%), 17.9% now nap (vs. 16.7%), and 11.1% no longer nap (vs. 10.4%). Among those who no longer napped at follow-up, on average, the LR group increased nighttime sleep (51.6 minutes), while controls decreased night sleep by 10.8 minutes ($p<0.05$). As a result, controls experienced an overall reduction in sleep of 75 minutes compared to the LR group's increase of 12.6 minutes per day ($p<0.01$). Conclusion: This study demonstrates that an occupation-based intervention may be associated with changes in sleep behaviors among adults who were previously nappers.

Poster #: 2
Title: Transperineal Sonography of the Male Pelvic Floor: Reliability and Validity
Name: Shawn Roll

Background: Chronic pelvic pain is the most frequent urological diagnosis for men under 50; point-of-care sonography could revolutionize diagnosis/treatment. Purpose: To validate image acquisition and establish image analysis reliability for transperineal imaging of the male pelvic floor (PF). Methods: The PF of two embalmed cadavers were dissected to validate sonographic acquisition of muscles on and around the bulb of the penis. Following validation, transverse images of the PF were acquired from 20 subjects (10 pelvic pain patients, 10 age-matched healthy controls) prior to and following PF muscle exercises. Cross-sectional area (CSA) and linear thickness of the bulb of the penis, urethra, bulbospongiosus (BS) muscles, and ischiocavernosus (IC) muscles were measured on 36 images by three raters. Reliability was calculated for all measures using two-way, mixed effects intra-class correlation coefficients within three trials by rater (intra-rater) and using averages across raters (inter-rater). Results: Measures of the bulb of the penis had the best reliability (>0.91) and muscle CSA had good inter-rater (0.80–0.89) and intra-rater reliability (0.70–0.86). Reliability for sagittal thickness of the BS near the central tendon was good (0.78–0.91); however, measuring the thickest portion of the muscles had varied reliability (0.56-0.86). Measures of the urethra had the poorest reliability. Conclusion: The bulb of the penis, muscle CSA, and thickness of the BS near the central tendon can be reliably measured using a transperineal approach with a linear transducer. These measures can be used in future research to begin identifying and differentiating patients with various PF disorders.

Poster #: 3
Title: Learning Strategies of Young Preterm and Term Infants
Name: Barbara Sargent

Background: Preterm infants are at increased risk for developing spastic cerebral palsy, which is characterized by walking limitations due to excessive in-phase hip-knee joint coordination (hip and knee flex and extend in synchrony). Previous research demonstrates that full-term infants will exhibit less in-phase hip-knee joint coordination when they kick a switch to activate an overhead infant mobile, however, it is unknown whether preterm infants can generate less in-phase hip-knee joint coordination. Purpose: The purpose of this study is to determine the ability of full-term and preterm infants to (1) learn the contingency between leg action and mobile activation, (2) demonstrate less in-phase hip-knee joint coordination when leg actions are reinforced with mobile activation, and to 3) identify strategies defined by the variance and torques used by infants to perform the task. Methods: On two consecutive days, fourteen full-term infants and six preterm infants participated in a task in which an overhead infant mobile rotated and played music when the infant moved either foot vertically across a virtual threshold. Results: Five full-term and three preterm infants learned the contingency and demonstrated less in-phase hip-knee joint coordination when interacting with the mobile on the second day. Infants who learned the contingency differed in the movement strategy used to increase the amount of mobile reinforcement as defined by the variance of their end-effectors (feet). Conclusion: These results provide the initial scientific support for the development of very early therapeutic interventions to reinforce more typical hip-knee joint coordination patterns of preterm infants at increased risk for cerebral palsy.

Poster #: 4
Title: Biocompatibility of Denture Base Resin Evaluated in Human Lymphocyte Cells
Name: Tae Kim

Background: 3D printing techniques have been introduced to manufacture new dental materials, including denture base material. New 3D printed denture base material requires biocompatibility tests according to FDA regulation. Purpose: Compare cytotoxicity of new 3D printed denture material (Dentca, Inc.) with Dentsply Lucitone 199 (Dentsply, Corp.). Methods: Raw Dentca material was mixed according to the manufacturer instructions. New material specimens were generated through 3D printer (Carima, Inc.). The printed specimens were washed with isopropanol alcohol, dried, post-cured under UV/Vis curing unit (Honle UV America Inc.) for 1h and cut into 1x1x0.2cm^3 size. The printed specimens (12 totals) were divided in two groups: polished (6) and unpolished (6). Dentsply Lucitone 199 (6 samples) was prepared according manufacturer instructions (heat cured). All samples were stored in artificial saliva for 1 day and placed in prepared lymphocyte cell culture. The viability of peripheral blood lymphocytes was evaluated at the day of placement and after 7 and 14 days using a dye exclusion technique. Quantitative assessments were made by determination of the percentage of viable, apoptotic and necrotic cells. For statistical analysis Pearson chi-square test was used. Results: In both cases of Dentca, no statistical significant difference was found when com-

pared to negative control (redistilled H2O)($p<0.01$). The Dentsply materials show less viable cells in comparison with Dentca and negative control group. No statistical significant difference was found for Dentca between first day, 7 and 14 days. Conclusion: New 3D printed material shows excellent biocompatibility when compared to negative control and conventional material, which is safe for clinical use.

Poster #: 5
Title: Full-day Monitoring to Relate Infant Kicking Quantity to Walking Onset
Name: Beth Smith

Background: Our overall goal is to use full-day monitoring with small movement sensors to determine quantity, type and quality of infants' leg movements and differentiate typical, delayed and impaired developmental trajectories very early in life. Very early identification of impaired infant neuromotor control is necessary for initiating and targeting early therapeutic intervention to promote optimal development. Full-day assessment is desirable due to high variability in infant performance. Purpose: Our specific goal here is to relate quantity of infant kicking to walking onset. Methods: We collected a full day (ranging from 8-13 hours) of leg movement activity from 12 infants with typical development (TD), ages 1 to 12 months, in their homes. To date, we have also collected data from 5 of 40 infants at risk for developmental delay (AR), as defined by the state of California. Infants were measured 3 times each, with 2 months between measurements. Gyroscope data (rate of rotation) were collected at 20 Hz from synchronized sensors attached to the front of the ankles. We low-pass filtered the data at 4 Hz and defined a kick as a leg movement of 30 degrees/s of total rotation sustained for at least 0.4 s. In follow-up, parents report the date their child first took 3 independent steps and their child's developmental status at 24 months. In the final analysis we will compare 3 groups: infants with TD, infants AR with delay at 24 months and infants AR without delay at 24 months. Results: Preliminary analysis shows a mean kicking rate of 600 kicks (SD = 151) per hour of awake time for infants with TD and 575 kicks (SD = 321) for infants AR. There was not a significant difference between groups (ANOVA, $p = 0.74$). To date, 2/5 infants AR demonstrated kicking rates well below the average of the infants with TD (174 and 393) while 3 did not. Six of the 12 infants with TD have started walking; their range for age of onset of 3 independent steps was from 288 to 481 days. Preliminary analysis showed a significant positive correlation of 0.93 ($p= 0.01$); infants who had higher average rates of kicking had later onset of independent walking. Conclusion: Our preliminary correlation between higher average rates of kicking and a later onset of independent walking in 6 infants with TD does not take into account the age and developmental ability of the infant at the time of testing, and so must be interpreted cautiously. Infants may kick less as their development progresses and they spend more time sitting, for example. Overall, our results show that we are able to measure quantity of kicking during full-day movement monitoring with small movement sensors attached to infants' legs. We will continue to validate the sensor-obtained data and relate leg movement trajectories to developmental milestones and outcomes.

Poster #: 6
Title: Cytotoxicity of Pre-Heated Resin Restorative Materials Polymerized through CAD/CAM Overlay
Name: Alena Knezevic
Faculty Advisor: Sillas Duarte

Background: Heated composite can be used for luting CAD/CAM composite and ceramic restorations; however, they have to be heated to improve flowability. Purpose: To compare cytotoxicity of two preheated composite resins used as luting materials polymerized through CAD/CAM overlay. Methods: Restorative composites (Gradia Direct Posterior, GC, Europe N.V., and Beautifil II, SHOFU Dental GmbH) were tested unpolymerized or preheated at three different temperatures (T1-37°C, T2-54°C, T3-68°C) using a composite heater (Calset, Addent Inc). The heated composite specimens were placed in a round mold (diameter 6mm; 0.65mm thick), covered with a Mylar sheet, pressed and polymerized with Bluephase LED (Vivadent) curing unit (1100mW/cm^2). Specimens were assigned to three experimental sub-groups: DP-direct polymerization, CRP-2mm thick CAD/CAM ceramic-reinforced polymer (LAVA Ultimate, 3M ESPE) and LDC-2mm thick CAD/CAM lithium disilicate ceramic (e.max, Ivoclar Vivadent) and polymerized for 40 seconds. After curing, polymerized samples were placed immediately in a prepared lymphocyte cell culture. The viability of peripheral blood lymphocytes was evaluated using a dye exclusion technique. Quantitative assessments were made by determination of the percentage of viable, apoptotic and necrotic cells. Data was then submitted to Pearson chi-square test ($\alpha<.05$) was used. Results: When left unpolymerized, Beautifil II had significantly higher cytotoxicity than Gradia ($P<0.0001$). At T1 direct polymerized Beautifil II had significantly lower cytotoxicity than Gradia ($P<0.0001$). At T2 and T3 Gradia showed lower cytotoxicity than Beautifill II (statistically significant at T2, $P=0.0013$). Conclusion: The lowest cytotoxicity was observed for both composites when pre-heated at 54°C.

Poster #: 7
Title: Influence of Leucine-rich Amelogenin Peptide on MSC Fate in vivo
Name: Yan Zhou

Background: Wnt signaling plays an important role in bone formation and regeneration. We have shown that Leucine-rich Amelogenin Peptide (LRAP) promotes osteogenesis of bone marrow mesenchymal stem cells (BMMSCs) at the expense of adipogenesis through activating Wnt signaling in vitro. This discovery makes LRAP amenable to novel therapies and interventions to treat Wnt-related skeletal disorders such as osteoporosis and bone healing. Compared to the glycosylated Wnt proteins (over 40 KDa), LRAP is much smaller (~ 6 KDa), giving LRAP a distinct advantage as a small molecule for delivery as a therapeutic agent. Purpose: The in vivo effect of LRAP on BMMSCs was characterized using both gain-of-function and loss-of-function studies. Methods: Transgenic mice were generated in which LRAP is overexpressed in bone marrow and adipose tissues. Functional knock-out of LRAP was achieved in amelogenin M180 knock-in mice. Results: BMMSCs derived from LRAP transgenic mice exhibited enhanced osteogenesis and decreased adipogenesis. In addition, microCT analyses indicated high trabecular bone mass in femora of LRAP transgenic mice. Conversely, BMMSCs from LRAP-null mice showed impaired osteogenic differentiation and enhanced adipogenic differentiation, which could be rescued by exogenous LRAP. LRAP-null mice also exhibited low femoral trabecular bone mass. Conclusion: LRAP is an effective regulator of mesenchymal stem cell fate to promote osteogenesis in vivo.

Poster #: 8
Title: Sensory Adapted Dental Environment to Enhance Oral Care in ASD
Name: Sharon Cermak

Background: Oral care is particularly problematic in children with autism spectrum disorders (ASD), in part due to their behavioral problems and related sensory issues. Purpose: To examine the feasibility and pilot test the efficacy of adapting the sensory characteristics of the dental environment to reduce anxiety and negative behavioral responses in children with ASD. Methods: Participants included 44 children 6-12 years (n=22 ASD, 22 typical). Children underwent two dental cleanings, three to four months apart, counterbalanced to regular dental environment (RDE) and sensory adapted dental environment (SADE) in which the lighting, sound, and tactile input were modified. Dental cleanings were videotaped and parents, dentists and children completed questionnaires. Outcomes included physiological arousal measured through electrodermal activity (EDA), behavioral measures of cooperation, and questionnaires of anxiety, cooperation and pain. Results: Implementation of the SADE was feasible and accepted by children, parents, and dental practitioners. To examine the efficacy of SADE, two (group) x two (condition) repeated measures analyses of covariance were performed. For EDA measures, group approached significance, with children with ASD showing greater physiological

arousal. Condition was significant with arousal lower in the SADE condition. Examination of behavior also indicated significant group differences, with children with ASD exhibiting more challenging behaviors than typical children. Environment was not significant, although in the hypothesized direction. Additionally, significantly more hands were needed to restrain children with ASD compared to the TD group, with fewer hands needed in the SADE condition compared to the RDE. Conclusion: Enhancing oral care is critical for children with special needs. Using a sensory adapted dental environment during routine oral care is feasible and indicates preliminary efficacy for children with ASD.

Poster #: 9
Title: Can Inertial Sensors Characterize Treatment-Induced Skill Acquisition in Chronic Stroke?
Name: Clarisa Martinez

Background: In individuals with stroke, kinematics of upper extremity (UE) movements can provide performance-based information useful to distinguish between the restitution of skilled movements from those performance gains associated with compensatory movement strategies. Wearable inertial sensors that measure limb accelerations and rotations can be used to quantify treatment-induced gains in motor control by characterizing the degree to which movement of the paretic UE approaches a gold standard multi-joint pattern. In this preliminary work, we demonstrate the use of a webcam and three synchronized wireless inertial sensors that are each comprised of a tri-axial accelerometer, gyroscope, magnetometer, and altitude sensor. Purpose: To describe the time course of skill acquisition in movement strategies in three case studies, and compare to a non-disabled individual. Methods: Sensors are placed on the proximal and distal aspect of the paretic arm and the trunk during the performance of a goal-directed, manipulation task— turning a knob using a grasp with repeated forearm pronation/supination movements. Results: With practice, improvement in skill is characterized by reduction in trunk acceleration, decreased acceleration of the proximal arm, and an increase in uni-planar rotation of the distal arm. A systematic approach to data analysis, including the development of metrics of success for feedback are discussed, as well as next steps for future development and testing. Conclusion: Inertial sensors can be useful for tracking and quantifying the time course of changes in motor control during rehabilitation, serve as an additional measurement tool for researchers and have future potential as biofeedback devices for patients.

Poster #: 10
Title: Reliability of Ipsilateral Silent Period to Measure Interhemispheric Inhibition.
Name: Clarisa Martinez

Background: The ipsilateral silent period (ISP) is a measure of transcallosal inhibition, in which stimulation of the primary motor cortex (M1) during voluntary ipsilateral muscle activation results in a brief reduction in EMG activity. Measures of ISP, such as duration or amplitude, are thought to reflect the balance in interhemispheric inhibition (IHI)—the extent to which homologous M1 areas mutually inhibit the contralateral side. An imbalance in IHI may be an important mechanism underlying impaired motor function after stroke, making ISP a useful and often cited measure. In stroke, ISP also allows for greater participant inclusion than other measures of IHI because it is assessed via stimulation of the non-affected M1. Our long-term goal is to measure ISP during volitional activation of the paretic hand in individuals with stroke, however, the reliability of ISP in first dorsal interosseous (FDI) has not been established. Additionally, current studies have utilized a maximal contraction of the affected hand, limiting the number of trials that could be completed before fatigue. Another issue is that differences in methodologies for identifying ISP in EMG traces can impact how duration of ISP is reported. Purpose: The purpose of this preliminary study is to test our methods, and to assess the reliability of ISP for FDI in non-disabled young adults. Methods: We will also test varying percentages of maximal volition contraction to determine the impact of muscle force on duration of ISP. Results: A systematic approach to data analysis will be discussed, as well as our next steps. Conclusion: ISP is a valuable measure for quantifying IHI. Next steps will include measuring ISP in persons with stroke.

Poster #: 11
Title: Periodontal Ligament and Gingival Mesenchymal Stem Cells for Tendon Regeneration
Name: Alireza Moshaverinia
Faculty Advisor: Songtao Shi

Background: Tendon injuries are often associated with significant dysfunction and disability due to tendinous tissue's very limited self-repair capacity and propensity for scar formation. Dental-derived mesenchymal stem cells (MSCs) in combination with appropriate scaffold material present an alternative therapeutic option for tendon repair/regeneration that may be advantageous compared to other current treatment modalities. The MSC delivery vehicle is the principal determinant for successful implementation of MSC-mediated regenerative therapies. Purpose: In the current study, a co-delivery system based on TGF-β3-loaded RGD-coupled alginate microspheres was developed for encapsulating periodontal ligament stem cells (PDLSCs) or gingival mesenchymal stem cells (GMSCs). Methods: The capacity of encapsulated dental MSCs to differentiate into tendon tissue was investigated in vitro and in vivo. Encapsulated dental-derived MSCs were transplanted subcutaneously into immunocompromised mice. Results: Our results revealed that after 4 weeks of differentiation in vitro, PDLSCs and GMSCs as well as the positive control human bone marrow mesenchymal stem cells (hBMMSCs) exhibited high levels of mRNA expression for gene markers related to tendon regeneration (Scx, DCn, Tnmd, and Bgy) via qPCR measurement. In a corresponding in vivo animal model, ectopic neo-tendon regeneration was observed in subcutaneous transplanted MSC-alginate constructs, as confirmed by histological and immunohistochemical staining for protein markers specific for tendons. Interestingly, in our quantitative PCR and in vivo histomorphometric analyses, PDLSCs showed significantly greater capacity for tendon regeneration than GMSCs or hBMMSCs ($P<0.05$). Conclusion: Altogether, these findings indicate that periodontal ligament and gingival tissues can be considered as suitable stem cell sources for tendon engineering. PDLSCs and GMSCs encapsulated in TGF-β3-loaded RGD-modified alginate microspheres are promising candidates for tendon regeneration.

Poster #: 12
Title: Biodentine Pulpotomies in Primary Teeth: A Retrospective Study
Name: Thomas Tanbonliong

Background/Purpose: The purpose of this study was to evaluate Biodentine as a medicament for primary molar pulpotomies compared to published data for formocresol pulpotomies. Methods: An IRB-approved retrospective review was conducted on charts of patients treated in the Pediatric Dental Clinic at the Ostrow School of Dentistry of the University of Southern California between April 2011 and May 2012. In total, 19 primary teeth requiring pulpal treatment received Biodentine pulpotomies. A clinical examination with bitewing and periapical radiographs was completed during the patients' routine 6 month re-care visits. Two calibrated pediatric dentistry faculty members examined the radiographs for signs of pathology. Clinical findings were reviewed in the patients' progress notes. A failure was defined as having at least one of the following findings: external root resorption, internal root resorption, furcal radiolucency, periapical radiolucency, widened PDL or clinical pathology. Pulp canal obliteration (PCO) was not considered a failure. Results: Nineteen teeth were evaluated after one recall visit with mean follow up times ranging from 3.1 to 9.2 months. PCO was present in 26% of teeth and failures occurred in 16% of teeth. For 10 teeth that were evaluated after a second recall visit with follow up times ranging from 9.8 to 18 months, PCO was present in 40% of teeth and failures occurred in 10% of teeth. No clinical pathology was noted. Conclusion: PCO was the most common radiographic finding in teeth treated with Biodentine. This study demonstrated a success

rate comparable to teeth treated with formocresol in the literature.

Poster #: 13
Title: Sensory and Motor Performance of Children Referred for Interdisciplinary Neurodevelopmental-Evaluation
Name: Stefanie Bodison

Background: According to the Diagnostic and Statistical Manual of Mental Disorders 5th Edition, Autism Spectrum Disorder (ASD) is clinically defined by persistent deficits in social communication and social interactions, and restricted, repetitive patterns of behavior, interests or activities. These symptoms are present early in development, often co-occur with other symptoms, and can significantly impact the child's ability to successfully engage in meaningful occupations that contribute to the child's overall growth and development. While much of the research to date has extensively documented delays in communication and reciprocal social interactions, there is increasing evidence of a high prevalence of sensory and motor delays within this population as well. Purpose: The purpose of this retrospective review of client records is to document the prevalence of sensory, motor, and adaptive behavior delays among children referred to a local children's hospital for an interdisciplinary neurodevelopmental evaluation. Methods: The client charts of over 200 children referred to a local interdisciplinary clinic for neurodevelopmental evaluation over the past 4 years were reviewed. Variables collected include age, ethnicity, cognition, sensory performance, motor skills, adaptive behavior ratings, and resultant diagnosis. Results: Descriptive summary statistics about the population will be presented as well as both t-test and ANOVA statistics assessing each variable separately for differences across the varying resultant diagnostic groups. Conclusion: The results of this study suggest that children with ASD do, in fact, have a high prevalence of sensory and motor delays, and that these delays may impact their adaptive behavior skills.

Poster #: 14
Title: Behavioral Consequences of Disrupted Met Signaling
Name: Barbara Thompson

Background: Utilizing genetically modified mouse lines to dissect the role of specific genes in the neurobiological underpinnings of neurodevelopmental disorders is an important approach. Our laboratory discovered that the gene encoding the receptor tyrosine kinase, MET, contributes to autism risk. Subsequent studies have shown a role for MET in functional and structural cortical connectivity in typically developing individuals and those with autism spectrum disorder. Furthermore, our studies have illuminated a role for Met in dendritic and spine architecture and excitatory drive in the cortex of mouse models of altered Met signaling. To further understand the contribution of Met to brain development and its impact on behavior, we generated two conditional mouse lines in which Met is deleted from select populations of cerebral cortex neurons. These mice were then tested to determine the developmental and long-term behavioral consequences of disrupting Met signaling. Purpose: The objective of these studies was to test our hypothesis that disruption of Met signaling during development has functional consequences on the maturation of cortical circuits and behaviors that are altered in autism. These studies define autism relevant specific social, emotional and cognitive behaviors caused by developmental disruption of Met cortical signaling. Methods: We generated two conditional mouse lines in which Met is deleted from select populations: 1) $Met^{fx/fx}/Emx1^{cre}$ (deleted from all cells arising from the dorsal pallium) and 2) $Met^{fx/fx}/Nestin^{cre}$ (deleted from all neural cells). A battery of behavioral tests was performed to assess cognitive, emotional, and social impairments that are observed in multiple neurodevelopmental disorders, including ASD, and that, are in part subserved by circuits that express Met. Multiple cohorts of n=6 mice per genotype were tested in early adulthood on rotarod, activity chamber, elevated plus maze, spontaneous alternation in the t-maze, olfactory dishabituation, social novelty preference, marble burying, and contextual fear conditioning. Results: Across multiple cohorts of animals we found that the null $Met^{fx/+}/Emx1^{cre}$ mice display significant hypoactivity in the activity chamber and in the t-maze despite normal performance on the rotarod. Additionally, these animals show a deficit in spontaneous alternation. The null $Met^{fx/+}/Emx1^{cre}$ mice show normal anxiety, olfactory dishabituation, social novelty preference, contextual fear conditioning, and marble burying. The null $Met^{fx/fx}/Nestin^{cre}$ mice display deficits in contextual fear conditioning, and a weak deficit in sociability in the social novelty preference task. The null $Met^{fx/fx}/Nestin^{cre}$ mice show normal performance on rotarod and activity chamber, anxiety, spontaneous alternation, olfactory dishabituation, and marble burying. Conclusion: These data suggest a complex contribution of Met in the development of social, emotional, and cognitive behavior. The impact of disrupting developmental Met expression is dependent upon the circuit-specific deletion pattern. The null $Met^{fx/fx}/Nestin^{cre}$ mice (Met deleted from every cortical cell) show behavioral phenotypes consistent with autism. In contrast, the null $Met^{fx/+}/Emx1^{cre}$ mice (Met deleted from all cells arising from the dorsal pallium) show a different behavioral phenotype, with decreased exploratory behavior and memory. Future studies will determine the impact of environmental interactions with the deletion of Met from the $Met^{fx/fx}/Nestin^{cre}$ mice on further social, emotional, and cognitive behaviors.

Poster #: 15
Title: Preventing Pressure Ulcers in People with Spinal Cord Injuries
Name: Celso Delgado

Background: Serious pressure ulcers (PrU) often result in diminished occupational engagement, increased healthcare costs, and even death. Investigators at the USC Division of Occupational Science and Occupational Therapy are conducting a randomized controlled trial to study the effectiveness of a one-year occupation-based PrU prevention intervention. Purpose: Secondary analyses were conducted to explore the following intervention-related issues: (a) how lifestyle change relates to PrU development; (b) the importance of customizing PrU interventions to meet the needs of clients; and (c) how age at onset of SCI may impact PrU risk by altering the course of emotional and social development. Methods: Treatment note data were utilized to conduct secondary analyses. First, a cross-case analysis was conducted on 47 participants to examine the relationship between lifestyle changes and PrU development during the intervention. Second, content analysis was conducted to examine treatment notes on participants demonstrating 80% intervention adherence (n=73). This analysis explored how interveners tailored the intervention, and the ways in which PrU risk was impacted by altered/interrupted development. Results: Four different PrU/lifestyle change patterns were identified. Several factors, including physical and occupational level, and existing knowledge of prevention strategies, were considered when tailoring the intervention, and this tailoring was important. Components of development such as coping and future orientation were impacted by age at onset of SCI, and these components impacted PrU prevention. Conclusion: Results can inform practitioners on the importance of lifestyle, individualization of treatment strategies, and special circumstances such as age at onset of SCI, as they relate to PrU prevention.

Poster #: 16
Title: An Intraoral CPAP Device for Delivering Oxygen at Night
Name: Stephen Yen

Background: Children and adults with obstructive sleep apnea are treated with masks that allow air to be delivered to the nose at a pressure that can maintain an airway. The masks are placed with elastic straps that can restrict the development of the maxilla during facial growth. Purpose: The purpose of this project is to develop an alternative method for delivering positive air pressure to the nose without stunting the maxillary growth of a child. Methods: In this case report, a nasal pillow was fitted onto a custom made splint by a metal wire. This poster shows the development of an orally retained device that can keep the pillow on the nose in order to maintain air pressure and air flow as measured by pressure gauges and minianemomoeter.

This device is similar in concept to a nasoalveolar molding appliance for newborn infants and is a prototype for developing a different type of CPAP device that can correct the skeletal deformity created by long-term face mask wear. Results: The device can provide the same airflow and air pressure as the conventional nasal mask. Conclusion: The goal of the device is to provide an alternative method for delivering air to the nose and correct a Cl III malocclusion using orthodontic forces and mechanics. This prototype succeeded in delivering the air pressure and flow for the patient. Modifications are needed to improve the comfort and design, and to attach the hooks needed for maxillary protraction.

OTHER

Poster #: 18
Title: Paradoxical Mandibular Growth Pattern in Patients with Craniofacial Microsomia
Name: Michelle Scott
Faculty Advisor: Stephen Yen

Background: Mandibular growth in craniofacial microsomia characteristically favors the affected side. However, we have observed the opposite growth pattern in a minority of patients. Here, we describe eight patients with facial features of hemifacial microsomia which showed a paradoxical growth pattern (occlusal plane remained level and the mandible did not shift to the side with the short ramus). Purpose: The purpose of this study was to analyze unusual mandibular growth patterns in subjects with hemifacial microsomia using measurements from panoramic radiographs and cone beam computed tomography (CBCT) scans. We will test the hypothesis that changes in mandibular body length compensated for the differences in ramal height. Methods: Eight subjects treated at Childrens Hospital Los Angeles (6 male and 2 female) age ranging from 4 to 17 years were found to have this paradoxical growth pattern. Four of these patients underwent CBCT scans. The subjects first had panoramic radiograph measurements: Ramal length (Co-Go) and body length (Go-Mid-symphysis) were measured on the affected and unaffected sides and mandibular length (Co-Mid-symphysis) by adjusting with proportionate ratios based on models of posterior teeth. These measurements were compared to control groups of hemifacial microsomia patients with similar ramal height deficiency, but who lacked the paradoxical growth pattern. The same measurements were repeated in three dimensions using New-Tom 9000 CBCT scan. Results: The panoramic radiographs showed that in the affected side, the mandibular body was longer than the unaffected side mandible body in patients with paradoxical growth. This difference in body length was not observed in the control group. Further there was no gap between the glenoid fossa and top of the affected ramus. The glenoid fossa tended to be in a lower vertical position on the affected side in patients with the paradoxical growth pattern. Conclusion: Patients with paradoxical growth showed lengthening of the mandibular body on the affected side rather than the unaffected side and the glenoid fossa was lower on the affected side. This unusual pattern of growth could compensate for a congenitally short ramus and keep the occlusal plane level. Patients with this type of paradoxical growth pattern express a less severe phenotype of hemifacial microsomia.

Poster #: 19
Title: Na, K-ATPase and NCX1 Coupling in Rat Enamel Organ Cells
Name: Xin Wen
Faculty Advisor: Michael Paine

Background: The role of the enamel organ is to facilitate enamel development and mineralization in tooth formation. The amount of calcium and other mineral ions in the mineralizing extracellular matrix increases at maturation stage in order to gradually replace water and matrix proteins deposited at the secretory stage. Purpose: NCX1 is one of the three Na+-Ca2+ exchangers leading to one Ca2+ movement across the plasma membrane in exchange of three Na+ influx. It has been proposed that NCX1 is involved in the directional Ca2+ extrusion pathway from ameloblasts to the enamel mineralizing front. However, NCX1 can reverse the direction of the transport if the concentrations of Na+ and Ca2+ change. Methods: We have previously shown that Na, K-ATPase is expressed in enamel organ cells. In this study, using rat enamel organ lysate, we showed that Na, K-ATPase interacts with NCX1 in co-immunoprecipitation assay. Results: We propose that the physical interaction of these two channels facilitates functional coupling, in which the Na+ gradient established by Na, K-ATPase is used for Ca2+ transport/extrusion through NCX1. Conclusion: In addition, we showed the increased expression level of NCX1 in maturation stage compare to secretory stage, consistent with the increased rate of Ca2+-transport during maturation stage.

Poster #: 20
Title: Differences in Number of Medications used by Distinct Older Populations
Name: Sumerian Abdullah
Faculty Advisor: Reyes Enciso

Background: Eighty percent of people 65 years of age and older have one or more chronic medical conditions. Drug therapy is often key to their medical management. Greater consumption of prescription and over-the-counter medications in this population puts them at higher risk for medication-related problems. Purpose: To understand differences in number of medications and herbal supplements taken by patients 65 years and over from three different clinical settings: outpatient (Special Patients Clinic=SPC), continuing care retirement facility (Hollenbeck=HOLL), and the Union Rescue Mission (URM). Methods: Over 300 charts of older adults were reviewed for demographics (age, gender, clinical setting) and number of medications and supplements used. Correlations and non-parametric analyses were conducted with SPSS and statistical significance of 0.05. Results: Among 377 patients (59.7% females) there was a statistically significant difference in median number of prescribed medications between females and male (F:6.0,M:5.0;p=.04). The homeless patients (URM) took the least amount of prescription medications and SPC patients took significantly less prescription medications than HOLL patients (HO LL:8.5,SPC:6.0,URM:1.0;p<.001). Similar results were found for herbal supplements. Overall there was an increase in the number of medications used with the aging (R=.164;p=.001). The mean number of medications increased from 5.35 (<=74yo), to 5.83 (75-84), to 6.72 (85+). Conclusion: Female gender and older age correlate with increased number of medications. Older patients in a retirement facility used more medications than the outpatients and the homeless patients. The aging homeless population may lack access to prescription drugs and supplements resulting in less medication and possibly more medical complications.

Poster #: 21
Title: FaceBase: A Resource To Aid In Craniofacial Research
Name: Thach-Vu Ho
Faculty Advisor: Yang Chai

Background: Craniofacial abnormalities account for half of all congenital malformations. The etiology of orofacial clefts, the most common craniofacial abnormalities, remains unknown for many patients and the phenotypes vary considerably. Further research into craniofacial abnormalities is vital in order to prevent and treat them. Purpose: To generate genetically engineered mouse models for understanding cellular mechanisms underlying the etiology and pathogenesis of craniofacial abnormalities in humans. These models will be submitted to the FaceBase Consortium, a resource database through which they will be disseminated among the craniofacial research community. Methods: *Wnt1-Cre;Tgfbr2$^{fl/fl}$*, *Wnt1-Cre;Tgfbr2$^{fl/fl}$;Alk5^{fl}/+*, *K14-Cre;Tgfbr2$^{fl/fl}$*, *Msx1$^{-/-}$*, *Ctgf$^{/-}$*, and litter mate control mice were generated at different embryonic stages, E13.5 to E.18.5, and postnatal P0. All mutant strains were maintained in a C57BL/6J background. Results: More than 150 micro-computed tomography (micro-CT) scans were submitted to the FaceBase Consortium. Microarray and gene expression analyses are currently being performed for each of the genotyped strains to allow the craniofacial research com-

munity access to comprehensive physical, molecular, and genetic data analysis. Conclusion: The availability of micro-CT, microarray, and gene expression data at different mouse embryonic stages via the FaceBase Consortium allows the craniofacial research community to study craniofacial development and abnormalities, as well as clearly analyze phenotype affects with the appropriate software.

Poster #: 22
Title: Evaluation of Antimicrobial Activity of Curcumin on Candida albicans
Name: Emily Chen
Faculty Advisor: Ramiro Murata

Background: Candida albicans is the most prevalent human fungal pathogen and has placed third for the most common cause of in hospital infections. C. albicans becomes opportunistic pathogens under conditions such as reduced immune competence or an imbalance of competitive bacterial microflora. The increase in antimicrobial resistance and the restricted number of commercially available antifungal drugs, emphasize the need for a new and more effective antifungal agent. Studies have shown that natural polyphenols, such as curcumin can be an attractive solution because of their various pharmacological activities including antioxidant, anti-inflammatory, antiviral, and antibacterial activities. Purpose: The objective of this project is to determine the antimicrobial activity of curcumin on Candida albicans. Methods: The antimicrobial activity of curcumin (0.5-250μM) will be tested in vitro against C. albicans SC5314 ($5x10^3$ to $2.5x10^3$ CFU/mL grown in RPMI 1640 at 37 °C in 5% CO_2) to determine the minimum inhibitory concentration. It will be compared to the vehicle control (1% DMSO), and positive control (Fluconazole). Cytotoxicity assays will be performed on Hela cells ($1x10^5$ cell/mL grown in EMEM/10%FBS at 37 °C in 5% CO_2) treated with same concentrations of curcumin. Cell viability will be observed by the fluorometric method (Resazurin). Morphological characteristics of Hela cells will be observed under the microscope. Results: N/A Conclusion: N/A

Poster #: 23
Title: Site Directed Mutagenesis of PHF6: A Study on Bojeson-Forssman-Lehmann Syndrome
Name: Philbert Mach
Faculty Advisor: Ruchi Bajpai

Background: Mutations in the gene PHF6 has been linked to Borjeson-Forssman-Lehmann Syndrome. Male and female patients carry many distinctive mutations and have non-overlapping phenotypes. PHF6 encodes a protein containing two plant homeodomain (PHD) fingers that participate in protein-protein interaction. Our lab has shown that each PHD finger domains recognize specific post translation modifications on histone proteins, that package DNA. Purpose: In this project we will be performing mutagenesis on targeted sites on the PHF6 gene in order to mimic mutations seen in male and female BFLS patients. Then we will study specificity of mutant PHF6 in binding histones, nucleosomes and other partner proteins to understand their impact on craniofacial development. Methods: We will be designing custom oligos to peform site directed mutagenesis on targeted base pairs. We will then proceed to amplify and transfect the plasmid into HEK293 cells, ultimately to conduct immunoprecipitation in order to analyze protein-protein interactions. Results: A library of PHF6 mutations have been generated that represent those identified in male and female patients and in putative histone 3 monomethyl binding sites. Most of patient mutations have been confirmed through sequencing, and the PHD finger domain mimic is still in the works. Conclusion: The mutagenesis has been successful in a smaller plasmid show that the targeted base pairs have been altered to the desired base pairs, thus mimicking the patient mutations, however more work needs to be done for the two PHD domains to mimic one another and to see protein interactions in either domain.

Poster #: 24
Title: Using TALENs to Target Enhancers and Pull Down Associated Complexes
Name: Jennifer Oki
Faculty Advisor: Ruchi Bajpai

Background: Transcription activator-like effector nucleases (TALENs), proteins that have a specific DNA binding site and a DNA cleavage site, are routinely used for targeted genome editing (Gaj et al., 2013). Previous work has shown that, DNA binding domain of TAL proteins can be utilized to pull down target promoter DNA along with its associated proteins (Das, A. and Bajpai, R. MS in prearation). Both enhancers and promoters regulate transcription and can bind proteins; enhancers are typically farther away from the transcription start site and less understood. Purpose: This study aims to determine, in an unbiased manner, complexes that assemble in neural crest and neuroblastoma specific enhancers, namely those associated with WNT1, RARG, LMX1A and ANKRD44. Methods: At specific stages of cell development doing a TALEN based pull down will isolate complexes bound to the enhancers. TALENs are a useful tool because of their high DNA-binding specificity and the flexibility of designing the TALE binding domains. TALENs were engineered to bind at regions flanking the enhancer site. After the enhancer is cut out, immunoprecipitation will be done to isolate the enhancer and complexes bound to it. Results: The data from the pulldowns at the enhancers has not yet been obtained. But, large scale TALEN assembly has been optimized. Conclusion: The results of this experiment will help us discover which proteins interact with enhancers to affect transcription during embryo development. A better understanding of control mechanisms involved during embryo development can help scientists better understand normal embryo development processes and how diseases occur at this age.

Poster #: 25
Title: Effect of β-Glucans on Bone Loss in Rats with Periodontitis
Name: Viviam Silva
Faculty Advisor: Ramiro Murata

Background: Periodontal disease (PD) is highly prevalent in the general population. It is characterized as a chronic multifactorial disease. New treatment options are being tested and the β-glucans (cell wall structural components of plants, fungi and some bacteria) have been used to stimulate the immune response. Purpose: To evaluate the effect of β-glucan derived from Saccharomyces cerevisiae on alveolar bone loss (BL) in rats with ligature induced periodontitis. Methods: Twenty-four male Wistar rats were used. The animals received 30mg/kg/day of β-glucan by gavage for 28 days with ligature placed on the 14th day. Shortly after euthanasia the jaws were also collected to assess the degree of BL by morphometric analysis. A completely randomized factorial (2 x 2) design with six replications were employed. Results: Ligature induced animals showed BL significantly higher (0.194 ± 0.038cm) than the other groups (0.109 ± 0.017cm) ($P < .05$). β-glucan administration reduced PO ($P < 0.05$) in the groups with DP (0.178 ± 0.035cm treated group; 0.210 ± 0.036cm untreated groupo). Conclusion: The use of β-glucans showed beneficial effect on the BL. More studies are needed to elucidate the mechanism of action of these agents.

Poster #: 26
Title: Biofilm Formation of Evolutionarily Divergent Aggregatibacter actinomycetemcomitans Strains
Name: Jason Chen
Faculty Advisor: Casey Chen

Background: Gram-negative facultative Aggregatibacter actinomycetemcomitans (Aa) is a major etiology of periodontitis. Essential to Aa's infection process is its ability to form tenacious biofilms. Our laboratory has found that, within each strain, 16.7-29.4% of its genes are not shared by other strains. These strain-specific genes may confer phenotypes, such as ability to form biofilm, that distinguish Aa strains of low and high virulence potentials. Purpose: Our long-term goal is to correlate variable biofilm formation among strains with the functions of strain-specific genes. Therefore, the aim of this study was to assess the biofilm formation of Aa strains grown in different growth conditions. Methods: A standard 96-well dye-based biofilm formation assay was performed to optimize the size of the bacterial inoculum, media and culture conditions. Subsequently, 9 evolutionarily divergent Aa strains were subject to biofilm formation assays

in standard trypticase soy broth with yeast extracts (TSBYE) with or without the following supplements: human serum, horse serum, human saliva and iron chelators. Aa grown in water or PBS served as controls. Results: The amounts of biofilm formed by individual strains differed by as much as 2-3 folds. The range of biofilm units (BU) formed among the study strains were: 0.9-1.8 BU in TSBYE; 0.7-1.5 BU in TSBYE/horse serum; 0.4-1.4 BU in TSBYE/human serum; 0.3-0.8 BU in TSBYE/human saliva; and 0.2-0.6 BU in ion-depleted medium. Conclusion: Evolutionary divergent Aa strains exhibit a wide range in the amounts of biofilm formed in different media.

ADVANCED SPECIALTY PROGRAM RESIDENT

Poster #: 27
Title: AMOR in Conjunction with Extraction Socket Device for Bone Regeneration
Name: Seiko Min
Faculty Advisor: Homa Zadeh

Background: A novel tissue engineering strategy has been developed in our laboratory to take advantage of the specificity and diversity of monoclonal antibodies (mAbs). A chimeric anti-BMP-2 mAb has been generated and immobilized on a scaffold to capture endogenous BMPs, inducing osteogenic differentiation of mesenchymal stem cells and accelerate bone regeneration. This process has been referred to as Antibody Mediated Osseous Regeneration (AMOR). The advantages of AMOR include: (i) endogenous BMP-2 is captured by antibodies (ii) the temporal and spatial process of osteogenesis is orchestrated by expression of endogenous BMP-2 and (iii) increased bioavailability and half life of captured BMP-2. Several studies have demonstrated the efficacy of AMOR in regenerating bone in various animal models. Regeneration of alveolar dehiscence defects is a significant clinical problem. Specialized devices have been fabricated to support the facial tissues and provide space (Socket cage) and to seal the opening of extraction socket and protect graft material (Socket cap). This study sought to evaluate the efficacy of chimeric anti-BMP2 mAb used in conjunction with extraction socket devices in regenerating alveolar dehiscence defects. Purpose: The purpose of this study was the efficiency of the AMOR, using chimeric anti-BMP2 mAbs in conjunction with extraction socket devices on the alveolar ridge preservation in extraction socket with buccal bone dehiscence defect in non-human primate model. Methods: Six young adult male Macaca fasicularis monkeys were used in this study. Bilateral upper and lower first premolars and first molars was extracted in each monkey followed by the removal of the facial plates using a surgical bur to create dehiscence defects. In half of the animals (experimental group) chimeric anti-BMP-2 mAb immbolized on absorbable collagen sponge (ACS) with or without socket cap and socket cage. The other half of animals (control) were treated similarly, where instead of specific mAb, isotype-matched control mAb was used. Animals were subjected to cone beam CT scan (CBCT), before, at 6 and 12 weeks after surgery. Quantitative analysis was of CBCT data was performed with Simplant software to measure bone fill within dehiscence defects at 1mm, 3mm, and 5mm from the marginal bone crest of adjacent tooth. Results: Quantitative and qualitative assessment revealed significantly increased bone volume and density within sites implanted with socket cage, anti-BMP-2 mAb and protected with socket cap, compared with control sites. Conclusion: The results of the present study have demonstrated the efficacy of a novel tissue engineering approach utilizing ant-BMP-2 mAb in conjunction with specific devices designed to maintain the alveolar contour and protect graft material.

Poster #: 28
Title: VISTA Technique for Soft Tissue Augmentation: Study Cast Analysis
Name: Seiko Min
Faculty Advisor:

Background: A variety of techniques are available for soft tissue augmentation of teeth with recession defects. In an effort to improve outcomes, Vestibular Incision Subperiosteal Tunnel Access (VISTA) technique has been developed. The aim of this report is to provide data on outcome of soft tissue augmentation using VISTA. Purpose: The purpose of this study was to evaluate the efficacy of VISTA technique for root coverage and soft tissue augmentation. Methods: 42 teeth in 8 patients were treated using VISTA technique. Briefly, after thorough scaling and root planning, odontoplasty and root conditioning with EDTA (3min), a vestibular incision was made followed by subperiosteal tunnel. Connective tissue graft (CTG) was harvested from palate or maxillary tuberosity. CTG was placed within subperiosteal tunnels over root dehiscences. Gingival margins of each tooth was coronally repositioned as much as possible and the position was secured with horizontal mattress sutures which were bonded to teeth with composite. The amount of attached gingiva and the volume of soft tissue augmentation were evaluated at baseline, 3 months and 6 months by clinical measurements and study cast analysis. Results: Initial observations included 2.54mm (1-6mm) recession and 2.02mm (0-7mm) attached gingiva. After mean follow up period of 3 months and 6 months, 0.2mm recession, 4.5mm attached gingiva was present. According to Miller classification, 100% root coverage in class I and II, 91% root coverage in class III were achieved. Conclusion: Data revealed that soft tissue augmentation and root coverage treatment of Miller class I, II, III recession defects using VISTA resulted in favorable clinical outcomes compared to published results with conventional methods.

Poster #: 29
Title: Regional Differences in Microtensile Bond-Strength of Sealant to Human Enamel
Name: Reena Grover
Faculty Advisor: Jin-Ho Phark/ Tom Tanbonliong

Background: Numerous in vitro studies evaluate the bond strength of sealants to enamel on surfaces other than the occlusal surfaces. Purpose: The purpose of this study is to determine whether there are regional differences in microtensile bond-strength (μTBS) values of fissure sealant bonded to human enamel. Methods: Extracted third molars were cut to obtain enamel specimens of the buccal, lingual, mesial, distal, buccal and lingual incline planes of the occlusal surfaces. Those surfaces were flattened and polished, then etched, sealed (Clinpro, 3M ESPE), and restored with a microhybrid composite (Z250, 3M ESPE). Half of the specimens were subjected to artificial aging by thermocycling (20,000 cycles in distilled water at 5°C and 50°C). Then all specimens were cut into untrimmed sticks using a high-precision saw (IsoMet 1000, Buehler) and subjected to μTBS testing with a universal testing machine (Instron 5965, Instron). Modes of failure were recorded. Statistical analysis was performed using non-parametric tests (Kruskal-Wallis and Mann-Whitney) at α=0.05. Results: For non-aged specimens, μTBS values were highest on buccal and lingual surfaces (23.60/20.00 MPa), while they were lowest on the buccal and lingual occlusal incline planes (13.49/11.05 MPa)($P<.05$). In aged specimens, buccal and mesial surfaces exhibited highest μTBS values (21.99/16.70 MPa) and distal surface and buccal-occlusal incline plane the lowest values (9.38/9.74 MPa) ($P<.05$). Mode of failure was predominantly adhesive. Conclusion: μTBS of resin sealant to human enamel significantly varies between different areas of the tooth. This must be taken into consideration when evaluating, interpreting, and comparing bond-strength data across different studies.

Poster #: 30
Title: The Incidence of CSF-Diverting Shunt Infections Following Dental Procedures
Name: Ernest Nehrer
Faculty Advisor: Mina Habibian

Background: Cerebral spinal fluid (CSF)-diverting shunts are often complicated by bacterial infections. Dental procedures are known to cause transient bacteremia that could potentially spread hematogenously to these implanted devices. No literature currently exists to inform practitioners as to the need for prophylactic antibiotics for patients who possess these implants. The authors performed a retrospective study to assess whether dental procedures and poor oral health

were associated with a higher incidence of CSF-diverting shunt infections. Purpose: The purpose was to investigate whether dental health and dental procedures were associated with CSF-diverting shunts infection. Methods: The study retrospectively investigated records of patients who had CSF-diverting shunt placement and revision surgeries at Children's Hospital Los Angeles (CHLA) between January 2007 and March 2013. The medical records were cross-referenced with dental records from the Division of Dentistry at CHLA. Extracted data from these records included: demographics, indication for shunt placement, microbiology of shunt infection when available, date of dental encounters and procedures, use of antibiotics for dental prophylaxis or for any other indication at or near the time of dental intervention, and measures of dental health. Results: A total of 204 neurosurgical shunt and 648 dental procedures were performed during study period. There were 7 atrial and 5 pleural shunts present and all other shunts were peritoneal. There were 375 (58%) dental procedures classified as "High risk for bacteremia". Of these, 49(20%) shunt procedures were performed within 3 months of a preceding dental procedure. Although there was an increased risk of developing a shunt infection within a year of any neurosurgical intervention of a shunt, there was no statistically significant risk of developing shunt infection following dental procedures. There was no significant association between measures of dental health and the likelihood of developing a shunt infection. Conclusion: Our results suggest that the bacteremia caused by dental procedures does not induce shunt infections. This observation should re-assure practitioners that prophylactic antibiotics are likely not needed for dental procedures.

Poster #: 31
Title: Long-term Bond Strength to a Novel CAD/CAM Polymer Infiltrated Ceramic
Name: Carlos Jurado
Faculty Advisor: Jin-Ho Phark

Background: In order to provide a stable micromechanical and chemical bond between restoration and resin cement, the intaglio surface must be modified. However, data about optimal treatment procedures for a novel CAD/CAM polymer infiltrated ceramic are not available, yet. Purpose: To evaluate the long-term micro-tensile bond strength (μTBS) of a dual-curing resin cement to a polymer-infiltrated ceramic using different etching times and coupling agents. Methods: 24 blocks (14.0x14.0x4.0mm) of Vita Enamic (VITA) were divided into 4 groups (not etched, etched with 5% hydrofluoric acid for 20s, 60s, and 120s). Each group was subdivided into three sets based on silane application [No silane, RelyX Ceramic Primer (RCP, 3M ESPE), Clearfil Ceramic Primer (CCP, Kuraray)]. Composite discs (Paradigm MZ100, 3M ESPE) with 5.0mm thickness and 14.0mm diameter were cemented to the blocks with a dual-cure resin cement (RelyX Ultimate, 3M ESPE). Samples were artificially aged (20,000 thermocycles), sectioned to untrimmed sticks (cross sectional area 0.8±0.2mm^2) and tested for μTBS until fracture. Data were submitted to two-way ANOVA and Bonferroni post-hoc tests (α=0.05). Results: μTBS values ranged from 61.50±13.4 (no etch/no silane) to 103.34±15.4 MPa (20s etch/CCP). Groups without silane were significantly lower than groups with silanes ($p<0.05$). In groups with silane, 20s etching yielded in significantly higher μTBS values, compared to longer etching times and no etching. Conclusion: For a stabile long-term bond of resin cement to polymer-infiltrated ceramic, surface treatment by etching with HF acid and the application of a ceramic coupling agent are essential. However, over-etching, exceeding 20s, should be avoided.

Poster #: 32
Title: Comparing Handicapping Labio-Lingual Deviation Scores on Digital vs. Plaster Models
Name: Hany Youssef
Faculty Advisor: Stephen Yen

Background: The Handicapping Labio-Lingual Deviation index (HLD) is an orthodontic treatment need index, which is used to assess the severity of malocclusion. States like California use HLD as a preliminary screening tool for whether a patient qualifies for subsidized treatment. Purpose: The objective of this study is to compare the HLD scores using plaster vs. digital models. Methods: A sample of 75 duplicate study models that were sent to Denti-Cal for evaluation from Children's Hospital Los Angeles (CHLA), were scanned by the 3D Ortho Insight scanner. The plaster models were scored by the Denti-Cal Orthodontic Consultant who is considered as 'Gold Standard' in the study, in addition to two raters, an orthodontic fellow and a senior orthodontic resident. The digital version of the same casts were individually scored by the two raters. Kappa statistics were used to compare inter- and intra-rater reliability of the dichotomous outcome of qualifying. Comparisons included (1) inter-rater reliability between plaster model scores of both raters vs. the gold standard; (2) Intra-rater reliability between digital and plaster model scores for each rater; and (3) inter-rater reliability between raters 1 and 2 for both plaster and digital model scores. Results: Intra-rater reliability digital to plaster was substantial for both rater 1 ($k = 0.79$) and rater 2 ($k = 0.67$). Inter-rater reliability between raters 1 and 2 was almost perfect for both plaster ($k = 0.83$) and digital ($k = 0.88$) models. Conclusion: This study supports the use of digital models with the HLD index. There is high correlation between raters when using digital models. Differences in HLD scores between digital and plaster models can be as high as 10% and combined Kappa for intra-rater agreement was 0.73, but the specific errors or differences are relatively simple to eliminate with software modifications. Our preliminary data presents digital models as a promising alternative to plaster models for use with the HLD index in the near future.

Poster #: 33
Title: Foreign Body in Mouth Mimicking a Benign Connective Tissue Tumor
Name: Amir Balouch
Faculty Advisor: Parish Sedghizadeh

Background: Foreign bodies implanted in the region of the oral cavity are described periodically in the dental literature, but recent reports are rare. This could be due to the more common use of rubber dams and techniques that avoid trauma and implantation in tissues. Purpose: Often the foreign bodies reported are dental materials, metallic projectiles, and glass. In most documented instances, patients present with oral pain and signs of inflammation with purulent discharge. Reports of asymptomatic foreign bodies affecting the oral cavity are rarely reported in the literature. This paper describes a patient with an asymptomatic lesion that presented as a benign tumor-like mass, but which was later found to be rubber-based impression material implanted in the mucobuccal fold. Methods: A 51-year-old man presented to the Ostrow School of Dentistry, with a 5mm by 3mm yellowish-white nodule that was visible in the mucobuccal fold region of the lower right.The mass was soft to rubbery-firm on palpation, with no surrounding induration. Results: The patient was referred to the Oral Medicine Clinic for lesion evaluation and definitive diagnosis. Lipoma was considered most likely because of the yellow color, morphology, and consistency on clinical palpation and absence of symptoms. The patient consented to biopsy for definitive diagnosis of the mass and removal. The final diagnosis was intramucosal foreign body consistent with rubber-based impression material. Conclusion: Dental clinicians should be aware that intramucosal foreign body can be an incidental finding on intraoral examinations and can mimic the appearance of a benign and well-defined connective tissue tumor.

Poster #: 34
Title: Long-Term Bond Strength to CAD/CAM Lithium-Disilicate Glass Ceramic
Name: Clarisa A. Gastelum
Faculty Advisor: Neimar Sartori

Background: Effective long-term bonding to CAD/CAM lithium-disilicate glass ceramic can be achieved by surface treatment utilizing a hydrofluoric acid etching and silane coupling agent. However, the role of different etching times in combinations with different silanes is unclear. Purpose: To evaluate long-term micro-tensile bond strength (μTBS) of a dual-curing resin cement to lithium disilicate glass-ceramic using different etching times and silane coupling agents. Methods: 24 sectioned

blocks (14.0x14.0x4.0mm) of IPS e.max CAD (Ivoclar Vivadent) were divided into 4 groups (not-etched, etched with 5% hydrofluoric acid for 20s, 60s, and 120s). Each group was divided into 3 subgroups, according to the type of silane (no silane, RelyX Ceramic Primer (RCP, 3M ESPE), Clearfil Ceramic Primer (CCP, Kuraray)). Composite disks (5.0 mm thickness, 14 mm diameter; Paradigm MZ100, 3M ESPE) were cemented to the blocks using a dual-cure resin cement (RelyX Ultimate, 3M ESPE). Samples were artificially aged by thermocycling (20,000 cycles), sectioned into sticks (cross sectional area of 0.8±0.2 mm^2) and tested for μTBS at a crosshead speed of 1 mm/min. Data was subjected to two-way ANOVA followed by Bonferroni post-hoc tests (α=0.05). Results: μTBS was highest for group 120s etching/RCP (129.64±32.0 MPa) and lowest for group no-etching/no-silane (0 MPa). Values for silanated groups were significantly higher than no-silane groups ($p<0.05$). Increase in bond strength was etching time dependent (the longer the higher; $p<0.05$), regardless of the silane application. Conclusion: Increased etching time (>60s) of CAD/CAM lithium disilicate glass-ceramic in combination with silane application significantly improved long-term bond strength to a dual-curing resin cement.

Poster #: 35

Title: Long-Term Bond Effectiveness of CAD/CAM Ceramic-Reinforced Polymer

Name: Afnan Kashkari
Faculty Advisor: Jin-Ho Phark

Background: CAD/CAM restorations fabricated from new ceramic-reinforced polymers are increasingly used, however data about factors effective long-term bonding are still scarce. Purpose: To evaluate the influence of sandblasting, cleaning, and silanes on long-term bond strength of a resin cement to ceramic-reinforced polymer. Methods: 24-sectioned blocks (14.0x14.0x4.0 mm) of Lava Ultimate (3M ESPE) were divided into 2 groups based on surface treatment (sandblasted/not sandblasted). Half of each group was left uncleaned (not etched), the other half was cleaned by etching with 37% phosphoric acid for 60s. Each subgroup was divided according to silane application (no silane/RelyX Ceramic Primer (RCP, 3M ESPE)/Clearfil Ceramic Primer (CCP, Kuraray). Composite discs (Paradigm MZ100, 3M ESPE) with 5.0mm thickness and 14.0mm diameter were cemented to the blocks using dual-cure resin cement (RelyX Ultimate, 3M ESPE). After artificial aging with 20,000 thermocycles, specimens were processed to untrimmed sticks (cross sectional area 0.8±0.2 mm2) and subjected to micro-tensile bond strength (μTBS) testing. Data analysis was performed by three-way ANOVA and Bonferroni post-hoc tests (α=0.05). Results: μTBS ranged from 47.63±12.7 (no silane/cleaned/not sandblasted) to 112.87±19.9 MPa (CCP/cleaned/sandblasted). Silane application significantly increased bond strength ($p<0.05$), regardless of etching or sandblasting. Sandblasted groups obtained higher values compared to not sandblasted groups ($p<0.05$). Etched and not etched were not significantly different ($p>0.05$). Combination of silane, sandblasting, and etching resulted in highest values (107.43±16.8 MPa for RCP; 112.87±19.9 MPa for CCP). Conclusion: Silanization is an essential step to provide long-term bond effectiveness to CAD/CAM ceramic-reinforced polymer. Furthermore, sandblasting increases bond strength while etching does not.

Poster #: 36

Title: Bond-Strength of a Multi-Mode Adhesive Under Different Application Modes

Name: Diana Leyva
Faculty Advisor: Sillas Duarte

Background: Long-term adhesion of a new multi-mode adhesive to dentin could be influenced by various factors such as tubular fluid, presence of smear layer, or agitation of the adhesive during application. Purpose: Evaluate the influence of pulpal pressure, etching mode, and application mode on microtensile bond strength (μTBS) of a multi-mode adhesive to dentin. Methods: Flat dentin surfaces of third molars were divided into 2 groups (pulpal pressure/no pulpal pressure). Each group was further divided according to the adhesive application mode with or without agitation. Then, half of each subgroup received the adhesive (Scotchbond Universal, 3M ESPE) in self-etch technique, the other half in etch-and-rinse technique after previous etching with 37% phosphoric acid (ScotchBond Etchant, 3M ESPE). Finally, all samples were restored with a micro-hybrid resin composite (Filtek Z250, 3M ESPE) and stored for 24 hours. They were then cut to sticks with a cross sectional area of 1±0.2 mm^2 and tested for μTBS until failure in a universal testing machine (Instron 5965, Instron) at a crosshead speed of 1 mm/min. All data was analyzed by three-way ANOVA test with Bonferroni post-hoc comparisons at α=0.05. Representative specimens of each group were observed under CLSM. Results: μTBS was highest in groups without pulpal pressure in the self-etch technique with and without agitation (55.58±16.8/46.55±17.6MPa) and lowest in group pulpal pressure/self-etch/no agitation (19.79±13.8MPa). Groups with pulpal pressure where significantly lower, compared to groups without ($p<0.05$). Conclusion: Pulpal pressure affected negatively bond strengths of multi-mode adhesive, irrespective of bonding approach used.

Poster #: 37

Title: Fatigue Resistance of CAD/CAM Composite-Resin Overlays with Different Bonding Techniques

Name: Jack Goldberg
Faculty Advisor: Pascal Magne

Background: There are concerns regarding the ability to light polymerize the luting composite resin through a thick restorative material. Purpose: To evaluate the accelerated fatigue resistance and fracture load of thick CAD/CAM composite resin overlays luted with three different methods and materials. Methods: 45 molars were organized and distributed in 3 groups. All teeth were restored with a 5-mm-thick CAD/CAM composite resin overlay: Group A: IDS (pre-bonding) with Optibond FL and luting with Herculite XRV. Group B: IDS with Optibond FL and luting with Nexus 3. Group C: Direct luting with Optibond XTR and Nexus 3. Masticatory forces were simulated using closed-loop servo-hydraulics. The masticatory forces were applied through a flat steel cylinder at a 45-degree angle under submerged conditions. Results: The survival table analysis for the fatigue test did not demonstrate any significant difference between the groups. The fatigue test generated 1 failure for group A, 3 failures for group B and no failures for group C. Load-to-failure testing of the fatigued specimens started to demonstrated differences above 3,000N. For group A, 4 specimens survived the load to failure test, 6 specimens for group B and 9 specimens for group C. Conclusion: Within the limitations of this in-vitro study it can be concluded that the use of dual-polymerized luting material provided better results and that solely light-polymerized luting composite in combination with IDS is not contraindicated with thick restorations.

Poster #: 38

Title: Force to Failure of Varying Reinforcement Techniques for Implant-Supported Prostheses

Name: Jack Goldberg
Faculty Advisor: Winston Chee

Background: Fracture strength of cantilevered fixed detachable prostheses is of great concern, multiple alternatives for reinforcing the prostheses have been developed through the years. Purpose: The purpose of this study is to evaluate the ultimate force to failure at the cantilever area of a fixed detachable prosthesis reinforced with a novel glass fiber compared to conventional techniques. Methods: 30 specimens were divided in 3 groups and reinforced with different alternatives. Group A: Unreinforced. Group B: Novel glass fiber reinforcement. Group C: Titanium milled bar reinforcement. The specimens were torqued to a base consisting of 4 implant analogs embedded in acrylic resin and a compressive load was applied to the cantilever at 10 mm of distance from the most distal implant, by using a universal testing machine, the load required to fracture the specimens was recorded. Results: The results will be reported in due course. Conclusion: The conclusions will be reported in due course.

Poster #: 39
Title: Cytotoxicity of Amine-free Dual-cured Resin Cement Under CAD/CAM Restorations
Name: Gelareh Ronaghi
Faculty Advisor: Alena Knezevic

Background: Adhesive resin cements have became popular due to their dual-cured properties to meet specific needs of bonding of CAD/CAM restorations. Purpose: The aim was to compare cytotoxicity of a amine-free resin cement (RelyX Ultimate, 3M ESPE) polymerized under different curing times through ceramic-reinforced polymer (CRP)(LAVA Ultimate, 3M ESPE) and lithium disilicate ceramic (LDC)(e.max, Ivoclar Vivadent) CAD/CAM overlays. Methods: A small amount of RelyX Ultimate was placed in a round mold (diameter 6.0mm, 0.65mm thick), covered with Mylar sheet, pressed and chemically polymerized for 10 min. Thereafter, one group of samples was light cured through 2.0mm thick CRP or LDC CAD/CAM overlay for 20 and 40 sec (Bluephase G2 LED, Vivadent; high intensity mode (1100mW/cm2)). Samples were placed immediately after curing in a prepared lymphocyte cell culture. After incubation, the dye exclusion method with ethidium bromide and acridine orange was employed for studying cell death and morphological changes. Quantitative assessments were made by determination of the percentage of viable, apoptotic and necrotic cells. Pearson chi-square test was used for statistical analysis (α<.05). Results: Less cytotoxic effects were observed when the material was polymerized through CRP CAD/CAM overlay (82.0% viable cells in case of 20 sec polymerization; 85.7% in case of 40 sec polymerization) than LDC CAD/CAM overlay (77.3% viable cells in case of 20 sec polymerization; 80.0% in case of 40 sec polymerization). However, no statistical significant difference was found between tested groups regarding viability of treated cells. Conclusion: RelyX Ultimate cement can be safely used for bonding of both, CRP and LDC CAD/CAM restorations.

Poster #: 40
Title: Retrospective Evaluation of the Treatment Outcomes of Gingival Recession Defects.
Name: Shoko Sato
Faculty Advisor: Homa Zadeh

Background: Surgical interventions of correcting gingival recession have been well documented. The current techniques for the treatment of gingival recession have some shortcomings, including scar formation due to surface incision, delayed healing due to disruption of vascular supply and inability to control the position of the gingival margin at a coronal location. Vestibular Incision Subperiosteal Tunnel Access (VISTA) procedure has been introduced to address some of the shortcomings of the traditional techniques. Purpose: The purpose of this retrospective study was to compare the efficacy of connective tissue grafting using Vestibular Incision Subperiosteal Tunnel Access (VISTA) procedure with that of partial thickness flap elevation and to the pouch intrasulcular tunneling techniques. Methods: The present project utilized intraoral photographs, as well as study casts to compare the pre-operative and post-operative gingival margin position and mucosal characteristics of patients who have undergone treatment of their gingival recession defects. The pre- and post-operative photographs were digitally superimposed in order to quantify the percentage of exposed roots that were covered after intervention. Similarly, digitized study casts of pre- and post-operative models were superimposed in an effort to measure the root surface coverage and alterations of soft tissue contour after therapy. Results: Quantitative measurements of photographs and study casts are currently in progress and data will be presented on Research Day. VISTA was able to achieve favorable root coverage outcomes compared with other intervention modalities. Conclusion: Determination of the outcomes of various intervention modalities for the treatment of recession defects is meritorious in order to assist clinicians in selecting an appropriate therapeutic modality.

Poster #: 41
Title: Three-Dimensional Immediate Post-Surgery Condylar Displacement
Name: Esther Moon
Faculty Advisor: Dan Grauer

Background: Two dimensional studies have shown displacement of the condyles immediately after orthognathic surgery. Some condylar displacement that occur with orthognathic surgery have shown to be related with greater relapse tendencies. With the development of cone beam CT (CBCT) scans, 3-dimensional images can show a more accurate direction of condyle displacement. Purpose: Establish a method to assess condylar changes in position after orthognathic surgery relative to the position of the glenoid fossa and temporal bone. Evaluate the 3-dimensional change in position of the condyle within one month of orthognathic surgery. Methods: Sample consisted of pre- and 1-month-post-surgical CBCT scans for 17 orthognathic surgical patients whose surgery was completed by one surgeon with a consistent technique. The glenoid fossa and temporal bone were superimposed to assess the 3-dimensional displacement of the condyle. Results: Semitransparencies and color maps depicting condylar displacements are shown and direction of condylar movement is elucidated. Conclusion: It is possible to assess condylar movement due to orthognathic surgery in 3-dimensions. The most frequent condyle displacement was a backwards rotation of the lateral pole around the long axis of the condyle.

Poster #: 42
Title: How Repeated Applications Affect Adhesive Performance of a Multi-Mode Adhesive
Name: Hamad Alharkan
Faculty Advisor: Neimar Sartori

Background: Dentin bonding agents can benefit from application of multiple coats. However, for a new multi-mode adhesive this fact is still unknown. Purpose: To evaluate the effect of numbers of applications of a multi-mode adhesive in self-etch mode on micro-tensile bond strength (μTBS) to human dentin with and without simulated pulpal pressure. Methods: A multi-mode adhesive (Scotchbond Universal, 3M ESPE) was applied to flat mid coronal dentin in self-etch mode. Bonding protocol comprised of a 20s long adhesive application with different numbers of coats (1, 2, 4). Half of each group was bonded under either absence or presence of simulated pulpal pressure at 15cm H_2O. All teeth were restored with a micro-hybrid resin composite (Filtek Z250, 3M ESPE) and cut into sticks (cross sectional area 0.8±0.2 mm^2). All sticks were tested for μTBS under tension at 1 mm/min until failure. Statistical analysis was performed by two-way ANOVA followed by Bonferroni post-hoc tests (α=0.05). Representative samples were subjected to ultramorphological evaluation under CLSM. Results: μTBS was highest for group with one-coat/no-pulpal pressure (56.45±16.0 MPa) and lowest for group one-coat/pulpal pressure (41.95±17.5 MPa), which were significantly different (p<0.05). Number of coats had no influence on bond strength, regardless of presence or absence of pulpal pressure (p>0.05). Conclusion: μTBS was highest for group with one-coat/no-pulpal pressure (56.45±16.0 MPa) and lowest for group one-coat/pulpal pressure (41.95±17.5 MPa), which were significantly different (p<0.05). Number of coats had no influence on bond strength, regardless of presence or absence of pulpal pressure (p>0.05)

Poster #: 43
Title: Premolar Extraction Influence on Third Molar Angulation
Name: Cabot Denny
Faculty Advisor: Glenn Sameshima

Background: Previous studies evaluating premolar extraction influence on third molar angulation have combined first and second premolar extractions into a common extraction group. By combining the extraction groups, individual influences of each premolar have been negated. Purpose: Separating the 2 extraction groups allows the influence of each premolar to be individually evaluated. Methods: In this retrospective study, 90 patients were divided into 3 groups of 30 patients each. Groups were determined by extraction pattern (nonextraction, first premolar extraction, second premolar extraction). The long

axes of the second and third molars were traced on initial and final panoramic radiographs. The angulation change between the molars was determined between initial and final angulations. Results: ANOVA testing showed that second premolar extraction treatment had more third molar uprighting than the other 2 groups. Conclusion: Second premolar extractions have greater third molar uprighting than the other 2 groups, possibly due to increased eruption space. This additional uprighting could cause less third molar impactions.

Poster #: 44
Title: Three-Dimensional Orthodontic Settling Between Debond and Retainer Delivery
Name: Andrew Seymour
Faculty Advisor: Dan Grauer

Background: Post-treatment tooth movement is an inevitable component of orthodontic treatment and it depends on many factors. Favorable post-orthodontic movement is often referred to as "settling." A better knowledge of how teeth tend to settle may help the orthodontic practitioner in choosing types of retention for different cases. Many studies have shown an overall improvement in occlusal relationships using both the ABO OGS and PAR grading scales. However, past studies have mainly focused on occlusal contacts and near occlusal contacts using wax bites. Fewer recent studies have evaluated the measurements of the settling dentitions in 3 dimensions. Purpose: The purpose of this study was to accurately assess the occlusal settling which takes place from the day of debond until retainer delivery 7-10 days later. Methods: Orthodontic plaster models were acquired for 24 consecutively debonded patients at two timepoints: debond and retainer delivery. These were scanned using a 3D bench-scanner. These scanned surfaces were superimposed in 3D to evaluate changes between time point for each of the 24 patients. Results: Although each patient showed slightly different settling characteristics, there were many similarities. Patients with teeth in extreme positions pre-treatment seemed to deviate back towards their pretreatment extreme. Anterior overjet was very important and if no contact was present at debond the lower/upper anteriors would flare/extrude/retrocline in order to establish contact with its counterpart. Conclusion: Occlusal settling varies from patient to patient depending on the post-orthodontic tooth position. Orthodontic cases have a tendency to relapse back to their pre-treatment positions.

Poster #: 45
Title: A Novel Biofilm Mediated Osteolytic Infection (BMOI) Model
Name: Navid S. Bosheehri
Faculty Advisor: Homa Zadeh

Background: Bacteria can occur in either planktonic or biofilm state. The behavior of bacteria in biofilm state is different. Bacteria in biofilm state are more resistant to clearance by immune components or antimicrobial agents. Currently, there is paucity of information about the immune response to biofilm bacteria. One of the obstacles is the lack of appropriate animal models to study biofilms. Purpose: The purpose of this study was to establish a novel animal model to study the host immune response to Aggregatebacter actinomycetemcomitans biofilm. Methods: Customized two-piece titanium implants (1.4 x 3.0mm) and abutment were fabricated and their surfaces were micro textured by grit blasting with Aluminum oxide particle and acid-etched with hydrofluoric acid. The abutments were inoculated in vitro with Wild type A. actinomycetemcomitans D7S-1 and a double knockout mutant of genes for Omp29 and a paralogue of omp29 were deleted (DN) (N=15 for each of wild type and the mutant strain). Sham-inoculated abutments served as negative control (N=15). The mutant was constructed by a marker less gene deletion approach and showed no growth defect in vitro. Sterile titanium implants were transmucosally inserted into rat maxillary alveolar ridge. The abutments with or without established A. actinomycetemcomitans biofilm were attached to implants and were followed up for 6 weeks. Periimplant tissues of animals were evaluated clinically. Micro-CT imaging was performed at 3-week and 6-week intervals to examine periimplant bone volume. The levels of A. actinomycetemcomitans on the implant surface were determined by quantitative real time-PCR and culture analysis. Results: On average $9.9\times10^{6}\pm4.9\times10^{6}$ wide type A. actinomycetemcomitans and $2.2\times10^{7}\pm8.4\times10^{6}$ of the double mutant of A.actinomycetemcomitans in biofilm were established on titanium implant abutment in vitro. An inflammatory response characterized by clinical inflammation, bleeding, ulceration, hyperplasia, and necrosis was observed around biofilm-inoculated titanium abutments. By 3 weeks 8/15, 6/15 and 6/15 implants remained stable in WT, DN and control implants, respectively. By 6 weeks 5/15, 5/15 and 5/15 implants remained stable in WT, DN and control implants, respectively. qPCR analysis of A. actinomycetemcomitans was performed for 9 of WT-inoculated, 7 of mutant-inoculated, and 2 control (sham-inoculated) implants at 6 weeks. The percentage of A. actinomycetemcomitans decreased to 77.1% for wild type and 99.77% for the mutant. In addition, the average number of cells in wild type Aa and in the mutant in comparison to the control increased to 6340.35% and 21.05% respectively. Bone loss was noted in bone surrounding implants inoculated with bacteria but not in sham-inoculated implants. Conclusion: These results describe a novel animal model where A. actinomycetemcomitans biofilm was established in vitro on titanium implant abutments prior to installation in rat oral cavity, leading to an inflammatory response, osteolysis, and tissue destruction. This model may have potential utility for investigation of persistent bacterial infection, the host responses to biofilm pathogens and anti-biofilm treatment modalities.

Poster #: 46
Title: Three Dimensional Measurement of Tooth Root Length and Root Movement
Name: Dovi Prero
Faculty Advisor: Glenn Sameshima

Background: Root resorption following orthodontic treatment is common and often does not have deleterious effects on the longevity of the teeth. Previous methods of imaging root resorption include panoramic radiographs and periapical radiographs. Cone Beam Computed Tomography (CBCT) is now available to assess root resorption in 3 dimensions. Purpose: To understand the 3 dimensional pattern of root resorption on maxillary incisors that underwent orthodontic treatment. Additionally, is there a correlation between direction of tooth movement and pattern of root resorption? Methods: 25 patients (100 teeth) were involved in this study. Cone Beam Computed Tomography (CBCT) scans which had been taken pre- and post-treatment were analyzed to assess root resorption pattern. Then pre- and post-lateral cephalograms were superimposed on each other to determine the direction that the tooth traveled. Results: Root resorption can occur not only at the apex in a vertical manner, but also at the mesial, distal, palatal and facial surfaces of the root. The mesial and distal surfaces may resorb during intrusion or extrusion of the teeth involved. Conclusion: Root resorption can occur in all 3 dimensions of the root surface. It is important for the clinician to understand this, and that it can only be most accurately diagnosed with CBCT. Further studies can be done to assess root surface area loss and volume of root loss.

Poster #: 47
Title: Healing Of Extraction Sockets Treated With Anorganic Bovine Bone:Micro-CT Analysis
Name: Neema Bakhshalian
Faculty Advisor: Homa Zadeh

Background: Bone resorption and ridge atrophy result from tooth extraction due to the lack of the stimulating signals from periodontal ligament. Ridge preservation using various bone grafting materials has been proposed as a means to minimize post-extraction atrophy. This retrospective study evaluated the healing of extraction sockets following ridge preservation procedure with anorganic bovine bone minerals (ABBM) using micro-computed tomography. The mechanism of wound healing of extraction sockets following ridge preservation grafting is not clear. It will be important to determine whether the healing occurs by apposition of bone extending from the walls of the extraction sockets away from parent bone or by de novo bone formation on or near the graft particles. Traditionally, de novo bone formation has been

evaluated by serial histologic sectioning. Purpose: The purpose of the present study was to examine de novo bone formation following ridge preservation procedure utilizing micro-CT imaging with 3D rendering of the images. Methods: Sixty-eight extraction sockets were filled with large particles (1-2 mm) of anorganic bovine bone (Bio-Oss, Geistlich) after tooth extraction using reduced-trauma technique. Sockets were covered by Polytetrafluoroethylene membrane (GBR-200, Osteogenics) for four weeks. Following the ridge preservation procedure (mean 147 + 100 days), core samples were collected from each site using trephine drills (3.3 mm outer diameter) prior to implant placement. Core samples were scanned using micro-computed tomography and the 3D reconstructed volumes were examined using Amira software. The percentage of bone, bone marrow, and remaining graft material were measured in each sample. Furthermore, de novo bone formation was evaluated by 3D rendering of the images. Results: Quantitative analysis of different segments revealed that the core samples were comprised by material with densities, which were consistent with the following material: bone (40.1%), bone marrow (47.9%) and residual graft particles (12.0%). Evidence of de novo bone formation was observed as newly formed bone surrounding with the graft particles as a secluded bone nodules not connected to the parent bone. This manifestation of healing was more apparent during earlier healing periods prior to complete healing of the sockets, where the new vital bone had coalesced. Conclusion: This study provided clear evidence for de novo bone formation during healing of extraction sockets grafted with anorganic bovine bone minerals.

Poster #: 48
Title: Management of Drug-induced Gingival Overgrowth
Name: Satish Kumar
Faculty Advisor: Kian Kar

Background: Drug-induced gingival overgrowth is an adverse event often noted in patients taking calcium channel blockers, cyclosporine and phenytoin. Mycophenolate mofetil, prednisone and other drugs comprise the list of suspected drugs to cause gingival overgrowth. Azithromycin has been reported in literature to elicit a favorable therapeutic response to cyclosporine-induced gingival overgrowth. Purpose: To present a clinical report of drug-induced gingival overgrowth attributed to cyclosporine, diltiazem, mycophenolate mofetil and prednisone outlining the etiopathogenesis, clinical features and management. Methods: A renal transplant patient with severe gingival overgrowth caused by cyclosporine and diltiazem (and possibly mycophenolate mofetil and prednisone) presented to the Advanced Periodontology Program at the Ostrow School of Dentistry of USC for definitive management. A thorough diagnostic work-up and treatment plan comprising initial medical/non-surgical therapy followed by definitive surgical therapy was finalized and is currently being implemented. Results: Significant clinical improvement in gingival overgrowth and associated inflammation was observed with administration of antibiotic medication (Azithromycin) within 3 days which was maintained with constant improvement following scaling and root planing, use of topical antimicrobial (chlorhexidine 0.12%) and continuation of Azithromycin for a course of one month. With significant reduction in gingival overgrowth and associated inflammation, only minimal surgical therapy will be required to return the gingival architecture to normal characteristics. Conclusion: Initial medical/non-surgical management will help to reduce the need and extent of surgery in successful management of drug-induced gingival overgrowth.

DENTAL HYGIENE

Poster #: 49
Title: Dive Into a Healthier Smile
Name: Dorothy Garcia
Faculty Advisor:

Background: According to the Centers for Disease Control, almost half of the U.S. population is affected by periodontal disease. However, only a few patients seek treatment or can afford it. Even when patients recognize the importance of daily plaque removal, only 50% or less are compliant. Mechanical debridement alone, performed by a dental professional, may not be sufficient to eliminate all periodontal pathogens. Therefore, a low cost at home regimen of diluted sodium hypochlorite solution may be used as an adjunct to help prevent the aggregation of supragingival plaque and reduce gingival inflammation. Research has shown that sodium hypochlorite reduces the formation of gram-negative bacteria and does not induce bacterial resistance. In 2011, Jorgen Slots evaluated an oral rinse with 0.05% sodium hypochlorite that resulted in significant reductions in biofilm accumulation and gingival inflammation. Due to its efficacy, safety, and affordability, a dilute sodium hypochlorite rinse may be a valuable addition to a patient's home care routine as an antimicrobial agent in the prevention and treatment of periodontal disease. Purpose: To advise the public that a mouth rinse using diluted sodium hypochlorite is safe, cost effective, and can be implemented in patients' home care and low income health care programs. Methods: A review of the current highest level literature, such as systematic reviews and case control studies, was done. Results: Studies recommend to rinse with 20 parts of water to 1 part of sodium hypochlorite, twice a week for 30 seconds, and the diluted solution has to be made daily. The advantages of mouth rinsing with sodium hypochlorite are that it has low toxicity at recommended concentrations, it is minimally invasive, and may be efficacious to reduce inflammation, bleeding on probing and presence of plaque. Conclusion: While a diluted sodium hypochlorite rinse is a valuable adjunct to any oral home care regimen, it is not widely accepted by patients due to its unpleasant taste. The next step is to find a way to make the mouth rinse taste better without reducing its efficacy.

Poster #: 50
Title: Take the Needle Out of Numbness: Intranasal Anesthesia
Name: Daniela Tirado
Faculty Advisor: Joan Beleno

Background: Patients often perceive the delivery of anesthetic agents using common hard and soft tissue injection techniques as the most painful component of dental treatment. These phobias often lead to extreme anxiety and avoidance of treatments performed by both dental hygienists and dentists; thus, a pain free nasal delivery modality for maxillary anesthetic is a beneficial alternative to current methods requiring the use of a dental syringe. Purpose: The purpose of this table clinic was to identify possible alternative methods in the delivery of local anesthesia in order to reduce patient anxiety and discomfort. Methods: There is current development for a new method of maxillary local anesthesia. This form of intranasal anesthesia does not involve the use of a needle and anesthetizes the maxilla with the use of a nasal spray. The intranasal anesthetic is composed of two FDA approved nasal solutions, 3 percent tetracaine and 0.05 percent oxymetazoline. Tetracaine is a nasal anesthetic that is used by Ear, Nose, and Throat specialists. Oxymetazoline is used as a nasal decongestant and vasoconstrictor. Results: Phase 2 clinical trials were successfully completed this April. Phase two clinical trials compared the efficacy of the intranasal anesthetic vs. lidocaine with epinephrine by injection through a double-blinded study. The results of the trial demonstrated no adverse effects. Conclusion: Currently, this new modality of maxillary anesthetia is in Phase 3 clinical trials conducting efficacy studies in healthy pediatric patients.

Poster #: 51
Title: Is Cancer Calling?
Name: Michelle Baum
Faculty Advisor: Joan Beleno

Background: According to the International Telecommunications Union the use of cellular phones has increased dramatically to a staggering 6 billion active users worldwide over the past 15 years. As there has been an increase of cell phone users, there has also been an increase of duration of use. Subsequently, as cell phone use has increased the incidence of parotid gland tumors has also been observed. Cellular phones emit low frequency radiation, more specifically radio frequencies, which the World Health Organization considers to be a possible carcinogen. This potential can be placed in the same category of "carcinogenic hazard" as engine exhaust, lead and chlo-

roform. It is important to note the correlation between the facial positioning and the type of cell phone frequency when assessing the increase of tumors, especially parotid tumors. Current studies show there is an increased incidence in parotid tumors in technologically advanced countries that has the potential of being an issue worldwide. Given the amount of data stating the danger of close proximity and long duration cell phone use, what are possible solutions to lowering exposure? Furthermore, how can the dental professional play an active role in educating their patients about this developing issue? Purpose: To determine if there is a link between cellular phone use and intence of parotid tumors. Methods: A literature review of Randomized Controlled Trials (RCTs) and Meta-Analyses was conducted using PubMed. Results: There has a been a slight increase in the instance of parotid tumors as the population's use of cellular phones increases. There has also been an increase in mHz emitted from cellular phones as their technological capabilities increases. Conclusion: More research needs to be conducted at this time due to lack of long term studies.

GRADUATE POST-DOCTORAL TRAINEE

Poster #: 52
Title: Disruption of MAPK/Erk Pathway in CNCC Leads to Pierre-Robin Sequence
Name: Carolina Parada
Faculty Advisor: Yang Chai

Background: Disruption of ERK1/2 signaling has been associated with several developmental syndromes including DiGeorge syndrome. Haploinsufficiency of ERK2 expression in patients causes anomalies that arise from perturbation of neural crest development. Purpose: To understand the function of Erk2 in regulating postmigratory cranial neural crest cells. Methods: We generated two models of Erk2 deletion: *Wnt1-Cre;Erk2$^{fl/fl}$* and *Osr2-Cre;Erk2$^{fl/fl}$* mice. Results: *Wnt1-Cre;Erk2$^{fl/fl}$* mice exhibited cleft palate, malformed tongue, micrognathia and mandibular asymmetry. Significantly, disruption of the Erk2 signaling did not affect neural crest cell migration or mesenchymal cell survival. However, proliferation heat maps showed an abnormal distribution of proliferating mesenchymal cells in *Wnt1-Cre;Erk2$^{fl/fl}$* palates. This phenotype was associated with delay or failure of palatal elevation, which was caused by the tongue malposition and micrognathia. *Osr2-Cre;Erk2$^{fl/fl}$* mice in which the mutation is restricted to the palatal mesenchyme do not display cleft palate, which supports that the palatal clefting in *Wnt1-Cre;Erk2$^{fl/fl}$* mice is due to malposition of the tongue. Furthermore, *Wnt1-Cre;Erk2$^{fl/fl}$* mice also exhibit microglossia, tongue malposition and disruption of the muscle pattern. The described tongue phenotype was extensively rescued after in vitro culture in which the mandible was removed, indicating that the tongue malformation in Erk2 mutants might also be due to the mandible defect. Finally, we also show that Erk regulates Bmp signaling to control osteogenic differentiation during mandible development. Conclusion: Collectively, our study demonstrates that mutation of Erk2 adversely affects the development of palate, tongue, and mandible, mimicking the Pierre-Robin sequence in human patients, and renders the Erk2 mutant mice as an excellent model for future studies.

Poster #: 53
Title: An In-Home Game-Based Rehabilitation Program for Stroke as Meaningful Occupation
Name: Rachel Proffitt
Faculty Advisor: Belinda Lange

Background: Stroke incidence is approximately 800,000 every year. In-home exercise programs are frequently used to improve motor function in those with chronic stroke. The use of video games and virtual reality systems for rehabilitation in a clinical setting has expanded rapidly. Few have explored how game-based rehabilitation programs are integrated into home life and the home environment. Purpose: The purpose of this study was to explore the lived experience of a person with stroke using a customized game-based rehabilitation program in the home environment. Methods: A 55 year old male 3 years post stroke with left hemiparesis completed a 6-week game-based, in-home, customized exercise program focused on improving motor function. To explore the lived experience, a semi-structured interview was conducted with the participant. The data were coded by two independent researchers and analyzed using a grounded theory approach. Rigor was established through member checking and triangulation with the participants daily exercise diary. Results: The participant played the games for an average of 45 minutes a day, 7 days a week. The program integrated well into both the home environment and daily home life. The meaning of the intervention for the participant in combination with the integration into established routines afforded the participant multiple roles including researcher, patient motivator and health/data agent. Conclusion: It is feasible to implement a game-based intervention for persons with stroke in the home environment. It facilitates the development of several roles for the person with stroke. Future plans include an exploration of the efficacy through a pilot randomized controlled trial.

Poster #: 54
Title: The Neurovascular Bundle is the Niche for Mesenchymal Stem Cells
Name: Hu Zhao
Faculty Advisor: Yang Chai

Background: Mesenchymal stem cells (MSCs) were first identified in bone marrow as a group of colony-forming cells with osteogenic, chondrogenic and adipogenic potentials. Subsequently, MSCs from various tissues have been identified. Although MSCs have been extensively studied, the in vivo identity, true physiological functions and supporting niche remain elusive. Purpose: Our current research is aiming to reveal the in vivo identity and the regulating niche of MSCs with mouse incisor as a model. Methods: Two different approaches including the label retaining analysis and the lineage tracing analysis were used to identified the mesenchymal stem cells within the mouse incisor. Denervation surgery was used to study the effects of nerve on regulating the stem cell. Multiple transgenic mouse strains were used to study the expression pattern. Conditional knockout models were constructed to study the effects of gene knockout on the stem cell regulation. Results: we provide evidence that the neurovascular bundle (NVB) acts as a stem cell niche in the incisor mesenchyme and nerve provides a source of Shh protein that activates Gli1 expression in adjacent slow cycling periarterial cells. These cells contribute to all mesenchymal cell derivatives, indicating they are MSCs. Denervation compromises Gli1 activity and disrupts stem cell homeostasis leading to abnormal incisor growth. NG2+ pericytes residing in the perivascular niche represent a MSC subpopulation derived from Gli1+ cells in the incisor mesenchyme. NG2+ cells express classical MSC markers including CD73, CD44, CD146, Sca1 and CD105. They contribute little to mesenchyme homeostasis but are actively involved in injury repair. Other rodents with continuously growing molars, such as guinea pigs, have Gli1+ cells in the mesenchyme surrounding the NVB. Conclusion: The NVB provides a niche for MSCs to support tissue homeostasis. Classical MSC markers define a stem cell subpopulation derived from periarterial Gli1+ cells that contribute mainly to injury repair but not homeostasis.

Poster #: 55
Title: Functional Significance of BMP Signaling in Regulating Late Tooth Morphogenesis
Name: Jifan Feng
Faculty Advisor: Yang Chai

Background: Tooth development requires sequential and reciprocal signaling cross-talks between the dental epithelium and the cranial neural crest (CNC)-derived dental mesenchyme. Previous studies have shown that BMP signaling regulates the development of multiple craniofacial organs and is required during early stages of tooth development for the transition from the bud to the cap stage. Conditional inactivation of Bmpr1α in CNC-derived dental mesenchyme leads to an arrest of tooth development at the early bud/ cap stages. However, due to this early arrested tooth development following BMP signaling interruption, the potential role of BMP signaling in regulating den-

tal mesenchymal cell fate beyond cap stage remains elusive. Purpose: The aim of this study is to investigate the functional significance of mesenchymal BMP signaling in regulating later stages of tooth development. Methods: Based on the expression patterns of transcriptional factor Msx1 in the embryonic odontogenic mesenchyme, we generated *Msx1-CreER;Bmpr1a*$^{fl/fl}$ mice to achieve time-and tissue-specific inactivation of Bmpr1α from E13.5 onwards. Results: Lineage tracing from E13.5 onwards showed that Msx1-driven Cre/LoxP system labeled embryonic odontogenic mesenchymal lineage contributing to the crown and root pulp mesenchyme. Msx1-mediated embryonic interruption of BMP signaling starting at E13.5 resulted in abnormal crown and root formation. Conclusion: Taken together, our study clearly indicates crucial functions of BMP signaling in regulating tissue-tissue interactions during later stages of tooth development. This study has important implications for our understanding of molecular regulation of tooth development during a crucial period that has not been studied comprehensively so far and provides vital information for potential applications in tooth regeneration.

Poster #: 56
Title: Epithelial Stem-Cell Fate Determination by BMP/Smad4 Signaling in Developing Tooth
Name: Jingyuan Li
Faculty Advisor: Yang Chai

Background: Ectoderm-derived organs, such as teeth, hair and mammary glands, share common morphological and molecular features especially during their embryonic development. In mouse dentition, incisors and molars start with similar developmental processes but differ in their tissue homeostasis which leads to their different ability in continuous growth postnatally. Stem cells are crucial for developmental events and tissue homeostasis, and their behavior change may be related to developmental malformations. Purpose: How BMP/TGF-beta signaling regulates dental epithelial stem cells during development and whether BMP/TGF-beta signaling contributes to the differential fate of epithelial stem cells in postnatal tooth development remain unclear. Methods: We have utilized developing mouse tooth of different mutant models to identify the key signaling pathway controlling dental epithelial stem cell fate. Results: In this study, we have discovered the difference in epithelial stem cell dynamics between the mouse incisor and molar in post-natal stages and the molecular mechanism in regulating these stem cells in mouse molars. We find that Sox2+ stem cells exist transiently during molar crown development, contribute to all epithelial cell lineages of the molar and disappear prior to root formation. Tissue-specific loss of Smad4 in the dental epithelium results in ectopic activation of SHH-Gli1 signaling and prolonged maintenance of Sox2+ dental epithelial stem cells and their niche in post-natal molar development. The BMP-Smad4, but not the TGF-beta-Smad4, signaling cascade regulates Sox2+ stem cell maintenance during molar development. SHH-Gli1 signaling activity may provide a niche to support Sox2+ dental epithelial stem cell maintenance during molar development. In parallel, ablation of Smad4 in the dental epithelium expands Sox2+ dental epithelial stem cells and their niche in continuously growing mouse incisors, through the alteration in spatial distribution of SHH-Gli1 signaling activity. Conclusion: Collectively, our study highlights the importance of crosstalk between two major pathways, BMP and SHH, in the regulation of the fate of epithelial stem cells through manipulation of their niche compartments during tooth development.

Poster #: 57
Title: Co-Localization of Ameloblastin with Amelogenin; An Immunofluorescence Confocal Microscopy Study
Name: Parichita Mazumder
Faculty Advisor: Janet Oldak

Background: Epithelially-derived ameloblasts secrete extracellular matrix proteins; amelogenins and nonamelogenins (ameloblastin and enamelin) whose complex intermolecular interactions believed to be important in controlling enamel formation. Purpose: To quantitatively analyze co-localization of ameloblastin and amelogenin providing evidence for their co-assembly during enamel formation using immunofluorescence confocal microscopy. Methods: Fluorescent-IHC staining has been performed on paraffin-embedded tissue sections from 1- 8 day mouse mandibular molars. Commercially available antipeptide antibodies against N-terminal (N18) and C-terminal (M300) of ameloblastin, and an antibody against the full-length recombinant mouse (rM179) amelogenin were used. Co-localization patterns were analyzed using different regions of interests (ROIs) with (20 μm ´20 μm) dimension. Results: Ameloblastin-M300 clearly reacted along the secretary face of ameloblasts from day 2-8, while significant reaction against ameloblastin-N18 was observed throughout the entire thickness of enamel from day 5-8. Co-localization analysis by ROIs along the secretary face of ameloblasts revealed that at day 2, equal amounts (~80%) of both the ameloblastin C-terminal and amelogenin co-localized. Co-localization decreased at day 8 when only ~66% of amelogenin and ~57% of ameloblastin-C-terminal co-localized. Analysis of the entire thickness from day 1 to 5 using the N-terminal antibody revealed lower and different values of co-localization for amelogenin and ameloblastin (48% and 30% respectively) while on day 8 co-localization was low and the same for both (~40%). Conclusion: With the progress of amelogenesis and ameloblastin degradation co-localization pattern changes as following: 1) there is a segregation of ameloblastin C- and N-terminal, 2) co-localization with C-terminal decreases while co-localization with the N-terminal is low and does not change.

Poster #: 58
Title: Real World Electrodermal Activity Collection: Preliminary Validation of the Q-Sensor
Name: Leah Stein
Faculty Advisor: Sharon Cermak

Background: Electrodermal activity (EDA) has long been utilized as a measure of arousal. Traditionally, wired measures of EDA require a laboratory setting, electrodes, and a stationary subject. New wireless EDA equipment, like the Q-Sensor, can record in the real world without the obtrusiveness of traditional, wired equipment. However, despite these advantages, the validity of such equipment has not been fully explored. Purpose: To validate the EDA data obtained from new wireless equipment (Q-Sensor) compared to data obtained from traditional, wired, gold-standard equipment. Methods: EDA data using traditional wired equipment and new wireless equipment were recorded from 37 children in their home environment during a passive attention-sustaining task (n=19 typical, n=17 autism). Analyses comparing skin conductance level (SCL), non-specific skin conductance response frequency (NS-SCR), and overall signal similarity (OSS) were undertaken. Results: No significant correlation was found in SCL between wired and wireless equipment; the wireless SCL was significantly lower than wired results. Due to the extremely low tonic SCL of the wireless signal, analyses were conducted to identify an appropriate smaller amplitude threshold of SCRs for Q-Sensor evaluation. Large correlations of NS-SCRs between wired and wireless equipment were found in children with ASD ($r=.71$, $p<.01$) and all children combined ($r=.57$, $p<.01$), but not in the typical-only group. First and second-order polynomial regressions indicate a moderate correlation in OSS between wired and wireless equipment ($r's=.302$-$.468$, all $p's\leq.05$). Conclusion: Preliminary support exists for the use of the new, wireless Q-Sensor when investigating NS-SCR frequency and OSS. However, further research is required to examine EDA collected with the Q-Sensor in different clinical and non-clinical populations.

Poster #: 59
Title: Physiological and Behavioral Stress: Children with ASD during Oral Care
Name: Leah Stein
Faculty Advisor: Sharon Cermak

Background: Children with autism spectrum disorders (ASD) commonly exhibit dental behavior management problems (DBMPs) during oral care, which impedes oral care. Although previous studies have utilized dentist-report measures of DBMPs in children with ASD, none have utilized an objective measure of children's behavior or a physiological measure of dis-

tress. Purpose: To investigate the behavioral and physiological stress and anxiety in children with ASD during routine oral care. Methods: Participants were 44 children (6-12 years; n=22 typical, n=22 ASD) receiving routine dental cleanings at Children's Hospital Los Angeles. Behavioral measures included dentist-report measures and the objectively scored Children's Dental Behavior Rating Scale; physiological measures included electrodermal activity. Comparison between groups in behavior and physiological variables were performed using ANCOVA; Spearman correlation coefficients were utilized to examine correlations between behavioral, physiological, and demographic variables. Results: Children with ASD exhibited greater uncooperative behaviors during dental care, compared to the typical group, on both dentist-report and researcher-coded measures of overt distress behaviors as well as on physiological measures of electrodermal activity. Correlations between EDA and behavioral measures of distress were found in the ASD group but not the typical group. Behavioral distress was correlated with age in the typical group and with expressive communication ability and sensory processing difficulties in the ASD group; physiological distress was correlated with parent-report of anxiety in the typical group and age and sensory processing difficulties in the ASD group. Conclusion: Children with ASD exhibit significantly greater behavioral and physiological distress during routine dental cleanings compared to typical children. In children with ASD, physiological stress is significantly correlated with overt behavioral distress, indicating that as physiological stress increases so does behavioral distress.

Poster #: 60
Title: Oral Health in Children with Autism Spectrum Disorders
Name: Leah Stein
Faculty Advisor: Sharon Cermak

Background: Oral health is integral to both physical and psychological well-being, yet is particularly challenging for certain populations such as children with autism spectrum disorders (ASD). Refusal to allow a parent or caregiver to brush a child's teeth is common in this population; likewise, uncooperative behavior during professional dental treatment may impede care. Past studies indicate that uncooperative behaviors in the dental office are associated with having an unmet dental care need. Ultimately, when oral hygiene is poor, there is an increased risk for the development of caries. Purpose: To investigate oral health in children with ASD and explore associations with uncooperative behavior in the home and dental clinic. Methods: Data were based on dental cleanings of 44 children aged 6-12 years (n=22 typical, n=22 ASD). Oral health measures included the Oral Hygiene Index-Simplified, Gingival Index, Plaque Index, DMFT score, and parent-report of toothbrushing frequency in the home; behavioral measures include the modified Anxiety and Cooperation Scale, Frankl Scale, and Children's Dental Behavior Rating Scale. T-tests were conducted to determine between group differences in oral health measures and Spearman correlation coefficients were used to examine correlations between oral health measures and uncooperative behavior. Results: Data analyses are currently underway. It is hypothesized that: (1) children with ASD will exhibit significantly poorer oral health, as measured by OHI-S, GI, DMFT score, and toothbrushing frequency, compared to typically developing children; and (2) measures of oral health will correlate with dentist-report and observational measures of uncooperative distress behaviors during oral care. Conclusion: This study will add to the growing body of literature examining oral health in children with ASD and provide information about the relationship between oral health and behavioral cooperation.

Poster #: 61
Title: Diauxic Growth of Aggregatibacter actinomycetemcomitans Stimulated by Human Serum
Name: Gaoyan Tang
Faculty Advisor: Casey Chen

Background: A. actinomycetemcomitans is a commensal oropharyngeal bacterium, a causative agent of localized aggressive periodontitis, and an occasional cause of systemic infections. Our laboratory has shown that the gene content and gene arrangement of the genome of A. actinomycetemcomitans varied among 14 sequenced strains. More than 1,200 accessory genes (genes not shared by all strains) with unknown functions have been identified. Purpose: This study explored the functions of accessory genes by correlating the expression of accessory genes with bacterial growth fitness in conditions mimicking in vivo environments. Methods: Bacteria were grown in 3% trypticase soy broth with 0.6% yeast extract (TSBYE) with saliva, horse serum, human serum and iron-chelators. The growth analysis was performed using Bioscreen. The transcriptomic profiles were examined by strand-specific-direct cDNA sequencing. Results: Strains exhibited poor growth in human saliva, and variable growth in iron-depleted- TSBYE media. Strikingly, human serum, but not horse serum, stimulated diauxic-growth in certain strains, and regulatable by glucose/fructose. Two logarithmic-phases were observed, with the second growing-phase twice faster, and the final optical-density of cells 4-6-fold higher than the first phase. Differential expressions of accessory and core genes (genes shared by all strains) were found in strains in different growth conditions. Particularly, an operon comprised of four core genes artPIMQ encoding an amino-acid-uptake system was 10-fold up-regulated in a strain with diauxie. Conclusion: A. actinomycetemcomitans exhibits a wide-range of phenotypes, which appears to be associated with the expression of strain-specific accessory genes and differential regulation of the expression of core genes.

Poster #: 62
Title: CNCC Guide Tongue Muscle Tegeneration through Canonical Wnt Signaling Pathway
Name: Zhe Zhong

Background: All the supportive tissues in the tongue are cranial neural crest cell (CNCC) derived. Interactions between cranial neural crest (CNC) derived tissues and muscle cells play an important role in the process of muscle development. Purpose: The aim of this project is to elucidate the mechanism by which CNC-derived cells guide muscle regeneration through canonical Wnt signaling after tongue injury. Methods: Using a tongue injury model, Wnt1-Cre;ZsGreenF/+ mice were utilized to investigate the relationship between newly formed muscle fibers and CNC-derived cells during the muscle regeneration process. We detected canonical Wnt signaling activity with Axin2-LacZ reporter mice, Real-time-PCR, in situ hybridization and double antigen staining assays. Transgenic mice were used to detect the functional requirement of canonical Wnt signaling in Pax7 dependent tongue muscle regeneration process. Results: The recruitment of CNC-derived cells to the injured region preceded new muscle fiber formation starting at 3 days after tongue injury. Several Wnt ligands are secreted from CNC-derived cells to activate the canonical Wnt cascade in Pax7 expressing cells. New myofibers fail to form in the absence of β-catenin in Pax7- expressing cells, 2 weeks or 1 month after injury. The pax7-expressing cells fail to commit into MyoD(+) myoblasts after deletion of β-catenin. Conclusion: After injury, as CNC-derived cells are recruited to the injured region prior to the arrival of myogenic cells, they provide the Wnt ligand-enriched niche to activate the canonical Wnt signaling pathway in satellite cells. The canonical Wnt signaling plays a critical role in regulating myogenic cell commitment and differentiation during tongue regeneration.

Poster #: 63
Title: Cell Membrane-Mimicking Vesicles Bind to Amelogenin Altering Protein Conformation
Name: Karthik B. Chandrababu
Faculty Advisor: Janet Oldak

Background: Amelogenin, the major extracellular matrix protein of developing tooth enamel is intrinsically disordered. It has the potential to interact with proteins, mineral and cell surfaces to assist enamel biomineralization by controlling the formation of highly organized enamel crystal arrays. Purpose: Our goal is to understand the mechanisms of amelogenin-cell interactions during amelogenesis by investigating the interactions of recombinant amelogenin rP172 and four different Trp mutants with small unilamellar vesicles as model membranes. Methods: Biophysical techniques like dynamic

light scattering (DLS), fluorescence spectroscopy, circular dichroism (CD) and nuclear magnetic resonance (NMR) were used for this study. Results: DLS revealed the appearance of larger-sized particles upon the interaction of rP172 and lipid vesicles. A blue shift in Trp fluorescence emission maxima in a lipid environment and the inaccessibility of Trp residues of rP172 to aqueous quencher acrylamide in lipid vesicle confirmed their binding. The circular dichroism studies revealed a disorder-order transition of rP172 in a membrane environment. Through all these results we showed that rP172 possesses membrane-binding ability mainly via its N-terminal close to residues W25 and W45 with a disorder to ordered conformational change. Conclusion: We suggest that amelogenin-lipid interactions may play key roles in enamel biomineralization and enamel malformation in cases of amelogenesis imperfecta with mutations at the N-terminal may also be the result of defective amelogenin-cell interactions.

Poster #: 64
Title: Trans, Trans-Farnesol as Antibacterial Agents Against Aggregatibacter actinomycetemcomitans
Name: Silvana Pasetto
Faculty Advisor: Ramiro Murata

Background: Aggregatibacter actinomycetemcomitans is implicated as the major etiologic agent of agressive periodontitis. Researchers have shown that natural compounds such as Farnesol (isoprenoid) can be used against bacteria and fungi which cause oral diseases. Purpose: The aim of this in vitro study was to evaluate the antibacterial activity of Trans, trans-Farnesol on A. actinomycetemcomitans. Methods: A. actinomycetemcomitans smooth strain (D7S-1) at 106 cells/ml (n=9), was cultured in TS-BYE medium at 37°C in 5% CO_2. The minimum inhibitory concentration-MIC was determined by exposing the cells to serial dilutions of Trans, Trans Farnesol/ 1% DMSO (range of 0.2μM – 2mM). Gentamicin 1mg/mL was used as a positive control and 1% DMSO was used as a vehicle control. To evaluate the inhibitory effect of those compounds, the bacterial growth was estimated after 24h. Results: The MIC of Farnesol was 200μM. The therapeutic index of Farnesol was 10. Conclusion: This study shows that Farnesol had inhibitory effects on Aggregatibacter actinomycetemcomitans growth and the therapeutic index show that this compound in the future can be used as an antibacterial agent in oral diseases.

Poster #: 65
Title: Canonical and Non-Canonical TGFβ Signaling Act Synergistically in Tongue Myogenesis
Name: Yang Liu
Faculty Advisor: Yang Chai

Background: We have reported that ablation of Smad4 in myogenic progenitors resulted in compromised differentiation of myofibers during tongue development. Purpose: The aim of this study is to detect whether canonical and non-canonical Tgfβ signaling function together in the development of tongue muscle. Methods: *MyoD-Cre; Smad4$^{fl/fl}$* mice were generated to ablate the canonical TGFβ signaling in myogenic progenitors. And *MyoD-Cre; Smad4$^{fl/fl}$; Tak1$^{fl/fl}$* mice were generated to ablation both the canonical and non-canonical TGFβ signaling in myogenic progenitors. The timed-pregnant females were euthanized at embryonic day 16.5. All pups were genotyped using tail lysate and fixed in 4% paraformaldehyde. The samples were analyzed by hematoxylin and eosin (HE) staining and immunohistochemical (IHC) assay. Results: *MyoD-Cre; Smad4$^{fl/fl}$; Tak1$^{fl/fl}$* embryos displayed microglossia which was much more severe than in *MyoD-Cre; Smad4$^{fl/fl}$* and the wild type control. The HE and IHC stain of myosin heavy-chain revealed sparse muscle fibers in the tongue after ablation of both canonical and non-canonical TGFβ signaling. Conclusion: The preliminary data indicate the possible synergistic roles of canonical and non-canonical TGFβ signaling in glossal myogenesis. Further investigation is needed.

Poster #: 66
Title: Comparison of Mouse Ameloblast-Like Cell Lines for Enamel-Specific Gene Activities.
Name: Juni Sarkar
Faculty Advisor: Michael Paine

Background: Enamel development is regulated by the epithelially-derived ameloblast cells that secrete enamel matrix proteins, critical for enamel formation. Ameloblast-lineage cells (ALC) are a spontaneously immortalized cell line derived from tooth germ of newborn mouse molar. ALCs show the ability to form calcified nodules and high-levels of alkaline-phosphatase activity. However, if ALC cells qualify to be acknowledged as representative of mature-stage ameloblast still remains to be identified. Purpose: Compare the expression profiles of enamel-specific genes and proteins in two available mouse derived ameloblast-like cell lines LS8 and ALC. This will provide insight into their possibility to contribute to biological studies to better understand the molecular activities involved in enamel biomineralization. Methods: Total RNA was isolated from confluent LS8 and ALC cells following published procedures. Real-time PCR and Western blot analysis was carried out to determine the expression profile of enamel-specific genes and proteins. Results: Our data suggest that LS8 exhibit gene expression profiles that relates closely to secretory-stage ameloblasts, while ALC cells expression profile and phenotype relate more closely to late-secretory or early maturation-stage ameloblasts. Conclusion: This data relates primarily to the developmental origins of these cell lines. The data also indicates that these cell lines do not express enamel-specific proteins at the levels noted in enamel organ cells, thus pointing out some deficiencies when relying totally on cell lines to study biological activities occurring in vivo. This studies also suggests that the development of additional ameloblast-like cell lines, representative of different stages of ameloblast differentiation, would be of great value for researchers studying enamel formation.

Poster #: 67
Title: A Novel Elastic Calcium Phosphate Nanocomposite with Brick-and-Mortar Structure
Name: Qichao Ruan
Faculty Advisor: Janet Oldak

Background: Due to its well-defined architecture and excellent mechanical properties, nacre (mother of pearl) has increasingly inspired researchers in the design of advanced functional materials. Generally, the formation of hierarchical nacre involves a precisely controlled biomineralization process under the mediation of a chitin matrix and acidic proteins. Purpose: Our objectives were (1) to synthesize an organized material containing calcium phosphate with nacre-like structures, (2) to investigate the self-assembly mechanism of nacre-like calcium phosphate under the mediation of chitosan-maleic acid matrix, and (3) to study the mechanical properties of the calcium phosphate nanocomposite. Methods: A chitosan/maleic acid matrix was designed to control the mineralization of calcium phosphate crystals. The morphology and composition of nacre-like calcium phosphate crystals were characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM), X-ray diffraction (XRD) and energy dispersionspectroscopy (EDS). The interactions among the chitosan, maleic acid and calcium ions were investigated by Fourier transform infrared spectroscopy (FTIR). A nanoindentor with a Berkovich tip was used to measure the mechanical properties of the composite. Results: Organized and parallel arrays of monetite tablets (anhydrous calcium hydrogen phosphate, CaHPO4) with a brick-and-mortar structure have been successfully synthesized in the presence of chitosan and maleic acid (MAc). The chitosan and MAc molecules formed an organized complex through hydrogen bonding and an electrostatic interaction between the positively charged amine groups and the negatively charged carboxyl groups. This complex further interacted with calcium ions in the crystals and guided the assembly of monetite mesocrystals to form a nacre-like structure, in which hard monetite tables are glued together with soft organic materials to form tiles. The Young's modulus of the nacre-like crystals was 3.65 ±0.14 GPa. This value was even lower than the modulus of elastic-featured human vertebral trabeculae, 13.5 ± 2.0 GPa. Conclusion: An elastic calcium phosphate nanocomposite has been successfully synthesized via a cooperative regulation process by a Chitosan/MAc matrix. This study demonstrates a successful strategy for artificially replicat-

ing natural materials that combine both elasticity and hardness. Such materials will have potential biomedical and industrial applications.

Poster #: 68
Title: New Mouse Model for Craniofacial Clefting- *Wnt1-Cre;beta-Catenin*$^{fl/fl}$ Mutant Mice.
Name: Arum Han
Faculty Advisor: Yang Chai

Background: Facial clefts are openings or gaps in the craniofacial region. While cleft palate with or without cleft lip is relatively common, other types of facial clefting are rare congenital defects that are extremely difficult to treat. The cause of facial clefting is not known but the failure of cranial neural crest cell migration or fusion of mesoderm has been suggested. However, there has been no animal model to test these hypotheses. Purpose: In this study, we present a novel animal model for studying craniofacial clefting and further investigating abnormal apoptosis and gene expression, the *Wnt1-Cre;beta-Catenin*$^{fl/fl}$ mutant mouse. We use this model to examine the cause of various clefts in the craniofacial region. Methods: Apoptosis was assessed by immunohistochemistry using Caspase-3 antibody on sectioned tissue slides of *Wnt1-Cre;beta-Catenin*$^{fl/fl}$ and control mice. Results: Based on the Tessier classification of clefts, we found that *Wnt1-Cre;b-Catenin*$^{fl/fl}$ mice exhibit midline, paramedian and lateral clefts, but not orbital clefts, all of which are found in humans. *Wnt1-Cre;beta-Catenin*$^{fl/fl}$ mutant embryos were able to survive to birth. Abnormal apoptosis activity was not found after E12.5, suggesting the facial clefts occur due to the failure of an early fusion process. Conclusion: *Wnt1-Cre;beta-Catenin*$^{fl/fl}$ mice show a very similar pattern of craniofacial clefts to those seen in humans. These mice will aid in the future study of the mechanisms of facial clefting.

Poster #: 69
Title: Palatal- tuberosity Tripod Overdenture: Design for Maxillary Provisional Complete Overdenture
Name: Husain Mohammad
Faculty Advisor: Homa Zadeh

Background: Edentulous maxilla requiring implant-supported rehabilitation often presents with an atrophic alveolar ridge necessitating augmentation. The success of alveolar ridge augmentation requires stability of the grafted site. Provisionalization during the post-augmentation healing phase presents the restorative dentist with a distinct dilemma. Retention of a conventional transitional denture requires an intact peripheral seal and continuity of the palatal surface to obtain retention (suction). A loss of this seal would not be functionally acceptable. In addition, a conventional complete denture can apply compressive forces on the graft and compromise the graft outcome. A number of approaches have been utilized by clinicians, namely soft liners, temporary implants, as well as requesting the patient to refrain from wearing the denture, all of which present with problems. Purpose: A novel alternative strategy to minimize compressive trauma in the grafted maxilla, the palatal-tuberosity overdenture (PTOD), will be presented. Methods: Four patients have been treated using the PTOD scheme. Two representative cases demonstrating application of this method for interim restoration during the healing phase following augmentation of maxilla will be presented. Results: The PTOD scheme applied for interim restoration in all four patients has been highly successful in terms of stability, retention and support. The stability of denture is provided by the tripod effect; retention and support by the implants and their associated retentive abutments prevents destructive forces onto the grafted ridge. Conclusion: Palatal-tuberosity overdenture (PTOD) for maxillary provisional overdenture minimizes trauma in the grafted maxilla.

Poster #: 70
Title: Dental Prevention Guidelines Proposed for the Special Needs Patients
Name: Calvin Chang
Faculty Advisor: Richard Green

Background: Prevention of dental caries and periodontal disease is a difficult task for the general public; needless to say, it is almost neglected in individuals requiring special medical attention. There has been numerous research published addressing the prevention of oral diseases among people with different medical conditions, such as Down's syndrome, autism, mental retardation, or physical impairments. However, currently there is no publication that brings all the guidelines and recommendations together. Therefore, our aim is to create a poster that brings together such guidelines to promote oral disease prevention in the clinic environment and community settings through oral disease risk assessment and customized prevention programs. Developing the ability to evaluate special needs patients in the routine office setting among dentists, medical doctors, and other health professionals could help translate into appropriate individualized care plans in catering specifically to the special needs patient and education to the care provider, guardian, and conservator. Purpose: Objective 1: To promote awareness in evaluation of oral disease prevention for special needs patients in the routine office setting among dentists, medical doctors, and other health professionals. Objective 2: To create a platform that brings together guidelines for promotion of oral disease prevention in the clinic environment and community settings through oral disease risk assessment and customized prevention programs. Objective 3: To develop and educate health professionals and the general public on appropriate individualized oral disease preventative care plans catering specifically to the special needs patients. Methods: There are no hypotheses to be tested. This is simply a project focused on online search of publications and literature through trusted sites that provide information regarding dental prevention guidelines for special needs patients. Search terms included "Down's syndrome", "special needs and dental prevention", "dental prevention", "dental and autism", et cetera. The literature topics were narrowed down to dental prevention guidelines for a few specific special needs populations, including autism, cerebral palsy, Down's syndrome and patients with physical disabilities. The information is then organized and presented in diagram and table format along with photo illustrations. Results: There are no statistical data tested for this project. Conclusion: In order to accommodate his or her understanding for dentistry and science, the dental practitioner must develop the ability to evaluate special needs patients, a percentage of whom may pose an increased risk for physical and developmental conditions. The implications of such barriers often times are perceived by dental professionals as a behavioral issue in the dental chair. However, open communication, proper preparation and a treatment plan which takes into consideration the patient's disabilities and needs are a great help in overcoming such shortcomings. The ability to address both the patient's dental as well as social need translates into the makings of a well-rounded and diverse health professional.

Poster #: 71
Title: Analysis of Antibiotic Resistance in Periodontitis Patients Over 14 Years
Name: Diane Anthony
Faculty Advisor: Casey Chen

Background: The use of systemic antibiotics is one of the tools for the treatment of periodontitis. Purpose: The aim of this study is to determine the antibiotic resistance profiles of selected subgingival periodontal pathogens, and the change of the profiles over the past fourteen years. Methods: Over 4,500 subgingival plaque samples processed by the Oral Microbiology Testing Laboratory (OMTL) at Ostrow School of Dentistry from January 1999 to April 2013 were analyzed for prevalence and antibiotic resistance among selected periodontal pathogens. Results: The percentage of samples positive for the selected periodontal pathogens illustrated an overall downward trend. When analyzing the overall percentage of antibiotic inhibition of the samples, the selected bacterial pathogens showed the least resistance to Amoxicillin and the greatest resistance to Metronidazole. Clindamycin and Amoxicillin showed the least amount of resistance in comparison to Metronidazole, Ciprofloxacin, and Azithromycin. Over the fourteen years, bacterial inhibition by Ciprofloxacin has decreased, but increased by the usage of Azithromycin and Metronidazole. The usage of Amoxicillin and Clindamycin has shown an initial decrease in bacterial inhibition followed by an increase to close to initial values. Conclusion:

It is evident that periodontitis patients can exhibit antibiotic resistance to subgingival periodontal pathogens with variability among different types of antibiotics and oral microbes. Thus, therapeutic antibiotics in clinical practice should be cautiously selected.

Poster #: 72
Title: Activity-Based Intervention for Infants with Neonatal Brachial Plexus Injury
Name: Susan Duff
Faculty Advisor: Linda Fetters

Background: Neonatal brachial plexus injury (BPI) places infants at risk for transient or persistent unilateral arm weakness and sensory deficits which can lead to arm disregard or prehensile difficulty. Purpose: This study examined whether infants/toddlers could learn the contingency between biceps brachii (BB) contraction and visual-auditory (VA) feedback (FB). We also hypothesized that wrist accelerometry and the Almli Test of Handedness would be equivalent measures of arm activity. Methods: Ten typically developing (n=8) and BPI (n=2) infants/toddlers < 2 years participated for two days in a 3-day timespan. Day one, the amount of arm activity was recorded with wrist accelerometers (m/s2) during the Almli test. Day two, BB activation was recorded with surface electromyography (SEMG) at baseline (2 min), intervention (5 min/arm) and extinction (2 min). BB activation above a set threshold triggered VA-FB during intervention. Duration (s) > threshold per arm was compared across baseline (no FB), intervention and extinction (no FB). Results: Amount of arm activity (m/s2) for all was highly correlated with Almli test findings (p=0.05). Most increased duration of BB activation > threshold with intervention (p=0.05), yet did not retain this change at extinction. Conclusion: Accelerometry and the Almli test seem to be equivalent measures of arm activity in infants/toddlers. All participants generated suprathreshold BB contraction to activate VA-FB. Yet, longer practice time may reinforce learning of the contingency. Future work will examine the efficacy of this paradigm with more participants and a longer intervention.

Poster #: 73
Title: The Role of Thrombospondin2 in Enamel Formation and Regeneration
Name: Zhan Huang
Faculty Advisor: Malcolm Snead

Background: Tooth enamel is formed by ameloblasts through the coordinated processes of morphogenesis and cyto-differentiation being signaled by sequential and reciprocal interactions from cell-to-matrix and cell-to-cell, through several well-known ligands and specific pathways. Thrombospondin2 (TSP2) belongs to a family of secreted glycoproteins that participate in cell-to-matrix communication during development. Purpose: To examine the role(s) played by TSP2 in cell–to-matrix interactions and enamel matrix biomineralization. Methods: Targeted disruption of the murine thrombospondin 2 gene generates a complex and subtle phenotype. The tooth enamel of TSP2 knockout (TSP2-/-) mice was characterized by x-ray micro-tomography, light microscopy, histo-chemistry, and scanning electron microscopy. Enamel matrix protein expression was analyzed by Western blotting. Results: The abundance of the enamel matrix protein amelogenin and a cell adhesion molecule, integrin beta1, were found to be remarkably reduced in embryonic day E18.5 and postnatal one-day (PN1d) TSP2-/- mouse molars compared with those of wild type littermates. The clinical tooth crowns of incisors and molars from one-year old (PN1y) TSP2-/- mice displayed moderate to severe wearing defects. The enamel microstructure was disrupted in PN1y TSP2-/- mice, where we observed enamel rods thinned, disorganized and intersected at irregular angles. Cultured TSP2-/- mouse primary enamel organ epithelial cells showed decreased mineralization in response to branched RGDS (Arg-Gly-Asp-Ser) peptide amphiphiles (bRGDS PA) matrix compared to wild type cells. When bRGDS PA was injected into the dental epithelia of TSP2-/- E18.5 mouse incisor, the apical surfaces of enamel-secreting ameloblasts failed to contact the surface of the peptide amphiphile artificial matrix and displayed reduced amelogenin expression. Conclusion: TSP2 plays an important role in regulating cell-cell and cell-matrix interaction and facilitating the proper organization of ECM during enamel formation and matrix biomineralization.

Poster #: 74
Title: Results from the Well Elderly II Study Using Robust Methods.
Name: Valerie Hill
Faculty Advisor: Florence Clark
Background: When using traditional statistical methods, results are often dismissed due to insignificant findings. Significant findings may be available using modern methods designed to effectively deal with violations of standard assumptions. Under general conditions, traditional statistics can have a low power and poor control over Type I Error probability due to ineffectively dealing with outliers, skewed distributions, and heteroscedasticity. Purpose: To illustrate the value of robust methods with a secondary analysis of the Well Elderly II study results. We hypothesized that there would be a relationship between cortisol awakening response and depressive symptoms related to the impact of the intervention. Methods: A secondary analysis exploring the associations between cortisol and depressive symptoms for 460 elders participating in a lifestyle intervention was conducted. The intervention consisted of individual, group, and community sessions led by an occupational therapist. Cortical awakening response was determined by cortisol levels. Depressive symptomology was determined by the Center for Epidemiologic Studies Depressive Scale. The statistical software R was used to analyze the data. Results: Welch's test for means, which does not assume variances, did not significantly differ including: mean awakening cortisol levels (p=.73) and mean cortisol measured later in the day (p=.96). When comparing medians with the percentile bootstrap method in conjunction with the usual sample mean, the p-values were p=.049 and p<.001, respectively. Individuals who experienced a large decrease in cortisol had higher depressive symptomology. Conclusion: Several statistical methods are available to effectively deal with outliers, skewed distributions, and heteroscedasticity. As illustrated with the Well Elderly II study, the use of robust methods is a useful technique to determine significant outcomes that would otherwise be missed using traditional statistical methods.

GRADUATE PRE-DOCTORAL CANDIDATE

Poster #: 75
Title: Monitoring of Root Movement via Crown Superimposition
Name: John Pham
Faculty Advisor: Hongsheng Tong

Background: In orthodontic treatment, various orthodontic appliances are utilized to move teeth from malocclusion to a functional and stable occlusion which is composed of teeth in their proper relationships to one another as well as in harmony with the maxillofacial hard and soft tissues. The six characteristics or "keys" that describe tooth locations in 3-dimensional space and are necessary to result in successful orthodontic treatment outcome were defined by Andrews in his study of the crowns of 120 sets of stone models of nonorthodontic patients with ideal occlusion. Andrews later developed the treatment goal concept in addition to the initial preadjusted orthodontic appliances which contained built-in dimensional and angular information for every tooth. These advancements resulted in a decreased amount of wire bending necessary for successful orthodontic treatment. Current preadjusted appliances are mostly derived from Andrews' original straight-wire appliances designed based on the crown norms he had measured. These preadjusted appliances allows the orthodontist to treat patients with more efficiency and improves the quality of orthodontic finishing. However, due to inaccuracies in bracket positioning during the initial bonding process and variations in tooth anatomy and bracket designs, Andrews' 6 keys are difficult to achieve for even experienced orthodontists. Furthermore, because Andrews focused solely on the crowns and not the entire tooth, root positions at the end of the treatment may be compromised. Thus, it is common to have improper root placement throughout orthodontic treatment resulting in the need to visualize

the roots frequently using radiographs in order to perform the necessary corrections. Traditionally, monitoring and finalizing the root position has been performed by using panoramic X-rays at the initial, progress, and finishing stages of orthodontic treatment. A 2008 survey shows that 67.4% and 80.1% of American orthodontists take progress and post-treatment panoramic radiographs respectively. However, multiple studies have indicated that panoramic X-rays do not accurately reflect the true root position, especially in the canine and first premolars, due to distortions that occur mainly as a result of the X-ray beam not being orthogonal to the target teeth. Therefore, a new method to accurately visualize the root position at different stages in orthodontic treatment is needed. In recent years, the development and use of cone-beam computed tomography (CBCT) has allowed for accurate visualization of the roots of teeth in 3 dimensions. However, CBCT scans use significantly more radiation than a panoramic radiograph, so multiple CBCT scans would not be suggested clinically. An imaging technique that can be performed multiple times throughout orthodontic treatment without any use of radiation is a digital intra-oral surface scan. This technique can accurately display crowns with high resolution, but it cannot display roots. While individually, both CBCT and digital intra-oral surface scans do not have the capability to safely and accurately visualize root positions at different stages of orthodontic treatment, root tracking may be possible through a combination of these two imaging techniques. Therefore, the aim of this study was to devise a new methodology that combines the pre-treatment CBCT scan with digital intra-oral surface scans resulting in safe and accurate root position assessment in 3 dimensions throughout orthodontic treatment. Purpose: The purpose of this study was to develop a new methodology to visualize in 3 dimensions the whole teeth, including the roots, at any moment during orthodontic treatment without the need for multiple CBCT scans. Methods: An extra-oral typodont model was created using extracted human teeth placed in a wax base. These teeth were arranged to represent a typical malocclusion. Initial records of the malocclusion, including CBCT and intra-oral surface scans, were taken. Threshold segmentation of the CBCT was performed to generate a 3-dimensional virtual model. This model and the intra-oral surface scan model were superimposed to generate a complete set of digital composite teeth composed of high resolution surface scan crowns sutured to CBCT roots. These composite teeth were individually isolated from their respective arches for single tooth manipulation. Orthodontic treatment for the malocclusion typodont model was performed, and post-treatment intra-oral surface scans before and after bracket removal were taken. A CBCT scan after bracket removal was also obtained. The isolated composite teeth were individually superimposed onto the post-treatment surface scan creating the expected root position setup. In order to validate this setup, it was compared with the post-treatment CBCT scan which contains the true position of the roots. Color displacement maps were generated to confirm accurate crown superimposition and to measure the discrepancy between the expected and true root positions. Results: Color displacement maps through crown superimposition showed differences between the expected root positions and true root positions to be 0.1678mm ± 0.3178mm for the maxillary and 0.1140mm ± 0.1587mm for the mandibular in the presence of brackets. Once the brackets were removed, differences of 0.1634mm ± 0.3204mm for the maxillary and 0.0902mm ± 0.2505mm for the mandibular were found. Conclusion: A new reliable approach was demonstrated in an ex-vivo typdont model to have the potential of tracking the 3-dimensional positions of the entire teeth including the roots, with only the initial CBCT scan and consecutive iTero scans. Since the presence of brackets in the intra-oral scan had minimal influence in the analysis, this method can be applied to any stage of orthodontic treatment.

Poster #: 76
Title: Epigenetic Regulation of TSP1/TGFβ/SMAD3 Autocrine Loop in Ossifying Fibroma
Name: Cunye Qu
Faculty Advisor:

Background: Abnormal stem cell function makes a known contribution to many malignant tumors, but the role of stem cells in benign tumors is not well understood. Purpose: With ossifying fibroma (OF) as a model, we hypothesized that the benign tumor contains stem cells which contribute to the disease development and correction of abnormal regulatory network of stem cells in OF would direct them into normal differentiation. Methods: Mesenchymal stem cells from OF were isolated and functionally characterized. Results: We show that OF contains a stem cell population resembling mesenchymal stem cells (OFMSCs) and capable of generating OF-like tumor xenografts. Mechanistically, OFMSCs show enhanced TGFβ signaling that induces aberrant proliferation and deficient osteogenesis via Notch and BMP signaling pathways, respectively. The elevated TGFβ activity is tightly regulated by JHDM1D-mediated epigenetic regulation of thrombospondin-1 (TSP1), forming a JHDM1D/TSP1/TGFβ/SMAD3 autocrine loop. Inhibition of TGFβ signaling in OFMSCs can rescue their abnormal osteogenic differentiation and elevated proliferation rate. Furthermore, chronic activation of TGFβ can convert normal MSCs into OF-like MSCs via establishment of this JHDM1D/TSP1/TGFβ/SMAD3 autocrine loop. Conclusion: These results reveal that epigenetic regulation of TGFβ signaling in MSCs governs the benign tumor phenotype in OF and highlight TGFβ signaling as a candidate therapeutic target.

Poster #: 77
Title: A Nucleolar Role for FGFR2 in Bent Bone Dysplasia Syndrome
Name: Cynthia Neben
Faculty Advisor: Amy Merrill

Background: Fibroblast Growth Factor Receptor 2 (FGFR2) is a crucial regulator of bone formation during development. While it is known that FGFR2 coordinates osteoprogenitor cell proliferation and differentiation, it remains unclear how the receptor couples these distinct cellular processes. Purpose: Analysis of the pathophysiology of the recently described skeletal birth disorder Bent Bone Dysplasia Syndrome (BBDS; MIM 614592) suggests that the receptor, in addition to its canonical activities, regulates bone formation within the nucleolus. We previously showed that the dominant FGFR2 mutations in BBDS reduce receptor levels at the plasma membrane and markedly diminish responsiveness to extracellular FGF2. Despite decreased canonical FGF signaling, cells with mutant FGFR2 show enhanced nucleolar localization with intracellular FGF2. The purpose of this study is to determine how nucleolar FGFR2 regulates preosteoblast proliferation and differentiation. Methods: In this study we will define the role of nucleolar FGFR2 in ribosome biogenesis by employing the BBDS mutations in a series of molecular and cellular approaches in calvarial preosteoblasts. Results: We show that nucleolar FGFR2 interacts directly at the ribosomal DNA promoter with UBF1 and FGF2 to promote rRNA transcription, which subsequently promotes preosteoblast proliferation. Our studies also show that nucleolar FGFR2 activity at rDNA block rDNA promoter occupancy of RUNX2, the master regulator of osteoblast differentiation and a known repressor of rDNA transcription. Conclusion: Together these data suggest that nucleolar FGFR2 links proliferation and differentiation in preosteoblasts by regulating rRNA transcription, the rate-limiting step in ribosome production.

Poster #: 78
Title: Ameloblastin-protein Interactions Facilitate Ameloblastin Redistribution During Amelogenesis
Name: Shuhui Geng
Faculty Advisor: Malcolm Snead

Background: Enamel hydroxyapatite crystallites form through a complex biomineralization process within an organic extracellular matrix during amelogenesis. This extracellular matrix is believed to guide crystallite organization to form the highly patterned enamel rod-interrod microstructure that predicts the unique wear properties of this bioceramic tissue. Ameloblastin, the most abundant of the non-amelogenin enamel matrix proteins, was suggested to be involved in establishing the enamel rod-interrod relationship through ameloblastin redistribution within the enamel matrix. Purpose: This study is aimed at investigating

how ameloblastin redistribution occurs during amelogenesis. We hypothesize that ameloblastin interacts with heretofore unknown target proteins to facilitate its redistribution within the enamel matrix. Methods: The yeast two-hybrid system was used to identify the putative interacting protein(s) for ameloblastin by screening a mouse ameloblast cDNA library. Immunohistochemistry was used to assess the expression of these identified protein(s) and their co-localization with ameloblastin. The interaction between ameloblastin and its partner(s) was verified by Western blot analysis. Results: In this study, proteasome subunit α type 3 (PSMA3) was identified to interact with ameloblastin in developing tooth. The immunostaining of PSMA3 showed intense reactivity in cytoplasm of secretory ameloblasts and Tomes' processes. Additionally, ameloblastin and PSMA3 co-localize in Tomes' processes, revealing a decussating pattern consistent with the mouse enamel rod-interrod arrangement. Western blot analysis confirmed the ameloblastin-PSMA3 interaction. Conclusion: These results suggest that ameloblastin redistributes within the enamel extracellular matrix to segregate the rod and interrod forming regions to produce the unique material properties of enamel, and this redistribution is likely guided by interaction with PSMA3.

Poster #: 79
Title: Subset of IL-17+ Mesenchymal Stem Cells Possesses Anti-Candida Albicans Effect
Name: Ruili Yang
Faculty Advisor: Songtao Shi

Background: Bone marrow mesenchymal stem cells (MSCs) comprise a heterogeneous population of postnatal progenitor cells with profound immunomodulatory properties, such as upregulation of Foxp3+ regulatory T cells (Tregs) and downregulation of Th17 cells. Purpose: Explore whether different MSC subpopulations possess the same range of immunomodulatory functions Methods: We isolated single colony hMSCs, then checked the different MSC colonies profile and their immunomodulation and anti-Candida Albicans properties. Results: We show that a subset of single colony-derived MSCs producing IL-17 are different from the bulk MSC population in that they cannot upregulate Tregs, downregulate Th17 cells, or ameliorate disease phenotypes in a colitis mouse model. Mechanistically, we reveal that IL-17, produced by MSCs, activates the NFκB pathway to downregulate TGF-β production in MSCs, resulting in abolishment of MSC-based immunomodulation. Furthermore, we show that NFκB is able to directly bind to the TGF-β promoter region to regulate TGF-β expression in MSCs. In contrast, IL-17+ MSCs possess anti-Candida albicans growth effects in vitro and therapeutic effect in C. albicans infectious mice. Conclusion: This study shows that MSCs contain an IL-17+ subset capable of inhibiting Candida albicans growth, but attenuating MSC-based immunosuppression via NFκB-mediated downregulation of TGF-β.

Poster #: 80
Title: A Comparative Study: Enamel Proteins between MMP-20 KO and WT Mice
Name: Saumya Prajapati
Faculty Advisor: Janet Oldak

Background: Amelogenesis is a dynamic process involving protein assembly, mineral growth and protein degradation. Proteins like amelogenins, ameloblastins, enamelins and proteases play critical roles in controlling enamel mineral formation. Matrix metalloprotease-20 (MMP-20) and kallikrein-4 degrade the enamel proteins to create space for the hydroxyapatite crystals to grow in length and width. Purpose: We hypothesized that loss of MMP-20 causes occlusion of proteins within the crystals, leading to enamel malformation. Our aim was to evaluate intracrystalline proteins in MMP-20 KO and WT mice in order to give insight into the function of MMP-20. Methods: Enamel samples from adult murine (WT and MMP-20 KO) incisors were isolated and rinsed with a series of extraction buffers to wash all the adsorbed proteins off the enamel crystals. The samples were then dissolved in 1M HCl to extract the proteins trapped inside them. Enamel crystals were qualitatively analyzed by SEM and TEM. Intracrystalline proteins were quantitatively analyzed by UV-adsorption (NanoDrop). Results: Adsorption analyses showed that more intracrystalline proteins were present in the MMP-20 KO enamel than in controls. SEM showed a disorganized prism structure in the KO mice. TEM showed a decrease in the length of enamel crystals with irregular shape in KO mice. Conclusion: Our data suggest that MMP-20 functions to a) prevent unwanted protein occlusion inside enamel apatite crystals, b) promote their growth in length and c) facilitate organized prismatic structure. This study will help us in our ultimate aim to make a biomimetic enamel material which can be used in a clinical setting to treat patients.

Poster #: 81
Title: Evaluation of CBCT for Diagnosing Periapical Cysts from Granulomas
Name: Jing Guo
Faculty Advisor: Reyes Enciso

Background: Cone-Beam Computed Tomography (CBCT) has been considered to be a nonsurgical alternative used in the differentiation between apical cysts and granulomas when evaluating whether apical true cysts can or cannot heal after nonsurgical root canal therapy. Purpose: The purpose of this study was to evaluate the reliability and accuracy of CBCT against the histopathologic diagnosis, for the differential diagnosis of periapical cysts (cavitated lesions) from (solid) granulomas. Methods: Thirty-six periapical lesions were imaged by CBCT scan. Apicoectomy surgeries were conducted for histopathological examination. Evaluator 1 examined each CBCT scan for the presence of six radiological characteristics of a cyst (location, periphery, shape, internal structure, effects on surrounding structure, and perforation of the cortical plate). For the purpose of finding the minimum number of diagnostic criteria present in a scan to diagnose a lesion as a cyst, we conducted six ROC (Receiver Operating Characteristic) Curve analyses comparing the CBCT diagnosis with the histopathologic diagnosis. Three independent evaluators examined the CBCT lesions. Statistical tests were conducted to examine the accuracy, inter-rater reliability, and intra-rater reliability of CBCT images. Results: Findings showed that a score of ≥4 positive findings was the optimal scoring system. The accuracies of differential diagnoses of three evaluators were moderate (AUC=0.76, 0.70, and 0.69 for evaluators 1, 2, and 3, respectively). The inter-rater agreement of the three evaluators was excellent (α=0.87). Intra-rater agreement was good to excellent (κ=0.71, 0.76, and 0.77). Conclusion: CBCT images can provide a moderately accurate differential diagnosis between cyst and granuloma.

Poster #: 82
Title: Evaluation of Root and Canal Morphology of Maxillary First Molars
Name: Jing Guo
Faculty Advisor: Reyes Enciso

Background: The correct understanding of the number of roots and canal morphology is essential in root canal therapy. With high rates of variation in maxillary first molars, accurate knowledge of the number of roots and canal morphology prior to root canal therapy is a concern for endodontists. Purpose: The purpose of this study was to evaluate the number of roots and canal morphology of maxillary permanent first molars in a US population. Methods: 317 cases with bilateral maxillary first molars were included. All images from Cone Beam Computed Tomography (CBCT) were carefully reviewed by two endodontists. Frequency of number of roots, presence of an additional mesiobuccal canal (MB2), and Vertucci's canal type for each root was tabulated. Age, gender and ethnicity differences were calculated with the Chi-square test. The intra-rater reliability was assessed using Cohen's Kappa statistic. Results: The fused root rate was 0.9%. The occurrence of three-rooted maxillary first molars differed between left and right sides (p=0.03). MB2 occurrence only showed statistically significant differences among age groups (p=0.005). In the mesiobuccal roots, the most common Vertucci's classification of canal types were Type IV (2-2, 41.9%), Type I (1, 28.3%), and Type II (2-1, 26.3%). There was a statistically significant difference in Vertucci's classification of canal type among five ethnic groups (African-American, Asian, Hispanic, Other, and Non-Hispanic White, p<0.001). Conclusion:

CBCT facilitates the identification of root and canal configuration. The information gained about the tooth anatomy and canal morphology before treatment could potentially facilitate root canal therapy.

Poster #: 83
Title: MiRNA Regulation of Enamel Maturation
Name: Kaifeng Yin
Faculty Advisor: Michael Paine

Background: MiRNAs are essential to the whole process of tooth development. Purpose: To identify the potential role of miRNA regulation in enamel maturation. Methods: We obtained RNA samples from both secretory- and maturation-stage enamel organs of Wistar Hannover rats. The RNA samples were subject to genome-wide miRNA profiling using miScript miRNA PCR arrays (Qiagen). For the identified maturation-stage specific miRNAs, target prediction was conducted using the prediction algorithms integrated in Ingenuity Pathway Analysis (IPA). In addition, a parallel genome-wide transcript profiling was also conducted, using the same RNA samples as those used for miRNA PCR array analysis, based on Illumina Rat Refseq-12 beadchips. In order to reduce the number of predicted targets for differentially expressed miRNAs, we did a parallel alignment between the list of predicted gene targets and the list of maturation-stage specific genes identified by transcripts profiling with IPA. The overlaps between these two lists of genes were then uploaded to Webgestalt for GO and KEGG analysis. Results: From genome-wide miRNA profiling, we identified 59 differentially expressed miRNAs (39 up-regulated and 20 down-regulated) at maturation-stage tooth development compared to the secretory stage ($p<0.05$, fold change >=1.8 or <=-1.8). Based on the parallel genome-wide transcript profiling, 2868 genes were shown to be differentially expressed (1301 down-regulated and 1567 up-regulated) in the maturation-stage enamel organ compared to the secretory-stage enamel organ ($p<0.05$, fold change >=1.5 or <=-1.5). The following alignment analysis identified 501 up-regulated genes and 546 down-regulated genes as the potential targets for the 39 down-regulated miRNAs and 20 up-regulated miRNAs respectively. Go and KEGG analysis showed that these genes were significantly enriched in multiple categories that could be generalized to ion transport, pH regulation, calcium handling and endocytotic activities. Conclusion: MiRNAs exhibit a dynamic expression pattern during the transition from secretory-stage to maturation-stage tooth formation, and the maturation-stage specific miRNAs could be involved in several key processes of enamel maturation.

Poster #: 84
Title: A Noncanonical Role for Fibroblast Growth Factor Signaling in Skeletogenesis
Name: Joanna Salva
Faculty Advisor: Amy Merrill

Background: Fibroblast Growth Factor (FGF) signaling plays crucial roles in osteochondral progenitor cell proliferation and differentiation as seen by the multiple skeletal dysplasias resulting from abnormal FGF signaling. Purpose: We identified that the skeletal dysplasia Bent Bone Dysplasia Syndrome (BBDS) results from unique FGF Receptor 2 (FGFR2) mutations that reduce canonical membrane signaling, while also enhancing a noncanonical nuclear role for the receptor in ribosome biogenesis. The purpose of this study is to distinguish the distinct roles of membrane and nuclear FGF signaling in bone development. Methods: To determine how canonical and noncanonical FGFR2 signaling individually contribute to skeletal development and the pathogenesis of BBDS, we blocked membrane FGFR2 signaling with a chemical inhibitor and enhanced nuclear FGFR2 signaling by employing the BBDS mutations in vitro and in vivo. Results: In a bone organ culture assay, avian mandibles grown with inhibitors of membrane FGF signaling displayed reduced bone formation and exhibited uncharacteristic hypertrophy of Meckel's cartilage. Expression of the BBDS FGFR2 mutations in developing chicken embryos caused increased proliferation and abnormal patterning in bone and cartilage. Conclusion: These results suggest that membrane FGF signaling is important in osteochondral progenitor differentiation and maturation while nuclear FGF signaling regulates proliferation. Combined our research shows that canonical and noncanonical FGF signaling have distinct roles during skeletal development.

Poster #: 85
Title: Biomechanical Analysis of Engineered Bone with Anti-BMP-2 Antibody Functionalized Scaffolds
Name: Sahar Ansari
Faculty Advisor: Homa Zadeh

Background: Our recent studies have demonstrated the ability of chimeric anti-BMP-2 monoclonal antibodies (mAb) immobilized on different types of scaffold materials to mediate de novo bone formation. Purpose: The objective of this study was to determine whether the scaffold used for tethering anti-BMP-2 mAb can affect the biomechanical properties of the regenerated bone. Methods: Chimeric anti-BMP-2 mAb was immobilized on four different biomaterials, namely, titanium microbeads (Ti), alginate hydrogel, anorganic bovine bone mineral (ABBM) and absorbable collagen sponge (ACS). The kinetics of mAb release from each scaffold were evaluated in vitro using UV absorption spectroscopy. The scaffolds immobilized with chimeric anti-BMP-2 mAb were surgically implanted into rat critical-size calvarial defects. Isotype-matched non-specific antibody was substituted for specific antibody as negative control. Animals were sacrificed after 8 weeks and the strength of the regenerated bone was evaluated using a universal mechanical testing machine. The specimens were secured in position while the load was applied vertically to the center of the former defect. For each group, four specimens were tested. The maximum load to fracture was determined as the maximum force applied during the biomechanical test, which is the force applied to cause fracture of the healed defect site. Following the mechanical testing, in order to characterize the morphology of the newly-formed bone and scaffold materials at the defect sites, scanning electron microscopy was utilized. Results: The results showed Ti microbeads and ABBM scaffolds showed the greatest amount of force to fracture in comparison to ACS and alginate. ABBM, Ti, alginate and ACS functionalized with chimeric anti-BMP-2 mAb were able to achieve 77%, 80%, 40% and 28% of the biomechanical strength of native bone, respectively. rhBMP-2 with ACS, used as positive control achieved 66% of the strength of native bone. Alginate scaffold showed the lowest amounts of mechanical properties ($P<0.05$) followed by ACS scaffold. The negative control group did not promote any bone regeneration, showing significantly lower mechanical properties ($P<0.05$). The SEM images clearly showed specimens immobilized with chimeric anti-BMP2 mAb formed new bone with organized collagen fibrils bridging the crack areas. In contrast, the negative control group did not promote any bone regeneration, showing connective tissue formation with unorganized collagen fibrils. Conclusion: The present data demonstrated that the scaffold used for tethering anti-BMP-2 mAb can affect the biomechanical properties of the regenerated bone. The ability of ABBM and titanium functionalized with chimeric anti-BMP-2 mAb to achieve 77% and 80% of the biomechanical strength of native bone demonstrated that antibody mediated osseous regeneration (AMOR) is an effective tissue engineering approach.

Poster #: 86
Title: Local and Systemic Responses to Biofilm-mediated Osteolytic Infection
Name: Susan Mahabady
Faculty Advisor: Parish Sedghizadeh

Background: Aggregatibacter actinomycetemcomitans (Aa) is a well-known pathogen associated with oral infections. Although Aa readily forms biofilms in vitro and in vivo, little is known about the pathogenesis of this organism and its interaction with the host immune response in its biofilm state. Purpose: In this study, we used an Aa biofilm-inoculated titanium implant animal model to study local and systemic responses to biofilm-mediated osteolytic infection. Methods: Analysis included evaluation of clinical inflammation, micro-computed tomography (microCT) of bone volume, polymerase chain reaction of Aa persistence, and Western blot analysis of antibody production.

Necropsies were performed for all study animals. Results: Rats treated with biofilm-inoculated implants exhibited clinical signs of inflammation 2 days post-operatively, which continued to exacerbate. Rats treated with control implants exhibited minor post-operative signs of mucosal inflammation also at day 2, but resolved by day 7. Clinical bone volume measured by microCT at week 6 indicated significant bone loss ($P < 0.05$) in Aa biofilm-inoculated implants compared to control implants. Five out of 15 rats treated with Aa biofilm-inoculated implants died during treatment. Following necropsy of this subset of animals, cause of death was likely Aa sepsis leading to multi-system organ dysfunction. Conclusion: These results may be important for future investigations in understanding pathogenic mechanisms of local and systemic host-pathogen responses as they relate to oral biofilms.

Poster #: 87
Title: miRNAs Regulate Skeletogenesis of the Craniofacial Complex
Name: Ryan Roberts
Faculty Advisor: Amy Merrill

Background: Precise timing of cranial neural crest cell (CNCC) differentiation into bone is essential for proper formation of the craniofacial bones. Delayed osteoinduction leads to micrognathia, whereas premature osteoinduction causes craniosynostosis. To understand the etiology of these birth defects, we must uncover the molecular mechanism that regulates the timing of osteogenesis. CNCCs autonomously control the timing of their differentiation into osteoblasts by regulating expression of Bone Morphogenetic Protein (BMP), yet how CNCCs establish the timing of BMP expression remains unclear. Good candidates for intrinsic temporal control of gene expression are miRNAs, small non-coding RNAs that target mRNAs for degradation. Purpose: To understand how miRNAs regulate the timing of skeletogenesis in the chick mandible. Methods: To identify specific miRNAs involved in mandibular osteogenesis, we performed microarray analysis on chick mandibles during the stages of osteoinduction. Results: We identified and validated temporal expression changes in miRNAs whose targets include BMP signaling pathway members that are known to be involved in bone formation. For example, miR-19b, which is upregulated at the start of osteogenesis, targets repressors of BMP signaling including Smurf1. Conversely, let-7a and let-7c, which are upregulated at the close of osteoinduction, target the BMP receptor AcvR-2B. Conclusion: These results suggest that miRNAs intrinsically control the timing of CNCC osteoinduction by regulating the period of active BMP signaling.

Poster #: 88
Title: Function of PHF6 in Neural Crest Cell Formation
Name: Erin Moran
Faculty Advisor: Ruchi Bajpai

Background: Birth defects involving neural tube malformations, intellectual disability, and craniofacial defects are highly prevalent, but the precise molecular mechanisms behind this group of birth defects remain largely unknown. Börjeson-Forssman-Lehmann Syndrome (BFLS) is a multi-system birth defect that is primarily defined as an obesity and intellectual disability disorder, but patients display characteristic enlarged facial structures. BFLS is caused by mutations in PHF6, a dual PHD finger protein of unknown cellular function. Purpose: This project aims to uncover a molecular mechanism behind the development of intellectual disability and enlarged craniofacial structures in BFLS through investigating the molecular function of PHF6 in neural crest (NCC) and neural ectoderm (NEC). Methods: In this project, we use Xenopus laevis and human embryonic stem cells as parallel and complementary models to study whole embryo phenotypic changes resulting from overexpression and knockdown of PHF6 as well as investigate the cellular function of PHF6 protein in NCC and NEC. Results: We have found that PHF6 is able to physically interact with modified histone proteins as well as chromatin modifying proteins in NEC and early NCC. Studies in Xenopus have also revealed that PHF6 overexpression leads to a reduction in NCC formation and an increase in cells residing near the neural tube. Conclusion: Our results indicate that PHF6 may act in these cells to check NCC formation in order to preserve the integrity of the dorsal neural tube, and that this may be dependent on an epigenetic reader function of this protein.

Poster #: 89
Title: Antifungal Activity of Flavonoids on Candida albicans Biofilm
Name: Dalia Seleem
Faculty Advisor: Ramiro Murata

Background: Candida albicans is a major fungal pathogen afflicting a range of disease from superficial mucosal diseases to deep seated mycoses. It is now regarded as a major human fungal pathogen in clinical settings. In the United States, candidiasis is considered the third leading cause of hospital-acquired infection, with reported mortality rate of 40-60%. Biofilm formation is a major virulence factor in pathogenicity of C. albicans, which is believed to cause a high antifungal resistance. Currently, research studies focus on prevention and management of biofilm formation. Purpose: In this in vitro study, we aim to test a polyphenol natural compound, namely flavonoids, in order to determine its potential antifungal use. Methods: Biofilms of C. albicans NIH (ATCC 14053) will be formed in yeast nitrogen base medium and will grow undisturbed for 24h at 37 degrees Celsius and 5% CO_2, then treated twice daily with natural compounds for 5 days. Fluconazole and solutions with 1% ethanol (v/v) will serve as positive and vehicle controls, respectively. The treated biofilms will be analyzed for biomass, polysaccharide composition, and protein content by colorimetric assays. Results: N/A Conclusion: N/A

Poster #: 90
Title: Telomerase Governs Immunomodulatory Properties of MSCs by Regulating Fas-Ligand Expression
Name: Chider Chen
Faculty Advisor: Songtao Shi

Background: Autoimmune disease is a major class of human disorders and its treatment remains a clinical challenge. Systemic infusion of bone marrow mesenchymal stem cells (BMMSCs) yields therapeutic benefit for a variety of immune disorders, but the role of the stem cell property in BMMSC-based immunomodulation is poorly understood. Specifically, it is unknown whether unique gene-driven functional commonalities of stem cells play a role in adjusting BMMSC-mediated immune responses. Telomerase plays a crucial role in maintaining BMMSC stemness and osteogenic differentiation. However, it is unknown whether telomerase activity regulates BMMSC-mediated immune therapies. Elucidating the role of telomerase in BMMSC-based immunomodulation may help to improve BMMSC-mediated immune therapies. Purpose: To examine whether telomerase reverse transcriptase (TERT) is important in regulating BMMSC-mediated immunomodulation. Methods: We used in vitro stem cell analysis approaches, including flow cytometry, inductive differentiation, telomerase activity, and Western blot analysis to assess immunomodulation of MSC. In addition, we utilized systemic MSC transplantation to treat systemic sclerosis-like Fbn1 mutant mice. Results: Here we show that telomerase-deficient BMMSCs lose their capacity to inhibit T cells and ameliorate the disease phenotype in systemic sclerosis mice. Restoration of telomerase activity by TERT transfection in TERT-/- BMMSCs rescues their immunomodulatory functions. Mechanistically, we reveal that TERT, combined with β-catenin and BRG1, serves as a transcriptional complex, which binds the FAS ligand (FASL) promoter to upregulate FASL expression, leading to an elevated immunomodulatory function. To test the translational value of these findings in the context of potential clinical therapy, we used aspirin treatment to upregulate telomerase activity in BMMSCs, and found a significant improvement in the immunomodulatory capacity of BMMSCs. Conclusion: Taken together, these findings identify a previously unrecognized role of TERT in improving the immunomodulatory capacity of BMMSCs, suggesting that aspirin treatment is a practical approach to significantly reduce cell dosage in BMMSC-based immunotherapies.

OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY STUDENT

Poster #: 91
Title: Videogame Play for Physical Activity and Social Interaction in Autism
Name: Amanda Foran
Faculty Advisor: Sharon Cermak

Background: Technology has been used successfully to enhance social engagement for individuals with Autism Spectrum Disorder (ASD), yet the majority of screen-based media are considered sedentary and solitary activities. Young adults with ASD are at risk for overweight/obesity and sedentary behavior. Exergaming is an emerging active occupation that may benefit individuals with ASD who are often drawn to technology, and may have limited opportunities for physical activity (PA) in the community. In pilot studies, subjects reported enjoying exergaming more than playing traditional seated videogames (TSVGs), and consistently achieved moderate or moderate-to-vigorous PA levels while exergaming . Purpose: Typically developing individuals tend to be more active and enjoy the activity more when playing with a partner. We measured the physiological and psychological responses of young adults with ASD to videogame play under varying conditions. We sought to describe the relationship of exergaming and PA levels in young people with ASD, and to determine if exergame playing condition (alone versus with a peer playing partner) influences PA level and/or enjoyment. Methods: We used a two group (ASD and neuro-typical) by two playing status (alone and with peer) by two game type (TSVG vs. exergame) quantitative design, with diagnostic group serving as the between-subjects variable and playing status/game type serving as the within-subjects variables. Results: Participants experienced high levels of enjoyment and perceived exertion while exergaming. For individuals on the Autism Spectrum, perceived exertion may be mediated by enjoyment - subjects reported significantly lower perceived exertion and greater enjoyment when playing the most physically challenging games with the greatest intensity (as measured by heart rate, energy expenditure, and activity counts [$p<0.05$]). Conclusion: For some young adults with ASD, exergaming with a partner contributes to greater enjoyment and higher-intensity gameplay as compared to playing alone and playing TSVGs. Exergaming is likely to represent a cost-effective and accessible way to incorporate PA into the daily lives of young adults with ASD, many of whom are at risk for sedentary lifestyle and overweight/obesity.

Poster #: 92
Title: Stigma: The Challenge of Social Experience for Children with Disabilities
Name: Carol Haywood
Faculty Advisor: Mary Lawlor

Background: As children with disabilities approach participation, they encounter many challenges. Little has been done to understand the facilitators and barriers to social engagements in the daily lives of children and their families. Purpose: This investigation examines ethnographic data to understand the role of stigma in the development and social participation of African American children with disabilities and their families. Methods: For the present analysis, a subset of data has been drawn from a 15-year, three-phase, longitudinal ethnographic study collectively titled Boundary Crossings, a study of African American children with special health care needs, their families, and the practitioners who provided services. Results: In the observation of daily life experiences for children with special needs and their families, themes of marginalization based on unique qualities and abilities of the child and family emerged across families' stories. While both individual and societal influences are apparent in this data, this analysis focuses on the joint actions and interactions between mothers and their children. Many families in this study narrated experiences of anticipating and/or encountering harsh criticisms and marginalization in social contexts. In some families, stigma was co-managed between the parents and the children. In others, children more autonomously attempted to manage constraints on participation. Implications related to identity, sense of self, stigma, and social engagements are discussed. Conclusion: Though stigma was not a term used by the families themselves, data analysis revealed ways the families understood and managed stigma. Profound examples emerged of how stigma affects family roles and how family roles affect stigma.

Poster #: 93
Title: Empowering Frontline Care Providers with Fall Prevention Knowledge
Name: Karen Crum
Faculty Advisor: Natalie Leland

Background: Falls, a Medicare quality indicator, are associated with increased healthcare utilization, morbidity, mortality, and long term institutionalization. Frontline caregivers—certified nursing assistants (CNAs) and home health aides (HHAs)—are essential members of the care team, and can play a pivotal role in preventing falls among their patients. Purpose: This study evaluated the relationship between a six-session fall prevention educational series and CNA/ HHA long-term recall of fall prevention knowledge. Methods: CNAs and HHAs were recruited from a local nursing home and two home health agencies. Individuals participated in 6 one-hour in-service educational sessions on fall prevention over three months. Session topics included information about the role of the environment, medications, medical status, aging, pain, and staff involvement. At baseline, each participant completed a demographic survey and 30-item pretest reflecting their existing fall prevention knowledge. Post-test assessments, capturing knowledge recall, were completed 30-days after the final training session. Results: Of the 108 participants (80% female, n=86), 75 had complete baseline and follow-up data, and an average 9.3 (+ 7.9) years of CNA/HHA experience. The average baseline score was 21.7(+/-3.2) with 41% affirming they knew how to prevent falls but less than 20% indicating they knew detailed fall-risk factors or the role of medications/environment in a fall event. The average follow-up score was 23.0(+/- 3.2), which reflects significant positive change ($t(74) = 3.98$, $p=0.0001$; mean difference 1.35, SD 2.93). Conclusion: This study demonstrates that fall prevention in-service sessions are associated with increased retention of fall prevention knowledge for CNAs/HHAs.

Poster #: 94
Title: Action Observation Network: Increased Neural Activity during Intention Understanding
Name: Emily Kilroy
Faculty Advisor: Lisa Aziz-Zadeh

Background: Understanding other people's actions and intentions is an essential component of successful social interactions and learning. The Action Observation Network (AON) is a set of brain regions that are active for both the execution of an action and the passive observation of the same action, albeit, to a lesser extent. Relative to passive observation, AON areas increase activity when subjects observe an action with the intention of subsequently reproducing the action later (Fey, 2006). Purpose: The purpose of this study was to determine if the AON is more active during action intention understanding than during action execution. Methods: Three healthy adults observed, executed and considered the intentions of an actor performing tasks with their hands (i.e., sewing) while undergoing functional Magnetic Resonance Imaging. Using a block design, each hand action was presented as a three second video, with each block consisting of 4 videos. Eight blocks of different videos for each condition (observation, execution, intention) were presented according to an optimized random sequence. A fixed effects analysis was performed contrasting blood oxygen level dependent activity of the action execution condition with the intention understanding condition in the AON. Results: The AON was more active during the intention condition when compared to all other conditions in the motor and premotor cortices, the pars opercularis and the anterior insula. Conclusion: The present study supports the relationship between intention understanding and action observation in the AON. Our findings suggest that individual differences during in-

tention understanding are reflected more in the AON circuitry during hand action processing when compared to execution of actions.

Poster #: 95
Title: The Social Life of Health Records
Name: Amber Angell
Faculty Advisor: Olga Solomon

Background: Medical records are commonly viewed as documents that objectively record 'what happened' (Berg, 1996). Drawing from medical sociology, we instead view records as a co-constructed textual artifacts created through interactions between patients, family members, and healthcare providers. Purpose: The primary goal is to elucidate the meaning and significance of health records in the lives of African-American families of children with autism. Methods: This ethnographic, discourse analytic study draws upon a data corpus collected for a larger mixed methods study on disparities in autism diagnosis, interventions and services for 25 African-American children living in Los Angeles County. This data sub-corpus includes health records for 14 of the children (95 medical, school, and legal documents) and data related to these records (9 interviews with parents and a practitioner, 4 clinic or school observations, and 1 email from a mother). Analysis was an iterative process that moved between parents' narrated experiences related to their children's records, and the records themselves. Results: A missing record resulted in a disruption in a child's autism diagnosis and services, revealing the significance of health records in obtaining and maintaining an autism diagnosis and services. Other data show that parents and practitioners engage with each other in the co-construction, interpretation, and use of children's health records, and that parents use the records to negotiate interventions for their children. Conclusion: Health records are central and consequential cultural artifacts in healthcare, and hold substantial authority in the determination of a diagnosis and subsequent services for the children in the study.

BIOKINESIOLOGY AND PHYSICAL THERAPY STUDENT

Poster #: 96
Title: CRP and Body Composition in Latina Breast Cancer Survivors
Name: Lindsey Avery
Faculty Advisor: Christina Dieli-Conwright

Background: C-reactive protein (CRP) has been well-documented as a general biomarker for inflammation and risk assessment of coronary events. Recent investigations have suggested a direct relationship between abdominal fat distribution and elevated levels of CRP, especially among sedentary populations. In clinical populations, specifically breast cancer patients, these effects of CRP are further pronounced and are associated with disease reoccurrence and mortality. Purpose: The purpose of the investigation is to provide descriptive characteristics relating CRP to abdominal fat distribution in Latina breast cancer survivors (BCS) as well as to identify predictability of serum CRP and body composition in identifying co-morbidities and long-term prognosis. Methods: A total of seventeen (n=17; aged 52.9 ± 10.07 yr) sedentary Latina women recently diagnosed with breast cancer were included in the analyses and were recruited from the Los Angeles County + USC Hospital and the Norris Comprehensive Cancer Center at USC as a part of a larger ongoing exercise trial study. Participants completed a comprehensive fasting blood lipid panel, DEXA scan and anthropometric measurements. Results: Mean CRP level for participants was measured at 2.94±2.76 mg/dL and was classified as 'moderate' to 'elevated' according to the American Heart Association. Increased CRP was correlated with increased TBFP in post-menopausal women only (p= 0.039). We observed a linear relationship between increased CRP and fat mass (FM) and inverse relationship with increases in lean body mass (LBM); (p=0.049 and p=0.006, respectively) in pre-menopausal women only. Conclusion: Latina BCS presented with moderate to elevated C-reactive protein levels, suggestive of inflammation associated with increased risk for the development of cardiovascular disease and cancer recurrence. Relationships between CRP and abdominal fat distribution were not observed in this population.

Poster #: 97
Title: Effects of Self-Efficacy Enhancement on Paretic Hand Selection in Stroke
Name: Yi-An Chen
Faculty Advisor: Carolee Winstein

Background: Low confidence (self-efficacy) of the paretic hand in individuals with stroke can aggregate a discrepancy (also called non-use) between motor capability and paretic hand use. Social-comparative (SC) feedback, which indicates relative performance success, has been shown to enhance self-efficacy in non-disabled adults. Purpose: The purpose of this pilot study was to examine the effects of enhanced self-efficacy on paretic hand selection in individuals with stroke. We hypothesized that SC feedback will enhance self-efficacy; if so, the probability of paretic hand selection will increase. Methods: Five participants with chronic stroke performed a reaching task before, after, and at least one day following the SC feedback. Participants were instructed to freely choose from either hand to reach targets. With SC feedback, they were informed that their paretic hand reaching performance was better than that of other recruited participants. Primary Outcome measures were paretic hand self-efficacy and the probability of paretic hand selection. Results: Consistent with our hypothesis, paretic hand selection increased in one participant (P03) after self-efficacy enhancement. Three participants (P02, P04, P05) showed a small increase or no change in self-efficacy after SC feedback, not unexpected given their high baseline confidence (ceiling effect). Surprisingly, P01's paretic hand selection increased without an increase in self-efficacy. He may have seen the study as an opportunity to practice. In spite of high baseline self-efficacy, P05's paretic hand use decreased after SC feedback, which might relate to fatigue. Conclusion: This pilot work suggests that self-efficacy can be enhanced in individuals with chronic stroke, even when motor capability is ostensibly low (i.e., P03). Confidence enhancement can increase individuals' paretic hand choice, if the paretic hand was not previously used to the fullest extent possible. Future research is needed to address limitations including: sample size, varied sample characteristics (e.g., handedness), and experimental tasks that may better affect community generalization. Of importance, other confidence enhancements that do not employ false information should be explored in the future.

Poster #: 98
Title: Do Western Shoe Runners Inherently Adopt the Barefoot Pattern?
Name: Rami Hashish
Faculty Advisor: George Salem

Background: Running is the most popular form of exercise in the U.S., but 50% of runners sustain a yearly lower-extremity injury (e.g. meniscal damage, patellar tendinopathy, tibial stress fractures). One suggested mechanism is repetitive, high loading rate (LR) impacts, during rear-foot strike (RFS) running, causing viscoelastic biological tissues to degrade. Whereas 89% of U.S. shod runners RFS, habitual barefoot runners forefoot strike (FFS), and present with lower LR. Accordingly, barefoot running has been purported to reduce injury risk, leading to the $1 billion minimalistic/barefoot shoe industry. Purpose: Therefore, the purpose was to determine whether western RFS runners adopt the FFS contact pattern, and associated reduction in LR, synonymous with habitual barefoot running. Methods: Twenty-four habitually shod RFS runners performed 4-10 trials of overground shod, and novice barefoot running, at self-selected velocities. Ankle kinematics were calculated using standard motion analysis. A RFS was initial contact made with the rear third of the foot, a mid-foot strike (MFS) with the middle third, and a FFS with the anterior third. The LR was defined as the peak rate at which the vertical ground reaction force rises upon foot-strike. Results: In the novel barefoot condition, 3 adopted a FFS, 12 adopted a MFS, and 9 maintained a RFS. Relative to the shod condition,

mean LR was significantly lower during barefoot FFS running (Δ=-50 BW.s-1; p=.033), and higher during barefoot RFS running (Δ=127 BW.s-1; p<.001); there was no significant difference during barefoot MFS running. There were also significant associations between ankle contact angles and LR during barefoot (R=.655; p=.001) and shod (R=-.502; p=.013) running. Conclusion: Greater dorsiflexion during RFS running exaggerates the ankle rocker mechanism, theoretically allowing for greater displacement/time to dissipate impact upon foot-strike. In order to attenuate LR during barefoot running, a higher magnitude of plantar flexion is required to sufficiently engage the triceps surae to eccentrically lower the body. Unaccustomed to this loading pattern, habitually shod runners often do not inherently adopt a FFS. Thus, in order to optimally reduce LR, clinicians should explicitly promote FFS running when barefoot. For shod RFS running, greater dorsiflexion at foot-strike should be encouraged.

Poster #: 99
Title: Relations between Reach Distance and COPE in Younger Adults
Name: Andrea Du Bois
Faculty Advisor: George Salem

Background: The reach distance measured during Functional Reach Test (FRT) has been proposed as a reliable measure of dynamic stability as it is strongly correlated with center of pressure excursion (COPE) in seniors (Duncan, 1990). These relations have not been explored in younger adults. Moreover, subject height can influence reach distance (Lin and Liao, 2011) with taller people reaching further and base of support (BOS) (foot length) can affect COPE as people with longer feet have the capability to move their COP further before becoming unstable. Purpose: Therefore, the purpose of this pilot study was to compare the relations between reach distance and COPE in normalized and absolute terms, in younger adults. Methods: Using established procedures (Duncan, 1990) three healthy participants (aged 20-28) stood on a force plate with their right shoulder flexed to 90 degrees. A yardstick was placed along their right arm at the level of the acromion. Subjects were instructed to reach forward as far as possible without taking a step and while keeping their right hand at the level of the yardstick. Scatter plots examined the relations between reach distance and COPE in absolute and normalized terms. Results: Contrary to the findings of Duncan (1990), a trend towards a positive relation was observed only when COPE and reach distance were normalized. Conclusion: Normalization is important when relating reach distance and COPE to dynamic stability in younger adults. These results should be considered when using the FRT in younger adults or when comparing FRT results across age groups.

Poster #: 100
Title: Estrogen Influence on Muscle Catabolism and Inflammation in Young Women
Name: Lindsey Anderson
Faculty Advisor: Todd Schroeder

Background: It is unclear whether estrogen influences muscular inflammation or catabolism in young women. Such evidence may elucidate the role of estrogen in muscular health, injury risk, and injury recovery. Purpose: To determine the influence of endogenous and exogenous estrogen during a catabolic stimulus on the regulation of skeletal muscle catabolism and inflammation in young women. Methods: Three groups will perform a single bout of neuromuscular electrical stimulation (NMES): non-contraceptive users-luteal phase (HI), non-contraceptive users-menstrual phase (LO), contraceptive users-pill consumption (OC). Muscle damage will be assessed by strength, soreness, creatine kinase (CK), and gene expression. Results: After NMES increases in IL-6, TNF-α, MuRF-1, MAFbx, and muscle damage will be attenuated and decreases in P-FOXO3a and myostatin will be greater during HI and OC than LO. No differences are expected in NMES-induced gene expression between HI and OC. Mixed ANOVA will be used to compare within-group changes over time and between-group differences. Power analyses revealed a sample size of 8; 12 participants will be recruited per group. Conclusion: Attenuation of inflammation or CK during high estrogen may indicate that estrogen is promoting membrane stability. Alterations in the catabolic response may point to direct pathway targets for estrogen action. Attenuated declines in maximal force production may indicate an estrogen influence somewhere in the excitation-contraction coupling process, while reductions in soreness may indicate a more specific influence on the muscle itself. Differences between exogenous and endogenous estrogen conditions may be due to differences in binding affinity or to the low estrogen formulations of new generation oral contraceptives.

Poster #: 101
Title: Excessive Hip Rotation and Knee Valgus on Patellofemoral Joint Stress
Name: Tzu-Chieh Lio
Faculty Advisor: Christopher Powers

Background: Patellofemoral pain (PFP) is a common condition seen in orthopedic practice. A commonly cited hypothesis as to the cause of PFP is increased patellofemoral joint (PFJ) stress secondary to abnormal lower extremity kinematics (i.e. excessive hip internal rotation and knee valgus). However, the influence of these motions on PFJ contact mechanics is unknown. Purpose: To assess the influence of hip rotation and knee valgus on PFJ stress using finite element (FE) analysis. Methods: Patella cartilage stress profiles for a healthy participant were quantified utilizing a subject-specific FE model. Input parameters included: joint geometry, quadriceps muscle forces, and weight-bearing PFJ kinematics. Using a nonlinear FE solver, quasi-static loading simulations were performed to quantify patella cartilage stress during a static squatting maneuver (45° knee flexion). To simulate hip rotation (0-8°) and knee valgus (0-12°), the femur and tibia were rotated in the transverse and frontal plane respectively in 2° increments. Results: Increasing hip rotation resulted in a linear increase in patella cartilage stress. In contrast, increasing knee valgus resulted in a decrease in patella cartilage stress. The combination of hip rotation and knee valgus did not result in higher PFJ cartilage stress compared to isolated hip rotation. Conclusion: Patella cartilage stress appears to be influenced to a greater degree by hip internal rotation as opposed to knee valgus. Surprisingly, higher degrees of knee valgus resulted in decreased cartilage stress (in the absence of hip rotation). Our finding supports the premise that persons exhibiting excessive hip internal rotation may be pre-disposed to elevated patella cartilage stress.

Poster #: 102
Title: Child-Adult Differences in the Control of Forward Momentum with Practice
Name: Guilherme Cesar
Faculty Advisor: Susan Sigward

Background: Control of body momentum during running is important for successful participation in childhood games and sports. Improvements with age in the ability to control forward momentum could be attributed to physical and neurological maturation, and also experience. Purpose: We aimed to determine the effects of practice (experience) on performance of a running termination task in children and adults. Methods: Sixteen adult males and 15 prepubertal boys were instructed to run as fast as possible (AFAP) for 13m and stop at a pre-determined location. Twenty-five trials were collected. Participants were provided feedback about trial time to encourage running faster. Approach velocity was calculated using forward velocity obtained from a kinematic marker (250Hz) placed over the sacrum. Average velocity for 0.12s prior to deceleration was normalized to maximum velocity (Vmax) achieved during a 21m unobstructed AFAP run. Approach velocity was averaged across first 5 (EARLY) and last 5 (LATE) trials. Repeated measures ANOVA determined the effects of practice on approach velocity in adults and children. Results: Significant interaction ($p<0.001$) was observed. In EARLY trials, children's approach velocity was 9% greater than adults ($p<0.001$). With practice, adults increased approach velocity (5.1%Vmax, $p=0.004$) and children did not (-1.76%Vmax; $p=0.25$). Conclusion: Adults approached this gait termination task with initially lower relative velocity and demonstrated increases with practice; children did not modulate their velocity within the 25

trials studied. Whether the lack of change in children's approach velocity over trials is a function of maturational limitations, extent of practice, differing task perspectives, or a ceiling effect for velocity awaits further investigation.

Poster #: 103
Title: Pointing the Foot without Sickling: Ankle Movement during Dance Jumps.
Name: Danielle Jarvis
Faculty Advisor: Kornelia Kulig

Background: The sauté is a relatively simple dance jump that can be performed by both highly skilled dancers and untrained non-dancers. However, there are characteristics of jumping unique to trained dancers, especially in terms of foot and ankle movement during flight. Purpose: The purpose of this study was to examine ankle movements in elite dancers compared to non-dancers. Methods: Twenty healthy females, ten with no prior dance training and ten professional dancers, participated. Twenty consecutive sautés were performed while three-dimensional kinematic data were collected. Sagittal and frontal plane kinematics were calculated and the vector coding method was used to quantify coordination patterns within the ankle in the sagittal and frontal planes. Peak ankle positions and coordination patterns between groups were examined using independent t-tests ($p<0.05$). Results: Dancers demonstrated greater peak plantar flexion ($p<0.01$) and less change in ankle angle during the flight phase ($p=0.01$), signifying holding the pointed foot position during flight. Peak ankle inversion was similar among dancers and non-dancers ($p=0.73$). There was no statistically significant difference in sagittal and frontal plane ankle coupling ($p=0.15$), but the dancers did show lower mean in-phase coupling (29% versus 36%), suggesting dancers' control of the foot against natural anatomic coupling. Conclusion: Dancers use greater plantar flexion while jumping, pointing the foot and holding the pointed position while in the air. Dynamic analysis of the foot and ankle during jumping demonstrates how elite dancers achieve the aesthetic requirements of dance technique.

Poster #: 104
Title: The Neuromechanical Adaptations to Achilles Tendinosis
Name: Yu-Jen Chang
Faculty Advisor: Kornelia Kulig

Background: When degenerated, the Achilles tendon exhibits lower stiffness as well as lower elastic modulus. This is partly due to disorganized collagen bundles presenting as altered tendon micromorphology identified on ultrasound images. These deficits in tendon mechanical properties, and its internal architecture, may lead to an alteration of muscle activation patterns of the triceps surae as well as its agonists and antagonists. The descending drive from the central nervous system (CNS) may also be altered in order to compensate the local mechanical deficit. Purpose: The purpose of this investigation is to study the effect of tendon degeneration on its mechanical properties, neuromechanical characteristics of surrounding musculature, and to explore the existence of the central nervous system (CNS) modulation accompanying tendinosis. We hypothesize that the degenerated tendon will lead to diminished tissue mechanical properties, protective muscle activation patterns, as well as an up-regulated descending drive from the CNS. Methods: Ultrasound images were acquired on Achilles tendons for morphological analyses. Participants performed ramped maximal voluntary isometric plantarflexion on a dynamometer while the torque output was recorded. Concurrently, the elongation of the tendon was obtained by a combination of ultrasound imaging and motion capture. Evoked H-reflex and V-wave were tested on the medial gastrocnemius. Kinetics and EMG data were collected while the participants performed single-legged hopping at 2.2Hz. All data were obtained on both limbs of tendinotic and control subjects to allow for side-to-side comparisons. Eight parameters were derived from the signals collected. 1) Micromorphology was obtained by performing a 2D FFT on the ultrasound image rendering a peak spatial frequency (PSF) variable. 2) Stiffness was determined by the slope on the later 40% of the force-elongation curve obtained from ramped isometric contraction. 3) Electromechanical delay (EMD) was the time interval between evoked gastrocnemius muscle EMG onset and torque output. 4) Preactivation was the time interval between gastrocnemius muscle activation and vertical ground reaction force onset during single legged hopping. 5) Maximal H-reflex. 6) Maximal V-wave. 7) EMG based contribution index (CI). 8) EMG based co-contraction Ratio (CCR). An independent sample t-test with bonferroni correction for multiple comparisons was used to test the impact of Achilles tendinosis on the side-to-side discordance of those eight variables between groups. Results: Mean side-to-side discordances for control and for tendinotic groups were as follows: 1) PSF: 0.05±0.05 and 0.48±0.16 mm^{-1} , 2) stiffness: 8.93±2.82 and 119.75±40.66 N/mm , 3) EMD: 0.87±0.66 and 10.24±3.76 ms, 4) preactivation: 1.15±1.02 and 18.79±7.48 ms, 5) H-Reflex: 0.02±0.01 and 0.16±0.02, 6) V-wave: 0.02±0.02 and 0.2±0.11, 7) CI: 0.05±0.05 and 0.34±0.15, 8) CCR: 0.14±0.15 and 0.33±0.14. The independent sample t-test showed significantly different side-to-side discordance in PSF, stiffness, EMD, preactivation, and H-reflex ($p=0.006$). Conclusion: The invariance between sides in controls and variance among tendinotic subjects suggests that these variables are capable of detecting pathology-induced side-to-side differences at tendon, muscle, and CNS levels. This long standing tendon degeneration results in a more compliant tendon, which imposes changes at the muscle, hence affects the motor command from the central nervous system.

Poster #: 105
Title: Modulation of Paraspinal Muscle Activity during Walking Turns.
Name: Jo Armour Smith
Faculty Advisor: Kornelia Kulig

Background: During locomotion, individuals with chronic back pain have increased activity in the paraspinal musculature compared with controls. However, it is unclear if modulation of this activity in response to changing locomotor speed is also affected by back pain. Purpose: To investigate modulation of deep and superficial paraspinal muscle activity during a locomotor perturbation performed at different speeds, and to compare this modulation in asymptomatic persons with recurrent low back pain (RLBP) and healthy controls (CTRL). Methods: 28 participants (RLBP n=14, CTRL n=14) performed walking turns at self-selected and fast speed. Subjects were instrumented with intramuscular EMG electrodes in the deep fibers of lumbar multifidus and the lumbar and thoracic fibers of longissimus. Duration of paraspinal activity was quantified across the stride cycle of the turn. Results: There was no significant difference in self-selected locomotor speed between groups. Duration of activity of both deep multifidus and thoracic longissimus was affected by locomotor speed. From self-selected to the faster speed, duration of deep multifidus activity increased in CTRLs but decreased in the RLBP group (RLBP – 3.86 (8.22%); CTRL +5.70 (11.77%), $p=0.004$) There was a significant association between group and change in deep multifidus activity ($p=0.05$). TES activity increased (RLBP +1.80 (3.13%); CTRL +0.66 (2.02%)) but was not significantly different between groups. Conclusion: This study demonstrates that even between symptomatic episodes, individuals with RLBP demonstrate altered modulation of paraspinal muscle activity in response to changing locomotor demands. The pattern of modulation in these individuals suggests an inefficient recruitment strategy and may contribute to symptom recurrence.

Poster #: 106
Title: Characterization of Ankle Plantar-flexion during Functional Reach Test
Name: Tulika Nandi
Faculty Advisor: George Salem

Background: Liao and Lin (Liao and Lin, 2008) documented 2 different kinematic strategies used for accomplishing the forward reach test (FRT). The hip strategy is characterized by greater than 15 degrees of hip flexion, with ankle plantar-flexion. The ankle strategy is initiated with ankle dorsiflexion and is associated with less than 15 degrees of hip flexion. However, previous studies do not address heel motion; thus, it is not reported whether participants went up on

their toes and changed the Base of Support (BOS). Purpose: The purpose of this pilot study was to explore the relation between ankle plantar-flexion angle and heel motion, potentially leading to change in BOS. Methods: Participants stood on a force plate with their right shoulder flexed to 90 degrees. A yardstick was placed along the arm at the level of the acromion. They were instructed to reach forward as far as possible without taking a step (Duncan et al. 1990). Results: 4 out of 5 participants used plantar-flexed their ankle while reaching. Of these, 3 participants raised their heels, consequently decreasing the BOS. Conclusion: The previously reported descriptions of ankle and hip strategies may not be adequate to characterize balance during the FRT. In the case where the heel is raised along with hip flexion, the decrease in BOS creates a more challenging balance control situation compared to hip strategy with fixed BOS.

Poster #: 107
Title: Eccentric Exercise Induces PGC-1α4 Expression in Muscle of Postmenopausal Women
Name: Jacqueline Kiwata
Faculty Advisor: Todd Schroeder

Background: PGC-1α4, a novel isoform of the transcriptional coactivator PGC-1α, has recently been shown to regulate skeletal muscle hypertrophy in mice, likely through the induction of IGF1 and repression of myostatin. PGC-1α4 mRNA expression is elevated at rest in muscle after a resistance training intervention in healthy adults. However, the acute effect of resistance exercise on PGC-1α4 remains unclear, especially in an older adult population who may benefit from therapy for sarcopenia. Furthermore, a comparison between PGC-1α4 and PGC-1α1, a regulator of muscle oxidative changes, has not yet been reported in response to resistance exercise. Such a comparison may yield a distinction between the regulatory roles of each protein. Purpose: We evaluated changes in mRNA expression of two transcripts of the PGC-1α gene – PGC-1α4 and PGC-1α1– in postmenopausal women following high-intensity resistance exercise. Methods: Skeletal muscle tissue samples were collected from 10 postmenopausal women (57.6 ± 3.1 yr) who performed 10 sets of 10 maximal eccentric repetitions of single-leg extension on a Cybex dynamometer at 60 °/s. Muscle biopsies were obtained from the vastus lateralis of the exercised leg before and 4 hours after the resistance training bout. mRNA expression was determined using RT-PCR for PGC-1α1 and PGC-1α4 with fold changes calculated using the 2-ΔΔCt method. Results: Following acute eccentric exercise, mRNA expression increased 3.0-fold for PGC-1α4, and 1.76-fold for PGC-1α1. Conclusion: In postmenopausal women, acute eccentric exercise increases a transcriptional coactivator involved in the regulation of muscle hypertrophy (PGC-1α4) and to a greater extent than increases in a variant responsible for muscle oxidative changes (PGC-1α1).

Poster #: 108
Title: Motor Cortical Connectivity to Precuneus Cortex Varies with Pain Intensity
Name: Moheb Shawky Yani
Faculty Advisor: Jason Kutch

Background: Previous research suggests that individuals with chronic pain exhibit impaired motor function, and that the motor cortex may play a role in the impairment. However, it is not known whether motor cortical function is altered due to interactions with other cortical areas. Purpose: Here we investigated whether there are changes in wholebrain functional connectivity of the motor cortex that are specific to the presence of chronic pain in a particular body region. Methods: We studied men with Chronic Prostatitis/Chronic Pelvic Pain Syndrome (CP/CPPS) as a model chronic pain population, as individuals in this group have been shown to have relatively localized pelvic floor pain and to have pelvic floor muscle activity that is associated with pain intensity even at rest. We performed validated functional connectivity analyses of resting state functional magnetic resonance imaging (fMRI) data using a seed region in motor cortex shown to project to pelvic floor muscles (pelvic floor motor cortex). Results: We identified a novel region in the precuneus cortex for which connectivity to the pelvic motor cortex varies strongly with pain intensity in men with CP/CPPS. As in previous studies in healthy individuals, the precuneus region in individuals with CP/CPPS is a node of the default mode network. Conclusion: These results represent, to our knowledge, the first demonstration of disrupted functional connectivity to areas of brain efferents that activate specific muscle groups affected by chronic pain. Furthermore, these results point toward a possible role for altered attention in impaired motor control in individuals with chronic pain.

Poster #: 109
Title: Segmental Kinematics and Joint Kinetics during Single-Limb Loading following ACLR
Name: Kristamarie Pratt
Faculty Advisor: Susan Sigward

Background: While rehabilitation programs aim to restore symmetrical knee loading following anterior cruciate ligament reconstruction (ACLR), detection of asymmetry is difficult clinically. Wearable-sensor technology allows for assessment of segmental kinematics without the use of 3D motion equipment. However, it is unclear how segmental kinematics relate to kinetic loading variables. Purpose: To identify the segmental kinematic variables that best predict knee sagittal plane moment and power absorption during a dynamic single limb loading (SLL) task. Methods: 6 subjects 93±11 days post-op ACLR participated. 3D motion analysis and inverse dynamics were used to quantify kinematics and kinetics during SLL (4 trials). Peak knee extensor moment and power absorption, peak thigh and shank angles relative to vertical and peak thigh and shank angular velocity in the sagittal plane were identified during deceleration. Separate stepwise regression analyses were performed to determine best segmental predictors of peak knee extensor moment (MOM) and power absorption (POW). Results: Larger peak shank and thigh angles predicted larger MOM. Shank angle entered the equation first explaining 72% ($p<0.01$) of variance with an additional 18% ($p<0.01$) explained by thigh angle. Shank angle was the largest predictor ($p<0.01, r^2=0.77$) of POW followed by thigh angular velocity ($p<0.01, r^2=0.97$) and thigh angle ($p<0.01, r^2=0.99$). Larger shank angle, thigh angular velocity and thigh angle were related to greater POW. Conclusion: Shank and thigh kinematics explain a large amount of the variance in knee kinetic variables, suggesting that they could provide objective information about knee loading. Translating these results into wearable sensor applications may be appropriate for identification of loading asymmetries in the clinic.

Poster #: 110
Title: Detection of Gait Asymmetries Using Wearable Sensors in ACLr individuals
Name: Ming-Sheng Chan
Faculty Advisor: Susan Sigward

Background: Inertial sensors have been utilized to detect asymmetrical spatiotemporal gait characteristics in individuals with stroke and Parkinson's disease. However, it is unknown if spatiotemporal asymmetries can be detected in individuals following ACL reconstruction (ACLr) using the same procedures. Purpose: The purpose of this study was to compare the stance (ST) and swing (SW) time between limbs during gait in individuals following ACLr. We hypothesized that following ACLr individuals will exhibit longer stance and shorter swing times in their surgical limb compared to their uninvolved limb. Methods: Three ACLr subjects (87±6 days post-surgery) participated in this study. Participants walked 5m at a self-selected speed (1.40±0.22 m/s). Data from the Y-axis of tri-axial gyroscopes secured on the anterior tibia were used to determine toe-off and heel strike events using previously validated procedures. Stance and swing time of 9 steps were calculated between and averaged. Between limb differences were determined using effects size. Results: Longer stance time and shorter swing time in the uninvolved leg were found compared to the involved limb (uninvolved: 0.61 ± 0.02s (d=1.07), involved: 0.58 ± 0.04s (d=1.46)). Conclusion: Differences in spatiotemporal gait parameters were detected between limbs following ACLr using tri-axial gyroscopes. As expected individuals exhibited longer ST and shorter SW time in the uninvolved limbs. Future investigation will be focusing on adding more

participants and validating the gyroscopes with a 3D motion system.

Poster #: 111
Title: DTI Analysis of Corticospinal Tract after Stroke Rehabilitation using Brainsuite13
Name: Yi Yu
Faculty Advisor: Carolee Winstein

Background: Post-stroke upper extremity (UE) motor impairment has been associated with microstructural changes in corticospinal tract (CST) as measured by diffusion tensor imaging (DTI). It is not fully understood how well changes in DTI measures can predict motor recovery and correlate with functional motor changes following neurorehabilitation. Quantification of the CST in a lesioned brain requires a standardized method to identify the CST within and between subjects. This project is part of the phase I clinical trial Dose Optimization for Stroke Evaluation. Purpose: Our purpose is to develop a sensitive and specific method to quantify changes in CST characteristics in stroke-induced lesioned brains. Methods: Participants with chronic stroke completed DTI and motor impairment assessments before and after 12 sessions of a reproducible UE therapy program within 4 months. Imaging data were processed using BrainSuite13 (http://brainsuite.loni.ucla.edu) as follows: (i) co-registration of diffusion images to T1-weighted images, (ii) labeling to the BrainSuite13 atlas, (iii) computing diffusion tensors, (iv) identification of the major white matter tracts using deterministic tractography. The CST was identified using regions of interest (ROIs) for the pons and posterior limb of the internal capsule. Results: We have established a processing pipeline to quantify CST fractional anisotropy (FA). Results from 6 patients will be presented to assess the sensitivity, specificity, and clinical usefulness of this approach in the study of focused rehabilitation for chronic stroke. Conclusion: Using BrainSuite13 software, we present a method to identify and quantify changes in CST characteristics.

Poster #: 112
Title: Accelerated Arm Recovery after Stroke through Cortical Modulation
Name: Yu-Chen Chung
Faculty Advisor: Beth Fisher

Background: A stroke-induced change in interhemispheric interaction (IHI) may increase the inhibition from the non-lesioned hemisphere toward the lesioned hemisphere, thereby impeding recovery of the paretic extremities. One plausible method to improve functional recovery is to decrease the excitability of the non-lesioned hemisphere and restore IHI balance by applying low-frequency repetitive transcranial magnetic stimulation (rTMS). Purpose: To determine the effect of rTMS applied over the non-lesioned hemisphere on paretic hand opening in individuals with sub-acute stroke Methods: Participants received active and sham rTMS conditions with a counterbalanced order. In the active condition, 1-Hz rTMS was applied over the representation area of extensor digitorum communis in the non-lesioned primary motor cortex (M1) at 90% resting motor threshold for 25 minutes. Hand opening performance was measured with a dowel-grasping task before and after rTMS. Results: Among the seven recruited participants, three showed a down-regulated excitability in the non-lesioned M1. A negative correlation was observed between age and the amount of reduction in excitability. Among the participants with decreased excitability, two showed increases in peak aperture and peak aperture velocity. The participant showing no improvement in hand opening had a relatively long post-stroke onset time and a low finger extension score in the Fugl-Meyer assessment. Conclusion: Preliminary data suggests that the ability of rTMS to modify brain excitability may be a function of age. Additionally, improved paretic hand performance following rTMS may vary depending on initial functional ability. The findings attest to the need to determine the subject-specific characteristics that would enable prediction of good outcome following rTMS.

Poster #: 113
Title: Effects of Cadence Manipulation During Gait Following ACL Reconstruction
Name: Paige Lin
Faculty Advisor: Susan Sigward

Background: The persistence of altered sagittal knee loading during gait following anterior cruciate ligament reconstruction (ACLR) suggests that gait training should be a focus during early rehabilitation. Moderate improvements in knee loading have been shown following a 6-week cadence manipulation gait program in individuals 6-weeks post-ACLR. A greater understanding of the effects of cadence manipulation on knee loading is needed. Purpose: To determine the effects of cadence cueing during walking on knee loading. Methods: 6 individuals (4 females, 23.8±10.8 years) status post-ACLR (41.5±11.8 days) walked under three conditions: self-selected cadence without cueing (nSS), self-selected cadence with cueing (cSS), and cadence cued at 110% cSS (110SS). Subjects matched their steps to metronome beats. Peak knee extensor moment and power absorption during stance were quantified using kinematics, ground reaction forces and anthropometrics in inverse dynamics equations. Repeated measures ANOVA were used to compare variables between limbs and across conditions; p?0.05. Results: Individuals walked 0.2m/s faster during 110SS than nSS and cSS ($p<0.01$). Main effects of condition were found in knee extensor moment ($p<0.01$) and power absorption ($p=0.04$). Moments were greater during 110SS than nSS ($p=0.008$) and cSS ($p=0.012$). Power was greater during 110SS than nSS ($p=0.037$) and cSS ($p=0.034$). Conclusion: A single bout of training at 110% self-selected cadence increased sagittal plane knee loading. It is not clear how this training can influence loading symmetry, as loading increased in both limbs. Future studies should examine the effects of short- and long-term cadence training interventions on knee loading strategies during early rehabilitation.

Poster #: 114
Title: Distinct Dynamical Fingertip Force Control in Individuals with Parkinson's Disease
Name: Na-hyeon Ko
Faculty Advisor: Francisco Valero-Cuevas

Background: Individuals with Parkinson's Disease (PD) experience deficits in manipulation, but the progression and recovery of those deficits have been difficult to quantify in detail. The Strength-Dexterity (S-D) test is a recently validated measure of dynamic manipulation, and fMRI studies have associated the performance of this test with function of the basal ganglia. Purpose: Because PD is associated with impaired basal ganglia function, our goal is to test how well the SD test can quantify dynamic manipulation in this population. Methods: The S-D test involves using the thumb and index finger to compress as far as possible, and hold, a slender spring prone to buckling. The spring was designed to require very low forces of ~300 grams at maximal compression. The ramp-up and ramp-down time, maximal compression reached (measured by miniature load cells), the variability of the force, and its dispersion (RMS) are the dexterity outcome measures. We tested both hands in nine individuals with PD and 26 age-matched, non-disabled adults. Results: The maximal compression was similar across both groups. The PD group showed significantly longer ramp-up and ramp-down times for both hands. Interestingly, the clinically "less affected hand" showed poorer dexterity as per rate of force and RMS. Conclusion: We conclude the S-D test is an informative tool to measure deficits in manipulation in individuals with PD. Because it may be able to quantify the progression of disability or effect of therapy, this test enables studies to understand the neural mechanisms for deficits in manipulation in this population.

Poster #: 115
Title: Spinal Control of Motoneuron Pools for Stepping in Chick Embryos
Name: Soo Yeon Sun
Faculty Advisor: Nina Bradley

Background: During embryogenesis in chicks, spontaneous repeti-

tive stepping is produced by leg flexor-extensor muscle alternation at frequencies comparable to locomotion at hatching. However, previous studies observed that repetitive flexor bursting often occurred without reciprocal extensor bursting, suggesting locomotor drive may preferentially recruit flexor motoneurons. When active, burst amplitude was often less for extensor muscles than flexors. Purpose: The apparent preferential drive to flexor motoneurons may originate within the central nervous system. Alternatively, it may be sensory-driven by in ovo environmental constraints imposed on posture and movement. The objective of this study is to test if a preferential drive of flexor motoneurons can be produced by spinal locomotor circuits. Methods: A thoracic spinal cord transection was performed on embryonic day (E) 18. On E19, recording electrodes were implanted in hip and ankle muscles, and muscle activity was recorded for several hours. Embryos produced little activity; however, a mechanical perturbation of leg posture triggered robust stepping and these sequences are reported for 3 experiments. Results: Results indicated that flexor bursts were 3 to 7 times more frequent than extensor bursts in 2 embryos. Also, burst amplitude was 32% greater in flexors than extensors. In 1 embryo, extensor bursts were 1.2 times more frequent than flexor bursts, and burst amplitude was 40% greater in extensors than flexors. Conclusion: Our data suggest that spinal locomotor network may preferentially drive flexor or extensor motoneurons during spontaneous stepping in the final days of development. However, we cannot rule out that somatosensory input may contribute to preferential drive of motoneurons during stepping in ovo.

Poster #: 116
Title: Movement Duration Effects on Hand Choice in Patients with Stroke
Name: Sujin Kim
Faculty Advisor: Nicolas Schweighofer

Background: Patients with stroke have a tendency to avoid using their affected arm and hand after stroke attack and one of the main reasons is their slowness in the movements with the affected side. In our previous study, the participants with stroke nearly equally used affected or unaffected hands to reach the target under no time constraint, whereas less used the affected hand under the condition requiring rapid reaching movement. Purpose: The aim of this study is to clarify the effect of movement duration on hand choice during a target reaching task in patients with stroke and age-matched non-disabled participants. Methods: Nine patients with stroke (age: 57.25 ± 3.92) and six age-matched non-disabled participants (52.50 ± 4.86) were enrolled. We used a Bilateral Arm Reaching Test (BART) system including three different movement time constraints; no time constraint, medium (around 1000 ms) and fast condition (around 500 ms). With BART system, all participants were asked to reach the target as many times as possible by either moving fast or switching hands. The percentage of amount of affected arm use was measured across different conditions. Results: Non-disabled group showed no differences in hand choice across the conditions. On the contrary, stroke group showed a decreased amount of affected hand use as the condition becomes fast. Total percentage of using affected hand in no time, medium and fast conditions were 52.06%, 37.70%, and 31.81% respectively and a statistically significant difference was found between no time and fast condition ($p = 0.034$, Mann-Whitney Test). Conclusion: Task difficulty modulated by changing movement duration can be one of the factors influencing on the hand choice during reaching in patients with stroke.

Poster #: 117
Title: Reaching to Virtual or Real Targets while Standing or Stepping
Name: Bokkyu Kim
Faculty Advisor: Carolee Winstein

Background: Goal-directed reaching movements are often used for dynamic balance training. Visuomotor control strategies are well understood for real target conditions but little is known concerning the kinematics of goal-directed reaches to virtual targets. Purpose: Using kinematic analysis, compare visuomotor control of older adults reaching to real (RT) and virtual targets (VT) performed during static standing and stepping conditions. Methods: Fifteen non-disabled adults were recruited (9 M, 6 F; 75.24±9.0 yrs). Participants performed approximately 102 total trials to RT and VT each under two Posture conditions (standing, stepping). We used a within-subject design where target condition was counter-balanced across participants. Wrist trajectories and accelerations were captured using the Kinect camera and tri-axial accelerometers secured to each wrist. Five dependent measures were derived for acceptable trials: movement time (MT), peak velocity (PV), time to peak velocity (TTPV), time to peak acceleration (TTPA), time after peak deceleration (TAPD). A 2 target x 2 Posture, repeated measures ANOVA was conducted separately, for each dependent variable. Results: There was a main effect of Posture on MT (stepping > standing). More interesting was the Target X Posture interaction (MT stepping > standing was amplified for VT compared to RT). Most revealing, TAPD was longer for VT than RT only when stepping but not when standing. Conclusion: Anticipatory planning strategies as evidenced by PV and TTPA were similar for Target conditions. The longer MT and TAPD for VT, particularly during stepping, suggest that more feedback-based adjustments were provoked by the natural uncertainty in target location inherent to VT compared to RT.

Poster #: 118
Title: Modeling Movement Duration to Assess Reaching Movement Recovery Post-stroke
Name: Hyeshin Park
Faculty Advisor: Nicolas Schweighofer

Background: Short-term training improves reaching performance post-stroke, but spatial characteristics of improvements are unknown. Reaching movement duration (MD) increases with distance (Fitts' law). In addition, the MD is maximal for direction of the largest inertia at the hand (Gordon et al. 1994). Purpose: We thus hypothesized that in stroke, does reach training induce 1) long-lasting decrease in MD and 2) decrease in MD by reducing the effect of distance and large inertia? Methods: Ten participants with stroke (2F, 61.5±12.7 yrs, FM 48.1±10.0; at least 1 year post-stroke) were asked to reach circular targets (diameter 3 cm) with the index fingers of their paretic hands as accurately and quickly as possible. All subjects were asked to visit the laboratory for three consecutive days: on the first two days they received intensive training of 600 movements per day on 5 targets arrayed on an arc ranging from 50 to 130 degrees at 25 cm from the home position. Before and after training in the first two days, on the third day and 1 month later, subjects performed a test consisting of reaching 35 targets presented arrayed from 30 to 150 degrees and at 10, 15, 20, 25, and 30 cm. We conducted a mixed model regression analysis with MD as the dependent variable, with test, target distance, angle, and with cross terms. Results: In stroke, 2-day intensive training produced a significant and long-lasting (1 month) effect on MDs. Conclusion: The effect of distance and angle on MDs is reduced with training as shown by decrease in regression coefficients.

Poster #: 119
Title: Plantarflexor Muscle Adaptations in Runners Who Transition to Barefoot Running
Name: Sachithra Samarawickrame
Faculty Advisor: George Salem

Background: There is a debate on the benefits and risks of transitioning from shod rear-foot-strike (RFS) running to barefoot forefoot-strike (FFS) or mid-foot-strike (MFS) running. There is currently no evidence about the training effect on the plantarflexor muscles during barefoot FFS/MFS running. Purpose: This prospective study is the first to quantitatively assess plantarflexor volume (VOL), peak torque (PT) and peak rate of torque development (PRTD) changes in a cohort of shod runners who transitioned to pure barefoot running (BFR). It was hypothesized that BFR would result in hypertrophic adaptations. Methods: Eight habitually shod RFS runners underwent an eight-week transition to BFR. Magnetic Resonance Imaging was used to measure muscle volumes of the medial and lateral gastrocnemius (V-MG, V-LG) and soleus (V-SOL). Dynamometry was used to measure isometric PT and

PRTD between 15° plantarflexion and 20° dorsiflexion. Measurements were made before and after the transition. Results: Post-transition, 7 runners adopted a FFS/MFS technique. Among these FFS/MFS runners, mean V-SOL, PT and PRTD increased 6.1% ($p<.05$), 9.2% ($p<.05$) and 10.5% ($p<.05$) respectively. The RFS subject demonstrated mean increases in PT and PRTD of 5.3% and 4.8% respectively. Conclusion: MDF/FFS barefoot running has a greater hypertrophic effect on the soleus than RFS running. This suggests that the soleus may be experiencing greater loads during barefoot MFS/RFS than indicated by previous research, possibly due to an increase in the eccentric component of loading. The Torque-Angle curves of the plantarflexors support this mechanism. This evidence is important for modifications in training programs for injury prevention, rehabilitation and performance enhancement.

UNDERGRADUATE DDS STUDENT-BASIC SCIENCE

Poster #: 120
Title: Antiresorptives and Periapical Disease Induce Osteonecrosis of the Jaw
Name: Simon Cheong
Faculty Advisor: Sotirios Tetradis

Background: Although inhibition of bone resorption is important in regulating unwanted osteolysis, bisphosphonate (BP) treatment is associated with potential complications, including osteonecrosis of the jaws (ONJ). The most commonly utilized antiresorptives are BPs, which directly affect osteoclast function and apoptosis. Lately, non-BP medications targeting osteoclast formation and differentiation, such as denosumab, have entered the clinical arena. Purpose: We recently developed an ONJ mouse model utilizing high-dose BP treatment in combination with experimentally induced periapical disease, emphasizing the importance of dental disease in ONJ pathophysiology. However, no other antiresorptives have been utilized to induce ONJ in animal models. Such studies would be important in providing support for the role of osteoclast inhibition in ONJ pathogenesis versus the possibility of a direct BP effect on oral tissues. Here, we extend our original report to test the ability of RANK-L inhibitors to induce ONJ in mice in the presence of periapical disease. Methods: Thirty C57BL/6J mice received intraperitoneal injections of either vehicle, RANK-Fc or OPG-Fc for 12 weeks. The crowns of the 1st/2nd mandibular molars were drilled to induce periapical disease. Results: Micro-CT analyses demonstrate radiographic evidence of ONJ in treated mice, including increased alveolar bone density, lamina dura thickening, and periosteal bone deposition. H&E histologic examination revealed that antiresorptive treatment resulted in periosteal bone formation, empty osteocytic lacunae, osteonecrosis and bone exposure. Conclusion: We present the first mouse model of non-BP antiresorptive-induced ONJ with radiographic and histologic features similar to human ONJ. Our findings suggest that osteoclast inhibition is pivotal to the pathogenesis of ONJ.

Poster #: 121
Title: Canonical and Non-canonical TGF β Signaling Role on Mandible Development
Name: Elenaz Sarshar
Faculty Advisor: Yang Chai

Background: TGFβ signaling plays a crucial role in craniofacial development, and loss of Tgfbr2 in CNC cells results in craniofacial skeletal malformations. Both diminished canonical and upregulated non-canonical TGFβ signaling cause craniofacial deformities in Tgfbr2 mutant mice. Although Tgfb2 haploinsufficiency rescued the CNC cell proliferation defect and cleft palate in *Tgfbr2$^{fl/fl}$;Wnt1-Cre* mice, mandibular defects were not rescued. In contrast, Tgfbr1/Alk5 haploinsufficiency rescued the CNC cell proliferation defect as well as palatal fusion and partially rescued mandibular defects in *Tgfbr2$^{fl/fl}$;Wnt1-Cre* mice. Purpose: To analyze the role of canonical and non-canonical TGFβ signaling on mandible development, using quantitative methods, to advance our understanding of mandibular development. Methods: We compared the size and the distance between the 14 different CNC-derived mandible landmarks (from E18.5 control, *Tgfbr2$^{fl/fl}$;Wnt1-Cre*, and *Tgfbr2$^{fl/fl}$;Wnt1-Cre;Alk5$^{fl/+}$* mice). The microCT images were collected using microCT (Scanco V1.28) with resolution at 20 µm from E18.5 embryos and reconstructed in 3D using Avizo 7.0 software. Results: We found that the size of CNC-derived craniofacial bone structures of the mandible (specifically coronary process, condylar process and Angular process) were significantly reduced in *Tgfbr2$^{fl/fl}$;Wnt1-Cre* mice compared to wild-type control mice. The reduction of the size of CNC-derived mandible was partially restored in *Tgfbr2$^{fl/fl}$;Wnt1-Cre;Alk5$^{fl/+}$*. Conclusion: Our data indicates that non-canonical TGFβ signaling is the main regulatory pathway which regulates the mandibular development.

Poster #: 122
Title: Proximity between the Mouse Incisor and Molars to Nerves
Name: Michelle Engel
Faculty Advisor: Yang Chai

Background: The apical region of the mouse molar contains mesenchymal stem cells (MSCs). Previous studies using label retaining techniques indicated that the neurovascular bundle (NVB) serves as a niche for MSCs in the mouse incisor. Further investigation using microCT imaging allows us to see the association between nerves branching off from the NVB and the apical regions of maxillary and mandibular molars. Purpose: The purpose of this study is to show where the inferior alveolar and maxillary nerves run in association with the molars in mice. Methods: Triple transgenic mice: *Wnt1-Cre;ROSA26LoxP-STOP-LoxP-tTA;tetO-H2BGFP* (WTH) were generated to obtain specimens with label retaining cells in the dental mesenchyme. Label retaining analysis using 4-6 week old WTH mice was followed by a four-week chase period. Images were taken using a Leica Inverted Flouresence Microscope at 10x objective. MicroCT images were collected using a Scanco V1.28 with a resolution of 10 µm from 1 month postnatal mouse and reconstructed in 3D using Avizo 7.0 software. Results: Imaging analysis confirmed the branching of the inferior alveolar nerve and maxillary nerve from the NVB. The images indicated a very close spatial association between the apical regions of the molars as well as incisors to the inferior alveolar and maxillary nerves. Conclusion: The alveolar and the maxillary nerves provide the apical regions of mouse incisors and molars with a niche for MSCs.

Poster #: 123
Title: Three-dimensional microCT Comparing Wild Type & Mutant Mouse Craniofacial Structures
Name: Shawn Ebrahimpour
Faculty Advisor: Yang Chai

Background: Craniofacial muscles and bones are highly complex, organized structures. As was demonstrated by our previous study, a high-resolution three-dimensional (3D) atlas furthers the study of the anatomy of craniofacial structures and will help with diagnosis and phenotype analysis. The wild type atlas serves as a useful standard of mouse craniofacial musculature to use as a baseline for comparison of various mutant models. Purpose: To generate a 3D volumetric comparison of wild type and mutant craniofacial muscles using 10 µm microCT scans of newborn mice. Methods: Four newborn wild type (C57BL/6J) and mutant (*Msx1, K14-Cre;Fgrfr2, K14-Cre;Tgfbr2*) mice were scanned by microCT (Scanco V1.28) at 10µm thickness to generate images which were reconstructed in 3D using Avizo 7.0 software. Using our systematic protocol of landmark analysis on coronal, sagittal and transverse sections, we labeled intrinsic and extrinsic muscles of the tongue and soft palate. Variability was initially tested between the mutant specimens. Next, an overall volumetric and phenotypic comparison was carried out between the mutant and the wild type specimens. Results: We were able to distinguish between the extrinsic and intrinsic muscles of the tongue and soft palate, and successfully compare the volume and phenotypes of twelve craniofacial muscles and bones between the wild type and mutant specimens. Conclusion: In this study we successfully generated a volumetric analysis of the craniofacial muscles of newborn wild type and mutant mice. Volumetric and phenotypic data were generated at a resolution of 10 µm, the highest resolution

ever achieved for these muscles. Furthermore, we demonstrated a decrease in mutant muscle volume compared to wild type controls. Our novel 3D imaging modality may be useful in yielding valuable data in the study of craniofacial defects in various mouse models.

Poster #: 124
Title: TGFβ Signaling during Craniofacial Bone Development: An Update
Name: Hoang-Anh Ho
Faculty Advisor: Yang Chai

Background: Craniofacial skeletal elements are primarily formed by intramembranous ossification through a mechanism that remains relatively uncharacterized. The majority of osteoblasts and chondrocytes in the craniofacial region are derived from cranial neural crest (CNC) cells, which produce the facial skeleton. TGFβ signaling plays a crucial role in craniofacial development, and loss of Tgfbr2 in CNC cells results in craniofacial skeletal malformations. We have recently reported that both diminished canonical and upregulated non-canonical TGFβ signaling cause craniofacial deformities in Tgfbr2 mutant mice. Purpose: The aim of this study is to describe to what extent canonical and non-canonical TGFβ signaling cascades contribute to CNC-derived intramembranous ossification as well as establishing landmarks of CNC-derived bones. Methods: We compared the size and volume of CNC-derived craniofacial bone structures (premaxilla, maxilla, palatine bone, and mandible) from E18.5 control, *Tgfbr2$^{fl/fl}$;Wnt1-Cre* (diminished canonical and upregulated non-canonical TGFβ signaling), and *Tgfbr2$^{fl/fl}$;Wnt1-Cre;Alk5$^{fl/+}$* (diminished canonical and restored non-canonical TGFβ signaling) mice. The microCT images were collected using microCT (Scanco V1.28) with resolution at 10 μm from E18.5 embryos and reconstructed in 3D using Avizo 7.0 software. Results: We found that the size and volume of CNC-derived craniofacial bone structures were significantly reduced in *Tgfbr2$^{fl/fl}$;Wnt1-Cre* mice compared to wild-type control mice. The reduction of the size and volume of CNC-derived maxillary bones (premaxilla, maxilla, palatine, and mandible) were partially restored in *Tgfbr2$^{fl/fl}$;Wnt1-Cre;Alk5$^{fl/+}$* mice. Conclusion: Our data indicate that intramembraneous bone formation is mainly regulated by non-canonical TGFβ signaling.

Poster #: 125
Title: Antifungal Activity of Flavonoids Against Candida albicans
Name: Christopher Patuwo
Faculty Advisor: Ramiro Murata

Background: Oral candidiasis (OC) is a significant opportunistic infection that often presents as a complication to existing conditions. The infection is conventionally managed with antifungals such as nystatin and fluconazole; however, there is a recent increase in OC that is resistant to these current drugs that necessitates the search for novel therapeutics. Flavonoids are natural products commonly found in plants that have shown to have biological activity against Candida albicans. Purpose: The aim of this in vitro study was to test the antimicrobial activity of flavonoids myricetin and quercetin against C. albicans. Methods: The minimum inhibitory concentrations (MIC) were determined according to NCLLS guidelines. C. albicans (ATCC: 90028) at 2.5 x 10^3 cells/mL was cultured in RPMI-medium at 37°C in 5% CO_2 for 24 hours (n=9) and serial dilutions of myricetin (0.7-7000 μM) and quercetin (4.5-4500 μM). Fluconazole (3.27 μM) and solutions with 1% DMSO served as positive and vehicle controls respectively. The MIC was determined after 24h. Results: Myricetin and quercetin inhibit C. albicans growth and an MIC was established as 30 μM and 25 μM respectively. Conclusion: Myricetin and quercetin had inhibitory effects on fungal growth that prove promising as novel antifungal agents.

Poster #: 126
Title: Antimicrobial Activity of Dental Adhesive Incorporated with New Antibacterial Agents
Name: Nikkie Tomblin
Faculty Advisor: Ramiro Murata

Background: Dental caries is the most prevalent oral infectious disease in the world. It is usually treated by removal and replacement of infected tooth tissues with restorative materials, including adhesively bonded resin composites. Most restorations fail within 5-7 years due to development of secondary caries. By incorporating antibacterial agents into an adhesive system we expect to increase the resistance of composite restorations against secondary caries and enhance the durability of such restorations. Purpose: To investigate the minimal inhibitory concentration (MIC) and minimal bactericidal concentration (MBC) of epigallocatechin gallate and myricetin incorporated with the adhesive system, and to evaluate if treatment can inhibit formation and cause disruption of the Streptococcus mutans biofilm without toxicity. Methods: The effects of epigallocatechin gallate and myricin on S. mutans, their MIC and MBC will be calculated. Then, S. mutans UA159 biofilms will be formed on polymerized composite discs while placed in batch cultures at 37°C and 5% CO_2. Tryptone-yeast extract broth containing 1% sucrose will be changed daily. After the 5th day, the biofilms (n=12) will be harvested for determination of the biofilm morphology by fluorescence microscopy and assessment of distribution of dead and live cells using the LIVE/DEAD BacLight Viability. Results: N/A Conclusion: N/A

Poster #: 127
Title: Synergistic Anti-fungal Activity of Flavonoids against Candida Albicans
Name: Keane Young
Faculty Advisor: Ramiro Murata

Background: Candida albicans is the major contributor to oral candidiasis in HIV infected individuals. Anti-fungal agents such as Fluconazole and Nystatin traditionally treat this condition. Recently flavonoids, found in plants and fruits, were discovered to exhibit similar effects on Candida albicans compared with traditional medications. Purpose: To test the synergistic antifungal effect in vitro of flavonoids Myricitin and Quercitin when they are combined against C. albicans. Methods: C. albicans (ATCC: 90028) at 2.5 x 10^3 cells/mL was cultured in RPMI-medium at 37°C in 5% CO_2 for 24 hours (n=9) according to NCLLS guidelines. Using determined Minimum Inhibitory Concentration (MIC) as a baseline, 25 μM and 30 μM for Quercitin and Myricitin respectively, the synergistic MIC concentrations of Quercitin and Myricitin were determined by testing a range from diluting the known MIC by half concentrations. Quercitin (1.56 μM – 25 μM) Myricitin (1.88 μM – 30 μM). Fluconazole (3.27 μM) and solutions with 1% DMSO served as positive and vehicle controls respectively. The MIC was determined after 24h. 20 μL of each solution from the cell culture well plates were plated on blood agar to determine the Minimum Fungicidal Concentration. Results: When mixed together, Myricitin and Quercitin inhibit C. albicans growth and an MIC was established as 15 μM and 12.5 μM respectively. The MFC was determined to be at 15 μM and 12.5 μM for Myricitin and Quercitin respectively. Conclusion: Myricitin and Quercitin synergistically inhibited fungal growth and proved to be more effective when used combining the flavonoids.

UNDERGRADUATE DDS STUDENT-CLINICAL SCIENCE

Poster #: 128
Title: Bond Strength of Composite Bonded to Dentin Treated with Desensitizers
Name: Rajan Gupta

Background: The treatment of hypersensitivity involves sealing of dentinal tubules or application of sedative agents and promotion of dentin remineralization. Some ingredients present in dentin desensitizers may induce chemical interaction with organic substances of the dentin that may consequently affect the sealing and bonding characteristics of the adhesive systems. The current study aims to evaluate the effect of pre-treatment of dentin with three different desensitizers: a Pro-Argin, a fluoride and a triclosan-containing desensitizer, on the bond strength of self etch composite. Purpose: The present study evaluated the effect of different desensitizers on the bond strength of self-etch composite to dentin. Methods: Study was conducted at Army College of Dental Sciences, Secunderabad after approval from the Research Commit-

tee. Forty freshly extracted intact premolars were taken and divided into four groups: Control group (C), and three desensitizer groups, namely, Pro-Argin (CP), Triclosan (T) and Fluoride (F) desensitizer groups. Specimens were embedded in acrylic resin and mid-coronal dentin was exposed. Teeth in desensitizer groups were treated with desensitizer paste and stored in distilled water for one week while no agent was applied in the control group. Self etch composite blocks were built on the dentin surfaces of all teeth and subjected to bond strength testing in a Universal testing machine. Results: The mean bond strength of the control was 18.3Mpa with a standard deviation of 1.72. For the desensitizer group, the mean bond strengths were 15.8Mpa (1.57 S.D.) for Pro-Argin, 15.75 Mpa (1.70 S.D.) for Triclosan and 8.39Mpa (2.96 S.D.) for Fluoride. Conclusion: All three desensitizers adversely affected the bond strength of self-etch composite. Fluoride desensitizer resulted in least values for bond strength. Pro-Argin and triclosan groups resulted in lowering of bond strength to a lesser extent.

Poster #: 129
Title: Keratocystic Odontogenic Tumor: Conservative treatment (Marsupialization): Histochemical Markers and Case-report
Name: Omid Hemmat
Faculty Advisor: Stan Hanes

Background: Odontogenic keratocyst (OKC) or Keratocystic odontogenic tumor (KCOT), as recognized by the latest World Health Organization report, has been known for its aggressiveness and propensity for recurrence. In this article, a large KCOT was treated by marsupialization and decompression with placement of a silastic catheter in order to keep the cavity open and for irrigation. A second stage enucleation of the tumor and surgical removal of the contained impacted 3rd molar was performed to avoid damage to vital structures. Purpose: We are reporting the effective management of KCOT with marsupialization and decompression changes the epithelium to a less aggressive form and this is thought to be due to a favorable relationship between inflammation and KCOTs. Methods: Histological specimens are shown at both the initial surgery and the second stage surgical procedure and these show the favorable changes encountered with KCOT linings and inflammation, most notably the changes in Bcl-2 expression. Some of the other various methods of treating large KCOTs are discussed. Results: In this article, we review the immunohistochemical cellular markers that pertain to KCOTs and potentially impact upon the behavior of the tumor. Conclusion: This may further instigate further investigations and understandings of the well-documented propensity for aggressiveness and recurrence, which may also shed more light on decision-making and management options in the future.

Poster #: 130
Title: Comfort of Senior Dental Students with Pediatric Dentistry upon Graduation
Name: Aaron Kang
Faculty Advisor: Julie Jenks

Background: Undergrad dental students at Ostrow School of Dentistry at USC have very structured pediatric dental experiences. Sophomore students have pre-clinic experience and lecture and lab classes. Junior students have junior block and clinical rotation as well as QueensCare. Senior students have QueensCare. Also there are other available clinical rotations such as multiple available community services. Purpose: The purpose of this study was to determine the comfort level of senior dental students with pediatric dentistry upon graduation. The survey seeks information across a comprehensive range of pediatric dentistry training including behavior management and clinical procedures such as treatment planning, prophylaxis, and operative treatment on children aged 0 to 5 years old. The information from this survey is being utilized to improve the pediatric dentistry training received by dental students. Methods: A 20 question written survey was administered to senior dental students when they signed out of pediatric dentistry. Comparison between male vs. female, mobile clinic vs. non-moblie clinic, advanced education vss non-advanced education, pedo study club vss non-pedo study club, pedo selective vs. non-pedo selective, and involved in community service vs. not involved in community service were made and analyzed. Results: The response rate for graduating seniors to the survey was 98%. Regarding behavior management of patients during the dental examination and treatment plan, student doctors who are involved with pedo selective, pedo study club, and had more mobile clinic and community service experiences are more comfortable treating pediatric patients from 0 to 5 years old. Also, student doctors who seek advanced education in pediatric dentistry have a higher comfort level with treating pediatric patients. Regarding behavior management of patients during operative procedures, two-thirds of respondents were uncomfortable with treating children form 0 to 5. Students who are involved in mobile clinic, pedo study club, pedo selective, and community service and who planned attending pediatric residency programs are more comfortable treating pediatric patients than other classmates. Conclusion: Students who attended mobile clinic and other community rotations responded that they were comfortable with treating infants and toddlers. Most senior dental students with pediatric dentistry experience upon graduation were proficient with providing an initial dental examination and treatment plan, but reported having difficulty with operative dental procedures with infants and toddlers.

Poster #: 131
Title: In Vivo Analysis of Human Twist1 Enhancer in Neural Crest
Name: William Ciozda
Faculty Advisor: Ruchi Bajpai

Background: Enhancers are short genomic regions that can bind specific proteins to increase transcription levels of target genes and play a pivotal role in gene regulatory networks. TWIST1 is essential for craniofacial development and is associated with Seathre-Chotzen Syndrome. TWIST1 is dynamically regulated but its craniofacial-relevant regulatory regions or proteins are not known. Identifying the enhancer for TWIST1 is a priority for its future use as a tool for purifying TWIST1 expressing cells for craniofacial repair. Purpose: My goal was to identify, validate and characterize the putative TWIST1 enhancer. Methods: My approach was to (i) amplify the putative TWIST1 enhancer, GR23, from the human genome and clone it in tol2-transposon based shuttle-vector with a GFP reporter, (ii) stably integrate GR23 vector into the Zebrafish genome by tol2-mediated transgenesis, (iii) characterize the Gr23 driven GFP expression in F2 generation, and (iv) develop TALEN based tools to determine enhancer–promoter interaction and novel regulators of TWIST1 expression. Results: We have generated stable transgenic Zebrafish lines carrying the human GR23 enhancer driving eGFP from a minimal promoter. The TWIST1 zebrafish embryos have a restricted pattern of expression similar to zebrafish twist1a gene. We have also generated sets of TALENs that target and cut in the vicinity of GR23 enhancer for knockout and biochemical pull down assays. Conclusion: GR23 appears to be a TWIST1 enhancer. We will determine direct interaction between the GR23 enhancer and TWIST1 promoter by chromatin cross-linking and pull-down assays.

February - June 2014

ORAL SURGERY FOR THE GENERAL PRACTITIONER
Sat, February 1, 2014

IMPLANT CPR! SUCCESSFUL MANAGEMENT OF PROSTHETIC IMPLANT COMPLICATIONS
Module I - Lecture: Fri, February 7, 2014
Module II - Hands-On Workshop: Sat, February 8, 2014

EMERGING DISEASES, INFECTION CONTROL AND CALIFORNIA DENTAL PRACTICE ACT
Sat, February 7, 2014

MASTERING MOLAR ENDODONTICS
Fri - Sat, February 21 - 22, 2014

PORCELAIN VENEERS: OPTIMIZING RESULTS USING SUPRA-GINGIVAL PRINCIPLES, AND UNDERSTANDING ADHESION AND OCCLUSION
Fri, February 28, 2014

IMPLANT THERAPY IN THE ESTHETIC ZONE
Fri - Sun, February 28 - March 2, 2014

SURGICAL AND PERIODONTAL PERSPECTIVES ON IMPLANT TREATMENT PLANNING
Fri, March 7, 2014

USC RUTH RAGLAND 28TH DENTAL HYGIENE SYMPOSIUM
Sat, March 8, 2014

FUNDAMENTAL PRINCIPLES OF RESTORATIVE IMPLANT DENTISTRY FOR THE SINGLE MISSING TOOTH
Part I - Lecture: Fri, March 14, 2014
Part II - Hands-On: Sat, March 15, 2014

LAS VEGAS TRAVEL & LEARN PROGRAM: PERIODONTAL SURGERY AND SUTURING TECHNIQUES FOR THE GENERAL PRACTITIONER - A HANDS-ON COURSE
The Cosmopolitan of Las Vegas - Sat, March 15, 2014

ESTHETIC FULL-MOUTH IMPLANT RECONSTRUCTION: FROM TREATMENT PLANNING TO FIXED RESTORATION
Module I - Lecture: Fri, March 21, 2014
Module II - Lecture: Sat, March 22, 2014
Module III - Hands-On Workshop: Sun, March 23, 2014

OBSTRUCTIVE SLEEP APNEA, SNORING AND DENTAL ADVANCEMENT
Fri - Sat, March 28 - 29, 2014

MASTERING BONE GRAFTING FOR ESTHETIC IMPLANT SITE DEVELOPMENT
Module I - Lecture: Sat, March 29, 2014
Module II - Hands-On Workshop: Sun, March 30, 2014

BASIC PROTOCOLS IN BONE AND SOFT TISSUE GRAFTING IN IMPLANT THERAPY
Fri - Sun, April 4 - 6, 2014

COMMON ORAL LESIONS: SOFT & HARD TISSUE DISEASES
Fri, April 11, 2014

ESTHETIC UPDATE IN ADHESIVE DENTISTRY
Module I: Fri - Sat, April 11 - 12, 2014
Module II - Part I: Fri - Sat, May 2 - 3, 2014
Module II - Part II: Fri - Sat, June 20 - 21, 2014

INTERMEDIATE DENTAL IMPLANT RESTORATIVE PRINCIPLES, PROCEDURES AND PROTOCOLS (LAS VEGAS, NEVADA)
Part I - Lecture: Fri, April 25, 2014
Part II - Hands-On: Sat, April 26, 2014

GENOMICS FOR CLINICAL DENTISTRY
Sat, April 26, 2014

APPLIED HYPNOSIS: TREAT PAIN, TMD & OTHER DENTAL CONDITIONS
Sat - Sun, April 26 - 27, 2014

LEARNING IMPLANT DENTISTRY FOR THE RESTORATIVE DENTIST
Sat, May 3, 2014

EXTRACTION SITE MANAGEMENT
Module IA - Lecture: Sat, May 3, 2014
Module IB - Hands-On: Sat, May 3, 2014

PHYSICAL EVALUATION
Mon, May 5, 2014

EMERGENCY MEDICINE
Tues, May 6, 2014

PHARMACOLOGY
Wed, May 7, 2014

MONITORING AND SIM-MAN
Thurs, May 8, 2014

ADVANCED RESTORATIVE OPTIONS WITH DENTAL IMPLANT FOR FULLY EDENTULOUS ARCHES
Part I - Lecture: Fri, May 9, 2014
Part II - Lecture & Hands-On: Sat, May 10, 2014

COMPREHENSIVE PERIODONTAL SURGERY: ESTHETIC AND FUNCTIONAL PROCEDURES FOR THE GENERAL PRACTITIONER
Pre-Course Lecture: Thurs, May 29, 2014
Module I - Lecture & Workshop: Fri, May 30, 2014
Module II - Lecture & Workshop: Sat, May 31, 2014
Module III - Lecture & Workshop: Sun, June 1, 2014

Ostrow School of Dentistry of USC
Office of Continuing Education

Ostrow School of Dentistry of USC
Office of Continuing Education
Phone: 213.821.2127
Fax: 213.740.3973
E-mail: cedental@usc.edu
Website: www.uscdentalce.org

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2013 - 2014

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