

THE EXPLORER

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THE EXPLORER





DEAN'S ADDRESS

Dear Students and Colleagues,

Our annual Research Day is always a very exciting time. Every year, as students and faculty share their scientific work, enjoy eye-opening keynote speakers, and honor the year's top projects, I find myself thinking about how bright the future of dentistry is.

Since the Ostrow School of Dentistry's founding in 1897, we have been on the forefront of dental and craniofacial scientific inquiry, from uncovering the mysteries of the developing face to creating the technical innovations that become dentistry standards. Each year, our faculty members continue to publish more high-impact, groundbreaking work than ever before, ensuring that our legacy as a scientific powerhouse continues. The graduate students and postdoctoral researchers who work with our faculty are provided with the mentorship and opportunities that help them become the next generation of great dental and craniofacial scientists.

This research powers the progression of the dentistry field, but it also has another important effect. When dental students, dental hygiene students, and specialty residents participate in research, it enriches their education in a way no other experience can. Conducting research can encourage students to better appreciate the role that science plays in their clinical practice and commit to remaining informed about new dental developments after they graduate, which in turn means that their future patients receive the best in evidence-based care.

A strong research environment makes for stronger graduates, no matter what their professional goals are. Seeing the wide scope of Ostrow students' involvement in research assures me that today's Ostrow students will go on to lead this profession on both clinical and academic fronts, just as their fellow alumni have done for more than a century.

Fight On!

Avishai Sadan, DMD

Dean

G. Donald and Marian James Montgomery

Professor of Dentistry

Ostrow School of Dentistry of USC

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DEAN'S ADDRESS
Avishai Sadan, DMD

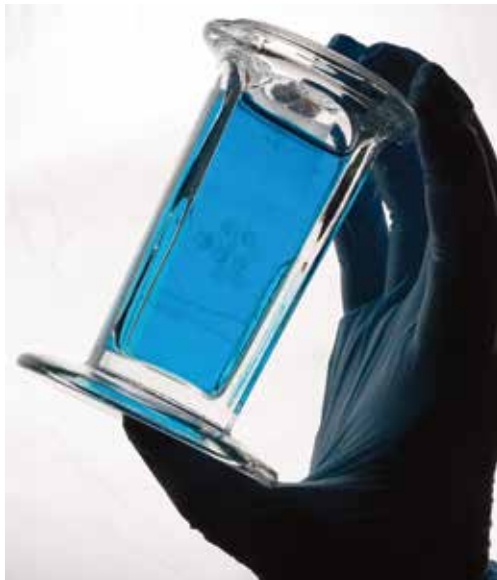
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WELCOME!

Dear Students and Colleagues,

Welcome to Research Day 2013! This annual event provides an exciting opportunity for all of us to celebrate the research discoveries of our innovative students, staff and faculty.

We at the Herman Ostrow School of Dentistry are proud to be part of the University of Southern California, an elite institution that places great value on excellence in research endeavors and on preparing students to become leaders in fields such as science and health care. We are particularly thrilled that the Ostrow School Student Research Group has been recognized for their enthusiastic dedication to this mission as well. Their publication, *The Explorer*, has won two richly-deserved accolades, the 2012 American Association of Dental Editors Lawrence H. Meskin Student Journalism Award and the 2011 American Association for Dental Research National Student Research Group Best Student Journal Award.

The faculty, staff, and students of the Ostrow School are dedicated to the mission of advancing education, scholarship, and patient services in dental and cra-

niofacial health and well-being. Our Biokinesiology and Physical Therapy as well as Occupational Science and Occupational Therapy programs continue to be national leaders in education and research. We provide students with a strong biomedical foundation that gives them the tools to tackle important problems affecting oral, dental, craniofacial, and general systemic health. Furthermore, we strive to translate our basic discoveries from scientific insights into practical health care. Looking towards the future, we will continue our quest to provide the best possible research opportunities for our students, and to equip them with the critical thinking skills, clinical training, and cutting-edge research experience necessary to advance the forefront of scientific knowledge and shape the future of health care.

Please join me in congratulating our students and post doctoral fellows on their successes as you explore the many excellent research projects being showcased during our Research Day.

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*



BATTLING THE CHALLENGES OF PERIODONTOLOGY

WORDS BY TIFFANY LEE AND PAYAL PATEL



Dr. Homayoun Zadeh, who just celebrated his 25 year reunion with the USC School of Dentistry, is currently the director of the postdoctoral periodontology program, the Laboratory for Immunoregulation and Tissue Engineering (LITE) and also maintains a part-time private periodontology practice. Dr. Zadeh has always been interested in periodontology because of its strong biological basis, room for inquiry, and ability to provide long term comprehensive care. His research incorporates the two major challenges faced in periodontology: 1. bone regeneration and 2. the pathophysiology of biofilm induced infection and the immune response.

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THE EXPLORER

Alveolar bone regeneration has been a topic of interest in periodontal research for many years, and there have been multiple forms of treatment developed. Bone grafts have generally been used in the past, but patients consider them unfavorable because of their invasive nature and long recovery time. The “Era of Biologics” has introduced the use of growth factors (GFs) to regenerate alveolar bone. A therapeutic growth factor, approved by the FDA for oral maxillofacial application in 2007, is recombinant human bone morphogenetic protein-2 (rhBMP-2). While rhBMP-2 has been therapeutically applied, there are many disadvantages, including the high cost which ranges from \$3,000-\$5,000 per dose. In addition, exogenous GF treatment also conflicts with the natural biology of wound healing by creating an influx of growth factors as opposed to the steady increase of the normal healing mechanism.

Instead of using these exogenous GFs, Dr. Zadeh developed the idea in 2006 to use antibodies to capture endogenous GFs to stimulate the regeneration of atrophic bone. The use of antibodies for treatment purposes has been on the rise due to its safety, specificity, and diverse nature, but his lab is the first to utilize antibodies for the purpose of bone regeneration. This concept is called Antibody Mediated Osseous Regeneration (AMOR). It involves binding GF-specific antibodies to a matrix scaffold, such as collagen, and then implanting this scaffold into the area of alveolar bone loss. His theory behind AMOR is that antibodies will capture and concentrate GFs to amplify the body’s intrinsic bone healing mechanism. The traditional bone graft acts as an osteoconductor, directing bone to grow on top of it, but when antibodies capture GFs, an osteoinductive mechanism is initiated. This induces healing and bone formation. In vitro and in vivo studies have helped demonstrate efficacy of this technique not only at USC, but

also in multiple countries. Figure 1 demonstrates through micro-CT analysis that the collagen sponges implanted with BMP-2 specific antibody clones did result in de novo bone formation. At USC, AMOR has been successfully tested on the cranial bone and tibia of rats and rabbits. In Asia, it has been tested on non-human primates and the jaws of dogs. These models have shown efficacy and no contraindications up to this point. However, further animal studies are required to ensure the safety and efficacy before moving to clinical trials.

The second branch of his research attempts to understand how oral biofilms, whether from teeth or implants, cause infection. In collaboration with Dr. Casey Chen, Dr. Zadeh is studying the virulence factors and genes of biofilm, as well as the host’s specific immune response. Bacteria grow in two different states: planktonic and biofilm. Planktonic bacteria are single-cells, whereas biofilms are organized communities of bacteria. Most infections are caused by bacteria in biofilm. However, the majority of research has tested bacteria in the planktonic state. Many biofilm bacteria subvert the immune response, allowing them to persist in the host and are difficult to eliminate clinically. Since infectious microbes tend to be in the biofilm form, their research relies on analyzing the pathophysiology of this specific state. Initially, his lab, along with many other research groups, inoculated animals with the bacteria in vivo but found that the host immune system would prevent the formation of a biofilm. In response, they designed a specific model in which biofilms were developed on titanium implants before placing them into the animal models. Figure 2 shows a successful establishment of *A. actinomycetemcomitans* biofilm on titanium implants. The National Institute of Health has awarded Dr. Chen and Zadeh a five-year grant to characterize the bacterial and host components involved in this biofilm mediated osteolytic infection model.

Even though his research targets periodontology, it has the potential to be applied to other aspects of healthcare. The use of AMOR in alveolar bone regeneration may have future applications to different types of bones in other parts of the body. A better understanding of the mechanism of infection caused by biofilm can also contribute to future studies on biofilms of other systemic etiologies. Although a recognized researcher, he attributes many of his ideas to his clinical experience and hopes to translate the results of his studies to patient care. He identifies with the values of being a clinician scientist because his first hand experiences with patients have allowed him to address major issues through his research and believes that there is a greater need for such clinician scientists in order to better improve the quality of care.

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FIGURE 1

Micro-CT analysis of bone volume within rat calvaria. Absorbable collagen sponge (ACS) alone (Neg) or with immobilized Abs were implanted within rat calvarial defects. The Abs used included isotype-matched Ab (Iso), polyclonal anti-BMP-2 Ab (pAb), or BMP-2-specific mAb clones (C3, C7, C9, C13, C18, C21, C22, C24, 4B12, and 3G7). Animals were scanned with micro-CT at 2, 4, and 6 weeks after surgery. Representative three-dimensional reconstructed calvarial specimens are shown in A. Bone volume within calvarial defects was quantified at each time point. Means and standard deviations of the volumetric measurements from replicate animals are shown in B. Statistical significance was assessed by Student's two-tailed paired t-test (* $p < 0.05$; ** $p < 0.01$, compared with isotype). CT, computed tomography; Abs, antibodies.

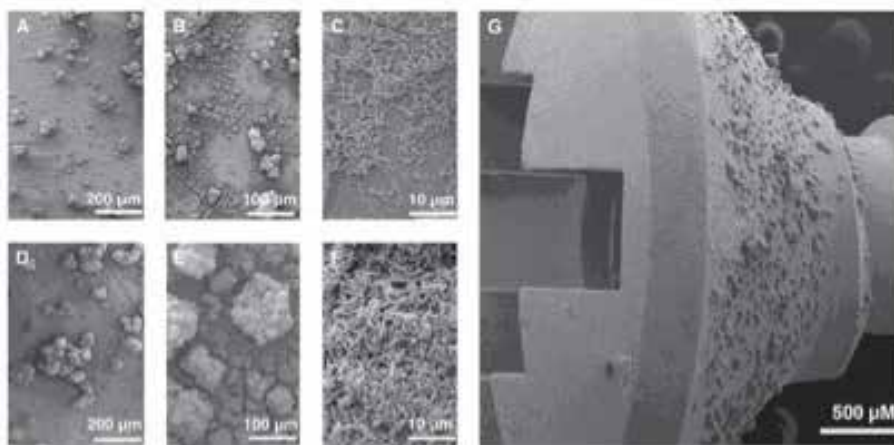
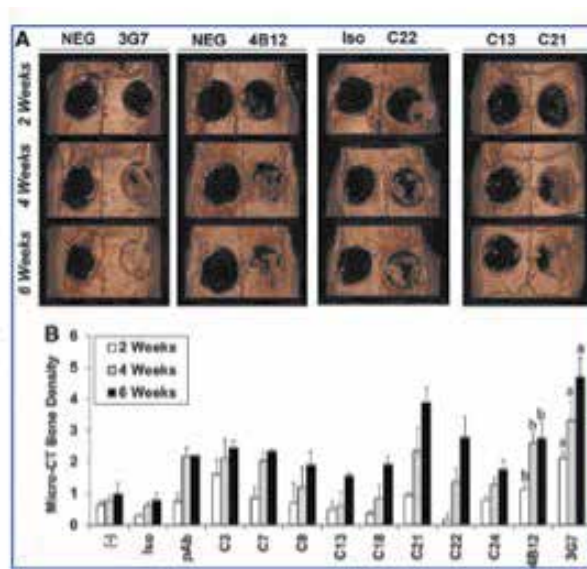


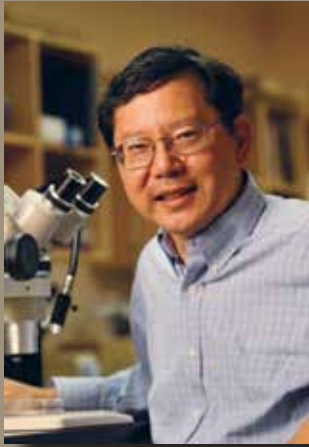
Figure 2.

In vivo establishment of *A. actinomycetemcomitans* biofilm on titanium implants. Machined and rough titanium implants were incubated in culture media inoculated with *A. actinomycetemcomitans* D75-1 for 1 to 3 days. SEM images of established biofilms on machined (A through C) and rough (D through G) titanium implants after 1 (A and D), 2 (B and E), and 3 (C, F, and G) days of culture.

DISTRACTION OSTEOGENESIS AND THE ACCELERATORY PHENOMENON

WORDS BY BRIAN GOO, SOO KYUNG LEE, AND CLAIRE LEEWING

DR. STEPHEN YEN



"All these projects are derived from my patients' needs. The research is part of the problem-solving process. When you work with patients with facial birth defects, their problems are quite extreme and challenging. We face a lot of problems that are hard to solve... and a lot of times the conventional ways of doing things don't always work."

After completing his DMD at Harvard, Dr. Stephen Yen came to USC for his residency in Orthodontics and PhD in Craniofacial Biology. Now one of the most influential and renowned clinicians and researchers in treating craniofacial birth defects, his focus on translational and clinical research is driven and inspired by the fresh challenges brought to him with each patient.

One of Dr. Yen's current main projects hopes to improve the treatment and outcomes of children with cleft lip and palate. A common surgical approach to treating the severe underbite seen with cleft lip and palate is a combination of orthodontics and orthognathic surgery to properly align the occlusion and improve facial aesthetics. Because this procedure is highly invasive, requires six to eight weeks of recovery time, does not take place until after adolescent growth is complete, and can relapse even when done correctly, Dr. Yen wondered, "What's the best way to treat these patients? Are there alternative treatments that are available to the patient? Can maxillary lengthening be done without surgery or with smaller surgeries?"

As a non-surgical alternative to orthognathic surgery, Dr. Yen is hoping to increase the mobility of the maxilla by utilizing a palatal expander to alternate expansion and contraction forces on the maxillary sutures or use small

surgeries to loosen the maxilla. Once mobilized, the maxilla can be advanced with headgear and elastics. "It doesn't work all the time, but in a cooperative patient it is 70-80% successful, and if it doesn't work, the patient can still have surgery," says Dr. Yen. His research, in collaboration with other major children's hospitals including Seattle Children's Hospital, examines cephalometric images, study models, and patients' quality of life before and after procedures. "Both surgical and non-surgical protraction cases have risks for relapse," says Dr. Yen, "so studying the mechanisms behind relapse is also important."

Another research project that Dr. Yen and his colleagues are conducting developed from his earlier studies on distraction osteogenesis. Distraction osteogenesis is a surgical technique that exploits the fracture healing process to lengthen bone. Currently, surgeons and orthodontists have used distraction osteogenesis with complete cuts in the alveolar bone to lengthen bone and to reposition bone segments in the face. But when a corticotomy, or partial cut, is made, the bone response is different. Alveolar bone initiates a rapid bone remodeling response that has been exploited to accelerate tooth movement. When bone initially demineralizes, teeth can move rapidly through the demineralized bone before the bone remineralizes. This rapid metabolic period during bone healing, known as the regional acceleratory phenomenon, is the focus of Dr. Yen at the Center for Craniofacial Molecular Biology.

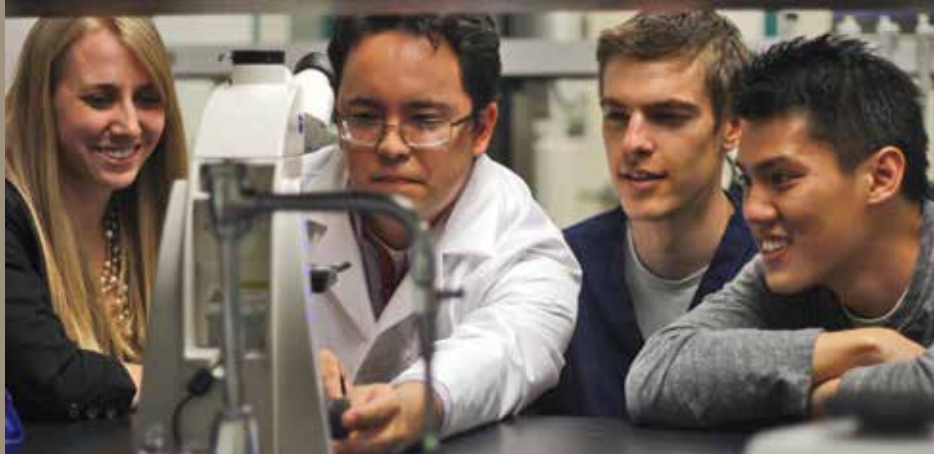
Although regional acceleratory phenomenon has shown success in significantly shortening orthodontic treatment times, it still requires a surgical incision. What if the bone reaction could be produced without surgery? Dr. Yen is therefore currently investigating whether there is an alternative method for producing the same rapid bone response and tooth movement without relying on surgery. The strategy Dr. Yen and colleagues are examining uses infrared light to penetrate the mucosa and stimulate a regional acceleratory phenomenon in alveolar bone, comparable to the bone response following corticotomies. In randomized clinical trials, Dr. Yen's colleagues found

that it is possible to achieve a 40-50% reduction in orthodontic treatment time using light stimulated therapy. To address the basic science behind this phenomenon, Dr. Yen wanted to know whether light causes a change in gene expression in the target cells. He used microarray and protein analyses on human bone marrow cells to see whether light can stimulate bone cells to change their gene expression and cause bone remodeling. The research team found that when applying two different wavelengths of infrared light on to the cells, specific genes, such as interleukins and matrix metalloproteinases, are activated and that different pathways are activated as the wavelength and energy levels changed. Through this research, Dr. Yen hopes to address conflicting results in the literature that were conducted under different conditions, and thus, to provide a model for bone remodeling and regional acceleratory phenomenon without surgery.

Treatment of a wide range of craniofacial patients requires integration of dental and medical specialties to form a team that finds solutions unique to each patient's needs. Though his work is truly innovative, it is his humble nature and love of collaboration in the clinic and in research that shines through. "Professionally, I live at the border of surgery and orthodontics. I don't treat patients by myself. The Dental Department is on the same floor as Plastic Surgery and Oral Maxillofacial Surgery so we can flow back and forth because we share the same patients," says Dr. Yen. "The people at CHLA really like being with kids and treating them. A lot of people could have gone on to different paths but what really keeps them there for a very long time is real enjoyment of working with kids and a love for solving problems together." The ability to collaborate is also the root of the USC specialty programs' strength. The great volume and variety of cases that are seen between the different USC-affiliated centers encompass the full range of practice for orthodontics and oral surgery, allowing for a very collegial learning environment. "Oral surgery is not in competition with plastic surgery or ENT but works together with other surgical disciplines. That doesn't always happen at a lot of centers. We're just happy to have help from everyone."

PHARMACOGNOSY: A SEARCH FOR NATURAL COMPOUNDS TO COMBAT DISEASE

WORDS BY ROBERT BERGER, CHRISTOPHER PATUWO, AND NICHOLE TOMBLIN



Pictured (left to right): Nichole Tomblin, Dr. Ramiro Murata, Robert Berger, and Christopher Patuwo

Finding himself completely transplanted miles across the other side of the country, Dr. Ramiro Murata spent these past few months ensuring that his move from New York University to the Ostrow School of Dentistry would be a smooth one. He worked diligently to order equipment, recruit lab members, and make sure samples from his ongoing projects followed him uncompromised – something which proved a bit more complicated due to the power outages during Super Storm Sandy. Dr. Murata's work with *Streptococcus mutans* showed promising results for the potential use of natural compounds as anti-caries agents. As a dentist armed with a PhD in pharmacognosy, Dr. Murata is setting up his new lab to further explore the application of various natural compounds to combat pathogens of the oral microenvironment.

Pharmacognosy is a branch of pharmacology that focuses on the search for new drugs from natural sources. Rather than mixing ingredients to synthesize drug compounds in a laboratory, researchers in pharmacognosy navigate the chemical diversity of secondary metabolites from plants and microorganisms to explore their candidacy for drug development. This use of natural products to prevent and treat infectious diseases dates back several thousand years and its applications in dentistry represent an important approach to new drug development against oral pathogens. Dr. Mu-

rata's research has focused on the antimicrobial activity of natural compounds against cariogenic bacteria, namely *Streptococcus mutans*. One compound that has showed great promise is the fruit of *Rheedia garneriana*.

The bacupari fruit of *Rheedia gardneriana* is a native of South America and traditionally used in folk medicine. Previous studies analyzing the chemical constituents of *Rheedia* have reported that polyphenylated benzophenones have antibacterial activity and may be the compound responsible for *Rheedia*'s pharmacological properties. 7-epiclusianone, a benzophenone, was found to be a main component of the fruit pericarp and was purified by high performance liquid chromatography. The activity of 7-epiclusianone was then tested against *S. mutans*.

S. mutans, a key pathogen implicated in the initiation of dental caries, is able to establish pathogenicity through virulence factors that facilitate biofilm formation and acidogenicity. *S. mutans* possesses the enzyme glycosyltransferase (GTF), which synthesizes glucans necessary for binding to the smooth surfaces of teeth. The insoluble glucans facilitate colonization of the bacteria and subsequent biofilm formation. The F-ATPase enzyme is associated with the acidogenic metabolism of *S. mutans*. When the activity of these key enzymes was individually assayed with 7-epiclusian-

one, the compound showed significant dose-dependent inhibition of GTF and F-ATPase activity. More general culture assays with the compound demonstrated the effects of this enzyme inhibition by showing an overall decrease in dry weight biofilm production and a significantly less dramatic drop in pH.

After, demonstrating these effects in vitro, Dr. Murata showed that these results remained consistent in vivo by emulating these experiments with a rodent model. His studies began by feeding the animal specimens a high sucrose diet to prime the teeth for *S. mutans*. Dr. Murata evaluated the cariogenic effects of *S. mutans* in animals treated with fluoride (positive control), 7-epiclusianone, fluoride and 7-epiclusianone, and a vector control with no treatment. Extraction of the rats' jaws and analysis for caries assessment showed that treatment with fluoride and 7-epiclusianone both significantly lowered the development of caries. Furthermore, when the two compounds were combined, they prevented caries more effectively than either compound individually.

Since 2010 Dr. Murata has been working as principal investigator in the K99/R00 grant from National Institute of Health (NCCAM). This project relates the influence of natural compounds on HIV infection and opportunistic infections, such as Candidiasis. Dr. Murata's primary research interest is to address biomedical therapy utilizing the interrelationships between pharmacognosy and molecular biology.

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FACULTY SPOTLIGHT: DR. PIEDAD SUAREZ DURALL

In 2004, Dr. Piedad Suarez Durall came to the United States from Costa Rica. She was 41 years old with a private practice and a daughter in Costa Rica, no research experience, and barely spoke a word of English. But a thirst for knowledge prompted her to apply to the Orofacial Pain and Oral Medicine program at the Ostrow School of Dentistry of USC on a whim. She used to teach TMJ Disorders in Costa Rica and she was in charge of the Orofacial Pain Clinic at the Latina University, so she wanted to get more knowledge/training in the field. Friends and family thought she was crazy for making such a drastic career shift at her age. She gave up her part-time teaching position at Latina University, sold her thriving dental practice of 15 years, and moved to a foreign country.

Despite all the naysayers, Dr. Suarez showed amazing resilience in the face of adversity. She remembers her earlier days in United States, particularly the challenges she came across in the postdoctoral program. Coming from a Spanish-speaking country, Dr. Suarez encountered language barriers in her day-to-day routine. She laughs about her attempts to communicate with the other residents in the program, between her broken English and their limited grasp of Spanish. "I spoke Spanish with a little bit of English while [they] replied in English interspersed with elementary Spanish," she recalls. But anyone who has met Dr. Suarez in person feels the vibrancy in her spirit and knows that she has overcome those apparent weaknesses to become the successful woman she is today.

Looking back, Dr. Suarez's perceived weaknesses – her age and limited command of English – actually became her strengths. Her fifteen years of private practice background, teaching experience, and fluency in Spanish allowed her to stand out amongst other applicants. In particular, her Hispanic cultural background and fluency in Spanish made her a valu-

able asset in the predominantly Hispanic Los Angeles community. Though it was challenging at first, Dr. Suarez quickly picked up English and now communicates effectively with the diverse pool of Spanish and English-speaking patients. With her age came experience and wisdom, giving her an edge in teaching skills and clinical ability.

Initially, she intended to return to Costa Rica after completing the Orofacial Pain/Oral Medicine program. But eight years later, she still remains at the Ostrow School of Dentistry as a faculty member and researcher. She specializes in cultural competency education, geriatric patients, and special needs patients, working with those who have physical or mental disabilities as well as patients with HIV/AIDS. Even though she arrived with no prior research experience, she is now a published researcher. "It's never too late to start," Dr. Suarez says as she mulls over all of the challenges and success she has encountered. "I was 41 years old with no research experience when I first arrived."

She credits her success to the guidance of key mentors – Dr. Glenn Clark and Dr. Roseanne Mulligan. Her current research on methods of cultural competency education, spearheaded by the collaborative efforts of Drs. Jacqueline Venturin, Roseann Mulligan, Glenn Clark, and Reyes Enciso, has been approved for publication in the *Journal of Dental Education*. Cultural competency training is an integral part of the dental curriculum and improves the student doctor's ability to cater to the diverse patient pool in Los Angeles. Through experimentation and research, educators are constantly looking for ways to teach cultural sensitivity more efficiently. The findings from their research suggest that both seminar-based training and web-based training are equally effective in teaching cultural sensitivity.

Words by Eugenia Chan, Kristine Hong, and Stephanie Ting

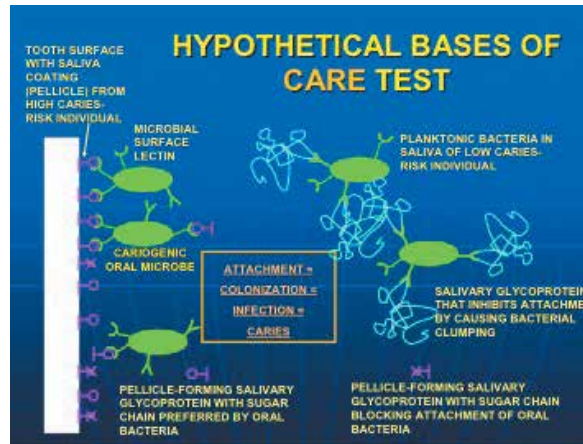


EARLY CARIES PREVENTION

WORDS BY CYNTHIA YOUNG

Dr. Paul Denny received his Ph.D. in Developmental Biology in 1966 from California Institute of Technology and he began his basic research at USC in the area of salivary gland development and has had continuous funding from the National Institutes of Health for more than 35 years. This early research laid the foundation for and the direction of the current translational project, the CARE test, which received Phase I and II funding from a STTR grant awarded by the National Institute of Dental and Craniofacial Research. Dr. Denny has published his research findings in numerous papers, in peer-reviewed journals, and has also presented his research at a number of scientific meetings. He is highly regarded by the research community for his work in the fields of salivary gland cellular development and differentiation, salivary glycoprotein structural analysis, and clinical application.

What if your dentist could predict whether or not your child is likely to develop caries by simply collecting a little saliva? Dr. Denny and his team are collaborating with an array of other teams and data from Delta Dental, studying the patterns of oligosaccharides found in saliva and comparing them to the development of caries in children. It is believed that the body produces a constant pattern of oligosaccharides, very similar to the body's production of certain types of red blood cells that are used to classify blood types as ABO. Depending on what type of oligosaccharides are produced by the body, it may be possible to anticipate caries development. This early identification of children at greater risk for caries may allow for more customized treatment including fluorides, sealants, antimicrobials and anticipatory guidance to parents and caregivers to reduce the incidence of caries.



DR. PAUL DENNY



Salivary oligosaccharides are found on salivary glycoproteins and depending on what kind of oligosaccharides are present, can affect the potency of microbial attachment and colonization on susceptible teeth. In other words, when the pellicle begins to form on susceptible teeth, salivary glycoproteins with “caries prone” oligosaccharides provide planktonic bacteria more opportunities to interact with the tooth surface, whereas “non pellicle glycoproteins reduce the ability of planktonic bacteria to interact with the tooth surface.” Studies using saliva samples from children ages 3-17 were collected and analyzed at USC, then compared with dental claims from Delta Dental. These studies have shown that the “ratio of the two classes of oligosaccharides in resting saliva correlates with caries history.” The al-

gorithm designed to analyze the data from the saliva samples was able to accurately assign individuals to one of two categories: (1) no caries and (2) caries or restorations in deciduous molars with a $\geq 95\%$ accuracy.

The CARE Test/ Deciduous (CT/D) is a step forward in potentially being able to predict risk for future caries in young children and can more accurately allow for education of the parents for preventive interventions.

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THE EXPLORER



ANESTHESIOLOGY IN DENTISTRY

WORDS BY ANDREW YOUNG

While he's been honored with various titles—from professional sandwich assembler to Subaru car enthusiast—most at the Ostrow School of Dentistry of USC know Dr. James Tom best as the school's attending dentist anesthesiologist. Himself a USC alumnus (he received his undergraduate dental education at USC in 1999 as a member of Dr. Stanley Malamed's Dr. STAT/IV Sedation Selective Team), Dr. Tom went on to complete a Dental Anesthesiology residency at The Ohio State University. He returned to Southern California to practice and teach dental anesthesiology and has now provided more than 10 years of expert dental anesthesia services at USC.

Since the early days of his dental career, Dr. Tom has always been exceedingly interested in physiology and pharmacology. The mechanistic approach with which he was able to grasp these topics drew him towards the field of dental anesthesia. As a part-time associate clinical professor, Dr. Tom has passed on his passion for the field and spent more than a decade facilitating student learning by promoting comprehensive dentistry. With the same tools



he gathered from his days at USC, including a heightened attention to detail and a strong curiosity for knowledge, he encourages his own students to be lifelong learners as well. According to Dr. Tom, "knowing state-of-the-art therapeutics makes everyone a better clinician or researcher...and ultimately, better clinical care is delivered."

Though the field of dental anesthesiology has grown rather rapidly, it remains a rather small and relatively unknown discipline. Thus, those who are trained in dental anesthesiology must face many relatively dynamic situations. Coupled with patients demanding more from clinicians, staying informed remains a priority for Dr. Tom, who applies what he studies to his everyday clinical practice. Admittedly

"skeptical," he uses research and evidence-based material that includes "a large body" of reports and articles to justify any changes to his own clinical practice.

To keep current efficiently, Dr. Tom often utilizes an extremely accessible tool—the internet—besides the traditional sources of reference. By participating in various anesthesia educational venues, he is able to keep abreast of anesthesia topics and ideas from anesthesia providers globally. Additionally, he is able to focus upon specific topics such as pharmacology, pediatric anesthesiology, and dental surgery. On top of internet research, he also uses the Wilson Dental Library and several traditional pharmaceutical newsletters and anesthesia journals to stay updated on the latest developments. For students who wish to focus on a distinct topic, Dr. Tom suggests sorting through relevant journals. In particular, a great source of information comes from editors, who have "a wealth of information, experience and judgment to articulate issues." Though his goal is to stay current, Dr. Tom enjoys reading editorials from several decades ago as ideas and attitudes towards current topics are stark in contrast or broadly based in comparison to today's specialization.

According to Dr. Tom, one of the hot topics of concern currently is how anesthetics potentially cause quantifiable neurologic damage to developing neurons in animal studies as it relates to human development and exposure. Those who perform general anesthesia on pediatric patients remain concerned about any significant neurotoxicity to humans. Understandably, this issue is problematic with human volunteers, thus patients, parents, and anesthesia providers alike remain concerned about possible correlative effects.

Though students at USC are learning the latest in dental practices, Dr. Tom still encourages all to dig deeper. While some principles and practices remain standard, new innovations and discoveries are being made every day. Thus, to stay fully in-the-know, students should actually strive to understand the reasoning behind clinical guidelines and practices by studying the literature. And because patients now have access to plenty of information (misguided or not) on the internet, students and dentists have to be well prepared to answer questions and dictate treatment to appease any misconceptions and worries.

THE IMPORTANCE OF DENTAL BIOMATERIALS

WORDS BY SAM SAAB AND KENNY SMITH

In today's sophisticated world, all dentists must take a close look at the new materials that they purchase. The dental market is flooded with different representatives claiming that their product is the most advanced and longest lasting material. While this might be true for some products, this claim might not be true for some others. Unfortunately, many dentists are fooled into purchasing these materials, without evaluating the products' pre-clinical and clinical research. Failing to analyze the data of a new material could lead to future problems for the dentist when the material fails. Although every dentist should use the best materials on the market to uphold the highest standard of care, dentists must choose products that have been tested rigorously. If a material fails the dentist will end up having to repeat the treatment. At the Ostrow School of Dentistry, we strive to uphold the highest standard of care by conducting research on all of the materials that are used on the clinic floor. The school cannot afford to be misled by salesmen and determines what materials to buy based upon the research, not the price. Using the highest quality materials can save dentists valuable time, money and patient satisfaction. Our interest in this topic led us to interview one of the lead researchers in this field, Dr. Jin Ho Phark, who is in the division of restorative sciences at the Ostrow School of Dentistry.

Q: What type of research are you doing?

A: "I am in the division of restorative sciences, conducting research on dental biomaterials. In our group we are evaluating and characterizing restorative materials such as adhesives and composites; we look for adhe-

sion of these materials to enamel and dentin. We also look at bonding to other restorative materials, such as ceramics or other composites. There are various ways to test this. Our most preferred method is the microtensile bond strength testing, where, after bonding, we cut the specimen into smaller pieces, about 1x1mm in size, and try to pull them apart to see how well the cement or adhesive bonds to the opposite surface. We usually do that in conjunction with artificial aging of the specimens. This is important, because in the oral cavity restorations are exposed to various challenges, such as masticatory forces and thermal stress. These factors at the adhesive interphase might weaken the bond between the restoration and the tooth surface, and possibly lead to debonding of the restoration. Additionally, water tends to weaken the bond between the tooth surface and the restoration. Therefore, we usually store the restored teeth in water for at least 6 months before testing. Thermal fatiguing is done to test the material under thermal stressors using a thermo-cycler. This might simulate the temperature changes in the oral cavity ranging from ice-cold beverages to hot teas or coffees. In many cases we see that the bond strength significantly decreases after the artificial aging (6 months and at least 20,000 cycles of thermal cycling) compared to the bond strength after only twenty-four hours."

Q: Besides bond strength testing of dental materials, what else does your lab work on?

A: "We also study the fundamentals to understand the molecular and chemical background

of the bonding process by using x-ray photoelectron spectroscopy, focused ion beam, and various methods of microscopy (for example, scanning electron microscopy, transmission electron microscopy, confocal scanning laser microscopy). We use these methods to try and understand the bonding technique better so that in the future we can develop our own, new ways of bonding. Moreover we do research on long term performance of materials in terms of wear from chewing. We use a device that is able to simulate the chewing process in a dual-axis chewing motion, doing vertical and horizontal movements at the same time. Mimicking the aging of teeth is a tough process, since there are a lot of factors involved in the oral cavity. Therefore we isolate each factor and test it separately. For example we use the thermal cycler to look at the effects of thermal stress, and the chewing simulator to test the mechanical stress. We are also able to simulate a caries attack, where we can immerse the specimen in a special solution that simulates caries. Another factor that we also look at is the influence of pulpal fluid coming from the dentin tubules on bonding procedures."

Q: What are some other methods currently used to test dental materials?

A: "A commonly used research technique in characterizing the bond is called 'micro leakage'. For this purpose often a class V cavity is prepared in a tooth resulting in one interface in dentin and another interface in enamel. Once restored, a dye is put onto the restoration. In case of adequate adaptation of the restorative material to the cavity no penetration of the dye at the interface will be observed.

However, in the situation of inadequate adaptation of the restoration to the cavity a microscopically small gap might occur and allow the dye to penetrate along the interface. This can for example happen if the bond to the tooth is not very strong and is exceeded by the stress caused by shrinkage in the composite restoration. A shortcoming of this technique is that there is no correlation between the micro leakage data obtained in the lab and results from clinical studies. So if the composite in the lab shows no micro leakage it doesn't mean that the same material is going to perform well clinically. So this is another thing the dentists should look for when presented with new dental materials."

Q: Why is there no strong correlation?

A: "Because the micro leakage by itself is not a good indicator in terms of how a filling is going to perform. Quite often the technique is not standardized, so that data from different research institutions cannot be compared with each other. Furthermore, outcome is dye and location dependent. Like the micro leakage technique, there are other techniques that are used to test dental materials in vitro that cannot really predict the clinical performance of the material. Clinical studies are the ultimate tool to find out how well a material performs in the oral cavity under the different stressors."

Q: Are there specific brands of adhesives and cements that you are currently testing?

A: "We test a wide array of materials, some

are new materials that are not on the market yet, and others are well known brands that have been around for a long time. Some products among the adhesives have established themselves in our field as gold standards. They have been on the market for quite a while and have consistently performed well. New materials are usually compared with the gold standard. Some of those established materials are even used here at our school on the clinic floor every day."

Q: What would you say is your greatest personal achievement in research?

A: "In terms of research, my focus has been on bonding onto zirconia. We did a lot of research to evaluate the surface characteristics of zirconia to determine what would be the best way to have a strong and long-term bond to zirconia. From our research we found that we need a really rough surface that provides enough micromechanical retention on the zirconia. We have been doing research on surfaces that do not require any sand blasting. Usually when you bond to zirconia you have to sand blast the surface to make it rough and increase its micromechanical retention. However, we are testing that materials and techniques that can be used with out having to sandblast the surface."

Q: What are the plans for future projects?

A: "Our division has launched a new advanced program in operative and cosmetic dentistry. This program was started in the summer of 2012 and we have four residents each year. Together with these residents we plan on doing

clinical research on different materials and techniques. We want to combine those clinical results with the results of the tests we are currently doing in vitro. So, all the materials that we are going to use in this clinical program are materials that we have already tested in the lab. Furthermore, we are expanding our collaborations with other disciplines, such as prosthodontics, pedodontics, periodontology, etc. in preclinical and clinical studies involving residents from these programs."

Q: What do you recommend that dentists do when deciding on a specific material to use?

A: "Dentists should look at the clinical data, and if not present as for some of the newest materials, at least the preclinical long-term data. When reviewing the scientific information, it is always important to look at the data and check if significant artificial aging was done to the specimen and meaningful tests were carried out. Unfortunately, some materials do lack thorough preclinical or clinical testing."

In order to sustain the highest standard of care, it is crucial for dentists to look at the research that has been done on the products they use in their practice. We should always be skeptical about the claims given by representatives, and always look at the research done to justify those claims. Solid clinical and preclinical research is the best indicator of how well a product will perform in the oral cavity.

ESTHETICS IN DENTISTRY AND LINGUAL ORTHODONTICS

WORDS BY RONALD CHUNG AND JOSEPH PARK

DR. DAN GRAUER



Dr. Dan Grauer is a Board-certified orthodontist with dual degrees in dentistry and orthodontics, both from the University of Barcelona, Spain and the University of North Carolina. He holds a PhD in Oral Biology from the University of North Carolina. Now he is a full-time assistant professor at the Ostrow School of Dentistry of USC and is one of the few who specializes in lingual orthodontics. His research includes various fields that help in optimizing treatment for his patients.

Over the past thirty years, esthetic driven patient care has been on the rise, both during and after treatment. There has been an increasing demand for superior aesthetics during orthodontic treatment; and as a result of this, aesthetic brackets, lingual brackets and Invisalign became more popular. An outstanding growth has been witnessed in demand for the ultimate invisible or hidden braces where appliances are bonded to the back of teeth. As opposed to having an appliance bonded to the facial surface as the name suggests, in lingual orthodontics the appliance is bonded on the lingual surface, hidden from the public.

There are three components to Dr. Grauer's approach. The first involves designing, building, and using customized lingual orthodontic appliances. These brackets are built by rapid prototyping and wires are bent by a robot. Each component is specific to each patient and his or her treatment plan.

The second approach involves the use of a facial-diagnosis approach based on the application of three-dimensional imaging to improve accuracy in diagnosis, treatment plan and appliance fabrication. The images from a cone beam computed tomography (CBCT) scan allows the visualization of not only the teeth but the exact location of the roots, position of the jaws and their relation to the patient's facial soft tissue. This greatly increases accuracy of treatment planning and the predictability of outcomes. It also allows for simulating treatment results for diagnostic purposes and for communication with patients and other health professionals.

Third, Dr. Grauer believes that the interdisciplinary management of esthetics in dentistry and orthodontics is crucial. Each member of

the interdisciplinary team should be aware of the possibilities and limitations of each discipline. Treatment planning should be the result of a team effort via face-to-face meeting or virtual meetings. New treatment modalities in orthodontics, like the use of skeletal anchorage, expand the limits of tooth movement possibilities, and impact decision making during dental treatment planning. With three-dimensional imaging an oral surgeon working together with an orthodontist can accurately predict and plan orthognathic surgical outcomes of patients. Dr. Grauer has developed protocols in order to communicate the diagnosis and treatment plan of cases amongst specialties by using computer generated predictions, and protocols for orthodontic retention phase, use of skeletal anchorage, and prevention of white spot lesions.

Dr. Grauer is currently working on assessing the accuracy and precision of customized appliances, and incorporating three-dimensional imaging into the treatment planning stages. When comparing the results obtained after treatment with customized with the prediction fabricated before treatment, outcomes are very predictable – in fact most teeth were positioned within 1 mm and 5 degrees of their predicted position in three planes of space. Time of treatment with lingual braces is similar to labial braces but lingual appliances produce less damage to the enamel and are less prone to cause white spot lesions.

New advances in technology and interdisciplinary management of patients make orthodontics and dentistry more interesting than ever. Digital dentistry and digital orthodontics are around the corner; are you in?



FACULTY SPOTLIGHT: DR. TAE KIM

WORDS BY AILEEN NGAN AND SHAWN EBRAHIMPOUR

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THE EXPLORER

DR. TAE KIM



Dr. Kim received his degree in dentistry from Seoul National University in South Korea and completed his residency in prosthodontics at Ostrow School of Dentistry of USC. Since then he has been Chairman of the Removable Section in the pre-doctoral program. Aside from being a faculty member at USC, he also visits numerous international universities presenting new and current studies on prosthodontics. Dr. Kim also conducts multiple research studies on various aspects of prosthodontics including immediate implant loading, denture base resin, and denture relining.

Currently, the standard for final immediate denture relining after tooth extraction is normally done after six months. This protocol commonly results in the clinician having to frequently and inconveniently adjust the den-

ture. "There are no documents that say when the ideal time to reline dentures are" according to Dr. Kim. His goal is to find it. The first three months is the time in which the greatest reabsorption occurs. Dr. Kim's study evaluates the dimensional changes of the alveolar ridge that occurs after tooth extraction by using the NextEngine 3D Scanner. "My goal is to use these studies to shorten the six month period," says Dr. Kim.

Dr. Kim also conducted a novel study tackling a previously unexplored topic within implantology: the immediate loading and full restoration of an implant. Prior to his study, experts contended that the immediate restoration of an implant was out of the question, owing to the belief that a lack of time for osseointegration would not allow the implant to be stable enough to handle full, or any occlusal forces. Common practice was to wait 4-6 months with an inconvenient temporary partial denture for the duration of the osseointegration. As of 2008, the most streamlined treatment that had been attempted to date was to restore the implant with a restoration that was adjusted completely out of occlusion until the structural stability of the bone to implant (osseointegration) was validated. This approach inhibited patients from immediately utilizing the restoration in mastication, and necessitated follow up visits to raise the crown into proper occlusal function.

According to Dr. Kim, "patients want immediate results. They want teeth right away." He stated that he enjoys conducting research to keep up with the demands of the field. As the principal investigator of his clinical trials, Dr. Kim collaborated with a team of USC Periodontists and researchers from the University of Zagreb, Croatia to conduct a clinical trial on "Immediately Restored and Loaded Dental Implants." He and his team selected 20 subjects fulfilling their specified criteria, namely the use of standardized Resonance Sequencing Assessment to verify the density of bone prior to placement of implant and full restorations adjusted into full occlusion. Dr. Kim followed up with patients at regular intervals since then and has proudly reported 100% success in his study to date. Since then he has been invited globally to lecture on his groundbreaking findings among his other areas of research.

In our interview with Dr. Kim he noted that the reason he enjoys his niche of clinical research is that there is "no lag time between conducting a study and its applications in the dental arena." He enjoys the fact that he publishes and that practitioners can immediately utilize his clinically relevant findings.

ORAL HEALTHCARE: FILLING IN THE GAPS

WORDS BY ISAAC SUN AND CATHERINE TAN



Dr. Roseann Mulligan, the Associate Dean of Community Health Programs and Hospital Affairs here at the Ostrow School of Dentistry of USC, is an expert in dental public health. One of her most recent publications, *The Impact of Oral Health on the Academic Performance of Disadvantaged Children* published in the September 2012 American Journal of Public Health, is the first study to determine the impact of oral health on academic achievement. The study provides a link between oral health and social outcomes, such as school and workdays missed due to dental problems. It stemmed from an earlier study, the Oral Health Needs Assessment Plan (OHNAP), which aimed to describe the oral health of underprivileged children in Los Angeles County.

OHNAP was funded by First 5 LA, The Annenberg Foundation, The California Endowment, and The California Wellness Foundation. Each of these organizations provided funding in hopes to incorporate the findings into their strategic plans for future programs aimed to improve oral health in local communities. OHNAP was conducted on a stratified sample of over 2,300 children and students, ages 2 to 5, 6 to 8, and 14 to 16 years, who were identified with being disadvantaged by participation in Women, Infants, and Children centers, Head Start preschools or attendance at elementary or high schools with at least 50% ethnic minorities and at least 62% receiving the reduced or free meals program. OHNAP confirmed the overwhelming need for oral health care in LA County by discovering the prevalence of untreated dental caries to be 73%, with a total of 81% needing dental care.

The more recent sub-study is an influential piece in the role of oral health on the development of children. The study shows that oral

health does in fact impact academic performance. A study of this depth and magnitude was the first of its kind, which Dr. Mulligan acknowledged might be due to the difficulty of conducting and organizing its many components. Some of the challenges included obtaining approval from several Institutional Review Boards, meeting objectives of several funders, gaining permission from the Los Angeles Unified School District which is the 2nd largest in the US, and parents for participation in the study, performing dental examinations by USC dentists and collecting records for thousands of children from 59 different sites.

The most notable finding from the elementary and high school-aged students, was that students with toothaches were 4 times more likely to have a low grade point average. Also, 11% of students with inaccessible dental care missed school compared with only 4% of those with access. Furthermore, for every 100 elementary and high school-aged students, 58 and 80 school hours were missed a year, respectively, due to dental problems. These problems also affect the student's families. Parents of students with toothaches are 4 times more likely to miss work.

The findings of these studies are indicative of the importance of addressing the epidemic of dental caries in Los Angeles County at the school, community, health system, and government levels. The Ostrow School of Dentistry aims to address these issues by providing dental education and care through many different community programs. One notable program is Mobile Dental Clinics where USC students, staff, and faculty volunteer their time to travel to communities all over Southern California to provide comprehensive care for those in need. According to Dr. Mulligan,

"It's all about caring for kids falling through the safety net." By traveling to areas of high need, the objective is to decrease the access to care issues that disadvantaged children face. While continuing to care for school-aged children, it is also necessary to focus more attention on those even younger. In an upcoming project, Dr. Mulligan and Community Health Programs are planning to partner with First 5 to expand education and oral care programs for children ages 5 and under to help maintain proper oral health and prevent dental caries.

By identifying issues in oral health through research, providing care through community programs, and encouraging prevention through education, the dental community can make an incredible impact on children. It is the role of the health care providers to act as leaders in eliminating disparities in oral health. We as dental professionals must strive to fill the gaps in care and education to meet the needs of disadvantaged children in our communities.

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BACTERIAL FLORA OF PERIRADICULAR LESIONS

WORDS BY SOPHIA KANG

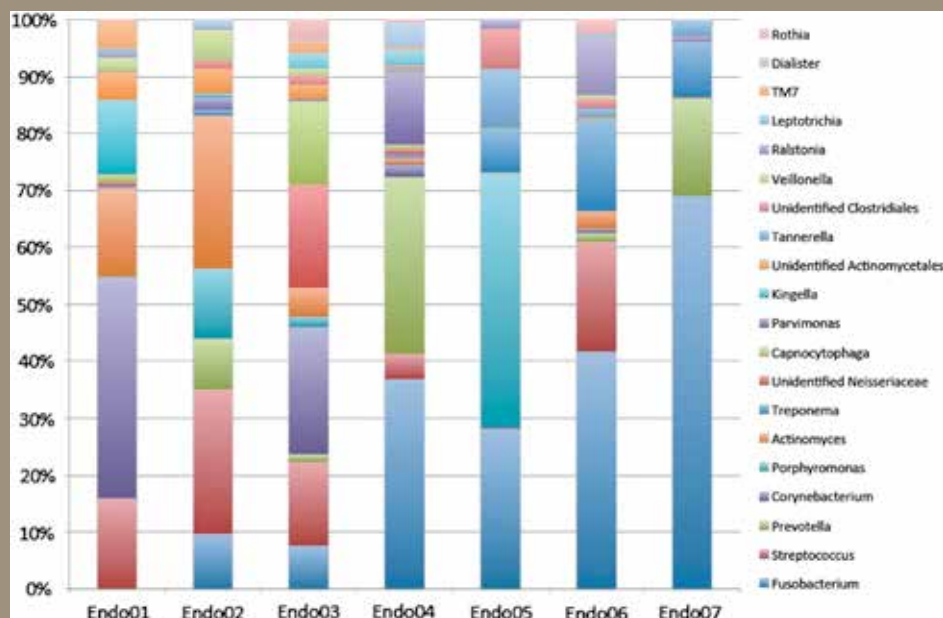


Figure 2. Distribution in descending order of frequency of the top 20 bacterial taxa in the 7 PCR-amplicon-positive periradicular lesions.

Periradicular inflammatory disease of endodontic origin is a prevalent dental infection that is initiated by bacteria from infected pulp. The Section of Endodontics at Ostrow School of Dentistry of USC carried out a metagenomic analysis of the bacterial flora of symptomatic dental periradicular lesions using the new 454-pyrosequencing technology and it has been published in The Journal of Endodontics in November 2012. This study may help elucidate the etiopathogenic role of periradicular bacteria and its therapeutic implications in the future.

Symptomatic teeth with periradicular lesions of infectious origin remain a significant challenge in Endodontics and the reason for the acute perturbation is incompletely understood. The traditional viewpoint is that the periradicular lesion itself is sparsely populated by low-grade pathogenic bacteria or is entirely devoid of microorganisms. However, recent studies have found bacteria and herpesviruses in a high proportion of symptomatic and large-

sized periradicular lesions. Yet, the presence and diversity of bacteria in persistent periradicular lesions after orthograde endodontic treatment have not been studied using the new molecular technology - pyrosequencing. Therefore, to better characterize the microbial content and diversity of periradicular lesions, Dr. Mohamed Saber with others from the Endodontic Department of Ostrow School of Dentistry of USC, carried out a metagenomic study of bacteria in symptomatic teeth with periradicular lesions using pyrosequencing of bacterial 16S ribosomal RNA (rRNA) genes. Thirteen samples of periradicular lesions from symptomatic, previously treated teeth were extracted during apical surgery. Dr. Saber says "around 90% of the teeth respond positively to endodontic treatments but we wanted to look at the remaining 10% where symptoms persist even after proper endodontic treatments." Sequencing of PCR amplicons of 7 of the 13 periradicular lesions generated high-quality DNA sequences belonging to 10 bacterial phyla and 73 bacterial genera. "Pyrose-

quencing technology allows a wider range of detection with a more conservative approach and reliable results and thus has been utilized for this study," says Dr. Saber. Despite great bacterial diversity, the research showed that symptomatic periradicular lesions tend to harbor a core microbial community consisting of anaerobic bacteria, especially *Fusobacterium* (21.0%), *Prevotella* (7.5%), and *Porphyromonas* (6.0%), and of facultative bacteria, *Streptococcus* (8.0%) and *Actinomyces* (5.8%). Non-dental bacteria, *Corynebacterium* (7.2%) which has not previously identified in the oral cavity, was also found in substantial amounts.

This study also showed that even well-performed root canal procedures cannot ensure the absence of periradicular microorganisms and a great variety of extraradicular bacteria can persist in symptomatic periapical lesions after orthograde root canal therapy.

Further research on the determinants of bacterial colonization of periradicular lesions and the clinical impact of such colonization still have to be established. Whether the root canal and the periradicular area harbor the same microbiota also warrants further study. Nonetheless, this present study on bacterial flora of periradicular lesions increases insight into the microbiota of endodontic pathosis and may serve as a stepping stone to a new way of understanding endodontic diseases and thus improve endodontic treatment. "This study contributed to our knowledge of bacteria in endodontics which can someday help develop targeted strategies to kill specific bacteria that cause infections in root canals," says Dr. Saber.

Reference:

Saber, Mohamed H., and Karen Schwarzberg. "Bacterial Flora of Dental Periradicular Lesions Analyzed by the 454-Pyrosequencing Technology." *Journal of Endodontics* 38.11 (2012): 1484-488

DIVISION OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY

FLORENCE CLARK, PH.D., OTR/L, FAOTA - ASSOCIATE DEAN AND PROFESSOR

The USC Division of Occupational Science and Occupational Therapy, ranked the nation's #1 occupational therapy graduate educational program by U.S. News & World Report, commemorates the 1942 birth of Trojan occupational therapy throughout the 2012-13 academic year. For 70 years, USC has been creating leaders: 4 Trojans have been elected President of the American Occupational Therapy Association, including the current officeholder, division associate dean and professor Florence Clark. For 70 years, USC has been shaping the profession: Trojan faculty created the world's first PhD research degree in Occupational Science to build a scientific evidence base substantiating clinical care. For 70 years, USC has been building better lives: Trojan occupational science research today, led by director of research and professor Mary Lawlor, is internationally recognized for its strengths in translational design, randomized clinical trials, and qualitative modes of inquiry, all of which inform clinical interventions delivered by occupational therapists to ensure patients can, by performing and participating in their everyday meaningful activities, live life to its fullest.

Since last year's Ostrow School of Dentistry of USC Research Day, several new projects have been funded and are now in operation. "Lifestyle Redesign® for Pressure Ulcer Prevention in Rural Veterans with SCI" is a new demonstration project to develop a sustainable, customized Lifestyle Redesign® program, delivered via telehealth systems, to prevent pressure ulcers in rural veterans with spinal cord injuries. Project director Michael Carlson and his team, in collaboration with the VA Long Beach Healthcare System (Long Beach, Ca.), will be developing a tailored Lifestyle Redesign® intervention manual, training and overseeing Veterans Affairs occupational therapists in its implementation, and collecting outcomes data.

Assistant professor Trudy Mallinson is serving as project director for "Measurement and Outcomes Post Severe Brain Injury," another rehabilitation-focused project in collaboration with the U.S. Department of Veterans Affairs. Likewise, the study aims to leverage Mallinson's health services research expertise in rehabilitation outcomes and psychometrics for enriching research currently being conducted at the Edward Hines, Jr. VA Hospital (Hines, Ill.) on the measurement and outcomes of traumatic brain injury.

Mallinson was also named co-principal investigator of "Examining the Relationship Between Clinician-Observed and Patient Self-Reported Visual Function in Everyday Activities," funded by Genentech, Inc. With co-investigator Rohit Varma, associate professor of ophthalmology at the Keck School of Medicine of USC and the Doheny Eye Institute, this study will determine the extent to which self-reported measures and observed performance measures provide comparable information about functional status of patients

with progressive visual loss caused by diabetic macular edema.

Assistant professor Shawn Roll is principal investigator of "Integrating Electromyography and Sonographic Imaging for Evidence-Based Physical Therapy for Chronic Pelvic Pain." Funded by the USC Keck School of Medicine-Southern California Clinical Translational Science Institute, Roll aims to apply his expertise in musculoskeletal diagnostic sonography to identify neuromuscular biomarkers in patients with Chronic Prostatitis/Chronic Pelvic Pain Syndrome, as well as determine the ability of neuromuscular biomarkers to enhance clinical phenotyping.



DIVISION OF BIOKINESIOLOGY & PHYSICAL THERAPY

JAMES GORDON, EDD, PT, FAPTA - ASSOCIATE DEAN AND CHAIR

The core mission of the Ostrow School of Dentistry's Division of Biokinesiology & Physical Therapy is to enhance the physical well-being and quality of life of humans, and one of the primary ways that we accomplish this is to conduct research that will expand our knowledge of the biological bases of human movement. This interdisciplinary focus on movement, which we call biokinesiology, includes four domains of research: (1) the neural basis of motor control and learning, (2) the biomechanics of the musculoskeletal system, (3) exercise and muscle physiology, and (4) the development of normal movement. In this issue of *The Explorer*, we highlight one of our ongoing stroke research clinical trials.

Dose Optimization for Stroke Evaluation

Principal Investigators: Carolee Winstein, PhD, PT, FAPTA and Nicolas Schweighofer, PhD

Stroke is the leading cause of disability in the US, and about 65% of stroke survivors experience long-term upper extremity functional limitations. Because each patient post stroke has unique impairments and function, it is important to depart from a "one size fits all" approach to rehabilitation. Although there is now evidence that motor therapy can improve function and use of the more affected limb for patients with moderate to mild impairments, change in arm and hand use in the months following therapy is variable.

The dose of stroke rehabilitation appears critical to recovery of function and use, but there is little systematic research pertaining to an optimal dose of therapy. Little is known about what constitutes an effective dose of therapy because patients have different functional impairments and unique needs for post-stroke rehabilitation. Furthermore, the change in use of the affected limb in the months following therapy is variable; for some patients there is an increase in use, but for other patients a decrease. Thus it is important to understand how arm and hand function changes in relation to the amount of therapy received, so that an optimal dosage of therapy can be determined for each patient based on their individual characteristics.

The Dose Optimization for Stroke Evaluation (DOSE) trial seeks to explore the relationship between dosage of therapy and changes in arm use for individuals with stroke. Additionally, this study aims to develop a model that can predict the optimal dosage for an individual using baseline measures of function and impairment. Led by Drs. Nicolas Schweighofer and Carolee Winstein, this five year NIH-funded phase 1 clinical trial will enroll 60 participants with stroke and paresis of the upper extremity.

Eligible individuals will be randomly assigned to one of four groups that differ in the total number of therapy hours (the therapy dose) given: 0, 15, 30 or 60 total hours over the course of three months. Individuals that are assigned to one of the non-zero groups will receive one-on-one training with a physical therapist using an adapted principle-based protocol termed the Accelerated Skill Acquisition Program (ASAP). The conceptual model of ASAP includes three fundamental non-exclusive elements: skill acquisition, capacity building, and motivational enhancements. Participant chosen challenging and meaningful tasks are used as a vehicle within the ASAP conceptual model to address neurorehabilitation and recovery. Measurements of each individual's reaching kinematics, ability to perform every day movements, and frequency of arm use will be taken at the beginning of the study and at regular intervals throughout their participation. The participants will be asked at each phase of the study about their ability to perform activities in their daily life. Additionally, magnetic resonance imaging (MRI), diffusion tensor imaging (DTI), and transcranial magnetic stimulation (TMS) will be performed at baseline, after the intervention period is complete, and after a 6 month follow up period for the purpose of characterizing the stroke lesion and determining the effect of therapy and its dose to elicit neuroplastic changes.

The DOSE team hypothesize that there is a threshold level of arm and hand function, such that if therapy brings function above this threshold, spontaneous use and function will reinforce each other in a virtuous circle. Further, they hypothesize that larger doses will lead to greater gains in spontaneous use at 6 months following therapy compared to those seen immediately post-therapy; contrarily smaller doses will lead to no gains or even reductions in spontaneous use at 6 months following therapy compared to those seen immediately post-therapy.

DOSE is coordinated by Dr. Clarisa Martinez, PT, DPT, a member of the Division's full-time research staff. If you are interested in learning more about DOSE, please contact us at 323-442-1410 or Clarisa@usc.edu.

Supported by the Eunice Kennedy Shriver National Institute Of Child Health & Human Development of the National Institutes of Health under Award Number R01HD065438.

Current study status: actively enrolling participants.

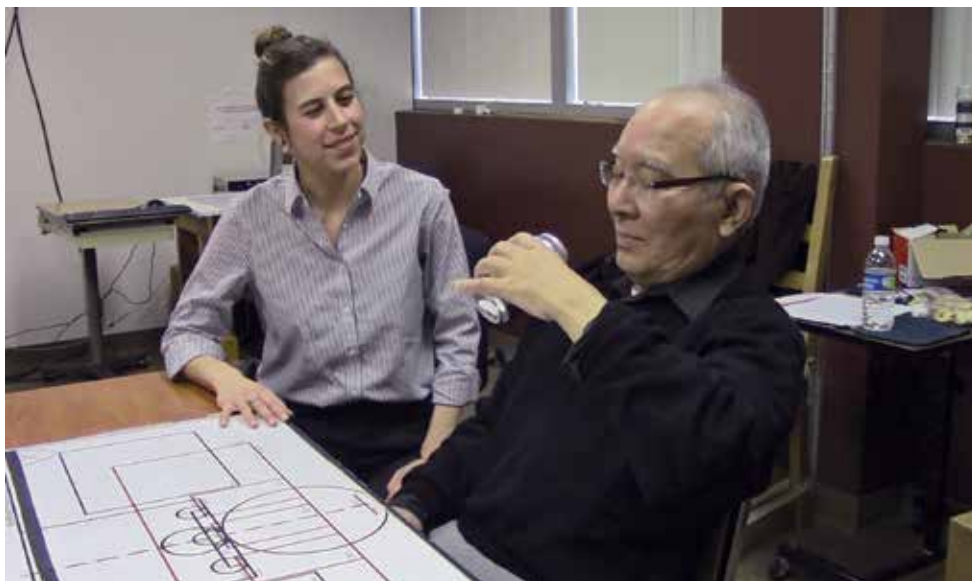
ClinicalTrials.gov Identifier: NCT01749358

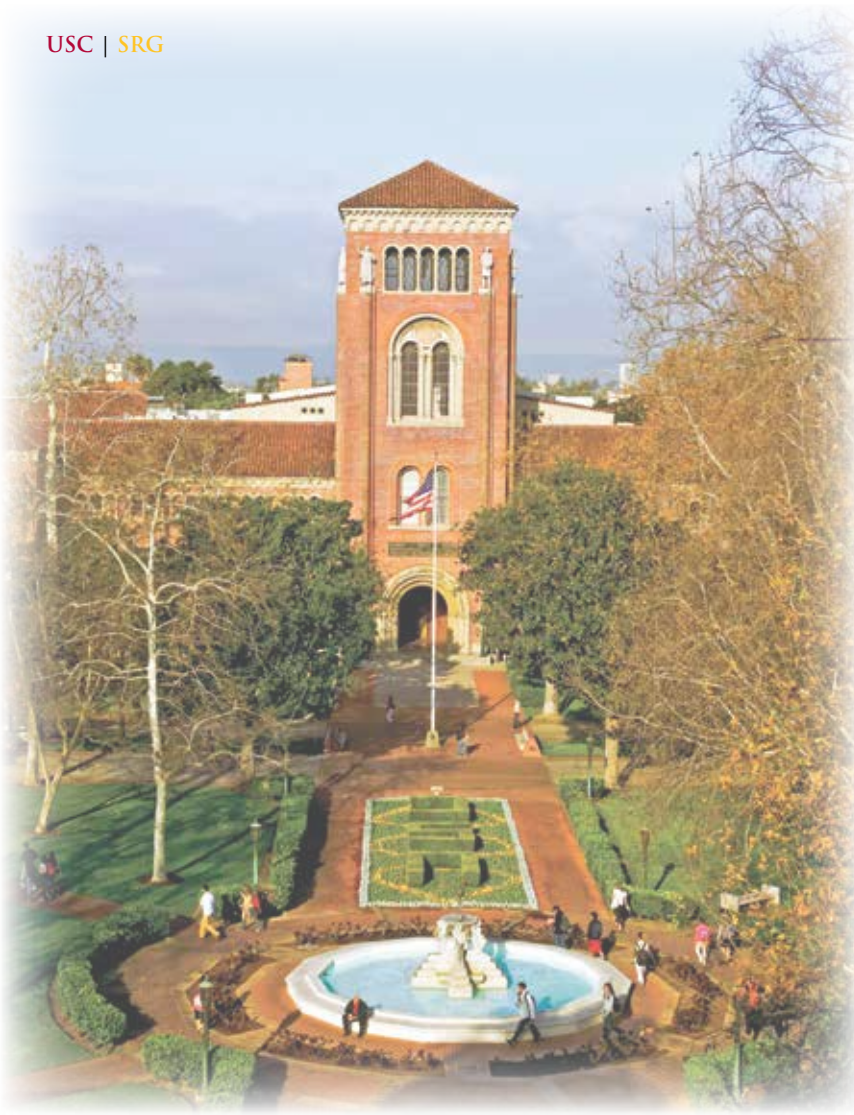
USC IRB: HS-11-00743



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THE EXPLORER





Poster Category Awards:

Awarded to outstanding posters within each category

- 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

USC Stevens Center for Innovation Award:

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 university wide resource in the Office of the Provost at the University of Southern California that helps identify, nurture, 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.

Dean's Research Award:

Awarded to the most outstanding project poster overall



Christopher H. Fox, DMD, DMSc

Dr. Christopher H. Fox is the Executive Director of the International Association for Dental Research (IADR) and its largest Division, the American Associations for Dental Research (AADR). The IADR is a non-profit organization with 12,000 individual members with a mission to advance research and increase knowledge for the improvement of oral health worldwide, to support and represent the oral health research community, and to facilitate the communication and application of research findings. The IADR hosts dental and craniofacial research meetings in all corners of the world and the AADR hosts the largest dental research meeting in North America as well as smaller, more focused symposia. The IADR and AADR jointly own the Journal of Dental Research, the leading scientific journal publishing in all disciplines of dental and craniofacial research.

Prior to joining IADR and AADR in 2003, Dr. Fox was the European Director of Professional Relations for the Colgate Palmolive Company. Dr. Fox completed his dental, post graduate and clinical studies at Harvard University, receiving a DMD, a Master of Science in Epidemiology, a Doctorate of Medical Sciences in Oral Biology and Oral Epidemiology, and completed residencies in Periodontology and Dental Public Health.

Since becoming Executive Director, IADR and AADR have undergone significant strategic initiatives, including expanding the scientific content of the Journal of Dental Research and partnering with a commercial publisher to greatly expand electronic access. IADR has regionalized their global membership structure and implemented a tiered-dues structure resulting in a 20% increase in membership from countries classified as low or middle income by the World Bank. AADR re-launched their brand position in 2008 with a new logo and communication platform, including the addition of the successful annual AADR Fall Focused Symposium.

IADR and AADR provide a unique platform to interact and influence international and domestic professional organizations, Governmental bodies like the World Health Organization and Ministries of Health, the corporate sector, dental academicians, and dental students towards broadly advocating for the importance of oral health and oral health research.

RESEARCH DAY: SCHEDULE OF EVENTS

FEBRUARY 20, 2013



Cheryl Mattingly, Ph.D.

Cheryl Mattingly is Professor of Anthropology in the Department of Anthropology and the Division of Occupational Science and Therapy, University of Southern California. She has been a frequent Visiting Professor of Anthropology and Philosophy in the Department of Culture and Society, Aarhus University, Denmark. Her primary research and theoretical interests include: narrative, moral reasoning, clinical reasoning, phenomenology, the culture of biomedicine, chronic illness and disability, and race and health disparities in the United States. In collaboration with Mary Lawlor, she has been the PI and Co-PI on federally funded grants from National Institutes of Health, Maternal and Child Health and the Department of Education. She has published extensively on these topics, including 55 peer reviewed articles and book chapters. She received the Victor Turner Prize (American Anthropology Association) for *Healing Dramas and Clinical Plots* (1998) and the Stirling Book Prize (Society for Psychological Anthropology) for *The Paradox of Hope: Journeys Through a Clinical Borderland* (2010). Her other books include: *Clinical Reasoning in a Therapeutic Practice* (1994); *Narrative and the Cultural Construction of Illness and Healing* (2000), co-edited with Linda Garro; *Narrative, Self and Social Practice* (2009), co-edited with Uffe Jensen; and *Moral Laboratories: Narrative Experiments in Family Life* (Forthcoming).

08:00am – 09:00am

09:00am – 12:00pm

11:30am – 12:00pm

12:00pm – 12:30pm

12:30pm – 12:45pm

Registration - Presenters and Judges

Poster Judging

General Registration

Lunch - Founders Club

Opening Remarks

Elizabeth Garrett

Senior Vice President for Academic Affairs and Provost
USC, Office of the Provost

Avishai Sadan

Dean
Ostrow School of Dentistry of USC

Yang Chai

Associate Dean of Research
Ostrow School of Dentistry of USC

12:45pm – 01:40pm

Christopher Fox – Keynote Address

“The Case for Increased Investment in Oral Health Research
and the Role of the Scientist-Advocate”

01:40pm – 02:30pm

Cheryl Mattingly – Keynote Address

“The Good Life: Practical Wisdom, Narrative Competency
and Clinical Practice”

02:30pm – 03:00pm

Awards Presentation

USC Stevens
Center for Innovation

03:00pm – 04:30pm

04:30pm – 05:00pm

Poster Viewing and Focused Group Discussions
Reception

13

30

DR. PARISH SEDGHIZADEH



STUDENT RESEARCH GROUP

USC | SRG

Ronald Lee Chung
Editor-in-Chief

Parish Sedghizadeh, DDS
Faculty Advisor

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Senior Editors

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Junior Editors

Tiffany Lee, Payal Patel
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Sam Saab
Treasurer

Elizabeth Newcomb, Stephanie Ting
Photographers



Back Row (left to right): Kenny Smith, Ronald Chung, Sam Saab, Andrew Young, Joseph Park

Front Row (left to right) Aileen Ngan, Catherine Tan, Soo Kyung Lee, Stephanie Ting, Cynthia Young, Payal Patel, Kristine Hong, Sophia Kang, Tiffany Lee

Not Pictured: Isaac Sun, Brian Goo, Robert Berger, Chris Patuwo, Nichole Tomblin, Eugenia Chan, Claire Leewing, Shawn Ebranhimpour

RESEARCH DAY POSTER ABSTRACTS

FEBRUARY 20, 2013

FACULTY

Poster #: 1

Title: Palliative Oral Care: Perceptions of Long-Term Care Certified Nursing Assistants
Name: Joyce Sumi

Background: Oral care deficiencies continue to occur in long-term care (LTC) institutions despite governmental standards. Reported low priorities of oral care among LTC nurses and limited interdisciplinary utilization of dental professionals contribute to diminished optimal oral care. Certified Nursing Assistants (CNAs), primarily responsible for providing palliative oral care (POC) to LTC residents with life-limiting illnesses, critically need sound oral care knowledge and training to ensure patients' quality of life. Further investigation to understand CNAs' role in POC of institutionalized populations is necessary, as studies have indicated differences between CNAs' reported oral care and actual practices. **Purpose:** This qualitative

study explored the perceptions and barriers of LTC CNAs who provide POC and situate those experiences within a health-promotion planning model. **Methods:** Digitally recorded, semi-structured interviews conducted with 10 LTC CNAs obtained POC knowledge, attitudes and barriers and were supplemented with field observations. **Results:** Although CNAs self-reported providing good POC, their informed oral care knowledge exhibited deficiencies; subsequently personal dental experiences became their preeminent source of information. CNAs described limited oversight and feedback, lack of guidelines and ineffectual interdisciplinary communications between dentistry and nursing leaving CNAs to self-monitor quality of oral care. **Conclusion:**

Lack of accountability in oral care contributes to this multi-dimensional problem and underscores the need for new models. Increased oversight and training for CNAs can initiate POC improvements. Augmented geriatric oral health education for dental and medical professionals is essential to improve interdisciplinary collaborations in achieving optimal oral health for all LTC residents.

Poster #: 2

Title: Relevance of Scapular Dyskinesia in Patients with Shoulder Pain
Name: Jonathan Sum

Background: Scapular dysfunction, alterations of movement or position of the scapula, has been implicated as a cause of shoulder pain. Scapu-

larmuscles control scapula motion and therefore a lack of scapular muscle performance and/or shoulder flexibility may contribute to scapular dysfunction. Laboratory studies have revealed abnormal scapular kinematics, reduced scapular muscle performance, and reduced shoulder flexibility in patients with shoulder pain as compared to asymptomatic shoulders. However, laboratory tests are impractical for the clinical setting. Clinical tests are needed to identify scapular dysfunction and determine the subgroup of patients that have scapular dysfunction related to scapular muscle weakness and/or reduced shoulder flexibility in patients with shoulder pain and functional loss. **Purpose:** The study purpose is to perform a cohort study designed to examine the

relevance of scapular dysfunction in patients with shoulder pain. Research determining the usefulness of 3 clinical tests for scapular dysfunction, and their relationship to scapular muscle performance and shoulder flexibility in patients with shoulder pain and functional loss is lacking. These scapular dysfunction tests, if demonstrated to be useful and related to scapular muscle performance, shoulder flexibility, and shoulder pain /functional loss, could be used to direct treatment for these patients. Methods: Patients with shoulder pain will be recruited for the study verbally by therapists or clinic employees such as front desk staff or physical therapy aids. Those who agree to participate will first complete the informed consent. Next, 3 scapular clinical tests will be used to assess scapular dysfunction. The scapular dyskinesis test (SDT) will be performed by observing for abnormal scapular motion (dyskinesis) as the patient raises up and lowers their arm. Patients will perform 5 repetitions each of flexion and abduction, using a 5-pound weight for those weighing 150 pounds or greater and 3-pound weight for those weighing less than 150 pounds. If patients have pain and cannot complete the motion with weight in their hand, they will perform the test without weight. Scapular motion will be rated and recorded as normal, subtle or obvious scapular dyskinesis based on scapular abnormalities of winging or dysrhythmia. The first examiner will then step out of the room and a second blinded examiner will examine the subjects with shoulder pain- but as a blinded examiner (they will not know if the patient has shoulder pain). The SDT will be performed by the blinded examiner, results will be recorded and this examiner will leave the room. Following this, the rest of the shoulder examination tests will be performed. The patients with shoulder pain will continue on with a standard shoulder evaluation, which includes the following shoulder assessments. Two symptom alteration tests, the scapular reposition test (SRT) and the scapular assistance test (SAT) have been designed to determine if manually changing the scapular position or motion has an effect on

the patient's shoulder pain. The two tests will be performed in patients with shoulder pain. With the SRT, the patient rates their pain on a scale of 0-10 (0= no pain) during resisted arm elevation and then again during resisted arm elevation with the scapula manually positioned in posterior tilt and external rotation. The SAT is performed by manually assisting the scapula into upward rotation and posterior tilt during arm elevation. The patient rates their pain on a 0-10 (0= no pain) numeric pain scale during arm elevation with and without manual assistance via the SAT. The SRT and SAT are positive with a pain reduction of $> 2/10$ when the scapula is manually positioned while elevation of the arm is resisted (SRT) or when the scapula is assisted during arm elevation (SAT) as compared to no scapula reposition or assistance. Scapular muscle performance will be performed in patients with shoulder pain using muscle tests described by Kendall, and have established reliability and validity. Patients will perform the lower trapezius, middle trapezius and the serratus anterior muscle tests. The lower trapezius muscle test involves the patient lying prone, their arm will be placed above their head, and then the patient will be asked to lift their arm off the table against resistance. The middle trapezius test has the patient lying prone, and resistance of their arm placed in 90° abduction with external rotation. The serratus anterior muscle test involves the patient seated with the arm held in 125° elevation, and then the patient will be asked to resist arm elevation. All 3 muscle tests are graded by observing the ability of the scapula to remain stabilized against the thoracic cage while resistance is applied to the arm. The muscle is graded as 'normal' if they can hold their arm with maximum resistance while maintaining the scapula against the rib cage, 'reduced' if they can maintain the position with min – mod resistance, and 'markedly reduced' if they can only maintain the scapular stabilization with no – min resistance. If weakness is detected, functional scapular muscle tests for the serratus and lower trapezius will be performed to determine the appropriate exercise for strengthen-

ing. Shoulder flexibility may also be a source of scapular dyskinesis or abnormal movement, specifically pectoralis minor length and posterior shoulder tightness. The determination of pectoralis minor muscle length will be performed in a manner depicted by Borstad^{17,18}. To perform this test, patients will stand in their normal, relaxed posture. The first examiner will palpate inferior and medial aspect of the coracoid process and the inferior border of the fourth rib one finger's width lateral from the sternal border. A measurement in centimeters will be taken between these two landmarks with a cloth tape measure. This amount will then be normalized to the patient's height by dividing the pectoralis minor length by their height in centimeters and multiplying by 100. Posterior shoulder tightness will be assessed by measuring the patient's glenohumeral internal rotation in a supine position. This clinical assessment has been found to accurately measure posterior shoulder range of motion limitations. Posterior shoulder tightness can accurately be assessed in a supine position when strict protocols are followed. For the purpose of this study, the measures will be taken in the supine position outlined in Awan et al. All physical therapists who will be participating in the data collection will undergo training of this assessment method. The assessment method is outlined as follows: The patient will lay supine on a firm examining table with the shoulder to be tested positioned at 90° of glenohumeral abduction. The patient's arm and glenohumeral joint is now passively taken into internal rotation maintaining horizontal abduction position. The end-range of internal rotation is determined at the point at which the posterior lateral acromion was visualized to raise off the table. This motion can be classified as anterior tilting of the scapula. At the end range of available glenohumeral rotation, further shoulder internal rotation will cause the scapula to tilt anteriorly, manifested by lifting of the scapula and shoulder girdle forward away from the examining surface. When this motion is observed, glenohumeral IR range is at its maximum and the measurement should be taken using

an inclinometer. For accuracy the measure will be taken three times and the average of the IR range of motion measure will be documented. Results: To be determined Conclusion: To be determined

Poster #: 3

Title: Therapy Intensity and Functional Gain in Patients with Hip Fracture

Name: Trudy Mallinson

Background: Hip fracture is a common and serious event among older adults. In 2008, 95.4% of hip fracture patients used post-acute care (PAC) services. Yet evidence supporting how therapy intensity can maximize functional outcomes following hip fracture repair remains limited. Purpose: To examine the relationship between therapy intensity and functional improvement in patients receiving post-acute care following hip fracture repair. Methods: This prospective cohort study included 147 patients from 4 IRFs (n=78) and 6 SNFs (n=69). Nurses collected functional status data using the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI) within 48 hours of admission and discharge; they also abstracted therapy minutes and length-of-stay (LOS) from the medical record. Results: There were significant differences in LOS across settings (SNF=27.7+13.8 IRF=15.1+5.4 days). IRFs and SNFs were similar in total minutes of occupational (OT) and physical (PT) therapy provided but were different in therapy intensity (minutes per day). IRF and SNF patients made similar gain in mobility; SNF patients made significantly but not clinically meaningfully more gain in self-care. There was little relationship between OT minutes per day and self-care gain per day (SNF $r=.13$ IRF $r=.31$) or between PT minutes per day and mobility gain per day (SNF $r=.18$ IRF $r=.24$). Simultaneous quantile regression run separately by setting revealed significant relationships but variance explained was negligible. Conclusion: There was little relationship between therapy intensity and functional gain for the patients receiving rehabilitation after hip fracture repair. The findings provides an opportunity for

rehabilitation providers to examine practice patterns and improve the quality of rehabilitation services.

Poster #: 4

Title: Head and Neck Cancer Rehabilitation: A Pilot and Feasibility Program

Name: Kimiko Yamada

Background: Treatment of head and neck cancer (HNC) often results in significant negative effects on swallowing, speaking, and shoulder and neck function. Extensive physical therapy is required to improve function and quality of life but is often limited by poor access to clinics and poor insurance coverage. The HNC Rehabilitation Program was developed to provide access to skilled physical therapy for patients with limited or no health insurance. Purpose: This study was designed to determine the safety and feasibility of a program for individuals after HNC treatment. We hypothesized that a group intervention would improve functional mobility, endurance, and quality of life. Methods: Patients were recruited from LAC+USC Hospital from May to December 2012. Four patients were enrolled per cycle of 4 weekly sessions and a one-month follow-up. Patients' medical history, functional and activity limitations, and pain levels were obtained. Disability and quality of life questionnaires, neck and shoulder range, upper extremity strength tests, deep neck flexor endurance tests, and 6-minute walk test were used as outcome measures. Results: Of 11 patients with complete data sets, the mean age was 48 years (SD=11.85) with 45.5% males. Modest to large improvements were made in all outcomes measures. 9 of the 11 of participants reported feeling better upon completion of the program. No adverse events were reported by any participant in the program. Conclusion: This program demonstrates the safety and feasibility of a group rehabilitation program to make a positive impact on disability, pain, cervical and shoulder range of motion, and endurance in patients after HNC treatment.

Poster #: 5

Title: Community Based Wellness

Physical Therapy for Persons with Neurologic Conditions

Name: Noriko Yamaguchi

Background: There are inadequate clinical sites for all students in the Doctor of Physical Therapy Program to work with patients with neurologic conditions. Additionally, wellness as a component of physical therapy is relatively new, and as it is unreimbursable by third party payors, there are even fewer sites that give physical therapy students an opportunity to work within their full scope of practice. This clinical experience was designed to meet both of these objectives. Purpose: The purpose of this study was to evaluate the efficacy of a 10-week wellness program for patients/clients with chronic neurologic conditions on the development of clinical skills in second year Doctor of Physical Therapy students. Results of the analysis were used to enhance the experience for future students. Methods: Students were randomly assigned to one of 4 possible clinical experiences. Pre- and post-participation surveys were conducted to measure student attitudes about and perceptions of community service. For the purposes of this study, only qualitative data related to skill acquisition were analyzed. Repeated analyses were performed by three separate evaluators until consistent themes emerged. Results: Four themes related to enhanced patient management skills and three themes related to personal development were identified. In addition, 97% of the students who participated felt that the experience provided unique knowledge that augmented their didactic learning. Conclusion: This experience provided a valuable learning opportunity for physical therapy students to enhance their patient management skills in a program directed at wellness for persons with neurologic involvement.

Poster #: 6

Title: Transperineal Sonographic Evaluation of the Male Pelvic Floor

Name: Shawn Roll

Background: Idiopathic male chronic pelvic pain is difficult to diagnose and treat. Sonographic imaging has been used to investi-

gate neuromuscular mechanisms in the female pelvic floor, but neither research nor books adequately describe sonographic evaluation of the male pelvic floor. Purpose: The purpose of this study was to develop and evaluate a transperineal sonographic technique for the examination of the muscles, nerves and vessels in the male pelvic floor that could be used for evaluation and treatment of disorders in this region. Methods: A repeated, single-subject design: 33 y/o male with intermittent reports of chronic pelvic pain & 40 y/o male with no pain. Image acquisition was standardized using a GE logiq E9 (11-MHz linear transducer). Settings were optimized and confirmed, and anatomical landmarks were identified and a map of the region was created. Results: The bulb of the penis, urethra, and the bulbospongiosus and ischiocavernosus muscles were identified in each image. While the relative positioning of these structures was the same, the bulbospongiosus muscles tracked laterally in the healthy subject whereas these muscles remained medial along the superficial surface of the bulb of the penis in subject A. Identification of the perineal body and the superficial transverse perineal (STP) muscles in the posterior perineum was challenging due to poor reference literature. Conclusion: This study demonstrates feasibility for obtaining transperineal sonographic images of the structures in the male pelvic floor. These techniques require validation and diagnostic measurements should be developed. Continued investigation of image analysis techniques that relate to screening, diagnosis, and biofeedback is warranted to advance the clinical utility of point-of-care sonography for male pelvic floor disorders.

Poster #: 7

Title: Narrating Autism, Elopement and Wandering in Los Angeles

Name: Olga Solomon

Background: Recent research has shown that half of all children diagnosed with autism 'wander off' or 'elope' from their homes and schools, yet families rarely receive advice from practitioners even after the fact (Law & Anderson, 2011;

Anderson et al., 2012). Purpose: This study explores how 'wandering' and 'elopement' is experienced, interpreted and narrated by a group of African American mothers living in Los Angeles to help generate an understanding of the problem from the participants' emic perspectives. Methods: We analyze a sub-corpus of narrative interviews collected between October 1, 2009 and August 31, 2012 for "Autism in Urban Context: Linking Heterogeneity with Health and Service Disparities", a larger mixed methods, federally funded, urban ethnographic project on disparities in autism diagnosis and services that followed a cohort of 25 children ages three to nine. Results: Drawing upon the social theorist and literary critic Kenneth Burke's theory of dramatism and the notion of 'Trouble' with a capital 'T' (Burke, 1969; Bruner, 1991), we demonstrate how the mothers' narratives become elaborated and transformed as they add new details and understandings to them. With an eye for the discursive constructions of the children's subjectivities, which at times align with, and at times resist, the biomedical view of autism, we consider multiple interpretations of the Trouble of 'elopement' and 'wandering'. The Trouble may be understood as a child with autism alone on a city street; a child with autism disappearing from sight; or a child with autism wandering off and few forthcoming measures taken in response by the service system. Conclusion: The stories of 'elopement' and 'wandering' become vehicles for pondering what kinds of social contexts these mothers and their children are inhabiting, and within what kinds of subject positions they are placed (Mattingly et. al., 2002). The article offers an ethnographic understanding of a complex and urgent public health, human services and public policy problem.

Poster #: 8

Title: Medical Records as Sites of Caregiver-practitioner Collaboration during Clinical Encounters

Name: Olga Solomon

Background: Medical records are inextricably linked to the practice of medicine yet little attention has been

given to the socio-interactional and relational processes that contribute to the joint construction of medical records by patients, caregivers and practitioners. Purpose: Following Charon's (2006) scholarship on narrative medicine, Mattingly's (1998, 2010) conceptualization of narrative emplotment, and Lawlor and Mattingly's (2009) work on families' experiences of illness and disability, we examine caregiver-practitioner interactions involving the social construction of a child's medical records. Methods: We draw upon a video- and audio- data corpus of health care encounters involving children with autism, their caregivers, and the practitioners who serve them. The data are part of a multi method, urban ethnographic study "Autism in Urban Context: Linking Heterogeneity with Health and Service Disparities" (NIH/NIMH R01 MH089474, 2009-2012, O. Solomon, P.I.) that follows twenty-six 3 to 8 year-old African American children, their families and the practitioners who served them across home, educational, clinical and community contexts. Results: The micro-level analysis illustrates that medical records serve not only as depositories of clinically-relevant information but as mediators of shared responsibility among caregivers and practitioners for the child's health and development. We use rigorous narrative, phenomenological and ethnographic methods to identify an interactional choreography that involves caregivers' narrative accounts and practitioners' note-taking that ratifies the narratives as noteworthy. This choreography engenders a mutual recognition of the shared expertise of the child's developmental history and health challenges. Conclusion: Discussion emphasizes the translation of findings at family, practitioner, and policy levels to promote collaboration among caregivers and practitioners.

Poster #: 9

Title: Translational Approaches for Investigating Neurodevelopmental Disorders

Name: Barbara Thompson

Background: There is significant heterogeneity in the genetic underpinnings and behavioral character-

istics of autism spectrum disorders (ASD). Our lab takes a translational approach in studying the underlying neurobiology responsible for the behavioral disruptions found in ASD by utilizing traditional mouse models and integrating those findings with clinical research techniques. We propose to determine whether the social interaction phenotype in children with ASD is due to an aversion to social interactions, or alternatively, a lack of reward from social interactions. Purpose: The proposed experiments will utilize an associative learning paradigm used routinely in animals, conditioned place preference (CPP), and will be adapted for use in children. This task provides an exceptional opportunity to determine whether decreased social interaction in ASD is due to an aversion to social interaction or a lack of reward from social interactions. This distinction is necessary for facilitating individualized intervention strategies in children with ASD. Methods: We first will establish CPP for toys in typically developing (TD) children. Next, we will determine whether children can learn a CPP for social stimuli. From there, we will then examine potential differences in social CPP between TD children and those diagnosed with autism (AUT). Results: We hypothesize AUT children will spend less time on the social paired side of the arena, and we will ascertain whether this indicates aversion to, or lack of motivation for social stimuli. In parallel, our mouse studies will aim to uncover the neural circuitry and genetics underlying these behaviors. Conclusion: In combination, these translational studies will guide future rodent and human research examining the cellular, anatomical, and behavioral heterogeneity of autism, as well as helping to design individualized intervention for individuals with neurodevelopmental disorders.

Poster #: 10

Title: Re-Situating Cultural Competence: Narrative Complementarities in Clinical Border Zones

Name: Mary Lawlor

Background: Cultural competence training has been used to redress health disparities but has generated a

history of strong criticism. Critiques include: the reduction of culture to a set of enduring traits; neglect of the fact that clinicians are cultural beings; "culture" has often been confused with race, ethnicity, social class, or language; and the notion of "competence" treats cultural knowledge as some kind of "content" or set of isolable skills. New approaches have been primarily process-oriented, foregrounding training to cultivate "open-mindedness," "cultural humility," "cultural safety" and "cultural confidence". We argue for a re-situating of cultural competence. Purpose: The research aims were to identify, describe, and situate how families contribute to the production of culturally responsive care, and to reveal the strategies families and practitioners employ to establish commonality, bridge differences, and effectively "partner up." Methods: We conducted a longitudinal, urban, ethnographic study of African American children with illnesses and /or disabilities, their families and practitioners who work with them in healthcare, educational and home and community settings. The conceptual foundations for this multiperspective, multimethod and event based study incorporate narrative, phenomenological and ethnographic approaches including microethnography. Results: We discuss findings related to "partnering up" processes within moments of healthcare encounters and across time. These include the management of misunderstandings and conflicts in the complex social terrain of healthcare. Conclusion: We offer a conceptual framework for effective partnerships that: 1) redefines health care practices as collaborations in clinical border zones; 2) addresses both structural and interactional contributions to health disparities through "narrative complementarities," a model we have developed to articulate the intersubjective, transactional, historical and particularity-oriented constitution of expertise and care.

Poster #: 11

Title: Psychosocial Obstacles to Transition among Low-SES Young Adults with Diabetes

Name: Elizabeth Pyatak

Background: Young adults with type 1 diabetes (T1D) are at high risk for poor health outcomes. This study examined healthcare trajectories of a particularly at-risk population: uninsured, primarily Latino (68.2%), low-SES young adults lacking routine diabetes care. Purpose: The purpose of the study was to (1) characterize psychosocial life circumstances of this population; (2) determine obstacles to successful transition from pediatric to adult care; and (3) examine impact of psychosocial issues on diabetes in the absence of routine care. Methods: Participants (n=22; mean age 21.1) were newly-enrolled patients in a YA T1D transition clinic in a public health system, discharged from pediatric care without an identified adult provider or lost to follow up for >3 months. We completed semi-structured interviews discussing participants' life circumstances, transition experiences, and diabetes care strategies. Results: Thematic analysis of interviews revealed multiple obstacles to transition to be the norm, including logistical barriers to accessing care (e.g. transportation, time off work, childcare) (n=7); unstable home situations (e.g. homelessness, foster care, abuse) (n=5), and other high-risk conditions (e.g. incarceration, mental illness, gang activity and substance abuse) (n=7). Problems with transition included mixed messages from pediatric providers, having routine care pre-empted by psychosocial issues, and difficulty navigating the public health system. Strategies used by participants lacking access to care included reducing or omitting insulin, fasting, obtaining medication through informal means, and exaggerating severity of health issues to obtain care. Conclusion: This population is at high risk for diabetes-related complications if psychosocial barriers to routine care are not addressed. An integrated approach to transition, addressing medical and psychosocial needs, may facilitate improved outcomes.

Poster #: 12

Title: FaceBase Biorepository: Resource for Craniofacial Research

Name: Pedro Sanchez

Background: The FaceBase Consor-

tium (www.FaceBase.org) began in 2009 with the major goal of creating a resource for investigators and clinicians involved in craniofacial development and disorders. Purpose: The goal of the FaceBase Biorepository is to provide clinical data and DNA samples to researchers studying craniofacial anomalies (CFA), such as oral facial clefting. Methods: The Biorepository started recruiting isolated and syndromic cases in February 2011. We are utilizing multiple recruitment approaches to create an international database of DNA samples and associated data. In addition to local recruitment at both the University of Iowa and Children's Hospital of Los Angeles, we have also mailed over 1000 recruitment letters to clinicians from around the world. Individuals may enroll by self-referral as well. We are also enrolling individuals with normal phenotypes who have detailed craniofacial measurements and/or 3D images available. Both submissions to and access from the Biorepository can be initiated by contacting the FaceBase Biorepository data access committee (<https://www.facebase.org/node/252>). Results: The Biorepository has collected DNA samples along with health history and phenotype data from 521 individuals (174 affected + 192 unaffected family members + 155 controls) to date with ongoing recruitment. There are 21 syndromes represented in the Biorepository and 97% of the affected subjects have an oral facial cleft. Conclusion: The Biorepository continues to focus efforts on increasing enrollment numbers and developing ideas on how to create a more dynamic resource for investigators studying CFA's. Fostering collaboration between investigators and clinicians may help us better understand the etiologies of CFA's as well as contributing to improving the outcomes for affected families.

Poster #: 13

Title: Pressure Ulcer Prevention Study: Challenges in Complex, Non-pharmacologic Rehabilitation Trials

Name: Cheryl Vigen

Background: Community-based clinical trials of complex, non-phar-

macologic rehabilitation interventions in disadvantaged populations present unique challenges with respect to participant recruitment and retention, intervention delivery and fidelity, randomization and assessment, and inadvertent "placebo" effect. Pressure ulcers (PrUs) are a common complication of spinal cord injury (SCI), associated with high treatment costs, reduced quality of life, and mortality. Purpose: To describe methods employed to address challenges implementing the USC – Rancho Los Amigos National Rehabilitation Center (RLANRC) Pressure Ulcer Prevention Study (PUPS). This randomized controlled trial assesses efficacy of an occupational therapy intervention, the Lifestyle Redesign® Pressure Ulcer Prevention Program (LR-PUPP), in reducing incidence and costs of medically serious PrUs in ethnically diverse people with SCI. Methods: Individuals with SCI recruited from RLANRC were randomized to a 12-month LR-PUPP intervention or a standard care control. The primary outcome, incidence of serious (Stage III-IV) PrUs, and secondary endpoints, ulcer-related surgeries, medical treatment costs, quality of life and mediating mechanisms were assessed at 12 and 24 months. Results: The study protocol has been successfully implemented, including recruitment of 170 participants, 90% treatment adherence, assurance of intervention delivery integrity, study assessment plan adherence, and database establishment. However, implementation presented substantial challenges in 1) Recruitment: Customized for a disadvantaged, ethnically diverse population. 2) Intervention delivery: Staff time increased to overcome economic and cultural barriers to retention and adherence, and 3) Treatment fidelity/replicability: Rigorous training and monitoring plan implemented. Conclusion: Creative solutions are necessary for overcoming unanticipated assessment and design concerns. Additional obstacles may emerge in data analysis and follow-up phases.

Poster #: 14

Title: MEK2 Haploinsufficiency: A Novel Mechanism for a Clinical RASopathy Phenotype

Name: Pedro Sanchez

Background: The RASopathies are a class of human genetic syndromes caused by germline mutations in genes encoding components of the Ras/mitogen-activated protein kinase (MAPK) pathway which plays an important role in cell proliferation and embryonic development. This is the first report of a MEK2 deletion altering regulation of the MAPK pathway and associated with a reproducible phenotype. Purpose: We report 6 patients with de novo MEK2-containing deletions of 19p13.3 (0.06-1.8Mb). Functional assays were performed using primary fibroblast cell lines derived from patient 1 and a healthy age/sex matched control. Methods: Serum starved cells were treated with epidermal growth factor (EGF), a factor known to stimulate the MAPK pathway, for 0-120min. Cells were harvested and protein lysates were subjected to western blot analysis with antibodies specific for various MAPK pathway components including phospho-MEK and phospho-ERK. Results: The patients present with a recognizable pattern of dysmorphic features that are similar to, yet distinct from, CFC syndrome. Clinical features include, but are not limited to, distinct craniofacial features, developmental delay, congenital heart defects, failure to thrive, obstructive sleep apnea, and skin anomalies. Studies in primary fibroblasts show that when the MAPK pathway is stimulated by EGF, phospho-MEK is less abundant in cells carrying the MEK2 deletion compared to the control. Differences in the levels of phospho-ERK and Sprouty 1 were also observed when comparing the deletion and control cell lines post stimulation. Conclusion: Our studies show that dysregulation of the MAPK pathway can be caused by MEK2 haploinsufficiency representing a novel mechanism that can cause a RASopathy.

Poster #: 15

Title: Bauru-CHLA/USC Research Initiative

Name: Stephen Yen

Background: Childrens Hospital Los Angeles(CHLA) has one of the

largest craniofacial teams in the US. The Hospital for Rehabilitation of Craniofacial Anomalies of the University of São Paulo (HRCA-USP) in Bauru, Brazil is the largest craniofacial team in the world. The overall goal of the collaboration is to develop joint research and education opportunities between USC and Bauru in areas of clinical care, genetic research and remote training of non-specialists in underserved areas. Purpose: Project 1 is a pilot prospective study to test the feasibility of conducting joint clinical trials. Project 2 is a pilot project to create methods to support clinicians working in remote areas. Methods: Method 1: Pre- and post-expansion study models from two groups of patients were analyzed for archwidth coordination against the lower dental arch. Group I used study casts of 30 patients from HRCA-USP treated with twin-screw rapid maxillary expanders. Group II – used 30 study casts of patients from CHLA treated with quad-helix appliances. All study casts are trimmed and scanned with a 3Shape R700 3D (3Shape A/S, Copenhagen, Denmark) laser scanner. Measurements will be recorded using Ortho-Analyzer™ 3D software (3Shape A/S, Copenhagen, Denmark). Coordination of arch width compares upper and lower casts using 1. intercanine distance, 2. intermolar distance, 3. bucco-lingual inclination of the posterior teeth. This is an ongoing pilot project that can serve as a model for intercenter coordination in clinical trials. Method 2: Using teleconference technology, journal clubs and specialist discussions will be used to provide support and education for clinicians in remote communities who are not specifically trained in craniofacial care. This approach will be used to educate and test the knowledge of participating clinicians in remote areas. The teleconference format may be a possible model for providing the participation of craniofacial team specialists in remote areas. Results: These ongoing projects were started this year as part of the USC-FAPESP(Brazil) Research Initiative. The two groups meet by teleconference every month. Conclusion: These two large craniofacial teams represent an unusual

resource for researchers at USC and Brazil to rapidly test clinical protocols, to search for genetic etiologies and to develop long-range support and training for clinicians in remote and underserved regions of the world.

Poster #: 16

Title: Validity: A Child's Self-Assessment of Handwriting and Goal Setting Tool

Name: Julie Bissell

Faculty Advisor: Sharon Cermak

Background: Proficient handwriting is an essential component of literacy and an important foundation needed to support a child's academic success. It is estimated that children in elementary school spend 31% to 60% of each academic day occupied with fine motor tasks and the majority of that time involves handwriting (McHale & Cermak, 1992). Research shows that between 10 to 30 percent of elementary school children struggle with handwriting (Karlsdottir & Stephansson, 2002, as cited in Feder & Majnemer, 2007). Literature in education extensively documents the consequences of poor handwriting on long term academic performance and future employment. Graham, Harris and Fink (2000) suggest that children who experience difficulty mastering handwriting may avoid writing and decide that they cannot write. This may lead to a significant lack of participation in a very important daily occupation for children and impact long term outcomes of education including post-secondary educational opportunities and future careers. This study examines the validity of Here's How I Write: A Child's Self-Assessment of Handwriting and Goal Setting Tool (HHIW) to help teachers and children identify components of handwriting problems. The research focuses on determining the ability of the assessment to discriminate between two groups; children with and without handwriting problems. Purpose: The purpose of the study is to establish the validity of a new handwriting assessment and to contribute scientific evidence to the field of occupational science and occupational therapy in the area of handwriting as it relates to emerging literacy and Language

Arts for elementary school children. The research focuses on the development of an English version the original Hebrew language child's self-assessment of handwriting and goal setting tool developed for Israeli/Hebrew speaking children (Kach Ani Kotev, Goldstand & Gevir, 2009). Methods: The participants in this study were 40 students (13 female, 27 male) with an average age of 8 years, 6 months in grades two through five attending a public school in an urban setting and their teachers. Twenty children with handwriting problems (illegible, messy, disorganized writing) and twenty children with good to excellent handwriting were identified by their teachers. Test items (24) were divided into three categories, 1) affect — how child feels about his handwriting 2) performance — how the child thinks he performs various components of handwriting and 3) physical factors — what the child thinks of his body posture and hand comfort and stability in handwriting. Data Analysis: The total child and teacher response scores were compared using a paired t test and scores of children with good and poor handwriting were compared to one another other using an unpaired t test. A comparison of the two handwriting groups in each category was made. Results: The results show statistically significant differences between the children with good handwriting and those with poor handwriting. The Correlation coefficient of all of the children compared to their teachers is .62. Children with poor handwriting rated their handwriting significantly lower than children with good handwriting in each of the factors: affect, handwriting performance and physical factors. The results of the study show statistically significant differences between the scores of children with good and poor handwriting. This suggests that children with poor handwriting are for the most part aware of their deficits, which supports the validity of the assessment and shows that the tool serves as an important first step in thoughtful child-directed remediation. Teachers of children with good handwriting had a high level of agreement with the children on the assessment and the differ-

ences were not statistically different. A number of teachers in the good handwriting group ranked the children higher than the children ranked themselves. Although children with poor handwriting rated themselves significantly lower than the children with good handwriting, they had a much higher opinion of their own handwriting than their teachers did. Children with handwriting problems stated that they did like to write (3.2) while their teachers thought that they did not like to write (1.8). The children with poor handwriting also reported that they wrote enough in tests and assignments (3.0) and their teachers reported that the almost always did not (1.4). Both the children with poor handwriting and their teachers agreed that it was difficult to read the child's handwriting. Conclusion: This study shows that children in second to fifth grade are able to self-assess aspects of their own handwriting supporting the validity of the Here's How I Write (HHIW) assessment. The children reported that they enjoyed the card game focused on understanding and improving handwriting. In conclusion, this shows that the HHIW assessment will be a valuable and valid tool to use as a platform to work in partnership with children and their teachers to better support the development of literacy and potentially long term educational outcomes through handwriting.

ADVANCED SPECIALITY PROGRAM RESIDENT

Poster #: 17

Title: Histological Analysis of Extraction Sockets Grafted with Anorganic Bovine Bone

Name: Seong Hong Min

Faculty Advisor: Homa Zadeh

Background: Alveolar ridge resorption has been considered an unavoidable consequence of tooth extraction. Atrophy of the alveolar ridge may cause esthetic and functional problems, such as an inadequate bone for the placement of dental implants. Ridge preservation has been proposed as a strategy to reduce post-extraction bone resorption. An array of ridge preservation protocols have been proposed, though data on the biologic outcome of the healing response is scant. Purpose: The histologic response of alveolar bone following ridge preservation grafting with anorganic bovine bone matrix (ABBM) protected by a non-resorbable membrane. Methods: Ridge preservation procedure, including minimally invasive extraction, placement of large particle size cancellous bovine anorganic bone, and non-porous polytetrafluoroethylene (PTFE) membrane coverage were performed for 118 subjects prior to implant placement. Following a minimum of 3 month healing (mean 5 months), bone cores were obtained using a trephine drill with outer diameter of 3.3 mm at the same time of implant placement and evaluated by histology examination. Quantitative histomorphometric analysis was performed (NIH Image J software) to identify osteoid bone, connective tissue, and residual xenograft. Results: Histologic observations revealed strongly eosinophilic osseous tissue containing round to ovoid osteocytes within lacunae demonstrating its viability. Distinct reversal lines were evident in the woven bone, and in areas of active apposition osteoblastic cells with large nuclei, occasional nucleoli and granular cytoplasm were seen rimming the bone and occasional osteoclasts were observed within Howship's lacunae or resorption pit adjacent to osteoblasts, all indicating active remodeling of the bone. Hematopoietic cells and

erythrocytes were observed in the lumen of the blood vessels within the fibrovascular stroma that surrounds the bone. Histomorphometric analysis revealed 38.26% vital osteoid bone, 13.34% residual xenograft, and 48.42% connective tissue within core samples obtained from extraction sockets. Conclusion: Histologic response of extraction sockets grafted with anorganic bovine bone demonstrated efficacy of this protocol in generating adequate vital bone to support osseointegration. Data on the outcome of implants placed into these grafted sites (reported separately) provide evidence for favorable implant survival rate and marginal bone response.

Poster #: 18

Title: Historic Understanding of Peri-Implant Disease and Emerging Science: A Review
Name: Maria Galvan
Faculty Advisor: Alon Frydman

Background: The use of implants to treat the absence of teeth has revolutionized dentistry. The advantages associated with implants are clear, yet implants are not perfect. The reports of high percentages of implants that survive or remain in the mouth has created a perception that implants are a treatment suitable for all. However, it is clear when following the lifespan of implants that case selection, experience, and training are heavily influencing success, management, and failure. Currently, many studies indicate that the number of implant complications, mucositis and peri-implantitis, are increasing at an alarming rate. Implant failure etiology, diagnosis, risk factors and treatment have become the new challenge. Several treatment modalities have been proposed to deal with peri-implant disease including surgical and non surgical therapy, both with or without the use of local and systemic antibiotics. Purpose: The aim of this review is to explore the various assumptions and conventional thoughts with regard to peri-implant disease in order to offer a predictable therapeutic model. Methods: Literature was compiled and reviewed through Pubmed searches with the keywords peri-implantitis, peri-implant mucositis,

implant therapy, implant disease, implant health. Results: See conclusions. Conclusion: Peri-implant disease following osseointegration is the result of an imbalance between the bacterial challenge and the host response. It can be concluded from the literature that non surgical therapy including mechanical debridement in combination with antiseptics seems to be the most effective means of arresting peri-mucositis. Treatment of peri-implantitis has shown greater predictability with surgical resection rather than regenerative grafting. The preponderance of literature supports the importance of prevention of peri-implantitis through management of peri implant mucositis.

Poster #: 19

Title: Kostmann Syndrome-Associated Aggressive Periodontitis: A Nine-Month Follow-Up
Name: Stephanie Gonzalez
Faculty Advisor: Alon Frydman

Background: Kostmann syndrome, is defined as a severe, non-cyclic neutropenia with an absolute neutrophil count of less than $0.2 \times 10^9/L$. A mutation of the gene that encodes the hematopoietic cell-specific LYN substrate 1-associated protein X1 is responsible for the decreased production of neutrophils and severe systemic and oral infections that is evident in these patients. Studies have shown that regular dental visits may improve the oral and systemic condition of these patients. Purpose: The purpose of this case report was to gauge the clinical efficacy of non-surgical treatment and frequent periodontal recall utilizing adjunctive chemotherapeutic agents in a patient with Kostmann syndrome-associated aggressive periodontitis. Methods: A 16 year-old Hispanic female diagnosed with Kostmann Syndrome received scaling and root planing in conjunction with subgingival irrigation with antimicrobials. The patient was placed on a two-month recall, and periodontal indices were recorded at 2 and 9 months. Results: Re-evaluation at 2 months and 9 months showed a reduction in bleeding on probing from 77.38% to 54.76%. The number of sites with a pocket depth ≥ 5 mm was reduced from 8 (4.76%) to

2 (1.19%). The number of sites with a pocket depth of 4 mm was reduced from 32 (19.0%) to 6 (3.57%), and the number of sites with a pocket depth of ≤ 3 mm was increased from 128 (76.19%) to 160 (95.24%). There was an average gain in clinical attachment of 0.50 mm. Conclusion: Kostmann syndrome-associated aggressive periodontitis can be successfully treated and maintained over the long term with frequent maintenance protocol utilizing adjunctive chemotherapeutic agents.

Poster #: 20

Title: CBCT Analyzed Tip and Torque for Orthodontically Treated Extraction Patients
Name: Nathan Coughlin
Faculty Advisor: Hongsheng Tong

Background: CBCT is a technology that allows us to view the whole tooth. CBCT gives us information to properly study the buccolingual inclination and the mesiodistal angulation of whole teeth including the roots. Before using CBCT in orthodontics it was difficult to study root positions as there is no good way to visualize all tooth structures. Purpose: The purpose of this study was to compare whole teeth buccolingual inclination and mesiodistal angulation of a group of patients who had undergone four premolar extractions for orthodontic reasons to a group of previously investigated near normal patients. Methods: Using CBCT radiographs we digitized every tooth in the arch. This information was then quantified using the University of Southern California root vector analysis system in Dolphin Imaging. After every tooth was digitized and analyzed we then compared this to a previously defined near normal group that had undergone the same procedure. We analyzed the data with various statistics. Results: We discovered that the mesiodistal angulation on the maxillary anterior teeth are different in the two groups. The buccolingual inclination in the maxillary and mandibular anterior teeth varied in the two groups. The left and right sides of the dental arches were relatively symmetrical in both groups. Conclusion: Although clinically the orthodontically treated group may look similar to the near

normal patients, when you compare the two groups using CBCT analysis they are significantly different.

Poster #: 21

Title: Relationship Between Arch Shape and Tooth Tip and Torque
Name: Bitu Moalej
Faculty Advisor: Hongsheng Tong

Background: Orthodontic treatment has generally consisted of the use of non-customized prescription brackets for each individual. In addition, bracket prescriptions have not been modified to reflect an individual's arch form. Purpose: To determine whether correlations are present between the tip and torque of each whole tooth for various arch forms. Methods: CBCT images of a sample of 76 near-normal cases were acquired. Maxillary and mandibular dental arches were digitized and anterior and posterior arch width and length obtained. Anterior and posterior arch width/length (w/l) ratio for each arch was calculated. Maxillary and mandibular anterior and posterior alveolar process height/length (h/l) ratio was calculated based on bony landmarks representing the anterior and posterior alveolar process height and corresponding arch length. Pearson and Spearman correlations between these ratios and the tip and torque of each whole tooth were studied. Results: We found no significant correlation between the maxillary and mandibular dental arch w/l ratios and the tip and torque of any teeth; there is a negative correlation between mandibular anterior h/l ratio and torque of the lower teeth from central incisor to the second premolar; there is a positive correlation between mandibular posterior h/l ratio and the torque of the lower first and second molar. Conclusion: There is a correlation between the mandibular bony arch h/l ratio and the torque of the lower teeth. Lower teeth torque need to be adjusted based on lower arch shape.

Poster #: 22

Title: Oral Manifestation of Crohn's Disease without Concomitant Gastrointestinal Involvement
Name: Mirhamid Salek
Faculty Advisor: Parish Sedghizadeh

Background: Crohn's disease (CD) is a chronic relapsing inflammatory disorder of unknown etiology and uncertain pathogenesis. CD can involve any segment of the gastrointestinal tract, and oral lesions consistent with granulomatous ulcers are considered an important yet rare extra-intestinal manifestation. Even more rarely reported is the presence of oral lesions in the absence of gastric and lower intestinal involvement. We report a case of a 64-year-old man with a history of Crohn's disease that was in remission for three decades, presenting with painful cobblestone-like ulcerations of the oral mucosa, but without gastrointestinal symptoms and otherwise healthy. Surgical biopsy of the oral lesions revealed non-necrotizing chronic granulomatous ulcers, similar to results from a biopsy of his small intestine three decades previously which established his diagnosis of CD. The patient was successfully treated with high potency topical corticosteroids which resulted in resolution of the oral lesions and associated symptoms. **Purpose:** Proving the possibility of oral manifestation of Crohn's Disease without concomitant gastrointestinal involvement, and efficacy of potent topical corticosteroid therapy for management of oral manifestations of Crohn's Disease. **Methods:** Reviewing post medical history, clinical exams, biopsy, reviewing the literature and treating the patient with potent topical corticosteroids. **Results:** Oral manifestations of Crohn's Disease without concomitant gastrointestinal involvement are possible. Potent topical corticosteroid therapy is efficient in the treatment and management of oral manifestations of Crohn's Disease. **Conclusion:** In the patients with oral involvement of Crohn's Disease and no other GI findings, applying potent topical corticosteroid can subside oral signs and symptoms of Crohn's disease.

Poster #: 23

Title: Identifying Microbiological Differences Between Supragingival and Subgingival Plaque In Periodontitis

Name: Chloe Cohen

Faculty Advisor: Jorgen Slots

Background: Technological advances have been made over the past decade to ameliorate bacterial taxonomy in phylogenetics. Such an instance would best be illustrated by the unearthing of the 16S rRNA gene and its ability to provide what is known today as the bacterial genome. Because of this discovery, we have evolved technologically from being able to run 500,000 DNA sequences at one time with 454 pyrosequencing, to 30 million sequences at one time with high speed, multiplexed 16S microbial sequencing. This allows for differentiation and association of species in the oral microbiome that exist supragingival and subgingival to the periodontal pocket. **Purpose:** Previous studies have shown that different species exist above and below the periodontal pocket. This study stands to accomplish identifying new taxa using high speed, multiplexed 16S microbial sequencing on the MiSeq® system both within and supragingival to the periodontal pocket in a diseased state. **Methods:** In this double-blind randomized clinical trial, a total of 22 otherwise healthy adult patients with periodontitis were included. Number of teeth, plaque index, gingival index, bleeding upon probing, probing depths (mm), recession (mm), furcation involvement, mobility, and supuration were all assessed. Whole unstimulated saliva samples were collected to determine the relative abundance and ratios of bacteria in the mouth at baseline through epifluorescence microscopy. Four supragingival sites with highest plaque accumulation were chosen for cultivation. Subgingival samples from the deepest pockets were obtained for culture-independent 16S rRNA analysis followed by high-speed, multiplexed 16S microbial sequencing. **Results:** Results pending. **Conclusion:** Conclusion pending results.

Poster #: 24

Title: Vestibular Incision Subperiosteal Tunnel Access (VISTA) Technique

Name: Chloe Cohen

Faculty Advisor: Homa Zadeh

Background: Intrасulcular tunneling has been proposed for mini-

mally invasive access for soft tissue augmentation. However, this method has a number of limitations including technique sensitivity, limited maneuverability and limited ability for coronal positioning. The vestibular incision subperiosteal tunnel access (VISTA) technique was developed in an attempt to provide a broader surgical access to facilitate placement of grafting material for various soft tissue augmentation procedures. **Purpose:** This case series provides data on outcome of soft tissue augmentation using VISTA. We hypothesize that the clinical outcome of soft tissue augmentation using VISTA for treatment of recession defects will compare favorably to historical data using classical methods. **Methods:** 135 teeth in 55 patients (mean age 52) were treated using VISTA technique. Briefly, after thorough scaling and root planning, odontoplasty and root conditioning with EDTA (3 min), a vestibular incision was made followed by subperiosteal tunnel. Connective tissue graft (CTG) was harvested from the palate or maxillary tuberosity. CTG was placed under the subperiosteal tunnel over root dehiscences extending approximately 3-5 mm beyond. Gingival margins of teeth were coronally repositioned with horizontal mattress sutures which were bonded to teeth with composite. **Results:** Initial observations included 2.9 (+0.9) mm mean (+SD) recession and 1.5 (+1.3) mm keratinized gingiva (KG). After mean follow-up period of 30.51 months, 0.3 (+0.6) mm recession and 2.5 (+0.8) mm keratinized gingiva (KG) was present. **Conclusion:** The results revealed that soft tissue augmentation and root coverage treatment of recession defects using VISTA compares favorability to the outcome of conventional method.

Poster #: 25

Title: Bone Angulation as Related to Tooth Angulation on Normal Patients

Name: Virginia Pham

Faculty Advisor: Hongsheng Tong

Background: CBCT opens new opportunities for alveolar bone studies by allowing precise measurements of teeth and their alveolar housing. This could provide new insights into

the role of tooth and bone geometry in normal occlusions. **Purpose:** To determine whether correlations are present between torque of teeth and torque of bone in patients with normal occlusion. **Methods:** CBCT images of a sample of 76 near-normal cases were acquired. Maxillary and mandibular teeth were digitized. Bone centers were also digitized at each interproximal area. Torque was calculated and compared for all teeth and all interproximal areas. Paired T-tests and Wilcoxon signed rank tests were used to compare (1) right and left measurements (2) bone and tooth measurements. The significance level was adjusted for multiple comparisons with the Bonferroni correction to keep the overall type 1 error at $\alpha = (0.05/7) = 0.0071$. **Results:** We found that bone and teeth torque values follow similar trends. **Conclusion:** There are correlations between the torque of teeth and the torque of bone. This information can be used in addition to crown standards for positioning the entire tooth, crown and root, within bone.

Poster #: 26

Title: Serotype Distribution of *Actinobacillus actinomycetemcomitans* in Periodontal Health

Name: Diane Anthony

Faculty Advisor: Casey Chen

Background: *Actinobacillus actinomycetemcomitans* is a gram-negative periodontal pathogen largely implicated in localized aggressive periodontitis. Serological characterizations of this commensal oral, facultative organism have identified six major strains of *A. actinomycetemcomitans* known as serotypes a, b, c, d, e, and f. In Turkish subjects, strains of serotype c seem to be largely associated with periodontitis, while the combination of serotypes a, b, and f were detected as frequently as serotype c alone and serotype d was undetectable in these affected patients. Serotyping analysis had distinguished *A. actinomycetemcomitans* into distinct clonal lineages with serotypes a, d, and e sharing a lineage and serotypes b and c stemming from two entirely separate evolutionary lineages. **Purpose:** The aim of this study is to obtain information on serotype preva-

lence and degrees of virulence and infectivity of *A. actinomycetemcomitans* in patients with periodontal health. Methods: Subgingival microbiological samples and clinical periodontal data were collected from periodontally healthy dental students in Marmara University, Faculty of Dentistry. Forty-eight of these 101 samples were positive for *A. actinomycetemcomitans*. PCR analysis of the 16S rRNA genes and serotyping determination through the subjection of each of the DNA samples to three different PCT assays for serotypes a/e, b/c/f, and d were conducted. Results: Among the 42 samples for *A. actinomycetemcomitans*, 21 samples had their serotypes identified. Fifteen were positive for *A. actinomycetemcomitans* serotype a (71.4%), 1 for serotype b (4.8%), 1 for serotype c (4.8%), and 4 for serotype f (19.0%), while serotypes d and e were undetectable. All patients that were serotyped were diagnosed as having no periodontitis except two, both of whom were positive for serotype a. Conclusion: The large percentage of subjects exhibiting *A. actinomycetemcomitans* serotype a suggested a stronger association of periodontally healthy individuals with the presence of serotype a. Alternatively, serotype a could be the dominant serotype of *A. actinomycetemcomitans* in the Turkish population and there may not be a bias for colonization by serotype a strains in healthy Turkish individuals.

Poster #: 27

Title: Comparison of Microleakage Between Composite Resin vs. Glass Ionomer Restorations: An In Vitro Study. Name: Sara Koshbin
Faculty Advisor: Thomas Tanbongliong

Background/Purpose: The purpose of this study is to compare microleakage of packable, light cured microhybrid composite (Herculite XRV, Kerr) to glass ionomers: Fuji IX GP Extra (GC America) and Chemfil Rock (Dentsply) at the enamel margins of class V restorations. Methods: Forty-five human, caries free premolars were selected. Class V preparations were prepared on the buccal surfaces of the teeth. The margins of the restorations

were all in enamel. The specimens were randomly divided into 3 groups: 15 teeth filled with Fuji IX GP Extra (GC America) (Group 1), 15 teeth filled with Chemfil Rock (Dentsply) (Group 2), 15 teeth filled with microhybrid composite (Herculite XRV, Kerr) (Group 3, control). All restorations were placed under the manufacturer's instructions. All specimens were thermocycled and then immersed in 1% methylene blue dye. The teeth were rinsed, embedded in acrylic and sectioned longitudinally in a buccolingual direction through the center of the filled restoration resulting in 90 surfaces examined under a 20x light microscope for dye penetration. The margins were evaluated and scored according to the degree of dye penetration along cervical and incisal margin of preparation using a 0-3 scale. A Kruskal-Wallis test was used to compare dye penetration between the three groups. A Mann-Whitney test was used to compare dye penetration between treatment pairs. Results: There was a statistically significant difference in the median dye penetration scores between Chemfil Rock (Dentsply) (group 2) and the Fuji IX GP Extra (GC America) (group 1) vs. the microhybrid Composite (Herculite XRV, Kerr) (control group) ($p < 0.0001$). There was no statistically significant difference in median dye penetration scores between Fuji IX GP Extra (GC America) (group 1) and composite (Herculite XRV, Kerr) (control group) ($p = 0.38$). Conclusion: Based on this in vitro study, Class V restorations filled with Chemfil Rock (Dentsply) had the greatest amount of marginal microleakage compared to restorations filled with Fuji IX GP extra (GC America) and microhybrid composite (Herculite XRV, Kerr). Restorations filled with Fuji IX GP extra (GC America) and a light cured microhybrid composite (Herculite XRV) exhibited the same degree of microleakage.

Poster #: 28

Title: Effect of a Disinfecting Solution on Microleakage of Class V Composite Restorations using a 4th Generation Bonding System Name: Ji Min Yochim
Faculty Advisor: Thomas Tanbongliong

liong

Background: 2% chlorhexidine gluconate (CHX) has been used to eliminate bacteria before cavity restoration, there is concern that the use of cavity disinfectants with dentin bonding agents may alter the ability of the hydrophilic resin to seal the dentin. Purpose: The purpose of this study was to determine the effect of varying the application time of a Chlorhexidine gluconate cavity disinfectant solution (Concepsis: Ultradent) on microleakage of class V composite restorations when using a 4th generation dentin bonding system (All Bond 2). Methods: Thirty extracted human permanent premolars with no caries, no restorations, and no cracks were used. Class V cavity preparations (4mm x 3mm x 2mm) were prepared on the buccal and lingual surfaces of each tooth. The specimens were randomly assigned to one of five groups, each consisting of 10 specimens: Concepsis treatment for 15 sec (CH15: group 1); Concepsis treatment for 60 sec (CH60: group 2); no Concepsis treatment, no etching or bonding (positive control: group 3). A negative control (CH15-cont and CH60-cont: groups 4 and 5, respectively) consisted of bonded restorations placed without application of Concepsis. Each tooth received both a Concepsis treatment (mesial surface) and negative control (distal surface). All specimens were thermocycled at 1,000 cycles between 5°C and 55°C and immersed in 50% silver nitrate for 1 hour and exposed in a photodeveloping solution for 8 hours to fix the silver nitrate staining. The specimens were sectioned buccolingually. Microleakage was assessed along the occlusal and gingival (cervical) walls of the specimens using a 20x light microscope. The following dye penetration scale was used: 0=no dye penetration along the occlusal/cervical margins of the preparation, 1=dye penetration up to 1/3 of the depth of the preparation, 2= dye penetration 1/3 – 2/3 of the depth of the preparation, 3= dye penetration 2/3 – the entire depth of the preparation along the cervical/occlusal margins). Results: Due to the small sample size and lack of variation there was no statistical significance. However, there

was less penetration of silver nitrate in both sample groups (CH15 and CH60) compared with the negative control groups (CH15-cont and CH60-cont). There was significantly greater microleakage at the cervical margin compared with the occlusal margin of both of the negative control groups and the sample groups. Conclusion: This in vitro study demonstrated that Chlorhexidine gluconate (CHX) treatment prior to placement of a class V composite restoration had no adverse effect on microleakage, but instead led to equal or less microleakage at the occlusal margin found in the negative control group. There was no time-dependent effect of CHX treatment on microleakage of class V composite restorations. In addition, this study showed that enamel sealing in all groups was better than dentin sealing.

Poster #: 29

Title: Effects of Non-Extraction Orthodontic Treatment on Tooth Tip and Torque
Name: Thao Nguyen
Faculty Advisor: Hongsheng Tong

Background: In a recent study by Tong, 76 subjects with near-normal occlusion, who were never orthodontically treated, were studied using CBCT to measure the tip and torque of each whole tooth (crown and root) in 3-dimensional space. The study provided a standard for positioning each whole tooth properly in the arches. Purpose: In this study, a subset of the 76 subjects were studied after they were orthodontically treated with non-extraction treatment. The purpose of this study is to determine the changes in tip and torque after orthodontic treatment was rendered. Methods: A sample of 24 patients with near-normal occlusion prior to orthodontic treatment was used in this study. Their final CBCT records were digitized using the custom University of Southern California root vector analysis software program. Paired t-tests were used to compare pre- and post-treatment values for tip and torque. Results: Results of the paired t-tests showed that there was a statistically significant difference for the tip value of lower first molars and torque values of upper second pre-

molars and lower first molars after orthodontic treatment was rendered. Conclusion: The tip and torque of each tooth was maintained throughout orthodontic treatment, except upper second premolars and lower first molars. This may be due to difficulty of determining proper band position for lower first molars and poor visibility for bracket position of upper second premolars. More studies with larger sample sizes are needed.

Poster #: 30

Title: Performance of Curing Lights in a Dental School
Name: Faris Alshahrani
Faculty Advisor: Jin-Ho Phark

Background: The purpose of this study is to examine the intensity output of light curing units and factors affecting their performance in a dental school. Purpose: The purpose of this study is to examine the intensity output of light curing units and factors affecting their performance in a dental school. Methods: Intensity output (mW/cm²) of 623 light curing units in a dental school (Ostrow School of Dentistry of USC) was examined using a radiometer (Bluephase meter, Ivoclar). Each unit was measured three times and the average was calculated. Furthermore, type of light curing unit, manufacturer, model name, months in service, and presence/absence of contamination on light tip were recorded. Statistical analysis was performed using Kruskal-Wallis and Mann-Whitney tests at $\alpha=0.05$. Results: Curing lights from 21 manufacturers, including 25 different models were evaluated. They were in service for 0-120 months (mean 20.79 $\pm$ 13.39 months). Intensity output ranged from 0-3000 mW/cm² (mean 753.48 $\pm$ 224.2). Output was $\leq$ 300 mW/cm² in 22 lights, 300-600 mW/cm² in 49 lights, 600-900 mW/cm² in 488 lights, 900-1200 mW/cm² in 55 lights, and $\geq$ 1200 mW/cm² in 9 lights. Mean output was comparable in corded LED lights (n=464) and corded quartz tungsten halogen lights (n=8) with 800.43 $\pm$ 5.14 and 797.92 $\pm$ 108.67 mW/cm², but significantly lower with 606.84 $\pm$ 30.2 mW/cm² in cordless LED lights (n=151). 52.2% showed contamination of the light

tip, however there was no significant difference in output between contaminated and not contaminated units. Output values varied significantly depending on manufacturer, model, and age. Conclusion: Curing light intensity output is influenced by various factors. Cordless lights should be recharged regularly to ensure sufficient output. Light intensity should be monitored regularly.

Poster #: 31

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 stimulating signals from the periodontal ligament. Ridge preservation using various bone grafting materials has been proposed as a means to minimize post-extraction atrophy. Purpose: This retrospective study evaluated the healing of extraction sockets following a ridge preservation procedure with anorganic bovine bone using micro-computed tomography. Methods: Sixty-eight extraction sockets were filled with large particles (1-2mm) of anorganic bovine bone (Bio-Oss, Geistlich) after tooth extraction using reduced-trauma technique and debridement. Sockets were covered by Polytetrafluoroethylene membrane (GBR-200, Osteogenics) for four weeks. Following the ridge preservation procedure (mean 147 $\pm$ 100 days), core samples were collected from each site using trephine drills (3.3mm 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 connective tissue, bone, and remaining graft material were measured in each sample. 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 (40.11%), connective tissue (47.88%) and residual graft particles (12%). Conclusion: The results of the present study provided important data regarding

the healing of anorganic bovine bone when used for ridge preservation. Additional data (reported in separate abstract; Wu, et al.) provide evidence for favorable outcome of implants placed into these grafted sites.

Poster #: 32

Title: Using CBCT to Assess Root Shape and Dilacerations
Name: Ryan Hecht
Faculty Advisor: Glenn Sameshima

Background: Abnormal root shape and dilacerations are well known to be associated with increased risk of external apical root resorption, however the limitations of using panoramic radiographs can prevent assessment of root shape. With CBCT, overlapping images can be removed to provide an accurate assessment of root shape and dilacerations. Only recently has the resolution of CBCT improved enough to make visualization of the root apex consistently viewable. It is conceivable that root shape looks different in three dimensions; in particular root dilacerations may be more evident. Purpose: To determine how root shape and dilacerations can be assessed with CBCT compared to panoramic radiographs. Methods: Panoramic and CBCT images of 50 patients were obtained before treatment. Each image was evaluated to assess the shape of the roots and the direction of dilacerations in the six maxillary anterior teeth. Results: With CBCT images root shapes could be assessed and the direction of dilacerations could be evaluated. With panoramic images this assessment was not always possible. Conclusion: Sometimes the roots of teeth would be impossible to evaluate from panoramic x-rays because of overlying structures and artifacts. CBCT was effective for detecting root shapes and dilacerations in vivo and allowed three-dimensional evaluation of dental roots without overlapping images.

Poster #: 33

Title: Facial Aesthetics of Class III Malocclusion Treatment in CLP Patients.
Name: Lily Chung
Faculty Advisor: Stephen Yen

Background: Patients with cleft lip and palate have a high incidence of Class III malocclusion. Purpose: The purpose of the study is to compare the facial attractiveness outcomes between two types of Class III treatment: late maxillary protraction vs. LeFort I orthognathic surgery. Methods: Standardized pre- and post-treatment photographs of 17 patients corrected by orthognathic surgery and 17 patients by maxillary protraction were randomly presented to raters and rated on a 10-point facial attractiveness scale via a web-based survey by 42 clinicians and 121 laymen from CHLA. Results: Both clinicians and laymen perceived an improvement of facial attractiveness, in degree and direction, from pre-treatment to post-treatment photographs. Laymen rated higher than clinicians. Clinicians rated the success of the two types of Class III treatment, protraction and orthognathic surgery, to be equivalent in improved facial attractiveness in patients with cleft lip and palate. Conclusion: Late maxillary protraction and orthognathic surgery achieved comparable final facial aesthetic ratings.

Poster #: 34

Title: Dentin Primer Reapplication Promotes Adhesive Luting of Sealed Preparations
Name: Ahmad Alawadhi
Faculty Advisor: Pascal Magne

Background: When using IDS (immediate dentin sealing), the preparation surface needs to be cleaned by abrasion before adhesive luting. There is a risk of re-exposing dentin when cleaning thin adhesive layers and exposed dentin is not easily detectable. Purpose: Reapplication of the primer during luting could help seal the exposed dentin but may contaminate the resin-to-resin bond on the rest of the preparation. The aim of this study was to evaluate the effect of primer contamination on the resin-to-resin bond. Methods: Ten freshly extracted human molars were obtained and divided into 2 groups. Flattened midcoronal dentin surfaces were treated with IDS (Optibond FL) immediately following preparation and covered with provisional restorations (Fermi) for 2 weeks. In group OB the

existing adhesive coating was air-braded, new adhesive reapplied and a definitive composite resin restoration (Z100) incrementally placed. In group OB+, primer and adhesive were reapplied before restoration. All teeth were prepared for a non-trimming micro-tensile bond strength test (MTBS) 24 hours later. Twenty-one beams ($0.9 \times 0.9 \times 11$ mm) were selected for testing each group. MTBS were compared using Mann-Whitney U test at $p=.05$. Results: Average MTBS for group OB was 34.83MPa vs 43.81 for OB+ and those values proved significantly different ($P=.026$). Conclusion: Reapplication of the primer during luting of sealed preparations may seal possible dentin exposure while promoting resin-to-resin bonding.

Poster #: 35

Title: Pulpal Necrosis due to Sick Cell Anemia: A Case Report
Name: Travis Chapman
Faculty Advisor: Tom Levy

Background: A case report of pulpal necrosis due to sickle cell anemia is presented. Diagnostic challenges and radiographic features are discussed as well as treatment considerations. Purpose: This case report will add to the literature in support of the finding that pulpal necrosis occurs due to sickle cell anemia. The report will also review the literature and provide recommendations regarding treatment and management of patients with this disease. Methods: Case report and review of previously reported oral complications associated with sickle cell anemia. Results: Sick cell disease presents many challenges in diagnosis and patient management. This case highlights these challenges. Conclusion: Sick cell anemia is a genetic and systemic disease which may cause pulpal necrosis. The disease also causes radiographic changes in the jaws and multiple challenges in both diagnosis and patient management. Special consideration should be used when treating patients with sickle cell anemia.

Poster #: 36

Title: Canonical Wnt Signaling Pathway Mediates Muscle Regeneration after Tongue Injury
Name: Steve Lim

Faculty Advisor: Yang Chai

Background: The signaling pathways involved in the repair process after a mechanical tongue injury are still unclear. Purpose: The aim of this project is to investigate the molecular mechanisms underlying new muscle formation after tongue injury. Methods: A 2mm punch was used to generate an acute penetration injury to mouse oral tongue. Tongue samples were analyzed at different time points following the injury with HE staining to evaluate the wound repair process. Satellite cells were analyzed for the molecular marker Pax7 using immunohistochemistry staining. Tamoxifen-inducible Pax7 Cre ERT2; R26RF/+ reporter mice were used to analyze the contribution of satellite cells to newly formed muscle fibers. Double antigen staining was performed to analyze the relationship between the behavior of satellite cells and the Wnt signaling pathway. Results: New muscle formation started as early as three days after injury as Pax7(+) cells started to proliferate. One week after injury, newly formed muscle fibers derived from Pax7(+) cells were evident. Two weeks after injury, the boundary between the injured and uninjured regions could not be clearly distinguished as the Pax7(+) cell distribution normalized to its previous state. Also, active β -catenin and Pax7(+) showed co-localization of their expression in tongue three days post-injury. The expression of active β -catenin was not restricted to Pax7(+) but also was seen in cranial neural crest cells. Conclusion: Canonical Wnt signaling may play an important role in satellite cell proliferation in new muscle regeneration after a tongue injury.

Poster #: 37

Title: Overbite Correction with Fully Customized Lingual Appliances
Name: Scott Morita
Faculty Advisor: Dan Grauer

Background: Overbite is the vertical relation of the upper to lower incisors. Overbite is considered normal within 1-3 mm, and excessive over 4 mm. Purpose: The goal of this study is to determine the mechanism of overbite correction with customized

appliances. Methods: Cephalometric radiographs for 39 consecutive cases with >4 mm of overbite were digitized and traced in Dolphin Imaging Software. In order to assess changes, tracings were superimposed by the Bjork structural method. All cases were from a single orthodontic office in Germany and treated with Incognito lingual system. Sample was divided into growing and non-growing subgroups according to chronological age. Descriptive statistics and comparison between subgroups are presented. Results: Treatment and growth changes in growing patients included: 1) molar extrusion 2) anterior incisor intrusion 3) anterior incisor flaring. Treatment and aging changes in growing patients included: 1) minimal molar extrusion 2) anterior incisor intrusion 3) greater anterior incisor flaring 4) mandibular autorotation. The difference between groups was the increase in facial heights. Conclusion: Growing and non growing differed (as expected) in the increase of facial heights. Incisor inclination depended on the desired inclination designed into the custom lingual appliance as opposed to increased inclination (flared) incisors often reported in other studies. Overbite correction was a combination of molar extrusion, incisor intrusion, incisor flaring, and mandibular autorotation. Future research is needed to define the target overbite for specific patients in order to prevent wear and allow for optimum function.

Poster #: 38

Title: Retrievable, Cement-retained Zirconia Restorations on Implant Abutments without Residual Cement
Name: Shoko Sato
Faculty Advisor: Homa Zadeh

Background: It has been shown that excess residual cement associated with cement-retained implant restorations is often the cause of peri-implant disease. One method for avoiding residual cement is the use of retrievable, screw-retained restorations made with custom abutments. Material choices for custom implant abutments are limited to titanium, zirconia and cast gold, and it has been shown that the most

tissue compatible materials for implant abutments are titanium and zirconia. While larger manufacturers of implants offer the capability of milled titanium and zirconia custom abutments for screw-retained final restorations for their implants, they may not offer such products for every implant system. Thus if milled titanium or zirconia custom abutments are unavailable, the only option for a screw-retained restoration would be porcelain fused to cast gold. This poster describes the use of commercially available, manufactured titanium abutments and customized milled zirconia crowns cemented together extra-orally and inserted as a retrievable, screw-retained final implant restoration without the intra-oral use of cement, thus eliminating the risk of peri-implant disease from excess residual cement. Many papers in implant dentistry have been written about the advantages of titanium and zirconia as an abutment material as well as the advantages of screw-retained final restorations for implants as opposed to cement-retained restorations. The problem is that not all implant companies provide the means for fabricating a custom titanium or zirconia final restoration that is screw retained. Such restorations would have to be made of cast gold which may not fit as well as milled components, may not be as compatible with the soft-tissue, and the gold may be costly. Purpose: The purpose of fabricating this screw-retained restoration is to avoid using cemented final restorations which have been shown to be associated with peri-implant disease. We were trying to fabricate a screw-retained final restoration for an implant using a milled titanium abutment interface with a zirconia final restoration for implant systems that may not have custom milled abutments available. Methods: We used a stock, manufactured titanium abutment so that it would have a milled implant interface and titanium soft tissue interface with the subgingival epithelium. We fabricated a zirconia crown with a screw access hole incorporated into the occlusal surface prior to sintering, so that no drilling would be necessary after sintering. We cemented the crown on the abutment extra-

orally so that all excess cement could be removed easily prior to fastening the abutment to the implant. Results: The final restoration was screw-retained, allowing us to avoid using a final restoration which had to be cemented in the mouth. There was no opportunity for retained excess cement which might be responsible for peri-implant disease. Conclusions: Retrievable screw-retained final implant restorations can be routinely fabricated for implants to avoid using cemented final restorations which have been shown to be associated with peri-implant disease, even for implant systems for which milled titanium or milled zirconia custom abutments are not readily available.

DENTAL HYGIENE

Poster #: 39

Title: Six Minutes Can Save a Life
Name: Andrea Wong
Faculty Advisor: Donna Smith

Background: Six minutes is the time that it takes to save a life. Dental professionals must be prepared to manage medical emergencies. The key to success is to have a plan which includes when, where, and how to handle each given situation. Research shows that effective implementation of a plan can greatly increase the survival rate should a medical emergency occur. The goal of this presentation is to increase the awareness of the importance of being prepared and to provide guidelines for developing and implementing an effective plan. Purpose: To inform and educate dental professionals about the prevalence and significance of medical emergencies that could possibly occur in the dental office. Methods: We compiled several different articles, books, and surveys pertaining to medical emergencies in the dental office. We also interviewed and consulted with Dr. Stanley Malamed, an expert in the field. Results: "95% of dental offices have experienced a medical emergency." "For each minute a person is in cardiac arrest their chance of survival decreases from 7-10%" The number one medical emergency that occurred in the dental office was syncope followed by asthmatic attacks, and epinephrine reactions. Conclusion: Because of the high prevalence of medical emergencies that occur in the dental office, and how quickly patients' health can decline during a medical emergency, it is extremely important that each office be prepared. Being prepared can be as simple as having a medical emergency plan of action and a well equipped medical emergency kit.

Poster #: 40

Title: Drool 4 The Cure
Name: Jonathan Ochi
Faculty Advisor: Diane Melrose

Background: During cancer development, the over abundance of abnormalities in or damages to specific proteins triggers rapid growth

and division of cancer cells. Salivary tests that measure these changes have been evaluated as an early detection method for breast cancer. Purpose: The purpose of the research was to examine and evaluate studies that currently employ salivary testing as detection methods for cancer. Methods: An in-office salivary test performed by a dental hygienist offers a convenient and accurate breast cancer screening. Upon completing a routine appointment, the patient would know if he or she was a carrier of the common proteins associated with breast cancer. The four proteins assessed during this hypothetical screening are BRCA1 & 2, HER2, and P53. The procedure measures antibody-protein binding in order to determine a positive or negative result. Results: Each of the four proteins represents an underlying risk factor for the development of breast cancer. Specifically, abnormalities in BRCA 1 & 2, overabundance of HER2, and damage to the P53 protein are all biomarkers for breast cancer development. Conclusion: With increasing knowledge of the characteristics and understanding of the role of these 4 proteins over time, attention in recent years has been focused on how this information can be applied clinically in patient care and management. Salivary tests offer a first line of defense against breast cancer with more frequent in-office screenings, less invasive testing, and affordable pricing for the patient. With an approximated 95% success rate in early detection, salivary diagnostics are the future of breast cancer screenings.

Poster #: 41

Title: Electronic Cigarettes: Tricky Aid or Risky Trade?
Name: Kristine Parungao
Faculty Advisor: Donna Smith

Background: In the United States, there are approximately 45 million tobacco smokers and only 4% have successfully quit smoking. A new product that claims to help with tobacco addiction is an electronic cigarette (E-cigarette). Proponents of E-cigarettes claim their usefulness with less carcinogenic content than tobacco cigarettes. They may help the tobacco addict deal with

their harms to tobacco. Opponents of E-cigarettes claim the device will be falsely marketed as a safe tobacco substitute without any scientific research available to prove its safety. This presentation will discuss different perspectives about E-cigarettes and whether they have potential to become a psychological trick or a risky trade. Purpose: To educate and inform tobacco users and non-tobacco users about E-cigarettes. Methods: We utilized literature reviews which tested two groups of participants chosen at random among a group of consistent smokers. One group of smokers smoking cigarettes. One group of smokers smoking electronic cigarettes. Participants smoked the product for seven minutes and then were examined by a cardiologist to check to see if there was a difference in respiration. Results: The results showed that there is still not enough evidence to show whether electronic cigarettes are safe or not. The research on electronic cigarettes is on-going and in the future it could possibly be an alternative option for tobacco cessation. Conclusion: In conclusion, research shows electronic cigarettes are hand held devices that deliver nicotine to the user with no tobacco. This product mimics the act of smoking while delivering the addictive component nicotine and can address both the pharmacologic and behavioral components of cigarette addiction.

GRADUATE POST-
DOCTORAL TRAINEE

Poster #: 42

Title: IFN- γ /TNF- α Synergistically Induce MSC Impairment and Tumorigenesis via NF κ B

Name: Lei Wang

Faculty Advisor: Songtao Shi

Background: An inflammatory microenvironment may cause organ degenerative diseases and malignant tumors. However, the precise mechanisms of inflammation-induced diseases are not fully understood. Purpose: We hypothesize that interferon γ (IFN- γ) and tumor necrosis factor α (TNF- α), as critical inflammatory factors, synergistically induce MSC deficiency, whereas their long-term effect can result in the induction of MSC tumorigenesis by oncogene activation. Methods: Ovariectomized (OVX) mice, which showed elevated IFN- γ and TNF- α levels, were used as degenerative disease and tumorigenesis models, respectively, and mesenchymal stem cells (MSCs) from bone marrow and derma were characterized. Results: Here we show that the IFN- γ and TNF- α synergistically impair self-renewal and differentiation of MSCs via nuclear factor κ B (NF κ B)-mediated activation of smad7 in ovariectomized (OVX) mice. More interestingly, long-term elevated levels of IFN- γ and TNF- α result in significantly increased susceptibility to malignant transformation in MSCs through NF κ B-mediated upregulation of the oncogenes c-fos and c-myc. Depletion of either IFN- γ or TNF- α in OVX mice abolishes MSC impairment and the tendency toward malignant transformation with no NF κ B-mediated oncogene activation. Systemic administration of Aspirin, which significantly reduces the levels of IFN- γ and TNF- α , results in blockage of MSC deficiency and tumorigenesis by inhibition of NF- κ B/smad7 and NF κ B/c-fos and c-myc pathways in OVX mice. Conclusion: This study reveals that inflammation factors, such as IFN- γ and TNF- α , synergistically induce MSC deficiency via NF κ B/smad7 signaling and tumorigenesis via NF κ B-mediated oncogene activation. Anti-inflammatory treatment,

such as Aspirin administration, prevents MSC deficiency and malignant transformation in OVX mice.

Poster #: 43

Title: Quantitative Co-localization of Enamelin with Amelogenin

Name: Victoria Gallon

Faculty Advisor: Janet Oldak

Background: Enamelin is critical for tooth enamel development and is thought to cooperate with amelogenin to control crystal nucleation and morphology. Our recent investigations on the interactions between amelogenin and enamel have been concentrated on in vitro strategies. Purpose: To quantitatively analyze co-localization of enamel and amelogenin in developing enamel using confocal microscopy and to provide evidence for their interactions in vivo. Methods: Antibodies against a 32kDa enamel peptide and against the full-length recombinant mouse (rM179) amelogenin were used to examine molars from 3, 8, 15 and 21-day mouse mandibles. Co-localization patterns were analyzed from the apical root towards the tip of molars and from the ameloblasts to the dentinoenamel junction covering the entire thickness of enamel. Regions of interest (ROIs) included: a large (45 μ m in height) and a small ROI (8 μ m diameter) area. Results: Enamelin and amelogenin co-localized near the secretory face of ameloblasts. Enamelin was mainly located along the secretory face, while amelogenin was seen throughout the entire thickness of enamel. In an 8-day mouse, analysis of the entire thickness by large ROI's revealed that approximately 58% of amelogenin co-localized with enamel and approximately 70% of enamel co-localized with amelogenin. By analyzing a small ROI near the ameloblasts at the apical root, we found that approximately 83% of amelogenin co-localized with enamel and approximately 85% of enamel co-localized with amelogenin. The percentage of co-localization decreases towards the tip. Conclusion: Enamelin was concentrated at the secretory face; supporting the theory that enamel induces nucleation at the beginning of enamel formation. More enamel co-localized with amelogenin

than amelogenin co-localized with enamel. Adjacent to ameloblasts there was an approximate 1:1 ratio of enamel and amelogenin. Co-localization of these proteins within small areas indicates that they interact in vivo suggesting that they cooperate to control crystal nucleation and morphology.

Poster #: 44

Title: Iron Deposition and Fth Localization in Rodent Teeth

Name: Xin Wen

Faculty Advisor: Michael Paine

Background: An iron rich layer on the labial surface is characteristic of the enamel of rodent incisors. Purpose: To address a role for iron content in continuously growing incisors during odontogenesis. Methods: We studied iron deposition patterns in enamel and dentin using Perls' blue staining and ferritin heavy chain (Fth) immunolocalization. Fth expression is regulated by iron level, therefore its localization can be used as a sensitive indicator for iron deposition. Results: Sagittal sections of 4-week old rat incisors showed a gradual increase in iron level in the enamel organ from secretory to maturation stages. In addition, iron was detected in ameloblasts of erupting third molars of 4-week old rats, suggesting iron plays a role in both incisor and molar development. In odontoblasts, the presence of iron was demonstrated, and this is consistent with iron's role in collagen synthesis. Using postnatal 3-, 6-, 9-day old mice, the spatial and temporal expression of Fth in tooth development again indicated the presence of iron in mature ameloblasts and odontoblasts. Conclusion: While these data do not explain what functional role iron has in tooth formation, it does highlight a significant molecular activity associated with the formation of the rodent dentition.

Poster #: 45

Title: Application of Liposomes as Models for Amelogenin-Membrane Interactions

Name: Sowmya Bekshe Lokappa

Faculty Advisor: Janet Oldak

Background: Amelogenin, an intrinsically disordered protein, is

the major component in the dental enamel extracellular matrix (ECM). ECM also constitutes other phosphorylated, glycosylated and sulfated proteins, proteinases and lipids. Due to this heterogeneity, complex protein-protein, protein-mineral and protein-lipid interactions can be envisaged during amelogenesis. Lipids constitute 0.2% of the developing enamel matrix. As amelogenin is synthesized by the ameloblast cells and secreted via matrix secretory vesicles, the study of its structure in the presence of cell membrane or membrane mimicking models can give more insight into its function during amelogenesis. Purpose: To investigate interactions of amelogenin with liposomes as artificial models for ameloblast cell membrane and matrix vesicles, to analyze the structural changes involved in amelogenin upon its binding to liposomes, and address the transformation between its disordered and ordered conformation. Methods: We used recombinant porcine full-length amelogenin (rP172) and a mixture of commercially available lipids and phospholipids. Binding between amelogenin and liposomes was analyzed by fluorescence spectroscopy, dynamic light scattering and transmission electron microscopy. Conformational changes in amelogenin were analyzed by circular dichroism. Results: Fluorescence studies revealed that monomeric rP172 is peripherally bound to the zwitterionic 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphocholine (POPC) liposomes but associated strongly with the anionic 1-palmitoyl-2-oleoyl-sn-glycero-3-phosphoglycerol (POPG) liposomes, as well as with the ameloblast cell membrane mimicking liposomes (ACML). Further, circular dichroism studies revealed that rP172 coils to form alpha helix following its interaction with the anionic POPG and the ACML liposomes. Fluorescence and CD studies indicated weak interactions of rP172 nanospheres with POPG and ACML liposomes. TEM studies suggests that amelogenin interactions are highly dependent on the lipid composition. Conclusion: Amelogenin molecules interact weakly with neutral liposomes, but strongly with negatively charged liposomes and the amelo-

blast mimicking liposomes, changing their conformation. These findings have important implications for understanding the interactions of amelogenin with ameloblasts and matrix secretory vesicles.

Poster #: 46

Title: TGF β /IRF6 Interaction in Regulating Palatal Fusion
Name: Junichi Iwata
Faculty Advisor: Yang Chai

Background: Cleft palate is one of the most common human birth defects and is associated with multiple genetic and environmental risk factors. Although mutations in transforming growth factor beta (TGF β) signaling molecules and interferon regulatory factor 6 (IRF6) have been identified as genetic risk factors for cleft palate, little is known about the relationship between TGF β signaling and IRF6 activity during palate formation. Purpose: To investigate how TGF β signaling regulates gene expression of Irf6 and the fate of the medial edge epithelium (MEE) during palatal fusion in mice. Methods: We generated Smad4fl/fl;K14-Cre;Irf6+/R84C mice to investigate the possible genetic interaction between Smad4 and Irf6. We treated palatal explants from wild-type and mutant mice with siRNA or overexpression vectors to test the functional significance of target molecules. We generated Irf6 transgenic mice to rescue submucous cleft palate in Tgfb2fl/fl;K14-Cre mice. Results: Smad4fl/fl;K14-Cre;Irf6+/R84C mice show compromised p21 expression and MEE persistence similar to Tgfb2fl/fl;K14-Cre mice, although the secondary palates of Irf6+/R84C and Smad4fl/fl;K14-Cre mice form normally. Furthermore, Smad4fl/fl;K14-Cre;Irf6+/R84C mice show extra digits that are consistent with abnormal toe/nail phenotypes in individuals with Van der Woude and popliteal pterygium syndromes, suggesting that the TGF β /SMAD4/IRF6 signaling cascade may be a well-conserved mechanism regulating multiple organogenesis. Strikingly, overexpression of Irf6 rescued p21 expression and MEE degeneration in Tgfb2fl/fl;K14-Cre mice. Conclusion: IRF6 and SMAD4 synergistically regulate the fate of the MEE,

and TGF β -mediated Irf6 activity is responsible for MEE degeneration during palatal fusion in mice.

Poster #: 47

Title: Cranial Neural Crest Cells Instruct Tongue Muscle Development in Mice
Name: Akiko Suzuki
Faculty Advisor: Yang Chai

Background: Microglossia is one of the common congenital birth defects in humans and adversely impacts quality of life. In vertebrates, tongue muscles derive from cranial mesoderm and occipital somites, whereas skeletal elements, tendons, and connective tissue in the craniofacial region originate from cranial neural crest (CNC) cells. Loss of TGF β type II receptor in CNC cells in mice (Tgfb2fl/fl;Wnt1-Cre) causes microglossia. However, it is still unclear how TGF β signaling in CNC cells regulates the fate of mesoderm-derived muscle cells. Purpose: To investigate how disruption of TGF β signaling in CNC cells affects tongue development. Methods: We performed microarray analysis and quantitative RT-PCR assays to identify downstream target molecules in the tongue of E14.5 Tgfb2fl/fl;Wnt1-Cre mice. To rescue proliferation and differentiation defects in tongue muscles, we tested candidate molecules in ex vivo organ culture. Results: Loss of TGF β signaling resulted in a failure of CNC-derived fibroblast differentiation, followed by a disruption of TGF β -mediated expression of both BMPs and FGFs and decreased myogenic cell proliferation and differentiation activities. Exogenous BMPs and FGFs could restore cell proliferation and differentiation in the tongue of Tgfb2fl/fl;Wnt1-Cre mice. Conclusion: CNC-derived fibroblasts regulate mesoderm-derived myoblasts via TGF β -mediated BMP and FGF signaling cascade during tongue development.

Poster #: 48

Title: The Neurovascular Bundle is a Mesenchymal Stem Cell Niche
Name: Hu Zhao
Faculty Advisor: Yang Chai

Background: The processes that regulates mesenchymal stem cell

(MSC) activities during tissue homeostasis and repair are poorly understood. Purpose: To find the niche of the mesenchymal stem cell. Methods: Label retaining analysis and lineage tracing analysis. Results: By comparing mouse incisors and molars, two highly similar organs, we provide evidence that the neurovascular bundle (NVB) acts as a mesenchymal stem cell niche and provides a source of Shh protein that activates Gli1 expression in adjacent slow cycling mesenchymal cells. These mesenchymal cells contribute to all mesenchymal cell derivatives during continuous incisor growth, indicating they are mesenchymal stem cells. Denervation compromises Gli1 activity and disrupts stem cell homeostasis leading to abnormal incisor growth. NG2+ pericytes residing in the perivascular niche represent a subpopulation of Gli1+ cells in the incisor mesenchyme and contribute little to the homeostasis. They function mainly in repairing tissue damage. Teeth that do not grow continuously, such as mouse molars, show no slow cycling mesenchymal or Gli1 expression cell associated with NVB. Mouse molars contain NG2+ cells which can only contribute to injury repair, so they cease growing but can only repair damage. Other rodents with continuously growing molars, such as guinea pigs, have Gli1+ cells in the mesenchyme surrounding the NVB and show stem cell characteristics. Conclusion: Thus, we propose that homeostasis and tissue repair are two distinct biological processes supported by different stem cell sub-populations with differential growth and repair abilities, and NVB provides a niche for the mesenchymal stem cells to mediate tissue homeostasis.

Poster #: 49

Title: Facial Growth Remodeling of the Maxilla after M2 Eruption
Name: Rodrigo Lacruz
Faculty Advisor: Michael Paine

Background: From childhood to adulthood, the normal development of the face experiences bone surface deposition and resorption in key areas of the maxilla. Bone resorption and bone deposition are important cell-mediated mechanisms that, in

addition to displacement, contribute to the balanced growth of the various facial bones. Specific distributions of remodeling fields (bone deposition vs. bone resorption) result in distinctive patterns of adult facial anatomy. When osteoclasts attach to the bone surface, they secrete acid and enzymes that break down bone matrix resulting in anisotropic resorption bays called Howship's lacunae. Areas of bone deposition by osteoblasts lack Howship's lacunae and instead have more isotropic surfaces that often contain bundles of mineralized collagen fibrils. Both patterns can be identified in periosteal bone surfaces. Purpose: Most studies of maxillary growth remodeling are concerned with growth stages around time of eruption of the first permanent molar (M1). Here we analyze four individuals with M2 erupted to determine their pattern of bone growth remodeling. Methods: The maxillae were recovered from an archaeological population dating back to the XII century in Burgos, Spain. Specimens were analyzed using environmental scanning electron microscope. Areas of bone deposition were marked as (+) whereas bone resorption was marked as (-). Results: Bone resorption was found in most areas of the naso-maxillary clivus. Conclusion: Osteoclastic bone resorption persists on the naso-maxillary clivus until later developmental ages, contributing to the retracted maxilla of humans.

Poster #: 50

Title: Amelogenin-Chitosan Hydrogel for Enamel Reconstruction
Name: Qichao Ruan
Faculty Advisor: Janet Oldak

Background: Enamel reconstruction is a significant topic of study in the material science and dentistry as a novel approach for prevention, restoration, and treatment of defective enamel. During amelogenesis, the initial formation of organized enamel crystals occurs in an amelogenin-rich gel-like matrix. Purpose: Amelogenin-loaded chitosan hydrogel was investigated as a matrix for enamel remineralization. Our objectives were 1) to investigate the interaction between chitosan and amelogenin, 2) to re-construct

enamel utilizing the amelogenin-chitosan hydrogel system. Methods: Chitosan-amelogenin interactions were investigated by Circular Dichroism (CD) and Fluorescence spectroscopy. To prepare the complex hydrogel, recombinant amelogenins (rP172) and HPO42- were mixed with chitosan, and Ca2+ ions were introduced by diffusion to initiate mineralization. For remineralization experiments the complex hydrogel was applied onto the acid-etched human enamel surface prior to mineralization in artificial saliva. The phases and morphologies of mineralized chitosan-based layer on enamel were characterized by X-ray diffraction (XRD) and scanning electron microscopy (SEM). Results: The interaction between chitosan and amelogenin was pH dependent. At lower pH values, chitosan interacted with rP172 through electrostatic interaction. Whereas, at pH higher than 5.5, chitosan's interaction was weak because of its low solubility and deprotonation. After mineralization for 7 days in artificial saliva, organized fluoridated hydroxyapatite crystals were formed on the enamel surface treated by amelogenin-loaded chitosan hydrogel. In contrast, only few random crystals were observed in the chitosan gel without amelogenin. Crystals formed in the hydrogel with amelogenin were tightly bound to the enamel crystallites, whereas a large gap between chitosan film and enamel was observed. Conclusion: These results revealed that amelogenin incorporated into chitosan hydrogel promoted the formation of oriented bundle of crystals. Our studies indicate that amelogenin-loaded chitosan hydrogel is a promising and easy-to-handle biomaterial for enamel repair.

Poster #: 51

Title: Dental Implants in Patients Treated with Bisphosphonates: A Systematic Review
Name: Azadeh Ahmadi
Faculty Advisor: Parish Sedghizadeh

Background: Bisphosphonates (BP) are commonly prescribed medications used in the treatment of metabolic and oncologic bone pathoses. A significant adverse effect

observed in patients using either oral or intravenous BP is Bisphosphonate Related Osteonecrosis of the Jaw (BRONJ). Currently there is limited data available in the literature regarding the outcome of placing dental implants in patients taking BP and the risk of developing BRONJ in these patients. Purpose: We conducted a systematic review to evaluate the success rate of osseointegration of dental implants and the risk of osteonecrosis of the jaw in dental implant patients with a history of BP therapy. Methods: Two investigators (GC and AA) independently queried the literature using these databases: PubMed/Medline and Cochrane Central Register of Controlled Trials. English language articles were searched dating from January 1st 1995 to March 31st 2011. Results: Based on the current literature, all of the retrospective studies with moderate strength of evidence indicate that the occurrence of BRONJ in dental implant patients taking oral or intravenous BP is negligible compared to dental implant patients not taking BP. However, there are some case reports and case series that report BRONJ cases in dental implant patients with a history of oral and intravenous BP use. Conclusion: History of oral or intravenous BP use is not an absolute contraindication for dental implant placement, and dental implants can be osseointegrated successfully in this patient population.

Poster #: 52

Title: Integrin Signals Mediate Enamel Regeneration through Triggering C/EBP α and c-Jun
Name: Zhan Huang
Faculty Advisor: Malcolm Snead

Background: Enamel formation involves highly orchestrated intracellular and extracellular events; following development, the tissue is unable to regenerate, making it a challenging target for tissue engineering. Purpose: To elucidate the intracellular signaling pathways responsible for enamel regeneration, we explore here the coupling response of integrin receptors to the branched RGDS (Arg-Gly-Asp-Ser) peptide amphiphiles (PA) and subsequent downstream gene expres-

sion profiles. Methods: Real-time PCR analyzed the levels of gene transcription leading to enamel regeneration in primary enamel organ epithelial (EOE) cells treated with bRGDS PA matrix. Western blot and confocal immunofluorescent analysis characterized the immediate molecular response of the EOE cells to the artificial matrix by examining the phosphorylation of focal adhesion kinase (FAK), the activation of c-Jun N-terminal kinase (JNK) and c-Jun. Transcriptional activity of the amelogenin promoter through the two c-Jun binding sites were evaluated by site-directed mutagenesis and luciferase assay. Results: We demonstrate that the artificial matrix mediated increased abundance of amelogenin and its transactivator CCAAT enhancer binding protein α by activating FAK to increase phosphorylation of JNK and c-Jun. Inhibition of FAK blocked gene activation. Inhibition of JNK abolished phosphorylated-c-Jun (p-c-Jun) and attenuated the pathways identified to promote enamel regeneration. Cognate binding sites in the amelogenin promoter were identified to be transcriptionally up-regulated in response to p-c-Jun. Conclusion: Elucidating these cues not only provides guidelines for the design of synthetic regenerative strategies and opportunities to manipulate pathways to regulate enamel regeneration, but also can provide insight into the molecular mechanisms involved in tissue formation.

Poster #: 53

Title: Dental Mesenchymal Stem Cells: Promising Candidates for Bone Tissue Engineering
Name: Alireza Moshaverinia
Faculty Advisor: Songtao Shi

Background: The ultimate goal of bone tissue engineering is the regeneration of a construct that matches the physical and biological properties of the natural bone tissue. Purpose: The purpose of this study was to study the application of encapsulated dental-derived mesenchymal stem cells in RGD-coupled alginate hydrogel in calvarial defect model. Methods: Calvarial defects in mice were generated and periodontal ligament stem cells

(PDLSCs) and gingival mesenchymal stem cells (GMSCs) encapsulated in RGD-modified alginate hydrogel microspheres were transplanted to observe the bone regeneration capacity of the encapsulated stem cell constructs. New bone formation induced by dental mesenchymal stem cell-biomaterial constructs was assessed using micro-CT and histological analyses after 12 weeks of transplantation. Results: The results showed that both PDLSCs and GMSCs express mesenchymal stem cell markers such as: CD 146 and CD 166. Additionally, PDLSCs and GMSCs showed significantly high numbers of single colony clusters (CFU-F) and an elevated cell proliferation rate compared to hBMMSCs. Furthermore, PDLSCs and GMSCs were found to express bone transcription factors (Runx2) and bone formation markers (osteocalcin), implying their in vivo osteogenic differentiation potential. PDLSCs and GMSCs were able to repair the defects with considerable amounts of mineralized tissue formation. However PDLSCs showed significantly higher amounts of bone regeneration in comparison to the GMSCs ($P < .05$). Conclusion: Dental mesenchymal stem cells-RGD-modified alginate constructs are promising candidates for craniofacial bone regeneration. This strategy appears to be a promising modality of treatment for potential dental and orthopedic applications.

Poster #: 54

Title: BMP-Smad4 Signaling Controls Switch from Tooth Crown to Root Fate
Name: Jingyuan Li
Faculty Advisor: Yang Chai

Background: TGF- β /BMP signaling is crucial during organogenesis, and the canonical Smad pathway is an important mediator of TGF- β /BMP signaling during development and disease. During tooth development, dental epithelial cells known as the Hertwig's epithelial root sheath (HERS) play a critical role in root formation following crown development. Previous studies have demonstrated that BMP signaling in the dental epithelium controls root development. However, the functional significance of Smad4 in the dental

epithelium during the switch from tooth crown to root fate remains unknown. Purpose: To investigate the function and mechanism of Smad4, the common Smad for TGF- β /BMP signaling, in the dental epithelium during the switch from tooth crown to root fate. Methods: To explore the role of Smad4 signaling during mouse development and adult life, we used an rtTA transactivator/tetracycline promoter approach that allows inducible attenuation of Smad4 signaling. Results: Ablation of Smad4 in the dental epithelium affects crown and root formation and results in a shift from brachydont teeth, with low crowns and high roots, to hypsodont teeth with high crowns and low roots, in adult Krt14-rtTA;Teto-Cre;Smad4^{fl/fl} mice. Without Smad4, the cervical loop, including the central core of putative epithelial stem cells, is maintained longer during crown development, and HERS and root formation are postponed leading to a higher crown. Meanwhile, deletion of Bmpr1a in the dental epithelium using Krt14-rtTA;Teto-Cre;Bmpr1a^{fl/fl} mice phenocopies Krt14-rtTA;Teto-Cre;Smad4^{fl/fl} mice. However, Krt14-rtTA;Teto-Cre;Tgfb^{2fl/fl} mice have well-formed crown and root. Conclusion: Our study demonstrates that BMP-Smad4 signaling cascade, not TGF- β -Smad4, controls the switch from tooth crown to root fate during organogenesis.

Poster #: 55

Title: Application of Diluted Sodium Hypochlorite as Periodontal Therapy

Name: Maria Galvan

Faculty Advisor: Jorgen Slots

Background: Conventional periodontal therapy includes an anti-infective phase if necessary followed by a surgical phase. Once the end-point of active therapy has reached, a maintenance phase is instituted. Anti-infective therapy includes mechanical removal of soft and hard biofilm. An array of adjunctive antimicrobial therapies have been proposed with varying results. The application of diluted sodium hypochlorite has been examined in previous studies and there is significant data in favor of the efficacy of

this agent. Purpose: We hypothesize that an antimicrobial therapy, which includes professionally-applied subgingival irrigation, followed by oral rinses with diluted sodium hypochlorite can significantly reduce periodontal inflammation. Methods: We propose a clinical trial that includes 30 healthy adults diagnosed with periodontitis. The following clinical variables will be evaluated: medical history, dental radiographs, number of teeth, plaque index, gingival index, bleeding on probing, pocket depth, and gingival recession. The following microbiological samples will be obtained: saliva, supragingival plaque, and subgingival plaque. At visit 1 (day 1), the clinical variables will be evaluated, and the samples will be obtained. Patients will randomly receive professional subgingival irrigation with either sodium hypochlorite 0.25% (test) or water (control). Patients will rinse at home twice a week for 2 weeks with either sodium hypochlorite 0.25% (test) or water (control). At visit 2 (day 14), the clinical variables will be evaluated, samples will be obtained, and need for further periodontal treatment will be determined. Results: Pending results. Conclusion: Pending conclusion.

Poster #: 56

Title: Functional Requirement for Smad4-mediated Signaling in Tooth Root Development

Name: Jifan Feng

Faculty Advisor: Yang Chai

Background: Smad4-mediated TGF β /BMP signaling plays a crucial role in regulating the fate of cranial neural crest (CNC) derived cells. Tissue-specific inactivation of Smad4 in the CNC derivatives, including the dental mesenchyme, resulted in incisor and molar development arrest at the dental lamina stage. Furthermore, ablation of Smad4 in dental mesenchyme in Osr2-IresCre;Smad4^{fl/fl} mutants impaired odontoblast differentiation and dentin formation. Purpose: The aim of this project is to further study the potential role of TGF β /BMP signaling in regulating the cell fate of dental mesenchymal cells during late tooth developmental stages when root formation occurs. Methods: We first analyzed the activi-

ties of Smad4-dependent signaling pathways in the molar mesenchymal cells during root development. To study their role in regulating root development, we utilized the inducible Cre/loxP system to generate in vivo time and tissue specific inactivation of Smad4-mediated signaling pathways during dental root development. Results: Smad4-mediated signaling activities, indicated by phospho-Smads expression, were detected in the developing molar root mesenchyme. Based on the presence of Gli1, a transcriptional mediator of Shh signaling, in the postnatal dental mesenchyme, an inducible Gli1-driven Cre/loxP system was utilized to postnatally interrupt Smad4-mediated signaling in the Gli1-expressing cells, including the dental mesenchymal cells. Our preliminary data showed that postnatal Gli1-mediated Smad4 deletion impaired molar root formation and resulted in shorter molar roots. Conclusion: Smad4-mediated pathways may also play an important role during molar root development via regulating dental mesenchymal cell fate. Inducible Cre-mediated deletion system could be used as a tool to further investigate this molecular regulatory mechanism during dental root formation.

Poster #: 57

Title: Deregulation of Molecular Pathways by IR and VR Light

Name: Jie Guo

Faculty Advisor: Stephen Yen

Background: There is anecdotal evidence that infrared (IR) and visible (VR) wavelengths of light can produce biological effects that influence bone repair, orthodontic tooth movement and dental implant osseointegration. However, the mechanisms for light-induced effects are not known. Purpose: The purpose of this study was to examine how light affects gene expression using microarray and protein array analysis. Methods: Clones of marrow fibroblast stem cells were isolated from human bone marrow and used for primary cell cultures. The cells were grown without light as a control and with light under eight different conditions: two wavelengths of light (830-IR and 633nm-VR) at four different energy

levels (0.5, 1.0, 1.5 and 2.0 joules / cm²). Results: Affymetrix Human exon microarrays of 22,000 protein-encoding genes (40 markers per gene) showed distinct sets of genes being deregulated for each of the eight experimental conditions. A two-fold screen for gene expression differences between control and light-stimulated cultures revealed a complex network of gene expression interactions for VR and IR stimulation of bone and the immune response. Protein arrays confirmed that at 633 nm TGF beta 1, TGF beta 1 receptors and Smad dependent TGF beta pathway proteins were upregulated but at 830 nm, these proteins were down-regulated and Akt1 pathway components were upregulated. Conclusion: This study provides strong evidence for light stimulating different sets of genes according to wavelength and energy level that can alter bone turnover. Different light conditions can activate specific gene networks that control different cell functions. The data provides a molecular explanation for the conflicting reports on tooth movement and light effects in the current literature.

Poster #: 58

Title: Self-Efficacy and Kinematic Performance for Reaching Movements after Stroke

Name: Eric Wade

Faculty Advisor: Carolee Winstein

Background: Self-efficacy (SE), or a person's prospective perceived ability to succeed at a specific task, may mediate spontaneous limb choice for that task, in people after stroke. It has been argued that experience may be the most important factor for the determination of SE. However, for a goal-directed reaching task, SE was found to be uncorrelated with experience as measured by the Motor Activity Log. For disabled adults, SE may be independent of motor capability. Thus there is support for the notion that SE is task-specific and prospective. Purpose: The purpose of the study is to determine if there is a relationship between self-efficacy and future task performance during reaching movements after stroke. Methods: Six participants post-stroke performed a seated, goal-directed reaching task.

Ten targets of radius 3cm were distributed in the reaching workspace egocentric to the participant at 5 directions ipsilateral to the reaching hand (0, 45, 90, 135, and 180 degrees), and at two extents (13.5 and 27.0cm). Participants began with their hands at a home position central to the targets, also of radius 3cm. Participants then reached to each of the 10 targets 10 times per hand, in a pseudo-random order. Reaches were monitored using electromagnetic tracking sensors placed on the participants' index fingers. Movement times were significantly longer for the paretic limb, and for far targets. Accuracy was significantly higher for the non-paretic limb, and for near targets. Further, self efficacy significantly predicted movement time and accuracy. Results: Movement Time was longer with paretic than non-paretic ($p < 0.001$), and longer for far targets than near targets ($p < 0.001$). Distance from Target was greater with paretic than non-paretic ($p < 0.001$), and greater for far targets than near targets ($p < 0.001$), resulting in a hand*distance interaction ($p < 0.001$). RSE predicts movement time for the paretic and non-paretic limbs ($R^2 = 0.229$, $p < 0.001$; $R^2 = 0.142$, $p < 0.001$, respectively). RSE predicts accuracy for the paretic and non-paretic limbs ($R^2 = 0.102$, $p < 0.001$; $R^2 = 0.048$, $p < 0.001$, respectively). When RSE is low, performance is worse (longer movement time, less accurate). When RSE is better, performance is better (shorter movement time, more accurate). Conclusion: As expected, movement times and accuracy were best with the non-paretic limb, and for near targets. When evaluated for each hand, prospective RSE does predict movement time and accuracy, though the percent variance explained is low, particularly for accuracy of the paretic limb. Future analysis will evaluate how performance in the forced condition (paretic limb only) can be used to provide insight into limb choice for reaching in the free choice condition. Previous results indicated that the effect of near/far targets varied depending on whether participants were concordant or discordant. Future analyses will investigate the relationship of self-efficacy and kinematic measures while controlling

for concordance and discordance.

Poster #: 59

Title: Role of Chromatin Remodelers in Lineage Specification
Name: Daniela Schmid
Faculty Advisor: Ruchi Bajpai

Background: Establishment of primary germ layers as well as neural crest, often called the fourth germ layer is accompanied by extensive chromatin remodeling and global epigenetic changes. We have shown that CHD7, a chromatin remodeling enzyme, is essential for the formation of multipotent migratory neural crest. Haploinsufficiency of CHD7 causes CHARGE syndrome, characterized by craniofacial defects. Purpose: To study the regulation of CHD7 family of proteins and the molecular mechanism by which they specify germ layers and control neural crest lineage formation from pluripotent cells. Methods: In vitro differentiation of pluripotent cells into primary germ layers and neural crest cells. Confocal microscopy based visualization of immunofluorescent tagged proteins in in vitro cell cultures and in vivo in mouse blastocysts. Xenopus embryology. Results: Although CHD7 was expressed throughout early development, we made the surprising discovery that the sub-cellular localization of this chromatin remodeler is dynamically regulated. To our knowledge this is the first remodeler that is sequestered out of the nucleus in undifferentiated, pluripotent state both in vitro and in vivo. Upon stimulation with differentiation conditions CHD7 family of proteins rapidly translocate to the nucleus even in the absence of new protein synthesis and accumulates at high levels in early neural crest cells. Dose dependent loss of CHD7 affects neural precursor and neural crest development. Conclusion: Our results suggest a role for CHD7 in lineage specification.

Poster #: 60

Title: Identifying Muscle Hyperactivity in Chronic Pain
Name: Manku Rana
Faculty Advisor: Jason Kutch

Background: Muscle hyperactivity is a potential cause of pain in pa-

tients with chronic conditions such as low back pain, temporomandibular joint disorders, tension type headache and Urologic Chronic Pelvic Pain Syndrome (UCPPS). Pelvic floor muscles are unique in that, even in pain-free individuals, they maintain an active muscle tone during rest. UCPPS patients have been found to exhibit an increase in pelvic muscle activity, but this finding has been based on measures of that could reflect biomechanical, rather than neural, changes. Purpose: The purpose of this study is to introduce a measure called maximum voluntary relaxation which quantifies the extent of neural control over the hyperactive muscles. Methods: Pelvic floor muscle activity will be measured in ten patients and compared with age matched controls using intra-rectal electromyographic (EMG) probes. Participants control the playback of a video that plays only when EMG is below a given target. Target is initially set to the resting state EMG, and subsequently reduced until the participant is no longer able to play the video. Results: Preliminary results showed that patients had greater resting state EMG than controls. Patients could voluntarily relax the EMG using video feedback to as low as 69% of resting state values, while this did not appear to be possible for controls. Conclusion: The ability to decrease the muscle activity below resting state levels in UCPPS patients, if shown to be robust across patients, indicates fundamental changes in resting state control of the pelvic muscles in these patients. Treating this excessive activity may be effective in reducing pain.

Poster #: 61

Title: Knockout of TGF β RI in the NCCs Results in Craniofacial Muscle Defects
Name: Arum Han
Faculty Advisor: Yang Chai

Background: TGF- β signaling plays important roles in embryonic muscle development, homeostasis and muscle repair/regeneration. Severe head muscle defects by the CNCC-specific deletion of type 1 TGF- β receptor (ALK5) implies the significant role of CNCCs on head myogenesis by tissue-tissue interac-

tion between CNCCs and migrating myogenic precursors. However, the underlying signaling cascade is not known in which CNCCs control the early muscle patterning and differentiation in the craniofacial region. Purpose: In this study, we are investigating gene expression changes in CNCCs in Wnt1-cre;Alk5f/f mutants and how those changes cause myogenic defects in the craniofacial regions. Methods: Gene expression patterns of the early myogenesis were assessed by In Situ Hybridization and immunohistochemistry in the extra-ocular muscles, masticatory muscles and tongue muscles of Wnt1-cre;Alk5f/f and control mice. Results: Muscle differentiation is dramatically reduced and the muscle organization was disrupted in the craniofacial region of Wnt1-cre;Alk5 mutants while the migration of myogenic precursors were not affected. Myogenic cell proliferation was also significantly reduced in concurrence with the reduction of BMP expression in Wnt1-cre;Alk5f/f mice compared to control mice. Interestingly, Scleraxis, a tendon-specific and connective-specific marker, was expressed where myogenic cells are populated in the tongue bud in control mice. In Wnt1-cre;Alk5f/f mice, however, Scleraxis expression was dramatically reduced suggesting the fate determination of Wnt1-cre-labeled CNCCs was failed to induce Scleraxis-positive tendon progenitors. Conclusion: Wnt1-cre;Alk5f/f mice showed two phenotypes in the craniofacial muscle development; disrupted muscle patterning and reduced muscle differentiation. Scleraxis expression, downstream of the Pax3-Six-Eya signaling cascade, by CNCCs seems very critical for muscle patterning in the tongue. In addition, the reduced proliferation of the migrated myogenic precursors were due to the reduced expression of BMP4 and FGF by CNCCs in the mutant mice. In summary, CNCCs regulate craniofacial myogenesis by providing niche for migrated myogenic cells and promoting the proliferation and differentiation of muscle progenitors.

Poster #: 62

Title: Feasibility of a Kinect-Based Fall Prevention Game for Older

Adults

Name: Rachel Proffitt

Faculty Advisor: Belinda Lange

Background: Thirty percent of adults over the age of 65 experience a fall each year. One of the most effective methods to help prevent falls is participation in a regular fitness or exercise program. Active video games are being explored as a delivery method for fall prevention exercises. **Purpose:** The purpose of this study was to explore the potential for the use of a Kinect-based fall prevention game with older adults. **Methods:** Fifteen older adults participated in focus groups that explored perceptions of health and wellness and ideas for a fitness and fall prevention game. The data were analyzed using open coding and the themes that emerged from the data were used in the design of a prototype game. The prototype was tested in an iterative process with 19 older adults who provided in-depth information in semi-structured interviews and rated their experience on questionnaires. **Results:** The feedback from focus groups and user testing sessions showed that the participants desired clear directions in the game to allow for optimal playability, feedback to promote engagement and motivation and technology that is easy to use and minimally intimidating for older adults. **Conclusion:** The game is feasible for use with the older adult population. In order to create an effective game for fall prevention in older adults, the findings should be considered and expanded upon in future iterations of the game.

Poster #: 63

Title: Using TALE Proteins to Identify Protein Assemblies on Endogenous Enhancers

Name: Ankita Das

Faculty Advisor: Ruchi Bajpai

Background: The multipotent neural crest contributes to the craniofacial skeleton. Understanding the molecular basis of neural crest differentiation from the neural tube will allow for generation of cell to replenish injured craniofacial tissue. Genomic enhancer regions have been shown to be critical for lineage differentiation by integra-

tion of signaling with transcriptional circuitry. Therefore, studying protein assemblies occurring on a group of genomic enhancers that undergo rapid transitions from 'poised-to-active' chromatin state during neural crest differentiation, will allow for understanding of the molecular basis of neural crest formation. **Purpose:** To develop a novel technique for a specific enrichment of DNA and protein complexes on genomic enhancers cells by using TALE domain proteins to identify macromolecules mediating neural formation. **Methods:** Chromatin Immuno-precipitation using tagged TALE proteins to target and enrich for neural crest enhancers in human pluripotent cells and neural crest cells, and immune-blotting to detect protein assemblies on the chromatin. **Results:** We find in our proof of concept experiments that TALE proteins can be used to enrich for specific human genomic regions as SOX2 promoter and HES1 enhancers. We also find that we can isolate protein complexes bound to the isolated genomic sequences, such as RNA Polymerase II at the SOX2 promoter and p300 at the HES1 enhancer respectively. **Conclusion:** TALE proteins can be used to isolate and enrich for genomic enhancers to identify novel regulators of neural crest formation.

Poster #: 64

Title: Factor Analysis of the Meaningful Activity and Participation-Frequency Questionnaire

Name: Stacey Schepens

Faculty Advisor: Florence Clark

Background: The Meaningful Activity and Participation Assessment—Frequency (MAPA-F) is a valid and reliable tool used to evaluate how often older adults engage in different activities. However, there is limited research on its measurement properties among different ethnic groups. Furthermore, the associations of underlying activity domains with self-perceived physical health in cultural subgroups have not been examined. These gaps in research are important to address because culturally-based response patterns may invalidate cross-cultural comparisons of activity behaviors and their relationships

to physical function. **Purpose:** The purpose of this study is to examine cross-cultural and cross-linguistic differences in the factor structure of the MAPA-F. A secondary purpose is to examine the associations of underlying MAPA-F activity domains with self-perceived physical health. **Methods:** A multi-group confirmatory factor analysis (CFA) framework will be used to identify underlying dimensions of the 29-item MAPA-F questionnaire within White, Hispanic English-speaking, and Hispanic Spanish-speaking older adults. Post-hoc analysis will be conducted to compare resultant activity factor solutions with self-perceived physical health as measured by the SF-36 physical functioning subscale. **Results:** We expect that the multi-group CFA will reveal factor structure variance in activity frequency across the three cultural groups. We also expect to find group differences in how the factor solutions relate to physical function. **Conclusion:** A multi-group CFA of the MAPA-F among Hispanic and White older adults will help to characterize activity patterns and identify potential differences in how activity patterns relate to physical function. Findings may inform the future design and implementation of lifestyle interventions that target mediators of physical function in Hispanic and non-Hispanic White older adults.

Poster #: 65

Title: Identifying 'regulome' for Determining Diagnostic and Prognostic Targets in Neuroblastoma

Name: Soma Samanta

Faculty Advisor: Ruchi Bajpai

Background: Neuroblastoma, a highly heterogeneous pediatric tumor, is derived from neural crest cells maturing into the adrenergic lineage. Unique, lineage-restricted, gene expression patterns in developing cells are determined by regulatory genomic regions called enhancers. Our studies, using recent advancements in genome wide identification of active enhancers in different stem cell has revealed that the repertoire of active enhancers is remarkably distinct even in closely related and morphologically indistinguishable

cell populations. Thus, active enhancers can serve as an excellent resource for lineage-labeling, isolating and characterizing functionally distinct cell types. **Purpose:** To determine enhancer repertoire of neuroblastoma cells to develop novel diagnostic and prognostic tools for neuroblastomas. **Methods:** Chromatin immunoprecipitation (ChIP) followed by high throughput sequencing for histone modifications and enhancer-associated proteins was used to identify regulatory elements activated in SKNSH, an aggressive neuroblastoma cell line; expression profiles of the original and 'cancer stem cell' enriched SKNSH population was obtained by RNA-sequencing. **Results:** Epigenetically marked enhancers in SKNSH showed the presence of several highly confident and statistically significant transcription-factor binding motifs. Some of these overlap with core transcriptional circuitry active in migratory neural crest cells and peripheral nervous system precursors while others are unique to SKNSH. The active enhancers also revealed groups of genes differentially expressed in various sub-populations within a heterogeneous neuroblastoma cell line. **Conclusion:** Neuroblastoma, in part, utilizes a neural crest-like transcriptional circuitry for self-renewal and/or metastasis. Thus, the chromatin based enhancer determination is a novel approach to identify regulatory factors and prognostic targets of heterogeneous neuroblastoma.

Poster #: 66

Title: Quantifying Elements of Gesture Copying in Children with Neurodevelopmental Disorders

Name: Stefanie Bodison

Faculty Advisor: Terence Sanger

Background: Motor learning is dependent upon our ability to imitate or copy the movements of others. When we copy the movements of others, we transform the sensory information collected through our visual, proprioceptive and tactile systems into adaptive, controlled motor responses. The ability to imitate others allows us to learn new motor skills and develop the complex motor responses needed to independently engage in everyday activi-

ties. According to the World Health Organization, approximately 6% of all children have difficulty with motor learning causing significant delays in the development of fine motor, gross motor skills, self-care, play & academic skills. Purpose: The purposes of this research study were to 1) quantify the elements of gesture copying under various sensory conditions in children with Autism Spectrum Disorder (ASD) and Developmental Coordination Disorder (DCD), compared to same age typically developing peers; and 2) explore the relationship between performance on the test of gesture copying with performance on the assessments of sensory and motor function in the children with ASD and DCD. Methods: The sensory, motor and adaptive behavior of 60 children ages 4-12 was assessed using standardized clinical tools and a newly developed test of imitation called the Test of Hand Gestures (TOHG). Participants included 20 children who were typically developing, 20 children with Autism Spectrum Disorder (ASD), and 20 children with Developmental Coordination Disorder (DCD). Results: Based on statistical analysis of the data obtained during the TOHG, children with ASD and DCD showed significant delays in imitation under certain sensory conditions when compared to same age typically developing peers. In addition, children with ASD and DCD also demonstrated significant delays across the standardized sensory, motor and adaptive behavior scales. Conclusion: The results of this study suggest that children with ASD and DCD have poor ability to transform sensory data into controlled motor responses during imitation tasks.

Poster #: 67

Title: Early Identification of Upper Limb Asymmetry in Infants At-Risk

Name: Susan Duff

Faculty Advisor: Carolee Winstein, Linda Fetters

Background: Infants who sustain perinatal brachial plexus injury (BPI) or stroke are at-risk for prehensile dysfunction. Early detection of interlimb differences may promote timely referrals to therapy to

aid recovery. Purpose: The primary aim of this study was to determine the utility of the Active Movement Scale (AMS) to detect interlimb differences in active motion in infants ≤ 7 months (mos) who sustain perinatal stroke. The secondary aims were to compare reach-to-grasp (RTG) control in infants with BPI or post-stroke against typically developing (TD) controls at 4 and 6-7 mos; and determine if AMS scores at < 3 mos would predict RTG control and hand preference at 6-7 mos. Methods: 15 infants (5 BPI, 5 stroke, 5 TD) < 3 to 7 mos with BPI or post-stroke and controls were seen for 3 sessions at: < 3 mos; 4 mos; and 6-7 mos. The AMS was performed at each session. At 4 and 6-7 mos infants performed 15 RTG trials (5 bimanual, 5 right, 5 left) while bilateral kinematic and biceps surface electromyography (SEMG) were collected. The Alml Test of Hand Preference was performed at 6-7 mos. Results: The AMS did not predict interlimb differences in infants post-stroke. All infants improved RTG control from 4 to 6-7 months. SEMG differed significantly between groups. The AMS was predictive of RTG control and hand preference for the infants with BPI only. Conclusion: The AMS is not a useful clinical tool for infants post-stroke. Kinematics and SEMG are useful tools to examine recovery and outcome in infants at-risk.

Poster #: 68

Title: Exome sequencing of families with inherited dental and neurological disorders

Name: Sunju Choi

Faculty Advisor: Pragna Patel

Background: Since the completion of the initial sequencing of the human genome, there has been significant refinement and optimization of whole genome sequencing with the first major development being the ability to sequence the 'exome,' defined as 'the set of exons in a genome' or that portion of the genome that encodes proteins. We have sampled families segregating various dental and neurological disorders. Several of these families were not large enough for linkage analysis, the more traditional approach for gene discovery, but

were amenable to examination for the underlying genetic mutation by "exome sequencing." Identification of the genetic basis of these inherited disorders will enable better diagnosis and treatment in the future. Purpose: Our goal is to identify the mutation underlying the genetic disorder in six families with a dental/craniofacial anomaly and two large families with rare neurological diseases. Our hypothesis is that sequencing of all the genes in selected affected and unaffected individuals from these families should identify mutations that are only evident in affected individuals but not in unaffected ones or in any of the public databases including dbSNP, 1000 genomes, and ESP6500 (6503 individual exomes) and will allow us to narrow our search for the disease-causing mutations. Methods: DNA from forty-five individuals from eight pedigrees segregating various forms of hypodontia, or supernumerary teeth, or other rare dental anomalies as well as two families segregating frontotemporal dementia and autoimmune myasthenia gravis, respectively were subjected to exome sequencing. Briefly, the exomes were selected by hybridization to custom arrays representing the coding sequence of the human genome and the selected material used to construct libraries that were then subjected to sequencing on Illumina HiSeq instruments. Using the ANNOVAR algorithm, variants were filtered against all relevant public databases to identify genes that had rare or novel protein-impacting variants in all or most affected but not unaffected individuals and which corresponded to the relevant inheritance model in each family, i.e. recessive or dominant. Results: We have identified 146 genes in total amongst affected individuals in the eight families bearing rare variants unique to the respective families. The vast majority of these are nonsynonymous single nucleotide variants which represent an altered amino acid within the protein encoded by the gene while a few are frameshift mutations that result in a shortened protein. Conclusion: The variants within each of the genes are being evaluated to determine if they change a highly conserved amino acid, or alter the

secondary and tertiary structure of the protein. They are also being re-evaluated within the raw sequencing data to determine if they are bona fide changes. Those that pass these tests will then be confirmed by the traditional method, namely Sanger DNA sequencing. All members of the family will then be examined for the presence of the mutation and additional isolated cases with the phenotype examined for variants within the same gene to prove causality. Depending on the gene, further in vitro or in vivo studies will be needed to implicate the gene in the particular disease phenotype.

Poster #: 69

Title: Mutation in FNIP2 associated with hypomyelination and tremors in Weimaraners

Name: Sunju Choi

Faculty Advisor: Pragna Patel

Background: The normal myelination of the central and peripheral nervous systems (CNS and PNS) requires intricate interactions between glial cells and axons during development. The molecular control of this process is complex and the genes involved must be expressed in the correct temporal sequence for proper glial cell differentiation, migration and myelin production to occur. An important approach to unraveling the factors involved in glial cell maturation and association with axons is the study of naturally occurring mutants in which the process has gone awry. Collectively, these animals have been called the myelin mutants, some of which are excellent models of human disease. An autosomal recessive disorder characterized by hypomyelination and tremors is widespread in the Weimaraner breed. At 10-12 days of age, a tremor involving the trunk and all four limbs that worsens on ambulation is noted. The degree of tremor may vary between siblings in a single litter; likewise the recovery is seen more quickly in less affected dogs, usually by 3-4 months, while some severely affected dogs may retain a mild tremor for life. On necropsy, a unique zone of non- or hypomyelination is seen around the periphery of the spinal cord, especially of the ventral and lateral columns. In the brain, there is a more

subtle but generalized decrease in myelin compared to controls. Purpose: The cause of this myelin defect was heretofore unknown but it had been speculated to involve the early differentiation of oligodendrocytes, their migration throughout developing white matter or their early death. We hypothesized that a positional cloning strategy could be used to identify the genetic defect in the affected Weimaraners by using DNA from animals from available pedigrees as well as unrelated affected and unaffected animals to scan their genomes. There is a particular advantage to genetic mapping in dogs compared to humans given their evolution from wolves followed by domestication and inbreeding of the domestic breeds. Methods: Towards positional cloning of the genetic defect leading to hypomyelination and tremors in the Weimaraner, we genotyped 48 animals : 35 from three unrelated pedigrees – nine affected animals, 18 known carriers, and eight phenotypically normal (“unaffected”) animals who may or may not be carriers – and 13 unrelated animals (“singletons”) – five affected animals, one known carrier, and seven phenotypically normal animals. These data were analyzed using the programs EMMAX as well as PLINK to narrow the candidate genomic region within bearing the mutated gene. All genes within this region were then subjected to DNA sequencing to identify the mutation. All 48 animals used in the scan were examined for the mutation as well as 105 additional Weimaraners and 102 dogs from different breeds in order to determine the carrier frequency. Results: Genome-wide association mapping localized the gene to a 5 Mb interval on chromosome 15. Homozygosity mapping further narrowed the interval to a 3.57 Mb region. Seventeen genes were examined for mutations and a deletion of a single A residue was identified in the gene encoding folliculin-interacting protein 2 (FNIP2). All fourteen affected dogs were homozygous for the mutation, eight obligate and 15 predicted carriers were heterozygous for the mutation, and four unaffected animals from two pedigrees as well as seven of eight unrelated “control” dogs did not bear the mutation. One

unrelated “control” dog was found to be heterozygous for the mutation. In addition, nine dogs out of 105 had a single copy of the I294L mutation. Conclusion: A single point mutation predicted to cause a frameshift and result in a truncated protein was found within the gene encoding folliculin-interacting protein (FNIP2). The carrier frequency of this mutation in the Weimaraner breed is the estimated to be 4.285% which is pretty high. The function of this protein in myelination remains to be identified but it may be responsible for a delay in differentiation of a sub-population of oligodendrocyte progenitor cells (OPCs). Further studies are underway in embryonic stem cells induced to differentiate into oligodendrocytes to confirm that role of FNIP2 in this process. In addition, carrier testing will be offered to breeders and other owners of Weimaraners and in the future, this recessive disease could be eliminated.

Poster #: 70

Title: FGF signaling controls the development and patterning of palatal rugae

Name: Carolina Parada

Faculty Advisor: Yang Chai

Background: Palatal rugae are periodic ridges on the hard palate of mammals that are mainly involved in sensing and holding food. Recently, it has been shown that during palate development, rugae are generated sequentially through an activator-inhibitor system consistent with a Turing-type reaction-diffusion mechanism. It is suggested that the FGF pathway acts as the activator and the Hedgehog pathway as the inhibitor. Purpose: The main goal of this study is to explore the specific functions of the FGF signaling pathway in the development and patterning of palatal rugae as well as its interaction with WNT canonical pathway in these complex processes. Methods: We have studied K14-Cre;Fgfr2fl/fl, Shh-Cre;Fgfr2fl/fl and K14-Cre;β-cateninfl/fl mice. Results: Both K14-Cre;β-cateninfl/fl and K14-Cre;Fgfr2fl/fl mice exhibit a similar phenotype including complete absence of rugae. Lack of rugae is associated with a reduced number of proliferating

cells in the palatal epithelium of both β-catenin- and Fgfr2-mutant mice compared to controls. The analysis of Sox2 expression showed no change in the number of epithelial progenitors in the K14-Cre;β-cateninfl/fl mice whereas it is slightly reduced in the K14-Cre;Fgfr2fl/fl mice. Next we analyzed the main components of the network regulating epithelial proliferation, i.e. FGF, BMP, SHH and WNT pathways. In wild type embryos, dpERK1/2, p-Smad1/5/8 and Gli1 are found in the inter-rugae zones whereas the rugae are negative for these markers. This is consistent with the rugae being depleted of proliferating cells. In contrast, β-catenin is expressed throughout the palatal epithelium. A slight reduction in the expression of Fgfr2 and dp-ERK1/2 was detected in the β-catenin-mutant mice compared to controls, suggesting that WNT/β-catenin signaling pathway is upstream of the FGF pathway during rugae development. The distribution of p-Smad1/5/8- and Gli1-positive cells was compromised in the epithelium of β-catenin-mutant mice as well. This finding was also observed in the K14-Cre;Fgfr2fl/fl mice. However, no change in β-catenin expression was detected in the Fgfr2-mutant mice. In order to understand the specific function of FGF signaling in the establishment of rugae pattern, we generated Shh-Cre;Fgfr2fl/fl mice. In these mice, Fgfr2 function is only lost in the rugae, whereas a normal Fgfr2 expression remains in the inter-rugae zones. In Shh-Cre;Fgfr2fl/fl mice, rugae are present but the proximal-distal pattern is completely disrupted. Instead of continuous stripes, lines of separated spots are generated. This finding is associated with significant changes in the distribution of proliferating cells in the epithelium. The underlying mechanisms are currently under study. Conclusion: Our data suggests that FGF plays a crucial role in the development and patterning of palatal rugae being downstream of WNT/β-catenin signaling pathway. From our results, it is tempting to speculate that the dosage and location of activated FGF signaling is essential to establish both the anterior-posterior and proximal-distal patterns during rugae development, which

are associated with the number and distribution of proliferating cells.

Poster #: 71

Title: Wnt signaling mediates tissue-tissue interaction during tongue regeneration

Name: Zhe Zhong

Faculty Advisor: Yang Chai

Background: The canonical Wnt signaling pathway has emerged as a critical regulator of stem cells involved in wound healing and tissue regeneration. Purpose: The aim of this project is to elucidate the function of the canonical Wnt signaling pathway in muscle regeneration after tongue injury. Methods: Wnt1Cre;rtTA;Teto-H2BGFP mice were used to detect the relationship between newly formed muscle fibers and cranial neural crest (CNC) derived cells. Axin2-LacZ reporter mice were used to detect canonical Wnt signaling activity after tongue injury. Wnt10a ligand activity was analyzed after injury with Realtime-PCR. Knockout and overexpression models were used to analyze the effects of inactivation and activation of canonical Wnt signaling in satellite cells after tongue injury. Results: The recruitment of CNC derived cells to the injured region preceded muscle fiber formation. Wnt signaling activity is not only restricted to satellite cells but is also present in CNC cells from 3 days until 2 weeks after injury. Wnt10a expression increased significantly in the tongue after injury. Newly formed muscle fiber was dramatically reduced in Pax7CreER;β-cateninF/F mice compared to wild type littermates. In Axin2LacZ/+ and Axin2LacZ/LacZ mice, no difference in the number of Pax7 positive cells was found. Yet, after injury, more Pax7 positive cells accumulated proximal to or within the injured region in Axin2lacZ/lacZ mice. Conclusion: As CNC derived cells are initially recruited to an injured region, they may secrete Wnt ligands to regulate myogenesis. Canonical Wnt signaling plays an important role in adult myogenic cell proliferation and skeletal muscle stem cell differentiation.

Poster #: 72

Title: Gingiva mesenchymal stem

cells from different origins show different characteristics

Name: Xingtian Xu

Faculty Advisor: Songtao Shi

Background: Organ and tissue development in the craniofacial region derives from different origins, with cranial neural crest cells being one of important sources that gives rise to mesenchymal structures such as bone and teeth. Gingiva is another important tissue functioning as the supportive structure for the teeth and bone, which also shows low inflammation and quick wound healing profiles compared with the other soft tissue. **Purpose:** To investigate the different role of the mesenchymal stem cells in gingiva (GMSCs), which come from the neural crest and mesodermal origin, in maintaining the tissue homeostasis. **Methods:** We isolate the gingiva mesenchymal stem cells from the Wnt1-Cre; ZsGreen mouse model, using green fluorescence to separate the cells. Western blotting, immunocytochemistry staining, Real Time PCR and Fluorescence-Activated Cell Sorting were used to test the difference of the cells in vitro. We use Wnt1-Cre, R26R mice to have in vivo staining to trace the cells. An induced mouse colitis model was used to test the in vivo immunomodulation capability. **Results:** Cranial neural crest derived GMSC shows similar potential of osteogenesis and adipogenesis capacity, but enhanced neural differentiation ability in vitro. They also showed a different expression of ECM components, and displayed a better immunomodulation and anti-inflammation function compared with the non-neural crest derived GMSC. Also, the cranial neural crest derived GMSC exhibited an important role in mucosa wound repairing process in vivo. **Conclusion:** The composition of the cells from different origins may function as a synergy leading to the distinct character of the gingiva tissue.

GRADUATE PRE-DOCTORAL CANDIDATE

Poster #: 73

Title: An Intracellular 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 disorder Bent Bone Dysplasia Syndrome (BBDS; MIM 614592) suggests that in addition to its activities at the plasma membrane, FGFR2 acts within the nucleus to regulate bone formation. 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, mutant FGFR2 retains nuclear localization where it exhibits enhanced localization with FGF2. We will determine the cellular and molecular effects of the BBDS mutations on FGFR2 signaling. **Methods:** In this study we define how dual activities of FGFR2 at the plasma membrane and in the nucleus regulate bone formation by employing the mutant receptor in vitro using an osteoblast culture system and in vivo utilizing the chick embryonic system. **Results:** We show that mutant FGFR2 activates the JAK/STAT, p38/JNK, and MAPK/ERK pathways in response to intracellular FGF signaling. Mutant FGFR2 activation increases proliferation and delays differentiation in MC3T3-E1 cells. Finally, targeted expression of mutant FGFR2 in osteoprogenitor cells in chick causes BBDS-like defects. **Conclusion:** Together our findings support a distinct role for nuclear FGFR2 during bone formation. By executing activities at the plasma membrane and in the nucleus, FGFR2 balances proliferation and differentiation through canonical

and non-canonical signaling, respectively.

Poster #: 74

Title: Effects of scaffolds tethering chimeric Anti-BMP-2 mAb in bone bioengineering

Name: Sahar Ansari

Faculty Advisor: Homa Zadeh

Background: We have recently discovered that specific anti-BMP-2 murine mAb's bound to a solid scaffold can mediate in vivo bone repair, termed antibody mediated osseous regeneration (AMOR). **Purpose:** To investigate the translational applications of AMOR, we generated a chimeric anti-BMP-2 mAb (cmAb), where the murine constant Ig region was replaced with that of human. The purpose of this study was to examine the role of various scaffolds used in conjunction with anti-BMP-2 cmAb in AMOR. **Methods:** Anti-BMP-2 cmAb or isotype control Ab were incubated with four different scaffolds (Ti microbeads, MBCP, alginate, and collagen sponge), followed by implantation into rat calvarial defects. After 8 weeks, dissected calvaria were scanned by Micro-CT followed by histological and histomorphometric analysis. **Results:** The specificity of anti-BMP-2 cmAb was examined by flow cytometric and western blot analysis, which showed cross-reactivity of anti-BMP-2 cmAb to BMP-2, -4, and -7. Micro-CT and histomorphometric analyses showed significant bone regeneration within calvarial defects implanted with chimeric anti-BMP2 mAb immobilized on each of the scaffolds, compared with isotype control Ab ($p < 0.05$). Ti microbeads and MBCP alloplastic graft maintained the bone volume at a higher degree. **Conclusion:** All 4 scaffolds investigated mediated bone repair when functionalized with anti-BMP-2 cmAb. They differed with respect to their ability to maintain bone volume with Ti and MBCP. Results also demonstrated cross-reactivity between anti BMP-2 cmAb and BMP-2, -4 and -7, suggesting a possible mechanism for bone repair involving in vivo capture of these BMPs by anti BMP-2 cmAb.

Poster #: 75

Title: miRNA Regulate Skeletogenesis of the Craniofacial Complex

Name: Ryan Roberts

Faculty Advisor: Amy Merrill

Background: Craniofacial bones are formed through the process of intramembranous ossification whereby the cranial neural crest cell (CNCC) progenitors differentiate directly into osteoblasts. Defects in the timing of CNCC osteoinduction lead to human disorders with premature or delayed bone formation like craniosynostosis and micrognathia respectively. While it is known that CNCC autonomously control the timing of their differentiation into osteoblasts, the molecular identity of the osteogenic clock within these cells remains unclear. **Purpose:** The goal of this project is to test our hypothesis that miRNAs within CNCC regulate the timing of osteogenic induction in the mandible. **Methods:** To test the potential of miRNAs to alter the timing of osteoinduction we overexpressed Dicer, an RNA III endonuclease essential for miRNA processing, in chick CNCC via electroporation in ovo. To identify specific miRNAs involved in mandibular osteogenic induction, we will perform microarray analysis on the miRNA isolated from chick mandibles during the established stages of osteoinduction. **Results:** Overexpression of Dicer in CNCC leads to abnormalities in the shape and size of the nasal, maxillary, and mandibular skeleton. Histological stains for bone and cartilage show delayed skeletogenesis in these structures. We have successfully isolated mandibular miRNAs and are preparing to conduct a microarray analysis. **Conclusion:** We conclude that miRNAs within CNCC regulate the timing of skeletogenesis in the craniofacial complex. Our future microarray studies will identify the specific miRNAs involved in this process. This project will help us understand the molecular mechanism that regulates the timing of bone formation in the face.

Poster #: 76

Title: Telomerase Governs Immunomodulatory Properties of MSC by Regulating FasL Expression

Name: Chider Chen

Faculty Advisor: Songtao Shi

Background: Telomerase reverse transcriptase (TERT) is a nucleoprotein that functions to preserve chromosomal integrity and quell p53-dependent DNA damage, as well as perform DNA repair activity at telomere ends. It has been reported that telomerase plays important roles in stem cell self-renewal and stem cell-based tissue regeneration, and is highly expressed in prospectively isolated BMMSC from aspirates of human bone marrow. However, the mechanisms that govern the immunomodulatory properties of BMMSCs are still not fully elucidated. **Purpose:** To address whether TERT plays a role in regulating BMMSC-mediated immunomodulation, we isolate BMMSCs from TERT null mice, B6.129S-Terttm1Yjc/J (TERT^{-/-}) and examine their function both in vivo and in vitro. **Methods:** We used in vitro and in vivo approaches, including histological staining, flow cytometry, inductive differentiation, molecular biological assays, and Western blot analysis to assess BMMSC functions. In addition, we utilized systemic stem cell therapy to treat a Fbn1^{+/-} SS mouse model. **Results:** Here we show that telomerase-deficient BMMSCs lose their capacity to inhibit T cells, activate Foxp3-positive regulatory T cells (Tregs), and ameliorate disease phenotype in systemic sclerosis (SS) mice. Restoration of telomerase activity by TERT transfection in TERT^{-/-} BMMSCs rescues their immunomodulatory functions, suggesting that telomerase activity controls the immunomodulatory properties of BMMSCs. Mechanistically, we reveal that TERT, combined with beta-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, which was associated with a reduction in the number of BMMSCs required to

treat SS mice. **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.

Poster #: 77

Title: Epigenetic Regulation of TSP1/TGFβ/SMAD3 Autocrine Loop in Ossifying Fibroma
Name: Cunye Qu
Faculty Advisor: Songtao Shi

Background: Tumorigenesis may be attributed by abnormal stem cell function. To date, the role of stem cells in benign tumor formation remains elusive. **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 mesenchymal stem cells (OFMSCs) with upregulated TGFβ activity capable of generating OF-like tumor xenograft. Mechanistically, enhanced TGFβ signaling activates Notch pathway and suppresses BMP pathway, leading to aberrant proliferation and deficient osteogenesis, two major characteristics of the OF phenotype. The elevated TGFβ signal is tightly regulated by histone demethylase JHDM1D-mediated epigenetic regulation of thrombospondin-1 (Tsp1) to establish a JHDM1D/TSP1/TGFβ/SMAD3 autocrine loop. Inhibition of TGFβ/SMAD3 pathway can rescue normal osteogenic differentiation and suppress stromal cell proliferation in OFMSCs. Interestingly, normal MSCs can be converted to OF-like MSCs by chronic activation of TGFβ via the JHDM1D/TSP1/TGFβ/SMAD3 loop. **Conclusion:** These results reveal a novel mechanism that epigenetic regulation of the JHDM1D/TSP1/TGFβ/SMAD3 autocrine loop in MSCs contributes to the benign tumor phenotype in OF lesions.

OCC. SCIENCE & OCC. THERAPY STUDENT

Poster #: 78

Title: Finding the Fun in Daily Occupation: An Investigation of Humor
Name: Michelle Elliot
Faculty Advisor: Mary Lawlor

Background: Humor and its perceived therapeutic benefits and utility in clinical encounters have been widely investigated across multiple disciplines. Occupational therapy's contribution to this exploration however has been primarily peripheral. The findings from the neuroscientific examination of humor suggest exciting new directions which occupational therapy can adopt in the promotion of meaningful engagement in life. **Purpose:** Humor as a biologically, socially, and contextually grounded aspect of the human experience which can influence the subjective nature of participation in occupation was explored. By deconstructing humor from its affective representations to its neural foundation, humor as an intrinsically human phenomenon was investigated. **Methods:** Literature on the scientific basis and benefits of humor and laughter from an interdisciplinary perspective was reviewed. The interpretation of these findings and a proposal for the translational potential of humor and fun in daily activity as well as clinical settings to erect social, emotional, and behavioral change was completed. **Results:** Humor in therapeutic and social practice pertains to the following: how humor is present or absent in daily life, how humor can be accessed and nurtured, the role of humor as a coping strategy or tool for social connection, and methods by which humor can be a motivating force in creating change. **Conclusion:** Taking humor seriously invites a larger translation of its therapeutic utility beyond the clinical realm into everyday life. Occupational therapists have much to contribute both to the study and integration of humor in practice with the perspective of how humor may alter the experience of occupational engagement.

Poster #: 79

Title: Fathering Occupations: An Ethnographic Study
Name: Aaron Bonsall
Faculty Advisor: Mary Lawlor

Background: Current research on fathers of children with disabilities lacks focus on what fathers are doing with their children and why they are doing it. Studying fathering occupations provides insight into how men perceive their experiences with children. **Purpose:** The aim of this research is to examine the experiences of fathers of children with disabilities as they engage in fathering occupations. **Methods:** In order to examine experience and the enactment of fatherhood, I have employed what Mattingly (2010) calls narrative phenomenology, a type of ethnographic research based on narrative that allows examination of near level experiences along with cultural, social, and historical contexts. Data collection included interviews and observations of men engaging in occupations with their children. **Results:** In this poster I explore the experience of fathering occupations for men with children with disabilities. Themes that emerged are: the importance of play and playfulness, moments of accomplishment, the influence of disabilities on fathering occupations, occupations as connections to family and community, and the co-creation of fathering occupations. **Conclusion:** The themes presented illuminate the importance of fathering occupations in the lives of men, both on a daily basis and through significant experiences. Fathering occupations can be influenced by diverse factors such as connections to families and communities, child's disability, and the experience of co-creating the occupation.

Poster #: 80

Title: Mirror neuron system and motor-network differences in DCD and dyspraxia
Name: Julie Werner
Faculty Advisor: Lisa Aziz-Zadeh

Background: Many individuals with developmental coordination disorder demonstrate imitation impairments, or dyspraxia. One neural network important for imitation is

the mirror neuron system, which involves frontal and parietal regions. Purpose: Using fMRI, we sought to determine if functional differences exist in this neural network during the imitation of novel gestures. Methods: fMRI was performed on 13 young adults with DCD with dyspraxia and 14 age- and gender-matched control subjects (22.0 +/- 3.3 years old). DCD was confirmed with an initial screening, the Adult DCD/Dyspraxia checklist, and the BOT-2; dyspraxia was confirmed with the SIPT Postural Praxis test (which we have previously used to assess imitation impairments in young adults). During functional imaging acquisition, participants imitated novel gestures of the bilateral hands, performed simple hand actions, or simply watched videos of novel gesture. This design allowed us to examine blood-oxygenation-level dependent (BOLD) signal during imitation. Results: Whole brain functional imaging data reveals numerous regional differences between the DCD and control groups. Greater activity was found in the control group as compared to the DCD group in many regions of the brain, including regions in the MNS (right inferior frontal gyrus, ventral premotor cortex, bilateral inferior parietal lobule) as well as the supplementary motor area, superior temporal gyrus/sulcus, and anterior cingulate cortex. The DCD group showed greater relative activity in the left inferior parietal lobule and bilateral prefrontal regions. Conclusion: Group differences include regions indicated as part of the mirror neuron system, including the IFG, IPL, and vPMC. In addition, other regions differing between the two groups include a number of areas related to motor function (SMA) and the perception of biological motion (STS). Finally, the differential involvement of prefrontal regions between groups may relate to motor planning and response inhibition required to complete the experiment task conditions.

Poster #: 81

Title: Behavioral and Physiological Measures of Arousal/Sensory Responsivity at the Dentist
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). One factor reported by dentists to be the greatest barrier in treating these children is negative and uncooperative behaviors. These problems may be caused by over-responsivity to sensory stimuli, which are well-documented in children with ASD. Sensory processing is most commonly measured by parent-report or observation; however, external distress due to exposure to sensory stimuli may not always mirror internal physiological stress. Electrodermal activity (EDA), a psychophysiological measure of the autonomic nervous system, is an objective way to measure arousal, sensory responsivity, and stress, allowing researchers to potentially validate parent-report and observational measures of sensory responsivity and stress as well as better understand children's responses to stimuli. Purpose: The purpose of this proposed project is to investigate arousal, sensory responsivity, and stress in children with and without ASD, as measured by physiological, behavioral, and parent-report questionnaire measures. Methods: Data were based on dental cleanings of 16 children in which both behavioral and physiological measures were collected. Behavioral measures included parent-report, dentist-report, and observational assessments; physiological measures included EDA recordings. Participants were 16 children aged 6-12 years (n=8 ASD; n=8 typical). Results: Data analyses are currently underway. It is hypothesized that: (1) children with ASD will exhibit significantly higher arousal and anxiety, as measured by EDA, in the dental office compared to typically developing children, and (2) measures of EDA will correlate with parent-report, dentist-report, and observational measures of sensory processing and anxiety. Conclusion: This study will highlight the role of occupational therapists as scientists and potential key players in the oral health setting and will increase understanding of physiological arousal, sensory responsivity, and stress during oral care in children with

ASD.

Poster #: 82

Title: Developing an Instrument to Assess Distress Behaviors at the Dentist
Name: Leah Stein
Faculty Advisor: Sharon Cermak

Background: Oral health is integral to physical and psychological well-being yet is particularly challenging for children with autism spectrum disorders (ASD). One important association has been found between oral care difficulties and sensory over-responsivity, a problem reported frequently in these children that may contribute to uncooperative behaviors in the dental office. The Sensory Adapted Dental Environment (SADE) Study, a currently funded NIH study, is an occupational therapy intervention that adapts the dental sensory environment, hypothesized to reduce anxiety and negative behaviors. A valid and reliable observational measure is needed to detect changes in children's behavior in order to examine the efficacy of this intervention. This study describes the development and testing of this measure. Purpose: To create a psychometrically-sound rating scale of children's challenging behaviors during dental care, the Child's Dental Behavior Rating Scale (CDBRS). Methods: Participants: 22 children aged 6-11 years (n=14 DD/ASD; n=8 typical) receiving routine dental cleanings at Children's Hospital Los Angeles. Procedure: Dental cleanings were videorecorded and parent-report and dentist-report measures of anxiety were completed. The CDBRS was developed using these videorecordings and existing behavior observation measures. Inter-rater reliability and validity analyses were assessed and Rasch analysis was used to critically examine the items and rating scale categories to maximize the instrument's usability and precision. Data was analyzed for adjustments in scoring, item reduction, and the number of coding intervals. Results: The initial version of the CDBRS included 11 behavior items (eg, head movement, block/hit/kick) and 3 external factor items (eg, restraint) observed during every one-minute interval of a child's routine dental

cleaning to assess children's distress behaviors. Inter-rater reliability was high for CDBRS ratings of each of the videos (K's=.73-.98). Selected behavior items and external factors were significantly correlated with both the parent-report CFSS-DS (r's=.43-.63) and the dentist-report A&C Scale (r's=.56-.85). Rasch analysis of the CDBRS data suggested that 5 items produced maximum reliability, fit the measurement model and formed an item hierarchy that made clinical sense (validity) of children's distress behaviors during a dental cleaning. Additionally, the revised scale successfully discriminated between DD/ASD and typical groups. Conclusion: Refinement of the CDBRS using Rasch analysis allowed researchers to develop the clinical construct of dental distress and to accurately and quantitatively compare changes in children's behaviors across dental environments. This rating scale will benefit future research analyzing children's behavior in the dental setting.

Poster #: 83

Title: Relationship Between Lifestyle Changes and Development of Pressure Ulcers
Name: Samruddhi Ghaisas
Faculty Advisor: Erna Blanche

Background: Pressure Ulcers (PrU) represent a major burden to patients with spinal cord injuries (SCI), negatively impacting health, well-being, and quality of life. In-depth studies of the interplay between lifestyle choices and the development of PrU are necessary for planning PrU prevention interventions. Purpose: To explore the relationship between lifestyle changes in response to intervention, and PrU development during a Lifestyle Redesign® (LR) program for adults with SCI. Methods: This study was a secondary cross-case analysis of electronic treatment notes from the USC/Rancho Los Amigos Pressure Ulcer Prevention Study 2 (PUPS 2), a randomized controlled trial involving 170 participants with SCI. In the study presented in this poster, the researcher examined treatment notes of a subset of 47 intervention participants, identified four patterns of relationships between PrU development and lifestyle changes,

categorized each of the 47 participants among those patterns, selected four exemplary cases, and wrote a detailed case summary for each of those cases. Results: The four patterns that evolved were: (a) positive lifestyle changes with positive PrU changes (e.g. healing a PrU); (b) positive lifestyle changes with negative or no PrU changes; (c) no lifestyle changes with positive PrU changes; and (d) no lifestyle changes with negative or no PrU changes. Components affecting lifestyle changes included motivation, sense of urgency, goal setting, existence of social support, and understanding the importance of skin health. Conclusion: The results of this study can aid practitioners in clinical decision making and the identification of lifestyle components associated with PrU risk.

Poster #: 84

Title: Observing occupational capacities and school readiness of Guatemalan preschool-aged children

Name: Amber Angell

Faculty Advisor: Gelya Frank

Background: Guatemala is undergoing an educational transition, part of widespread post-civil war efforts to build society. Common Hope, a non-government organization, aims to contribute to this national agenda by providing support for 8,000 sponsored families who live in poverty, focusing on improving children's educational outcomes. Common Hope has targeted the problem of high first grade failure rates (typically the first year children enter school) through social work home visits to monitor and support first-graders' academic progress. Purpose: The purpose of this study was to bring an "occupational lens" to home visits, observing the occupations (meaningful, purposeful activities) of young children in the home and their relation to school readiness. Methods: The methods were qualitative and naturalistic. The design was a rapid ethnographic assessment. Participant observation was utilized, wherein researchers observed home visits without intervening. Results: During home visits, social workers focused on students' school performance. Occupational

observations of younger children, however, revealed their readiness for learning. Preschool-aged children were active and curious, engaged in creative play with few toys. Their play revealed motor, social, cognitive, and sensory capacities which are important for school readiness. Conclusion: Our occupational perspective sheds light on a missed opportunity for Common Hope to engage young children to improve educational outcomes. We recommend that Common Hope provide more formal learning opportunities for preschool-aged children, capitalizing on their readiness to learn and facilitating more successful transitions into the classroom. This insight can have further policy implications, supporting Common Hope to make a case for early education at this crucial moment in Guatemala.

BIOKINESIOLOGY & PHYSICAL THERAPY STUDENT

Poster #: 85

Title: Context-Dependent Learning in People with Parkinson's Disease

Name: Ya-Yun Lee

Faculty Advisor: Beth Fisher

Background: It is often observed that people demonstrate superior performance in the context in which they originally learned a motor task and do not perform as well if the task is carried out in a novel context. This behavior is called context-dependent learning (CDL). Clinical observations suggest that people with Parkinson's disease (PD) have difficulty generalizing learned motor skills to different contexts. However, it is not known whether this observation represents CDL. Purpose: The purpose of this study was to investigate whether people with PD demonstrated greater CDL compared to healthy subjects. Methods: Nine people with idiopathic PD and 9 age-matched healthy controls participated in this study. The participants were required to practice three finger sequences embedded in specific display contexts (colors and locations). Retention tests, 1-day post practice, were given under SAME and SWITCH conditions. In the SAME condition, the sequence-context (S-C) associations remained the same as practice, while the S-C associations were changed for the SWITCH test. The primary outcome was total time accuracy cost (TTAC), calculated as the time for a subject to complete the sequence task divided by the proportion of accurate trials. The TTAC was decomposed into reaction time accuracy cost (RTAC) and movement time accuracy cost (MTAC). Switch cost was calculated as $(\text{SWITCH} - \text{SAME}) / \text{SAME test} \times 100\%$; with a larger switch cost indicative of greater CDL. Repeated measures ANOVA and independent t tests were used to calculate the group differences. Results: All participants improved over practice ($p < 0.01$) with no significant group differences at the end of practice. At retention, the switch cost for the PD group was higher than that of the

control group for all three measures (TTAC: PD=56.7, control=22.1, $p=0.05$; RTAC: PD=45.3, control=24.1, $p=0.16$; MTAC: PD=75.1, control=18.9, $p=0.01$). Conclusion: The results suggest that people with PD demonstrate greater CDL than healthy adults.

Poster #: 86

Title: Impact of Varying Light Exposure during Incubation on Locomotor Navigation

Name: Jay Porterfield

Faculty Advisor: Nina Bradley

Background: Light intensity and exposure have been shown to modify incubation length and locomotor development in chicks. Chicks begin walking hours after hatching, so in this study we asked if light conditions during embryogenesis effect locomotor navigation during overground walking on the day of hatching. Purpose: Our goal was to determine if the magnitude and direction in path trajectory during forward locomotion varied with difference in light exposure during embryogenesis. We predicted that veering angles would be greater and more variable for hatchlings incubated in continuous darkness, because they exhibited greater step width during locomotion than chicks incubated in light. Methods: We performed new analyses on published kinematic data from a study of locomotor performance in chicks incubated under 1 of 3 light conditions: continuous light (24L), cycled light 12 hr on/off (12L), and continuous darkness (24D). Chicks ($N=30$, 10 per condition) were trained to walk along a darkened tunnel prior to the first of two video recording sessions on the day of hatching. A MATLAB® function was developed to calculate foot placement angles for consecutive steps from digitized 2D coordinates. Performance of the function highly correlated with protractor measurements. Results: Two Way ANOVA results indicated that veering magnitude and variability decreased from the first to second session. Veering parameters also varied across conditions. There was a significant interaction was observed for variability of both magnitude and direction. Post hoc comparisons indicated 24D condi-

tions yielded the greatest variability. Conclusion: Results suggest that light during embryogenesis accelerates vestibular development for locomotion at hatching.

Poster #: 87

Title: Movement duration effects on hand choice in patients with stroke
Name: Sujin Kim
Faculty Advisor: Nicolas Schweighofer

Background: The participants with stroke nearly equally used their affected or unaffected hand to reach the target when there was no time constraint. On the contrary, they showed different hand choice patterns (e.g., relying more on the unaffected hand, thus decreasing the use of the affected hand) under a 1.2 second movement time-constraint condition. In this study, we are trying to understand how patients with stroke respond to different movement duration constraints. Purpose: The aim of this study is to clarify the effect of movement duration on hand choice during a target-reaching task conducted with patients with stroke. Methods: Four patients with stroke were enrolled in two-day testing sessions. We used the Bilateral Arm Reaching Test (BART) system, including three different movement time constraints: no time constraint, medium (around 1 second), and fast (around 0.5 second). The participants were asked to reach the target as many times as possible by either moving quickly or switching hands. The percentage of affected arm use was measured across different conditions. We used one-way ANOVA to clarify the change in hand choice as the condition speeds increased. Results: Because of the small sample size used, we failed to have statistically significant differences among conditions. However, there was a tendency that the patients with stroke showed a decreased amount of affected hand use as the conditions become faster. Conclusion: Task difficulty can be modulated by changing movement duration. Moreover, task difficulty can be one of the factors influencing stroke patients' hand choice during reaching.

Poster #: 88

Title: Adaptation of Contact Dynamics Following a Transition to Barefoot Running
Name: Rami Hashish
Faculty Advisor: George Salem

Background: An increasing number of runners are transitioning to barefoot (BF) on the premise that the associated forefoot initial contact (IC) reduces the loading rate (LR), and potential for overuse injuries. However, the spatiotemporal characteristics of novice BF running are also associated with an increase in leg stiffness, which is a risk factor for knee injury. Purpose: The purpose of this exploratory investigation was to examine the effect of an eight-week transition from SH to BF running on this paradox. Methods: Three-dimensional dynamics were collected on two habitually SH distance runners performing overground SH and BF running. These runners were measured again following an eight-week transition to BF running consisting of a weekly incremental increase in BF running percentage. Absolute change and the associated effect sizes (ES; Cohen's *d*) between the two conditions are reported for the various measures. Results: Relative to SH running, novice BF runners demonstrated an increase in ankle plantar flexion (-23.7°; ES 2.52), a reduction in LR (-65.6BW.s⁻¹; ES 4.05), yet an increase in leg stiffness (1.0; ES 2.18). Following the transition, there was a reduction in plantar flexion at IC (2.2°; ES 1.027), LR (-57.4BW.s⁻¹; ES 1.08) and leg stiffness (-4.4; ES 1.36). Conclusion: Despite being able to adapt a forefoot IC and a reduction in LR, novice BF runners presented with an increase in leg stiffness during ground contact. However, following the transition, there was a marked reduction in both LR and leg stiffness, suggesting that these runners adapted their movement strategy and contact dynamics—potentially reducing their injury risk.

Poster #: 89

Title: Finite Element Analysis of the Fulkerson Procedure for Patella Instability
Name: Jennifer Bagwell
Faculty Advisor: Christopher Powers

Background: The Fulkerson procedure is an intervention utilized in persons with persistent patellofemoral pain and patella instability. The procedure involves moving the tibial tuberosity antero-medially which is thought to decrease the laterally directed forces acting on the patella. Although good clinical outcomes have been reported with this surgery, the influence of this procedure on patella cartilage loading remains unclear. Purpose: To assess the influence of the Fulkerson procedure on lateral patella cartilage hydrostatic pressure using finite element analysis. Methods: One person with a diagnosis of PFP participated in this study. This individual underwent MRI assessment and biomechanical testing (squatting task). A subject specific finite element model was created using previously described methods. The initial model was then modified to simulate the Fulkerson procedure. Specifically, the tibial tuberosity was moved 5 mm medially and 10 mm anteriorly. Models were run using Abaqus software during a simulated squat task at 15° knee flexion. Mean hydrostatic pressure at the lateral patella chondro-osseous interface was the primary variable of interest. Results: Following the Fulkerson procedure, there was a decrease in mean hydrostatic pressure at the lateral patella chondro-osseous interface (2.22 MPa vs. 1.94 MPa). Conclusion: The Fulkerson procedure appears to be effective in reducing patella cartilage stress. The observed changes in cartilage stress may, in part, explain the improved clinical outcomes associated with this surgery.

Poster #: 90

Title: Modifying Sagittal-Plane Trunk Posture Affects Patellofemoral Joint Stress during Running
Name: Hsiang-Ling Teng
Faculty Advisor: Christopher Powers

Background: Patellofemoral pain (PFP) is a common knee injury in runners. A widely accepted cause of PFP is elevated patellofemoral joint (PFJ) stress. An increase in PFJ stress could be the result of an increase in the knee flexion angle and/or an increase in the knee ex-

tensor moment. Recent literature suggests that trunk posture can have an influence on sagittal plane knee kinematics and kinetics. As such, modifying sagittal-plane trunk posture may be a potential strategy to reduce PFJ stress during running. Purpose: To examine whether altering sagittal plane trunk posture leads to changes in PFJ stress during overground running. Methods: Twenty recreational heel-toe runners participated. Subjects ran at a velocity of 3.4 m/s under 3 trunk conditions: self-selected, forward lean and backward lean. Trunk and knee kinematics, ground reaction forces and EMG signals from the knee musculature were obtained. A previously described biomechanical model was used to estimate PFJ stress during the stance phase of the running cycle. The peak PFJ stress was identified and compared across the 3 running conditions using a repeated-measures ANOVA. Results: When compared to self-selected trunk condition (11.4°), the forward lean condition (17.6°) resulted in a significant reduction in peak PFJ stress (19.2 vs. 21.1 MPa). In contrast, running with a backward trunk lean (8.0°) increased peak PFJ stress compared to the self-selected condition (22.4 vs. 21.1 MPa). Conclusion: A small increase in trunk forward lean appears to be effective in reducing PFJ stress during running and may be utilized as a rehabilitation or injury prevention strategy.

Poster #: 91

Title: Coordination Variability is Higher in Non-Dancers Than Dancers During Jumping
Name: Danielle Jarvis
Faculty Advisor: Kornelia Kulig

Background: The study of coordination patterns across multiple segments provides an in-depth approach to the examination of skilled athletic movements. Movement variability across repeated trials is related to athletic skill and plays an important role in sports performance. Characterization of coordination patterns and variability in persons of varying athletic skill will indicate qualities associated with elite task performance. Purpose: To examine trunk and lower ex-

tremity (LE) kinematics and coordination variability in dancers and non-dancers during rate-controlled sautés (bipedal vertical dance jumps). Methods: Twenty healthy females, ten with no formal dance training and ten professional dancers, performed 20 consecutive sautés at a controlled rate. Kinematic variability was assessed using the mean standard deviation of angular displacement for individual joints or trunk segments, and the angular deviation of the coupling angle between segments was used to assess coordination variability. Results: Kinematic profiles were similar between the two groups, indicating that both groups were successful in performing the jumping task. Kinematic variability was higher for non-dancers ($3.2 \pm 1.8^\circ$) than for dancers ($2.3 \pm 1.6^\circ$) in the LE joints ($p < 0.01$), but there was no difference between groups for the trunk ($p = 0.16$). When looking at coordination variability between joints, non-dancers had higher variability ($38.0 \pm 8.9^\circ$ trunk; $21.5 \pm 16.8^\circ$ LE) than dancers ($31.8 \pm 8.5^\circ$ trunk; $16.4 \pm 15.6^\circ$ LE) for both lower extremity ($p < 0.001$) and trunk ($p = 0.009$) couplings. Conclusion: Trained dancers demonstrate similar kinematics but lower coordination variability compared to non-dancers during a simple jumping task. Examination of coordination between joints may allow for a more thorough understanding of skilled athletic movements than kinematic analysis alone.

Poster #: 92

Title: Comparison of patella and femur cartilage stress in symptomatic females

Name: Tzu Chieh Liao

Faculty Advisor: Christopher Powers

Background: Excessive patellofemoral joint stress has been hypothesized to contribute to patellofemoral pain (PFP). Although cartilage is aneural, PFP is thought to be the result of abnormal loading of the subchondral bone which is highly innervated. Previous studies have shown that cartilage thickness influences cartilage stress and bone stress, and that femoral cartilage is 23-40% thinner than the patella cartilage. This suggests that femur

cartilage stress may be higher than patella cartilage stress. Purpose: To compare hydrostatic pressure in patella and femoral cartilage during a squat task using finite element modeling. Methods: Seven females with PFP underwent magnetic resonance imaging (MRI) and biomechanical testing. Subject-specific finite element models of the patellofemoral joint were created using previously described methods. Models were run using Abaqus software during a simulated squat task at 15° and 45° of knee flexion. Peak hydrostatic pressure at the cartilage-bone interface was compared between the patella and femur at both knee flexion angles using a 2x2 mixed model ANOVA ($\alpha = 0.05$). Results: There was no interaction between cartilage location and knee flexion angle, however there was a significant main effect for cartilage location. When averaged across knee flexion angles, the mean peak hydrostatic pressure in the femoral cartilage was higher than that observed in the patella cartilage (2.87 MPa vs. 2.14 MPa, $p < 0.05$). Conclusion: In persons with PFP, femur cartilage stress was greater than patella cartilage stress. Thus, is it conceivable that PFP symptoms may originate from the femur subchondral bone layer as opposed to patella subchondral bone layer.

Poster #: 93

Title: The Influence of Footwear Tread Groove Parameters on Available Friction

Name: Mark Blanchette

Faculty Advisor: Christopher Powers

Background: Footwear tread affects contaminant dispersion, available friction (COF), and ultimately slip potential. To date, no study has simultaneously evaluated the influence of groove width, depth and orientation using actual shoes and with a common outsole material. Purpose: To evaluate how various combinations of tread groove width, depth and orientation influence COF. Methods: Twenty-seven pairs of men's size 10 shoes were assessed for COF using the SATRA STM 603 whole shoe tester. Each shoe's tread differed in the combination of groove width, depth and orienta-

tion. To determine the influence of groove parameters on COF, shoe outsoles were manufactured using 3 widths (3, 6 and 9 mm), 3 depths (2, 4 and 6 mm) and 3 orientations (parallel, perpendicular and oblique). To determine which groove parameter had the greatest impact on COF, an analysis of effect size was performed using the eta-squared values obtained by a 3-way factorial ANOVA. To determine which groove combination produced the greatest slip resistance, the COF of all 27 groove combinations was ranked from highest to lowest. Results: The eta-squared analysis revealed that orientation had the greatest impact on COF, explaining 81% of the variance in COF. The most slip resistant groove combination was obliquely oriented, 3 mm wide and 2 mm deep. The least slip resistant groove combination was parallel oriented, 6 mm wide and 6 mm deep. Conclusion: Our results indicate that of the 3 tread groove parameters, orientation has the greatest impact on COF. Data from this study may be used in the development of slip resistant footwear.

Poster #: 94

Title: Exercise and Whey Protein Supplementation in Prostate Cancer Patients

Name: Jacqueline Kiwata

Faculty Advisor: Todd Schroeder

Background: Prostate cancer is the most prevalent new cancer among men in the United States. Androgen deprivation therapy (ADT) is an important component of prostate cancer treatment that aims to impede testosterone-driven tumor progression. However, the reduction of endogenous testosterone to castrate levels adversely affects lean body mass (LBM), compromising muscle strength, physical function and quality of life. To date, the limited resistance training (RT) interventions in prostate cancer patients have served to reduce, rather than enhance, ADT-associated loss of LBM. Thus, the potential for muscle hypertrophy may be underestimated for these patients. Whey protein supplementation (WPS) with RT is a successful method for increasing muscle hypertrophy in older adults, yet this method is

also largely uninvestigated in prostate cancer patients. Furthermore, WPS alone may increase concentrations of glutathione (GSH), an antioxidant and anti-carcinogen. Purpose: To examine the effects of high-intensity RT with or without WPS on LBM, physical function, quality of life, and lymphocyte GSH levels in prostate cancer patients receiving ADT. Methods: Men with minimally symptomatic prostate cancer receiving ADT will be randomized to RT+WPS (50 g/day), WPS (50 g/day), RT, or control groups. The RT+WPS and RT groups will engage in a 12-week periodized, high-intensity, total body RT program 3 times/week. Body composition, physical function, muscular endurance and maximum voluntary strength will be assessed at baseline, week 6 and week 12. Results: Expected outcomes include increases in LBM, physical function and lymphocyte GSH levels, and decreases in fat mass and fatigue. These changes should be greatest in the RT+WPS group. Conclusion: n/a

Poster #: 95

Title: Does insertion of intramuscular EMG electrodes affect trunk kinematics?

Name: Jo Armour Smith

Faculty Advisor: Kornelia Kulig

Background: Intramuscular EMG is widely used in low back pain (LBP) research. As healthy subjects have altered postural control in response to anticipated experimental back pain, the anxiety and discomfort associated with insertion of EMG electrodes into the paraspinal muscles may result in altered control of the trunk in healthy subjects, and this may occur to a greater degree in persons with a history of LBP. Purpose: The purpose of this study was to compare trunk kinematics during anticipated walking turns in persons with a history of LBP (RLBP) and healthy controls (CTRL) pre- and post-insertion of intramuscular EMG electrodes. Methods: 9 subjects performed walking turns at self-selected and controlled speed, before and after insertion of intramuscular EMG electrodes into the paraspinal musculature (RLBP n=5, CTRL n=4). Anticipated and actual pain during and after electrode

insertion was recorded. Results: Anticipated and actual pain during insertion was higher in CTRLs than subjects with RLBP (anticipated: CTRL 3.4 (2.3); RLBP 2.2 (0.6) Effect size 0.7, actual: CTRL 3.9 (2.0); RLBP 2.8 (2.5) Effect size 0.5). Self-selected walking speed increased by 0.2m/s in CTRLs after electrode insertion. Peak amplitude of trunk motion, relative motion between the trunk and pelvis and variability of trunk/pelvis motion was not systematically affected in either group. Conclusion: Insertion of fine-wire EMG electrodes was associated with low levels of anticipated and actual pain in healthy subjects and persons with RLBP, but this did not result in substantial adaptations in trunk kinematics.

Poster #: 96

Title: Acute Estrogen Influence on Muscle Atrophic Proteins after Muscle Damage
Name: Lindsey Anderson
Faculty Advisor: Todd Schroeder

Background: Skeletal muscle damage up-regulates atrophic (catabolic and inflammatory) processes which trigger anabolic/regenerative processes that are beneficial for muscle hypertrophy. Estrogen may attenuate this atrophic response after damage. It is unknown whether attenuation of muscle damage is beneficial for muscle hypertrophy as changes in muscle mass are largely determined by regulation of both atrophic and anabolic pathways. Purpose: To determine the acute influence of endogenous estrogen on skeletal muscle atrophic proteins. Methods: 12 women (18-30 years; BMI 18-27) will perform a maximal eccentric exercise bout on the dominant leg extensors during the luteal (high estrogen) and menstrual (low estrogen) phase of their menstrual cycle. Outcomes for comparison between each eccentric bout will include: muscle biopsy immediately pre and 1-hour post exercise; maximal strength and soreness pre, immediately post, 1-hour post, 48-hours post, and 5-days post exercise; plasma creatine kinase immediately pre and 5-days post. Estrogen and progesterone will be assessed for cycle phase confirmation. Atrophic gene (mRNA and

protein) expression of P-FOXO3a, MURF1, Mafbx, Myostatin, IL-6, and TNF- α will be determined from muscle biopsies. Results: It is hypothesized that atrophic gene expression, soreness, and plasma creatine kinase will increase and strength will decrease after each eccentric bout. Changes in gene expression, strength, soreness, and plasma creatine kinase will be attenuated during the luteal compared to the menstrual phase. Conclusion: If hypotheses are observed this will be the first report of endogenous estrogen attenuating muscle damage via functional proteins, providing preliminary data for investigation of the long-term mechanistic influence of endogenous and/or exogenous estrogen on muscular adaptation to exercise.

Poster #: 97

Title: Impact of Achilles tendinosis on Triceps Surae muscle activities
Name: Yu-Jen Chang
Faculty Advisor: Kornelia Kulig

Background: Achilles tendinosis is a common disorder among runners and sedentary people. When degenerated, the Achilles tendon stiffness decreases, which may lead to an alteration of muscle-tendon performance, presented as prolonged delay of the force transmission, from the triceps surae to calcaneus. We further hypothesize that during single legged hopping, the Gastrocnemius muscle activation will be premature to achieve an optimal stiffness of the ankle joint at landing. Purpose: To investigate the effect of Achilles tendinosis on the neuromechanical characteristics of the triceps surae muscle. Methods: EMG signal was recorded from bilateral medial Gastrocnemius muscle on 2 tendinotic and 4 healthy subjects. The electromechanical delay (EMD) was tested isometrically on a dynamometer. Gastrocnemius EMG and ankle torque were recorded while a transcutaneous electrical stimulation was applied to the tibial nerve. The time interval between the onsets of EMG and torque was defined as EMD. Preactivation was measured while the subject performed single-legged hopping task on a force plate at 132bpm. The time interval between the onsets of

the EMG and the vertical ground reaction force was determined as preactivation of the Gastrocnemius muscle. Results: Tendinotic subjects showed prolonged EMD on the involved side. The difference between sides in tendinotic subjects is greater than that in healthy subjects. Gastrocnemius muscle activity was premature on the involved side, as compared to the non-involved side. Conclusion: These preliminary results suggest that accompanying Achilles tendinosis, the EMD of the Gastrocnemius muscle-tendon unit is prolonged. During hopping, the Gastrocnemius muscle is activated earlier to stiffen the joint in preparation of landing. Further studies are warranted to investigate the impact of Achilles tendinosis on its agonist and antagonist muscle activities.

Poster #: 98

Title: Validity and Reliability of Foot Muscle Volume Determination by MRI
Name: Sachithra Samarawickrame
Faculty Advisor: George Salem

Background: Muscle volume is used to determine the effects of strength training, effects of pathologies like diabetic neuropathy and plantar fascitis, adaptations to space flight, effects of aging, and for force estimation in biomechanical models. While Magnetic Resonance Imaging (MRI) is the most suitable tool for in-vivo volume measurement, there is no current data on the validity and reliability of using MRI to determine foot intrinsic muscle volume. Purpose: To quantify the validity and reliability of MRI for in vivo volumetric analysis of intrinsic foot muscles. Methods: Five cadaveric feet were scanned in a 3.0 T MRI system using a 3D FSPGR T1 weighted sequence. Two water phantoms were scanned to quantify distortions in the field of view. Two scans were obtained 10 weeks apart on the foot of a human subject in order to quantify test-retest reliability. Muscle volumes of the abductor hallucis, quadratus plantae, abductor digiti minimi, and flexor digitorum brevis were measured from 3D image sets manually using SliceOmatic® software. The feet were then dissected, each muscle weighed and its volume calculated.

The degree of agreement between dissection and MR-based volume measurements was calculated using ICC(2,1) ($P < 0.05$), and relative error through average percent difference (APD). Results: Linear measurement errors for the two phantoms were 1% at maximum. There was good agreement between the measurement techniques: Abductor hallucis ICC(2,1) = 0.91, APG 3.6%; Abductor digiti minimi = 0.92, 4.5%; Quadratus plantae = 0.80, 6.4% and Flexor digitorum brevis = 0.74, 9.2%. Test-retest reliability for a single examiner was excellent (ICC(2,1) = 0.98, APD 2.2%). Conclusion: Valid and reliable measurements of intrinsic foot muscle volumes in-vivo can be made using MRI. This study will encourage the design of prospective studies that measure muscle volume changes.

Poster #: 99

Title: Postural strategies for running termination: comparison between children and adults
Name: Guilherme Cesar
Faculty Advisor: Susan Sigward

Background: An understanding of the development of postural strategies through childhood for control of momentum during running will allow for the identification of children who are not achieving age appropriate motor skills for physical activity participation. Mature gait is achieved by the age of 7 years; however, it is not known if children utilize mature postural strategies to control forward momentum of the body's center of mass (COM) during running tasks. Purpose: To determine if children utilize a stereotypical extension strategy employed by adults to terminate running. Methods: Three adults and two 8-year-old children ran 13m at maximum effort and stopped in a pre-determined area. Approach velocity, horizontal position COM, and lower extremity and trunk angles were calculated across the deceleration phase of termination. Three trials were averaged and effect sizes were used to detect group differences. Results: Children decelerated at a faster relative approach velocity ($ES = 2.08$) than adults. Compared to adults, children positioned their COM less posteriorly throughout

deceleration with more profound differences noted during initial deceleration (7%, ES=1.08 and 14%, ES=1.68 less posterior, respectively). Children utilized more trunk flexion (ES=1.33) and ankle plantarflexion (ES=0.91) than adults throughout deceleration. Conclusion: A less posterior position of the COM and greater trunk flexion indicate that children were not using an extension strategy to decelerate suggesting that they have not developed a mature postural strategy to control forward momentum. However, the strategy employed by children was successful and may have been necessary given the differences in approach velocity.

Poster #: 100

Title: Strychnine Alters Ankle Flexor-Extensor Muscle Activity Pattern in Chick Embryos
Name: Soo Yeon Sun
Faculty Advisor: Nina Bradley

Background: During late stage embryogenesis in chicks, spontaneous repetitive kicking is produced by a leg muscle pattern of flexor-extensor alternation at rhythmic frequencies comparable to locomotion in hatchlings. A widely-regarded model for control of locomotion suggests that the pattern and rhythm of leg muscle activity are separately controlled. Purpose: One aim of our current investigations is to determine if the muscle pattern and rhythm for kicking in chick embryos are separately controlled. It is hypothesized that glycine mediates reciprocal inhibition between flexor and extensor motor neurons to produce the locomotor pattern. In this study we asked if administration of strychnine, a glycine receptor antagonist, would convert alternating flexor-extensor bursting of ankle muscles to synchronous bursting. Methods: Embryonic day 20, ankle muscles were implanted bilaterally for electromyographic recording, and spontaneous muscle activity was recorded for 2 hours. Strychnine was then given by intraperitoneal injection and recording continued for an additional 2-3 hours. Several burst parameters for muscle activity before and after strychnine were compared (n=7 embryos). Results: Strychnine disrupted flexor-

extensor alternation in all embryos. Rhythmic bursting persisted, however burst frequency increased in 5 embryos ($p<0.05$). Alternating flexor-extensor activity and initial burst frequencies were gradually reestablished within 2 hours after strychnine application. Conclusion: Our data suggest that glycinergic inhibition is required for ankle flexor-extensor alternation during locomotion. Glycinergic inhibition does not appear to be essential for rhythm generation, but may modulate rhythm frequency. It remains to be determined if locomotor pattern circuitry is selectively mediated by glycine, or also GABA, in late stage chick embryos.

Poster #: 101

Title: Ischemia-Reperfusion and Tourniquet Use During Knee Surgery
Name: Brian Wu
Faculty Advisor: Todd Schroeder

Background: During TKA, ACL, and knee scope surgeries a tourniquet is applied to the proximal thigh to stop blood flow and maintain a clear surgical field. Following surgery, the tourniquet is released and blood flow is re-established. Muscle cells are particularly sensitive to tourniquet use with damage to tissue beds increasing relative to the duration of ischemia. By far the most significant clinical barrier following TKA, ACL and knee scope surgery is persistent muscle atrophy and weakness. Purpose: We hypothesize that post-operative muscle atrophy that occurs following surgery is directly attributable to the degree of muscle tissue injury and cell death that occurs due to tourniquet-induced ischemia-reperfusion injury occurring during and after tourniquet use. Methods: We will study men and women (18 years old and older) who are scheduled to undergo TKA, ACL reconstruction, or a knee scope at the orthopedic medicine clinic at Keck School of Medicine at USC with an orthopedic surgeon. Use of tourniquet will be determined by the orthopedic surgeon and recorded. A total of two (2) muscle biopsies will be performed utilizing the surgical incision prior to cuff inflation (tourniquet group) and after 5 minutes

of cuff deflation. Blood will also be drawn at these times. Results: Specific cell signaling pathways probed will be stress response and catabolic pathways. Conclusion: We hope to discover future therapeutic methods that induce cellular resistance to ischemia-reperfusion injury induced by tourniquet use during knee surgery that will help to prevent and/or significantly reduce the impact and better preserve muscle cells.

Poster #: 102

Title: Development of an interactive virtual game for children with Autism
Name: Na-hyeon Ko
Faculty Advisor: Francisco Valero-Cuevas

Background: Autism spectrum disorder (ASD) is the most common neurodevelopmental disorder in children. Children with ASD exhibit atypical communication skills, social interaction, and motor behaviors. They also display motor deficits such as hypotonia, motor apraxia, and coordination problems. Studies have reported that children with ASD interact better in virtual environments. However, research in this realm has primarily focused on improving communication and social interaction skills but not on gross motor skills. Purpose: We will develop a virtual game to encourage jumping skills in children with ASD and show the skill improvement with kinematic data. Methods: An onscreen character interacted with children by copying their jumps and rewarding them with virtual coins. Sensors were attached to the children's trunk to detect acceleration when jumping. Wireless telecommunication between accelerometer sensors and game receiver was accomplished using a custom-built Bluetooth device. We used a Kinect (Microsoft Corporation, Redmond, WA) to collect kinematic data while jumping to evaluate the effectiveness of the virtual game on gross motor skills. Results: Typically developing children and children with ASD played the interactive virtual game wearing a belt with sensors and practiced jumping. The acceleration data from the box were transmitted wirelessly to the video

game receiver. The Kinect device captured kinematic data: jumping height, distance, velocity, and trunk displacement. Conclusion: Children with ASD exhibit gross motor deficits. However, it is often difficult to encourage them to participate in improvement activities. We have developed the interactive virtual game to encourage them to jump and collected the kinematic data to evaluate its effectiveness on gross motor skills.

Poster #: 103

Title: Whole Body Posture for Running Change of Direction Tasks
Name: Kate Havens
Faculty Advisor: Susan Sigward

Background: The ability to change directions quickly is essential for participation in multi-direction sports; however, cutting is also associated with knee injury. Changing direction involves braking, translation and rotation, which is accomplished through changes in whole body posture. Specifically, the whole body center of mass (COM) and under-foot center of pressure (COP) separate for deceleration in the original direction and acceleration towards the new path. Understanding the control of this separation is critical to our interpretation of segmental mechanics, thus knee injury. Purpose: To characterize the effects of cutting angle and speed on whole body posture. Methods: 22 healthy soccer players performed 45° and 90° sidestep cuts as fast as possible and at 80% speed. 2D COM-COP separation distance was quantified relative to the lab's global coordinate system and relative to the individual's anatomical position, and was normalized to height. To determine the effects of speed and angle on the dependent variables, 2x2 repeated measured ANOVA was used ($P \leq 0.05$). Results: Main effects for angle and speed were found for global posterior, global medial and anatomical medial separation distances ($p<0.001$). In all cases, more severe cuts and faster speeds resulted in larger COM-COP separation. An angle x speed interaction was found for both medial COM-COP distances. Conclusion: Differences were found in the individuals' body position for braking

in the original direction of progression but not towards the new travel path. Body posture to allow greater medial translation was found with greater angle and speed, with the effects of speed more pronounced in the 45° cut.

Poster #: 104

Title: Comparison of loading patterns: ACL reconstructed versus uninvolved limb

Name: Kristamarie Pratt

Faculty Advisor: Susan Sigward

Background: Persistent asymmetrical loading patterns following anterior cruciate ligament reconstruction (ACLR) contribute to risk for re-injury. Early detection and correction of asymmetries may minimize long-term impairments. However, information regarding early asymmetries is limited to gait mechanics. Purpose: Identify loading asymmetries between ACLR and uninvolved limbs during functional tasks in individuals 12-16 weeks post-ACLR. Methods: One male, 12-weeks post-ACLR was assessed performing: gait (GAIT), running (RUN), and stop-and-go (GO) tasks at self-selected speeds. Using 3D motion analysis, stance phase hip, knee and ankle peak angles, net joint moment impulse and average power (absorption and generation) in the sagittal plane were compared between ACLR and uninvolved limbs. Results: When compared to the uninvolved limb, ACLR had similar sagittal ankle and hip angles for all tasks. During GAIT, RUN and GO tasks ACLR exhibited decreased knee flexion (17.9%, 16.7% and 2.5%, respectively), smaller knee (27.0%, 62.2% and 28.4%, respectively) and larger hip (58.2%, 107.2% and 19.6%, respectively) extensor impulse than the uninvolved limb. During RUN and GO tasks ACLR exhibited on average a 17.2% decrease in power at the knee and a 25% increase in power at the hip and ankle. Conclusion: Despite kinematic similarities between the involved and uninvolved limbs, differences in loading patterns were observed between limbs. A trend to shift loading away from the knee toward the hip and ankle was most pronounced during the more dynamic RUN and GO tasks.

Further work is needed to identify appropriate tasks for assessment of loading asymmetries during acute rehabilitation.

Poster #: 105

Title: Rest Interval Influences Adaptations to Resistance Training in Older Men

Name: Matthew Villanueva

Faculty Advisor: Todd Schroeder

Background: Short-term resistance training (RT) induces muscle growth and strength enhancements in older men; these adaptive responses may be partly attributed to acute resistance exercise- (RE-) induced increases in endogenous anabolic hormones. Purpose: To determine: i) if 8 weeks of strength RT with 60-second RI (rest interval) (SSRT) induce greater improvements in body composition (BC) and muscular performance (MP), compared to the same RT program with 4-minute RI (SLRT); ii) if strength RE (SRE) with 60-second rest interval lengths between sets (SS) elicit greater increases in total testosterone (TT) and growth hormone (GH), compared to SRE with 4-minute RI (SL). Methods: 22 men were assigned to one of two groups, following 4 weeks of hypertrophic RT (SSRT: n=11, 65.6±3.4years; SLRT: n=11, 70.3±4.9years). 18 of 22 participants completed 1 hypertrophic RE protocol (HRE) and 2 SRE, at Week 0, 4, and 12, respectively; blood was drawn pre- (PRE), immediately post- (POST), 15 minutes post- (15 MIN), and 30 minutes post-exercise (30 MIN). Results: Across the 8-week strength RT phase, compared to SLRT, SSRT experienced greater increases in lean body mass (p=0.001) and MP (p<0.01). HRE increased TT and GH from PRE to POST, 15 MIN, and 30 MIN (p≤0.05). In response to SS, the acute change (POST-PRE) in TT (p<0.001) and percent change ((POST-PRE)/PRE) in TT and GH (p<0.005) were greater, compared to SL. Conclusion: In older men, short RI enhance the acute TT and GH response to strength RE and induce greater enhancements in body composition and muscular/functional performance following short-term periodized strength RT.

Poster #: 106

Title: White Matter Tract Integrity and Dose of Rehabilitation after Stroke

Name: Matthew Konersman

Faculty Advisor: George Salem

Background: Upper extremity motor impairment after stroke has been related to motor tract integrity, as measured by diffusion tensor imaging (DTI). It is unknown how well initial DTI measures can predict: (1) baseline impairment and (2) functional motor changes in response to dose of therapy. This project is part of a larger phase I clinical trial that aims to determine prospectively the dose of therapy that will lead to continued improvement of upper extremity use after completion of therapy for individuals with chronic stroke. Purpose: The purpose of this study is to investigate the relationship between white matter characteristics associated with initial upper extremity (UE) function and motor performance changes after therapy. Methods: Six subjects with chronic stroke completed DTI and motor impairment assessments before and after UE training. We examine fiber tract integrity, measured by whole-brain tractography, and fiber coherence of the corticospinal tract, measured by fractional anisotropy (FA) and mean diffusivity (MD). Results: Larger regional FA and MD value asymmetry are predictive of more severe baseline upper extremity impairment. Decreases in FA and MD asymmetry after task oriented upper extremity training are associated with improvement in upper extremity function. Reduced asymmetry between lesioned and non-lesioned hemispheres indicates a structural neuroplastic effect attributable to the task oriented UE training. Conclusion: DTI measures of structural white matter integrity may be used as a predictor of motor impairment after stroke. Intensive task oriented UE training can attenuate the hemispheric asymmetries due to brain damage. This line of research may help to predict recovery potential after stroke.

Poster #: 107

Title: Measuring attentional demand in healthy elders under virtual reality condition

Name: Yi-An Chen, Yu-Chen Chung

Faculty Advisor: Carolee Winstein

Background: Previous studies reported that participants show higher engagement while performing tasks under virtual reality (VR) than real-world conditions. Up until now, this finding has been supported exclusively using self-report questionnaires and interviews. Little to no research has directly compared attentional demands using an objective measure of engagement. Purpose: The aim of this study was to use a more quantitative method to understand participants' engagement level under VR-based conditions. Methods: Thirty participants performed a standing and a stepping reaching-task under two conditions: a virtual target and a real target condition. Using a dual-task probe paradigm, participants were instructed to respond to an unanticipated auditory tone as soon as possible on 27% of the reach trials. Response time was measured to characterize participants' attentional demand. Participants' subjective engagement level was also measured via using standard questionnaires and a post-task interview. Results: Our results showed a significantly longer response time in the virtual target condition compared to the real target condition. Comparison of catch trials and probe trials showed that these results were not due to a trade-off between the primary and probe task, but instead suggest greater attentional demand in the virtual target condition compared with the real target condition. This finding was independent of the posture demand (standing or stepping). Further, participants reported not only being more engaged but also more challenged in the virtual target condition. Conclusion: This is the first study to use a dual-task probe paradigm to measure and compare the attentional demands between VR and real-world conditions. Our findings suggested that VR-based games are more than just fun; they also require participants to attend more to the task. In the future, we can use VR-based games as a tool to engage and motivate individuals to participate in posturally challenging exercises.

Poster #: 108

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 of the lesioned hemisphere from the non-lesioned side, thereby impeding recovery of the paretic extremities. One plausible method to improve recovery of function is to decrease the excitability of the non-lesioned hemisphere and restore some degree of IHI balance by applying low frequency repetitive transcranial magnetic stimulation (rTMS). **Purpose:** The purpose is to determine the effect of rTMS applied over the non-lesioned hemisphere on paretic hand movement in individuals with acute and sub-acute stroke. **Methods:** The study design is within-subjects comparison. Participants received two rTMS conditions separately on two consecutive days: active and sham rTMS. The order of rTMS condition is counterbalanced between participants. In the active rTMS condition, 1 Hz rTMS is applied for 25 minutes at 90% resting motor threshold over the hotspot of extensor digitorum communis muscle in the non-lesioned hemisphere. Hand opening kinematics was measured pre and post rTMS when participants grasped different sizes of dowels at a self-selected speed. **Results:** One participant was recruited 2-months post-stroke onset. Across dowel sizes, the pre-post changes in reaction time, movement time and peak aperture of index-thumb finger were similar between active and sham rTMS conditions. The maximal extension angle and peak extension velocity of the index finger increased after real-rTMS. **Conclusion:** Preliminary data from one participant with sub-acute stroke suggested the effect of 1 Hz rTMS may accelerate hand recovery, especially in finger extension excursion and peak extension speed.

DDS STUDENT - BASIC SCIENCES

Poster #: 109

Title: Three-dimensional X-ray Computed Tomography Atlas of Mouse Craniofacial Structures

Name: Moshe Eizdi, Shawn Ebrahimpour

Faculty Advisor: Yang Chai

Background: Craniofacial muscles are highly complex, organized structures. Although previous X-ray computed tomography (microCT) studies have been conducted on various organs in mice at a thickness of 35 microns, we are unable to visualize details of craniofacial muscle structures in these images. A high-resolution three-dimensional (3D) atlas will further the study of the anatomy of craniofacial muscles and will help with diagnosis and phenotype analysis. **Purpose:** To generate a 3D atlas of craniofacial muscles using 10 μ m microCT scans of newborn wild-type mice. **Methods:** Four newborn wild-type (C57BL/6J) mice were scanned by microCT (Scanco V1.28) at 10 μ m thickness to generate 3D reconstruction images using Avizo 7.0 software. We developed a CT scanning protocol for soft tissues in the craniofacial region. Human anatomical landmarks were used in labeling intrinsic and extrinsic muscles of the tongue and the soft palate. Reproducibility was tested between two researchers and variability was analyzed between scans of individual muscles by statistical analysis. **Results:** Using 10 μ m microCT scans, we were able to distinguish extrinsic and intrinsic muscles of the tongue and soft palate muscles, suggesting that microCT images are useful for the study of craniofacial muscle development. Intra- and inter-observer analysis showed reproducibility and acceptable variability between scans of individual muscles. **Conclusion:** We successfully generated a complete 3D atlas of the tongue and the soft palate of newborn mice. Our 3D atlas may be useful as a reference in the study of craniofacial defects in various mouse models.

Poster #: 110

Title: Smad4-Dependent TGF β Signaling Regulates Tongue Muscle

Development

Name: Chase Judd

Faculty Advisor: Yang Chai

Background: The tongue is a muscular organ that has important physiological functions in suckling and swallowing, assisting in speech, tasting, and chewing. Myogenic and cranial neural crest cells interact in the tongue throughout development. We have recently found that ablation of Smad4 in myogenic cells in mice (Smad4^{fl/fl};Myf5-Cre) results in microglossia and fewer tongue muscle fibers. However, it is still unknown to what extent the Smad4-dependent pathway contributes to tongue muscle development. **Purpose:** To assess the contribution of the Smad4-dependent pathway in tongue muscle development, we compared tongue muscle volume in Smad4^{fl/fl};Myf5-Cre and littermate control mice. **Methods:** We performed 3-D MicroCT imaging and volumetric analyses of tongue muscles at 10 μ m resolution to label and compare tongue muscle structures in E18.5 Smad4^{fl/fl};Myf5-Cre and littermate control mice. Avizo 7.0 software was used to measure intrinsic tongue volumes. Samples from each genotype were measured three times each. Averages and t-tests were calculated to compare the tongue volumes of each genotype. **Results:** We found a significant reduction in the volume of the intrinsic tongue muscles of Smad4^{fl/fl};Myf5-Cre mice compared to littermate controls. **Conclusion:** The tongues of Smad4^{fl/fl};Myf5-Cre mice exhibited microglossia, indicating that the Smad4-dependent signaling pathway is crucial for tongue myogenesis.

Poster #: 111

Title: Orientation of anti-BMP-2 mAb applied in antibody mediated osseous regeneration

Name: Justin Raanan

Faculty Advisor: Homa Zadeh

Background: Recent data in our lab have demonstrated that anti-BMP-2 mAbs complexed to a scaffold such as absorbable collagen sponge (ACS) can mediate bone repair in a process referred to as antibody mediated osseous regeneration (AMOR). **Purpose:** The present study sought

to investigate the effects of binding anti-BMP-2 mAb with different orientations to solid scaffolds, which can participate in AMOR. **Methods:** In vitro binding of anti-BMP-2 mAb/rhBMP-2 immune complexes to C2C12 cells was compared to that of protein G (PG)/anti-BMP-2 mAb/rhBMP-2 immune complexes by flow cytometry. To determine the in vivo effects of the orientation of mAb, ACS was incubated with or without PG, followed by incubation with anti-BMP-2 mAb or isotype control mAb. The resultant ACS with immune complex of PG/anti-BMP-2 mAb were implanted into critical size rat calvarial defects. After 8 weeks, dissected calvaria were scanned by Micro-CT followed by histological and histomorphometric analysis. **Results:** Flow cytometric analysis showed that PG/anti-BMP-2 mAb/rhBMP-2 immune complexes bound with higher intensity to C2C12 cells than those without PG ($p < .05$). The micro-CT and histomorphometric analyses showed increased bone formation within calvarial defects implanted with ACS/PG/anti-BMP-2 mAb than those without PG. **Conclusion:** The results of this study showed that when PG was used as a linker to bind to anti-BMP-2 mAbs, the binding to target cells was enhanced in vitro, and higher degree of bone repair occurred in vivo. Since PG binds to the Fc region of antibodies, it is likely that binding of anti-BMP-2 mAbs to PG preferentially exposes their antigen-binding sites.

Poster #: 112

Title: Canonical and Non-canonical TGF β Signaling during Craniofacial Bone Development

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. TGF β signaling plays a crucial role in craniofacial development, and loss of Tgfb2 in CNC cells results in craniofacial skeletal

malformations. We have recently reported that both diminished canonical and upregulated non-canonical TGF β signaling cause craniofacial deformities in Tgfr2 mutant mice. Purpose: The aim of this study is to describe to what extent canonical and non-canonical TGF β signaling cascades contribute to CNC-derived intramembranous ossification. Methods: We compared the size and volume of CNC-derived craniofacial bone structures (frontal bone, premaxilla, maxilla, and palatine bone) from E18.5 control, Tgfr2fl/fl;Wnt1-Cre (diminished canonical and upregulated non-canonical TGF β signaling), and Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+ (diminished canonical and restored non-canonical TGF β signaling) mice. The microCT images were collected using microCT (Scanco V1.28) with resolution at 10 μ m 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 Tgfr2fl/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 frontal bone) were partially restored in Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+ mice. Conclusion: Our data indicate that intramembranous bone formation is mainly regulated by non-canonical TGF β signaling.

Poster #: 113

Title: The effects of nonsteroidal anti-inflammatory drugs on orthodontic tooth movement

Name: Kristina Sakas

Faculty Advisor: Dennis Tartakow

Background: The practice of orthodontics is based on tooth movement through bone in response to mechanical forces. Bone remodeling occurs through an inflammatory process involving prostaglandins. By inhibiting prostaglandin synthesis, nonsteroidal anti-inflammatory drugs (NSAIDs) inhibit the rate of orthodontic tooth movement. Purpose: This research explains the methodology of how analgesics affect the rate of orthodontic tooth movement, and may help clinicians during treatment planning and ad-

vising patients about their care. Methods: Data were collected from the ADA and AAO libraries and online databases. Consumer health information regarding NSAIDs was collected from the FDA, Slone Epidemiology Center surveys and American College of Preventative Medicine. Results: Scientific articles were used to research the effects of NSAIDs on orthodontic tooth movement. All data were consistent with the following: Traditional NSAIDs (ibuprofen and aspirin) decreased orthodontic tooth movement. Acetaminophen (a non-NSAID analgesic) had no effect. The ability of NSAIDs to inhibit tooth movement results from the inhibition of prostaglandins, which are critical mediators of the inflammatory process during tooth movement. Conclusion: NSAIDs can affect orthodontic tooth movement and prolong orthodontic treatment. Practitioners must be aware of all medications taken by patients during orthodontic treatment. Acetaminophen, an inactive inflammatory agent, does not inhibit tooth movement and should be considered as the analgesic drug of choice for patients undergoing orthodontics, unless contraindicated by the patient's medical history or physician.

Poster #: 114

Title: Transforming Growth Factor Beta (TGF β) Signaling in Mandible Development

Name: Ronald Chung

Faculty Advisor: Yang Chai

Background: The mandible forms through intramembranous and endochondral ossification. TGF β signaling regulates cranial neural crest (CNC) cell-derived bone and cartilage development. We have recently reported that non-canonical TGF β signaling is activated in the absence of Tgfr2 (Tgfr2fl/fl;Wnt1-Cre mice). A haploinsufficiency of Tgfr1 largely rescues craniofacial deformities in Tgfr2 mutant mice (Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+) via reduction of ectopic non-canonical TGF β signaling. However, the relative contribution and distribution of canonical and non-canonical TGF β signaling during intramembranous and endochondral ossification remain unclear. Purpose: To

quantify the contribution and distribution of TGF β signaling during mandibular development. Methods: We performed microCT analysis to compare the size and volume of mandibles in control, Tgfr2fl/fl;Wnt1-Cre, and Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+ mice. We generated three-dimensional computerized images and compared the proportion of craniofacial structures between the different mice. In addition, we compared the size and volume of specific areas in the mandible derived from endochondral or intramembranous ossification. Results: We found that size and volume of the body and the ramus of the mandible are smaller in Tgfr2fl/fl;Wnt1-Cre mice compared to control, and this decrease is rescued in Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+ mice. Endochondral bone formation of the condylar and coronoid processes of the mandible was compromised in Tgfr2fl/fl;Wnt1-Cre mice and not restored in Tgfr2fl/fl;Wnt1-Cre;Alk5fl/+ mice. Conclusion: Our data indicate that the size and volume of the mandible body and ramus are primarily regulated by non-canonical TGF β signaling, whereas the size and volume of the condylar and coronoid processes are regulated by canonical TGF β signaling through endochondral ossification.

Poster #: 115

Title: Silencing p66Shc in Type II cells decreases surfactant protein expression.

Name: Kenneth Smith

Faculty Advisor: Matt Lee

Background: The p66Shc adapter protein mediates antimutagenic, apoptotic, and oxidative stress signaling by many different pathways. It is highly expressed in the early fetal lung, but is dramatically downregulated with maturation. Levels of p66Shc begin to decrease on the last day of gestation and are silenced at birth. Its function in the developing lung is unclear. Purpose: We hypothesized that p66Shc regulates the maturation of alveolar type II cells. These cells produce surfactant proteins that are necessary for lung function at birth. Methods: To test this hypothesis, p66Shc expression was modulated in Type II

cells isolated from E16 fetal mice (Term 18.5 days). Cells were transfected with either a p66Shc specific siRNA or a nonsilencing control siRNA. Cells were also infected with either a p66Shc adenovirus or a GFP control virus. Cells were maintained in culture for four days, then lysed, total protein contents were equalized and the resulting expression of surfactant proteins assessed by Western blot. The results of the four conditions used in the experiments are as follows: siCtl (No knockout)/GFP (No overexpression) = Control; siCtl (No knockout) / Ad66 (Overexpression) = Increased p66Shc; si66 (Decrease p66Shc) / GFP (No overexpression) = Decreased p66Shc and si66 (Decreased p66Shc) / Ad66 (Increased p66Shc) = Return to Control. Results: The results revealed that silencing p66Shc reduced the expression of surfactant protein C, thereby suggesting that p66Shc regulates epithelial maturation in the developing lung. Conclusion: In conclusion, p66Shc is required for lung maturation and the development of alveolar type II, SP-C producing cells.

DDS STUDENT- CLINICAL SCIENCES

Poster #: 116

Title: Population pharmacokinetic and pharmacodynamic modeling for assessing risk of BRONJ

Name: Peter Lee, Ronald Chung

Faculty Advisor: Parish Sedghizadeh

Background: Recent evidence has shown that the common anti-resorptive bisphosphonate (BP) drugs may have toxic effects on oral soft and hard tissues by interfering with wound healing. **Purpose:** We hypothesized that patients with BP-related osteonecrosis of the jaw (BRONJ) accumulate higher levels of BP in bone, which contributes to disease development, as compared to patients without BRONJ. **Methods:** Using the Pmetrics package and published data, we designed for the first time a population pharmacokinetic model of BP concentration in plasma and bone and derived a toxic bone BP threshold of 0.2 mmol/L. With the model, and using patient individual BP duration and bone mineral content estimated from lean body weight, we calculated bone BP levels in 153 subjects. **Results:** Mean bone BP in 69 BRONJ cases was higher than in 84 controls (0.20 vs 0.10 mmol/L, $P < 0.001$), consistent with the toxic bone threshold of 0.2 mmol/L. BRONJ was also associated with longer duration BP therapy (5.3 vs 2.7 years, $P < 0.001$), older age (76 vs 70 years, $P < 0.001$), and Asian race (49% vs 14%, $P < 0.001$). **Conclusion:** Our pharmacometric model accurately discriminated BRONJ cases from controls among patients on BP therapy and identified new risk factors for disease. Novel pharmacometric approaches applied to the characterization of drug-related diseases such as BRONJ provide significant insight into disease pathogenesis and risk factors, allowing for application to clinical care and risk assessment.

Poster #: 117

Title: The correlation between incisive papilla and maxillary anterior teeth

Name: Andrew Kang

Faculty Advisor: Tae Hyung Kim

Background: The maxillary anteriors occupy the space between the incisive papilla and the occlusal plane as dictated by esthetics and phonetics. The incisive papilla remains relatively constant, and is frequently used as an anatomic landmark. Studies have been made using incisive papilla as guides to arrange maxillary anteriors for edentulous patients. **Purpose:** The aim of this study was to determine the relationship between the maxillary anteriors and the incisive papilla and to compare this with the classical estimate value. **Methods:** The horizontal distances between the labial surface of the central incisors and the incisive papilla (CPIP, CAIP, and CCIP) and the size of incisive papilla (SIP) were measured by a digital caliper on the stone casts formed from 103 dentate subjects. The Pearson correlation coefficient was used to investigate and quantify the correlation, while simple linear regression analyses were conducted to determine the strength of the association between the variables ($\alpha = .05$). **Results:** Pearson correlation coefficients for the SIP and the distance between the labial surface of the central incisors and the incisive papilla (CPIP, CAIP, and CCIP) were significant ($P < .05$). A simple linear regression analysis was performed on the data and showed that SIP contributed significantly to the prediction of the distances between the labial surface of the central incisors and the incisive papilla (CPIP and CCIP) ($P < .05$). **Conclusion:** Using regression methods within the population tested, it was found that the distance between the labial surface of the central incisors and the incisive papilla could be predicted by the size of the incisive papilla.

Poster #: 118

Title: CBCT Pan-Like Images: A Trend In Mesiodistal Tooth Angulation Discrepancies

Name: Ammar Siddiqi

Faculty Advisor: Hongsheng Tong

Background: Although panoramic x-rays have been used throughout dentistry, there have been many studies describing the distortions in these 2-D images. However, to date there hasn't been a study that has looked at a trend in the distortions

and compared it to an ideal coordinate system. The ultimate goal of our research was to compare tooth positions from a generated 2-D panoramic image to a more ideal Cone-Beam Computed Tomography (CBCT) 3-D volumetric image. By generating 3-D images of the teeth and the maxillofacial structures, CBCT allows us to see the exact location of both crowns and roots and their relation to the neighboring tissues. This study will be looking at 76 patients with interincisal angles divided into 3 ranges to compare if there is a trend in the mesiodistal angulations based on the changes in interincisal angulation. **Purpose:** The objective of this study was to determine if there were differences in the tooth mesiodistal angulation measurements from the constructed 2-D panoramic-like images as compared to direct measurements from 3-D volumetric images, and if there is a trend based on the interincisal angle. The hypothesis is that there is a trend in distortions based on the interincisal angle. **Methods:** 2-D panoramic images were constructed using the 3-D dicom data on Dolphin Imaging software. The long axis was drawn through each tooth and the angle was measured against the occlusal plane. These measurements were compared to the true mesiodistal angulations that were measured directly from the 3-D volumetric image. **Results:** There are definite distortions in the mesiodistal angulations on the constructed panoramic images; however, the statistics have not yet been completed. **Conclusion:** The final results have not yet been determined.

Poster #: 119

Title: Recombinant Chromosome 4: Chromosome, FISH and CGH microarray study

Name: Omid Hemmat

Faculty Advisor: Morteza Hemmat

Background: Recombinant chromosome 4 is a very rare constitutional rearrangement. To date only 11 cases have been reported which involve a recombinant chromosome 4 arising from pericentric inversion. **Purpose:** We report a one year old patient, carrying a recombinant chromosome 4 resulting in partial trisomy of 4p and partial deletion

of 4q. **Methods:** The result was obtained by cytogenetic analysis and confirmed by FISH assay. CGH microarray was performed in order to further characterize the rearranged chromosome 4 and to determine the breakpoints. **Results:** The results revealed that the rearranged chromosome 4 was a recombinant chromosome 4 consisting of a duplicated segment of 4p14->4pter and a deleted segment of 4q34->4qter; accordingly, the abnormal karyotype was designated as 46,XY,rec(4)dup(4p)inv(4)(p14q33)pat. **Conclusion:** The follow-up study of the family revealed that the father had a balanced pericentric inversion of chromosome 4, inv(4)(p14q33). The father's chromosomal abnormality had been revealed by amniocentesis followed by the early death of his sister due to congenital abnormalities. The same inverted chromosome 4 in the paternal grandmother revealed the inheritance of this chromosome by the patient's father.

Poster #: 120

Title: Comparing Dental Needs in the United States with Foreign Countries

Name: Nicole Ranney

Faculty Advisor: Dennis Tartakow

Background: USC Dental Humanitarian Outreach Program (DHOP) student members travel overseas each year to countries where residents are underserved with their dental needs. The 2011 and 2012 abroad clinic locations assessed were Cartagena, Colombia and Nairobi, Kenya. This study compares the oral health statuses of underserved individuals in the United States (U.S.) with underserved individuals outside of the U.S. **Purpose:** The aim of this study was to evaluate and compare the oral health statuses of individuals from three different regions: Cartagena, Colombia; Nairobi, Kenya; and Los Angeles, California. **Methods:** At each dental clinic, all patients had their treatment planned by student dentists, obtaining approvals from USC dental school volunteer faculty. After proper data collection, the need for specific dental care was determined. The patient's plaque, calculus, and inflammation levels were measured as low, moderate,

or severe, and then determined to be either generalized or localized. The severity of decay and restorability of each individual's teeth were also determined. Dental treatment was limited to prophylaxis, restorative treatment, and extractions. Results: The results of each dental clinic showed that individuals in underserved, third-world communities had varying degrees of need for dental care. Need for dental care within the three locations: (a) Cartagena, Colombia: Moderate to Severe; (b) Nairobi, Kenya: Severe; (c) Los Angeles, California: low to moderate. In Cartagena approximately 490 patients had treatment planned and were provided with prophylaxis followed by quadrant dentistry. In Nairobi 187 patients had treatment planned and provided with a full-mouth cleaning followed by quadrant dentistry. Proportional to the number of patients treated, more prophylaxes than restorative treatments were completed in Cartagena. The decreased number of patients treated in Nairobi was affected by limited power supply, delay in supply arrival, and the time allotted to each patient due to the severity of dental needs in Nairobi compared to Cartagena and Los Angeles. Conclusion: Regardless of whether individuals live within underserved communities or in Los Angeles there is always a need for dental care and maintenance. Alarming, one does not have to visit a foreign country to see conditions similar to third-world oral health. As dental professionals, it is our obligation to treat the dental needs of all individuals in order to adhere to the principles of social justice for the well-being of our communities and society.

Poster #: 121

Title: Comfort of senior dental students with pediatric dentistry upon graduation

Name: Dong-Gil Kang

Faculty Advisor: Julie Jenks

Background: This study aimed to determine the comfort level of senior dental students with pediatric dentistry upon graduation. Students who attended mobile clinics and other community rotations responded that they were comfort-

able with treating infants and toddlers. 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 on infants, toddlers, preschool and school age children and adolescents. 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. Results: The response rate for graduating seniors to the survey was 91%. Regarding behavior management of patients during the dental examination and treatment plan, the majority of respondents were comfortable managing children throughout the age spectrum. Regarding behavior management of patients during operative procedures, two-thirds of respondents were uncomfortable with treating infants and just less than half (43.6%) of respondents were uncomfortable treating toddlers. The majority of respondents were comfortable to very comfortable with treating preschool age, school age and adolescent children. Conclusion: Students responding with a high score (80% or above) on a base knowledge quiz were most likely to be comfortable with treating infants and toddlers. Also, students who attended mobile clinics 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 at providing an initial dental examination and treatment plan, but reported having difficulty with operative dental procedures with infants and toddlers.

Poster #: 122

Title: V2 Nerve Block: Anatomical and Clinical Study Using CBCT Scans

Name: George Jaber

Faculty Advisor: Fariborz Farnad

Background: Cone-Beam Computed Tomography (CBCT) scans'

detailed anatomical information provides clinicians with relative landmarks rather than relying solely on feel when performing local anesthetic injections. Clinicians frequently cite difficulty in locating the greater palatine foramen (GPF) as a primary reason for not utilizing the V2 (maxillary) nerve block. Purpose: This study seeks to demonstrate that analysis of the greater palatine canal (GPC) using CBCT scans helps clinicians to predetermine potential obstacles prior to the procedure, and if necessary, to modify their technique, making V2 nerve blocks safer and more successful. Methods: CBCT scans taken with a Kodak CareStream 9300 CBCT machine of forty-seven (n=47) patients were studied bilaterally to measure several parameters sagittally and coronally. The sagittal plane encompassed the majority of the clinically relevant information including the location of GPF, length of GPC, and curvature of GPC. Results: Antero-posteriorly, GPF was located between the 1st and 2nd molar in 60% of cases. Medio-laterally, GPF was located in the midpalatal third of the hemimaxilla. The average length of the GPC was 30.0mm. In 82% of patients, a curvature of GPC was mostly found between 11 and 20 mm into the canal with an average angulation of 155 degrees. Conclusion: Describing the anatomical location of the GPF and the 3-D structure of GPC accurately through CBCT may facilitate success of the V2 nerve block as it provides information previously unavailable to the clinician. Developing a protocol for GPC analysis for clinicians to use will be the future of this research.

OTHER

Poster #: 123

Title: Soft Palate Muscle Development in Mice with Submucosal Cleft Palate

Name: Thach-Vu Ho

Faculty Advisor: Yang Chai

Background: Submucosal cleft palate is one of the common cleft palate types in humans. Individuals with submucosal cleft palate often require long-term therapy. Although recent studies have advanced our un-

derstanding of the regulatory mechanism of palatogenesis, the mechanism of submucosal cleft palate is not well studied, in part because of the paucity of animal models that exhibit this phenotype. Purpose: To analyze muscle development in mouse models with submucosal cleft palate (Smad4^{flfl};K14-Cre;Irf6^{+/R84C} and Tgfb^{2flfl};K14-Cre mice). Methods: Littermate control, Smad4^{flfl};K14-Cre;Irf6^{+/R84C}, and Tgfb^{2flfl};K14-Cre mice were scanned at embryonic day 18.5 (E18.5) using X-ray computed tomography (microCT; Scanco V1.28) at a 10µm resolution. Two muscles in the soft palate, the levator veli palatini (LVP) and the tensor veli palatini (TVP), were manually delineated, reconstructed, and analyzed in 3D using Avizo 7.0 software. Anatomy and volume were compared to histological slides at 7µm. Analyses of the muscles were performed according to established protocols. Volume analysis was calculated using t-tests. Results: MicroCT imaging resolution was consistent with histological images showing discontinuous muscle formation of the LVP and TVP in Smad4^{flfl};K14-Cre;Irf6^{+/R84C} and Tgfb^{2flfl};K14-Cre mice. The volume of the LVP and TVP in Tgfb^{2flfl};K14-Cre and Smad4^{flfl};K14-Cre;Irf6^{+/R84C} mice was significantly reduced compared to wild-type controls. Conclusion: MicroCT imaging reveals detailed information on the muscle phenotype in mice with submucosal cleft palate which recapitulates that of humans with submucosal cleft palate. The use of microCT imaging modalities in animal models can supplement our studies of the molecular and cellular mechanisms underlying submucosal cleft palate.

Poster #: 124

Title: HLD Index Scores based on digital vs. plaster models

Name: Hussain Ebrahim

Faculty Advisor: Stephen Yen

Background: In California, the Handicapping Labio-Lingual Deviation(HLD) Index is used by MediCal/DentiCal to assess whether a malocclusion is severe enough to use state funds to pay for orthodontic treatment. Currently, plaster study models are sent to Sacramento

for evaluation and scoring in a blind fashion by a team of orthodontists. In order to shorten the turn-around time, to ensure models are not lost in the mail and to provide long-term records of a case, digital models made from laser scans were assessed and compared against HLD scores made from plaster casts. Purpose: The purpose of this investigation was to evaluate the agreement between digital vs. plaster cast HLD scores. Methods: Under IRB approved protocols, thirty-two pre-treatment plaster study models of orthodontic patients were independently scored by two orthodontists at Children's Hospital Los Angeles using the HLD index. The study models included CI III, CI II and CI I malocclusions. Then 3-dimensional virtual models were produced on a laser scanner (OrthoInsight3D and Motion View Software, Hixson TN) and scored by the same orthodontists. Data analysis consisted of paired t-tests and weighted Kappa statistics by the USC Biostatistics Department. Results: This study is comparing the precision between the measurements of HLD index directly from models and digitized models created with a laser scanner. Having a kappa statistic of 0.711 indicates that there is a good agreement between the measurements directly from the models and digitized models created with a laser scanner. To assess whether there is any difference between the measurements between these 2 methods, a paired t-test was performed. No statistically significant difference in scores between the measurements directly from the models and digitized models created with a laser scanner ($p=0.2819$) was observed. Using dichotomous data (plaster vs. digital), the Kappa statistic shows strong agreement between the measurements directly from the models and digitized models created with a laser scanner ($\text{kappa}=0.8672$). Conclusion: HLD scores for digital models correspond to scores made from plaster models, though the digital models do not provide the tactile feel for how models occlude.

Poster #: 125

Title: Assessing Effectiveness of Care Delivered Periodically via Mobile Dental Clinics

Name: Matthew Yekikian
Faculty Advisor: Reyes Enciso

Background: Periodicity of dental visits and continuity of care for children is based on age and disease susceptibility. Frequently mobile dental clinics are unable to provide follow-up care to the same children at < six-month intervals. Purpose: To compare the oral health of children who attended the Ostrow School of Dentistry of USC Mobile Clinic (MC) at least twice with matched children attending the clinic for the first time. Methods: Over 1000 charts of children attending a MC in 2008-2012 were reviewed for repeat visits. Two sets of controls were identified: one matching the cases at their first visit, and a second matching the cases at their second visit. Cases and controls were matched by age (± 6 months), gender, race, and zip code. A total of 237 charts were scored for decayed and filled surfaces. Paired t-tests with Bonferroni correction were conducted. Results: 79 children (49.4% females) had repeat MC visits. The mean age of the case group was 9.6 ± 2.74 years (range 5-20) with mean duration between visits being 1.5 years. Overall, 98.7% were Hispanic and 1.3% were African-Americans. Controls had significantly more decay in permanent teeth than cases ($p < .001$). From 1st visit to 2nd visit, cases had lower deciduous decay, but larger numbers of filled permanent surfaces without recurrent decay at the second visit (both at $p < .001$). Conclusion: Children attending a second MC had lower rates of decay than children visiting the clinic for the first time, and less decay than at the first visit. MCs can be effective in preventing caries, even when the interval between visits is longer than optimum.

Poster #: 126

Title: Cytomegalovirus and salivary gland tumors
Name: Krysta Deluca
Faculty Advisor: Tina Jaskoll

Background: Mucoepidermoid carcinoma (MEC) is the most common malignant tumor arising from the minor and major salivary glands. Our laboratory has shown cytomegalovirus (CMV) to be an im-

portant component of human MEC tumorigenesis. Purpose: The goal of this research is to investigate CMV modulation of submandibular gland (SMG) tumorigenesis. With a better understanding of the pathology of CMV-induced SMG pathogenesis, we can develop new therapies to treat SMG tumors. Methods: Newborn mouse submandibular glands were incubated with 1×10^5 PFU/ml of lacZ-tagged mCMV RM427+ on day 0 for 24 hours and then cultured in virus-free media for 14 days with or without EGFR/ERK inhibitors and/or the antiviral acyclovir starting on day 6. SMGs were analyzed with hematoxylin and eosin histology, immunolocalization, or viral distribution. Results: We report: (1) CMV-induced upregulation of the EGFR/ERK signaling pathway; (2) kinase inhibitors, alone or in combination, fail to fully rescue established SMG pathology but did promote tumor stability; (3) acyclovir treatment alone improved, but did not completely rescue, the abnormal SMG phenotype; and (4) complete rescue occurs only with combined treatment with the antiviral and ERK inhibitor. Conclusion: Our findings suggest that CMV dysregulation of host cell signaling pathways results in SMG tumorigenesis. Our data also suggest that continued SMG pathology is dependent on active CMV infection. The results of our study will provide a foundation for future clinical trials using combination treatments of FDA-approved kinase inhibitors and antivirals.

Poster #: 127

Title: Techniques for Discovery of Regulatory Mechanisms of Craniofacial Disease
Name: Richard Pelikan
Faculty Advisor: Ruchi Bajpai

Background: Many craniofacial pathological conditions, such as cleft palate, arise as a result of dysfunction of cranial neural crest (CNC) cells during embryonic development. The network of molecular interactions in CNC cells is far from completely understood, and increasing effort is being spent on technology to analyze CNC cells at the epigenomic level, to determine spatio-temporal sequences of ge-

netic activity that result in proper development. The recent paradigm shift from genomic to epigenomic analysis adds complexity to the analysis of these patterns, which requires computational methods to take advantage of existing data repositories such as the ENCODE Project. Purpose: To guide the discovery process of novel developmental mechanisms, we developed several bioinformatics techniques for a variety of data types. Methods: We performed high-throughput sequencing of chromatin immunoprecipitated DNA (ChIP-Seq) and coding RNA (RNA-Seq) to analyze the epigenome and transcriptome of several developmentally relevant stages of CNC and other similar cell types. We developed a method for performing transcription factor motif profiling, which clusters active genomic regions into classes based on their chance to bind regulatory molecules. Phylogenetic footprinting is used to identify gene-gene interaction loci which can participate in novel regulatory mechanisms. Results: Among active genomic regions, we observed patterns of gene expression which were correlated with developmental timepoints. Transcription factor motif profiling further subcategorizes enhancers into functionally related classes. Conclusion: These results suggest that epigenetically marked, developmentally regulated genes can be tracked as prognostic devices for proper tissue development. Using knowledge about these genes can guide the design of disease pathway models for several common craniofacial conditions.

Poster #: 128

Title: Craniofacial Birth Defects: Stem-cell approaches for prediction, prevention and therapy
Name: Mallory Holland
Faculty Advisor: Ruchi Bajpai

Background: Craniofacial abnormalities are among the most frequently occurring birth defects, often caused by aberrant development or differentiation of cranial neural crest cells (NCC). However, the genetic and environmental causes of these defects are not known in the majority of cases. We have established a human pluripotent stem

cell based differentiation model that recapitulates multiple stages of neural crest development. Extensive transcriptome and epigenomic profiling has revealed at an unprecedented scale, uniquely activated transcripts (potential candidates for genetic basis of human craniofacial defects) along with their regulatory regions (likely mediators of environmental influences). This raises the need for a systematic and high-throughput analysis of effects of mutation and environmental factors on human neural crest development. Purpose: To develop a complementary set of transgenic zebrafish and human embryonic stem cell based resources for (i) high-throughput detection of environmental, drug and genetic causes of craniofacial abnormalities (ii) cell replacement therapies. Methods: 1. Generating transgenic Zebrafish with human enhancer driven fluorescent reporters to shortlist a set of enhancers that mark different stages of neural crest development and label discrete elements of the craniofacial complex. 2. Generating a matched set of human pluripotent stem cell

lines with the same enhancers, testing their activity in neural crest differentiation assays and potential use for drug screening, cell sorting and cell transplantation. Results: Our in vivo analysis of the activity of epigenetically determined human neural crest enhancers revealed unique human regulatory elements that are utilized in (i) pre-migratory NCC, (ii) NCC undergoing epithelial-to-mesenchymal transitions, (iii) cranial neural crest cells that populate individual branchial arches and (iv) those that label specific tissues within the craniofacial region. Moreover these regulatory reporters showed a similar response to candidate drugs in both transgenic zebrafish and human stem cell lines. Conclusion: Our results have revealed an inherent heterogeneity among cranial neural crest cells that is established very early during development in an evolutionarily conserved manner. In our focused analysis of candidate drugs these resources have proven to be powerful tools for the assessment of targeted effects of these drugs on different cranial neural crest sub-populations.

Poster #: 129

Title: Validation of inter/intra observer reproducibility of three-dimensional craniofacial volume and anatomy using micro-CT modalities in wildtype mouse embryos.

Name: Pooyan Nasibi, Hamid Barkhordar

Faculty Advisor: Yang Chai

Background: Morphometric studies are essential in craniofacial developmental biology for understanding the 3D relationship of tissue morphogenesis and the physical influences of genetic defects. Micro-imaging has facilitated the detection and definition of many developmental abnormalities. In order to validate our data sets, inter/intra-observer variance must be quantified and assessed. Purpose: The aim of this study was to assess the inter/intra-observer reproducibility of mice anatomy measurements using images from 10µm micro-CT scans, and to validate the utility of this method to define and measure craniofacial morphogenesis. Methods: Data gathered by two dental students was used

for this analysis. The participants received individualized training in craniofacial anatomy with emphasis on muscles of the soft palate and intrinsic tongue. Six mice at the same embryonic stage (P0) were imaged at 10µm resolution using micro-CT scans and manually segmented to generate 3D reconstructions of the intrinsic tongue, tensor veli palatine and levator veli palatini. The three volumetric measurements for each sample were generated and analyzed for variance using ANOVA calculations. Results: Statistical analysis of the volumetric data obtained from manually segmenting mice intrinsic tongue muscles showed that variance in tissue volume within the same observer and between observer A and B were insignificant. Conclusion: Our data shows that the differences in volume of the same sample from one trial to the next are insignificant. Therefore, inter/intra-observer reproducibility is achievable. This research demonstrates that this technique can be used in future studies to analyze craniofacial development.

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FRI, MAR 8

UPDATES IN PERIODONTICS: DIAGNOSIS AND TREATMENT DECISION-MAKING
FRI, MAR 8

USC RUTH RAGLAND 27TH DENTAL HYGIENE SYMPOSIUM
SAT, MAR 9

IMPLANT THERAPY IN THE ESTHETIC ZONE
FRI - SUN, MAR 15 - 17

ESTHETIC FULL-MOUTH IMPLANT RECONSTRUCTION: FROM TREATMENT PLANNING TO FIXED RESTORATION
MODULE I: FRI, MAR 22
MODULE II: SAT, MAR 23
MODULE III: SUN, MAR 24

MASTERING BONE GRAFTING FOR ESTHETIC IMPLANT SITE DEVELOPMENT LECTURE & HANDS-ON WORKSHOP
MODULE I: FRI, MAR 23
MODULE II: SAT, MAR 24

FUNDAMENTALS OF RESTORATIVE IMPLANT DENTISTRY FOR THE GENERAL DENTIST
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OBSTRUCTIVE SLEEP APNEA, SNORING AND DENTAL ADVANCEMENT
FRI - SAT, MAR 29 - 30

BASIC PROTOCOLS IN BONE AND SOFT TISSUE GRAFTING IN IMPLANT THERAPY
FRI - SUN, APR 5 - 7

APPLIED HYPNOSIS: TREAT PAIN, TMD & OTHER DENTAL CONDITIONS
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ESTHETIC PERIODONTAL SURGERY FOR THE GENERAL PRACTITIONER: A HANDS-ON COURSE
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COMMON ORAL LESIONS: SOFT & HARD TISSUE DISEASES
FRI, MAY 3

LEARNING IMPLANT DENTISTRY FOR THE RESTORATIVE DENTIST
SAT, MAY 4

ATRAUMATIC EXTRACTION AND MINIMALLY INVASIVE IMPLANT SITE DEVELOPMENT
MODULE IA: SAT, MAY 11
MODULE IB: SAT, MAY 11

PHYSICAL EVALUATION
MON, MAY 13

EMERGENCY MEDICINE
TUES, MAY 14

PHARMACOLOGY
WED, MAY 15

MONITORING AND SIM-MAN
THURS, MAY 16

"PREPLESS" PORCELAIN VENEERS
SAT - SUN, MAY 18 - 19

TEMPOROMANDIBULAR DISORDERS, ARTHROCENTESIS AND BOTOX/ TRIGGER POINT INJECTIONS
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ADVANCED SOFT TISSUE AND BONE GRAFTING WITH CADAVER WORKSHOP
FRI - SUN, JUN 7 - 9

ENDODONTICS FROM A TO Z: HANDS-ON WORKSHOP FOR THE GENERAL PRACTITIONER
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SIMPLIFYING ANTERIOR RESTORATIONS: PROBLEM SOLVING IN THE ESTHETIC ZONE
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CLINICAL INTRAVENOUS SEDATION
PART I: THURS - SUN, JUL 12 - 14
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LAS VEGAS TRAVEL & LEARN PROGRAM
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ADVANCED CLINICAL DENTAL HYGIENE TECHNIQUES
PART I: FRI, JUL 26
PART II: SAT - SUN, JUL 27 - 28
PART III: MON, JUL 29

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COURSE

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