The EXPLORER

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February 2012 vol. 4

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AADR American Association for Dental Research

2011 Best Student Journal Award

USC SRG

Student Research Group

Ostrow School of Dentistry of USC

FEATURES

RESEARCH DAY

POSTER ABSTRACTS

WELCOME TO THE EXPLORER JOURNAL

DEAN AVISHAI SADAN

Dear Students and Colleagues,

Each year, Research Day showcases the best and brightest scientific minds of the Ostrow School of Dentistry of USC. The investigations conducted by our faculty and students in all programs never fail to impress and inspire!

This past year, we've seen our faculty members continue to frequently receive highly sought-after grant awards and publish in extremely selective, high-impact scientific journals. We've also recently welcomed into our faculty additional researchers whose work is world-renowned. In addition, many students have continued to take advantage of our research environment, publishing articles and presenting their work. This School's role in the scientific community is vast and is something of which to be very proud.

The Ostrow School of Dentistry remains firmly committed to providing an environment full of creative research opportunities and strong support for every researcher, both those on our faculty and those on our student roster. During the next few years, supporting our Ph.D. programs will be a special priority, as well as providing improvements to the School's research infrastructure and more opportunities for Ph.D. students and faculty. There will also be expanded opportunities for students wishing to conduct biomaterials research.

Remaining on the forefront of scientific progress is important to everyone at the Ostrow School of Dentistry. It's especially important to every student, from those who will center their careers on research and education to those who will use their scientific perspectives to solve problems and help patients in the clinic. Congratulations to everyone participating in Research Day 2012.

Fight On!

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

STUDENT RESEARCH GROUP

THE EXPLORER JOURNAL VOL. 4

Back row (from left to right): Joseph Park, Wilson Jing, Myat Htut, Peter Lee, Andrew Kiss. **Front row (from left to right)** Dr. Parish Sedghizadeh, Andrew Young, Sean Gardner, Swati Agarwal, Cynthia Young, John Mizukawa, Sam Saab, Steven Johnson, Ronald Chung. *Not pictured:* Niki Katoozi

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MESSAGE FROM DR. CHAI

ASSOCIATE DEAN OF RESEARCH

Dear Students and Colleagues,

We are excited to celebrate our research achievements at our school this year following the release of our university's new Strategic Vision Matching Deeds to Ambitions. In this concise and forward-thinking document, our university community has set forth (1) Transforming Education for a Rapidly Changing World; (2) Creating Scholarship with Consequences; and (3) Connecting the Individual to the World as three paths for our journey. As we reflect on the history of this university and look forward to our continued innovation and discovery, we are proud to play a part in shaping the future of USC.

Innovation and discovery are the foundation for our professional competitiveness. Training in research will promote inquisitiveness, intellectual confidence, and crucial thinking skills that our students will take with them upon graduation and benefit from throughout their career development. At Ostrow School of Dentistry of USC, our faculty, students, and staff are actively engaged in cutting edge research aimed at illuminating and solving real world challenges. Our research in Dentistry and Craniofacial Sciences, Biokinesiology and Physical Therapy, and Occupational Science and Occupational Therapy continue to be top-ranked programs of their kind in the country. Many of our faculty members are nationally and internationally recognized leaders in their field. These achievements provide an array of opportunities for our students, post-doctoral fellows and trainees to learn and be part of the process of changing the future of health care. To facilitate the training of future leaders in research, we successfully competed for and received training grants from the NIH in 2011. Along with other elite research universities in this nation, our competitiveness in obtaining training grants is directly connected to our potential impact in academia and society. We are thrilled to have the opportunity to use this training grant to recruit outstanding graduate students and post-doctoral fellows to USC. Working with our colleagues at different schools, we are building a vibrant research community, one that will allow our students to freely explore their intellectual interests and equip them with life-long skills for innovation and discovery in order to tackle the major challenges of the 21st century.

As we plan for another exciting year at the Ostrow School of Dentistry, we will align our objectives with the university Strategic Vision. In our research development, we will continue to build on our existing strengths and recruit the best and brightest people to USC. Our effort to develop interdisciplinary research will help us embark on complex research projects. We will continue to seek opportunities to build our translational research in order to benefit society. We will expand our functional genomic analyses. When we achieve goals, we will proudly celebrate our success. Working together, we will continue to move our school towards the next level of excellence.

Fight on!

Yang Chai, DDS, PhD
George and MaryLou Boone Professor of Craniofacial Biology
Associate Dean of Research
Director, Center for Craniofacial Molecular Biology
Ostrow School of Dentistry of USC

MODULATION OF HOST IMMUNE SYSTEM TO IMPROVE TISSUE ENGINEERING

WORDS: ANDREW KISS, DDS 2013

Researchers at the Center for Craniofacial Molecular Biology (CCMB) at the Herman Ostrow School of Dentistry of USC have recently discovered that "Mesenchymal stem cell–based tissue regeneration is governed by recipient T lymphocytes via IFN-gamma and TNF-alpha" cytokines. Four years of hard work and dedication in the research laboratory have led Dr. Songtao Shi's group to a publication in Nature Medicine, the premier journal for biomedical research. Respected internationally for the quality of its articles, the journal seeks to publish research that "demonstrates novel insight into disease processes, with direct evidence of the physiological relevance of the results."

Tissue engineering is the use of a combination of cells, engineering and material methods, and suitable biochemical and physio-chemical factors to improve or replace biological functions. Stem cell–based regenerative medicine is a promising approach in tissue engineering and reconstruction. Hoping to improve tissue engineering, a variety of studies have centered on either the actual cells that are being transplanted into the host or on the materials that are used to alter those cells and allow for their integration; few studies have focused on the host itself. "Our approach was to focus on the host, specifically the host immune system, to look for ways to improve tissue regeneration" says Dr. Liu, first author on the paper and post-doctoral researcher in Dr. Shi's group.

Bone marrow-derived mesenchymal stem cells (BMMSCs) are non-hematopoietic multi-potent stem cells capable of turning into many types of cells including osteoblasts, adipocytes, and chondrocytes. A variety of studies have shown that exogenously added BMMSCs can give rise to new bone and bone-associated tissues to replace damaged and diseased tissues. It is known that BMMSCs function to help the regenerative ability of endogenous cells in the area, but the actual function of the recipient cells, especially immune cells, in BMMSC-based tissue regeneration is still vague.

Previous studies showed that BMMSCs reduce inflammatory cytokines by interacting with several types of immune cells. The ability of BMMSCs to regulate the immune system gives them great interest for clinical application to treat diseases such as acute graft rejections and systemic lupus, as well as promoting integration of tissue grafts. On the

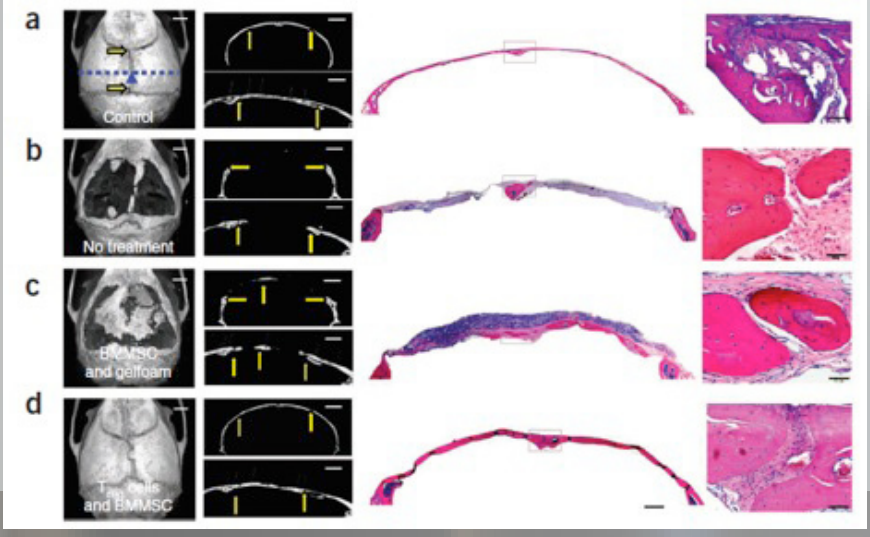

Figure 1. Microcomputed tomography (microCT) images (left) H&E images of the coronal calvarial bone (right) and the magnification of suture morphology (far right) of (a) unmanipulated wild-type bone, (b) untreated experimentally-induced calvarial defects, (c) calvarial defects after implantation of BMMSCs and gelfoam, and (d) calvarial defects after implantation with BMMSCs and systemic infusion of Treg cells.

other hand, interleukin-2 activated natural killer cells and T cells activated by CD3 and CD28 can induce BMMSC cell death. Dr. Shi's group therefore believes that the cross-communication between implanted donor BMMSCs and recipient immune cells may have a key role in determining the success of BMMSC-mediated tissue regeneration. Generally T cells are known for their role in protecting the body from infection. Dr. Shi's group set out to prove that T cells also could block transplanted BMMSCs as well. The aim of their study was to show that recipient immune cells, specifically T cells, govern BMMSC-based tissue regeneration.

The study was based on a fundamental experiment where different subsets of T cells were infused into nude mice, which are genetically altered laboratory mice that have an inhibited immune system with reduced T cells. These infused T cells also could block BMMSCs-based new bone formation in nude mice. Under normal conditions, the T cells of wild type mouse could produce an inflammatory response and trigger the formation of interferon-gamma and tumor necrosis factor-alpha. These cytokines attacked and killed the stem cells, and inhibited the production of new bone. However, when the mice were given injections of regulatory T cells (Tregs), the levels of the IFN-gamma and TNF-alpha decreased, increasing the rate of bone re-growth and allowing for repair of the bony defects. Furthermore, administering the simple, non-steroidal anti-inflammatory drug aspirin at the site of the defect also accelerated the rate at which the BMMSCs were able to re-grow bone. Their data collectively shows a previously unrecognized role of recipient T cells in BMMSC-based tissue engineering.

While the field of biomedical research is making great progress, many of the findings do not actually become a direct benefit in the everyday world of clinical medicine and dentistry. "One of the benefits of this study is that the results are quite translational," said Dr. Shi, meaning that the outcome of the study has a potential of reaching the clinic in terms of new therapies and diagnostics. Translational research is the application of findings derived in basic science to the development of new understanding of disease mechanisms, diagnoses, and therapeutics in humans. The discoveries published in this article will undoubtedly impact other stem cell-based tissue regeneration studies in the future and cause for more investigation into the role of the immune system in tissue engineering in humans.

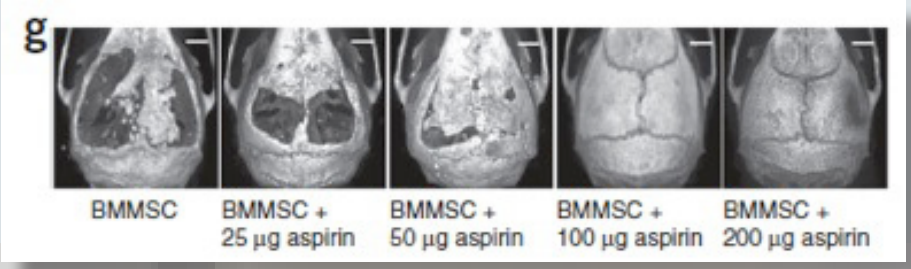

Figure 2. MicroCT images of calvarial defect areas after treatment with different doses of aspirin.

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For more information on how to get involved please contact us at USCSRG@gmail.com

CELL IMMUNOTHERAPY CURES BISPHOSPHONATE ASSOCIATED OSTEONECROSIS OF THE JAW IN TRANSLATIONAL ANIMAL MODEL

WORDS: WILSON JING, DDS 2013

When people think of scientific researchers they may envision the mystical science fiction-type mad scientists in white coats handling a plethora of fluorescent solutions, however it is unlikely that they envision their own clinicians and doctors working in laboratories to combat clinical challenges. As a clinical researcher, Dr. Anh Le is one of the clinicians working to combat clinical challenges in the laboratory. She strongly believes that standard clinical protocol and research innovation complement one another, and that a balance to exceed in both areas is necessary to advance and further her own field of oral and maxillofacial surgery.

One of Dr. Le's areas of study is oral manifestation of systemic diseases. Bisphosphonates (BPs) represent a major class of antiresorptive drugs utilized in the management of skeletal complications associated with osteoclast-mediated bone loss in osteoporosis, primary osteolytic pathology of bone such as Paget's disease and multiple myeloma, and complications of metastatic diseases. BPs inhibits osteoclast-mediated bone resorption to restore bone mineral density and strength in order to reduce the incidence of bone fractures. Over the past decade, oral health professionals have noticed that some BP patients undergoing tooth extractions demonstrated abnormally slow healing processes. The disease of exposed necrotic bone in the maxillofacial region that fails to heal after 8 weeks is known as bisphosphonate-related osteonecrosis of the jaw (BRONJ). Review of BRONJ patients from 2003 to 2006 revealed that 94% of patients were treated with intravenous BPs (primarily zoledronate and pamidronate), and 85% had multiple myeloma or metastatic breast cancer. Risk factors of BRONJ include length of exposure to BPs, use of immunosuppressive or chemotherapeutic drugs and invasive dental procedures such as tooth extraction and dentoalveolar surgery, which have been reported in 60% of affected patients. Despite identified clinical correlation of BPs with incidence of BRONJ, the lack of an experimental model represents a formidable challenge to the evidence-based study necessary to decipher the underlying cause and pathogenesis.

In 2010, The Ostrow School of Dentistry of USC became the first group to report a murine BRONJ model induced by the equivalent treatment regimen for advanced multiple myeloma. An interdisciplinary USC team made up of Dr. Anh Le of oral surgery, Dr. Parish Sedghizadeh of oral medicine, and Dr. Songtao Shi a well-recognized stem cell and translational animal model researcher, transferred the disease profile from the clinic to the bench top. The team developed a translational animal model that exhibited characteristic features of delayed healing, displayed orally as an open alveolar socket without mucosal coverage, exposed necrotic

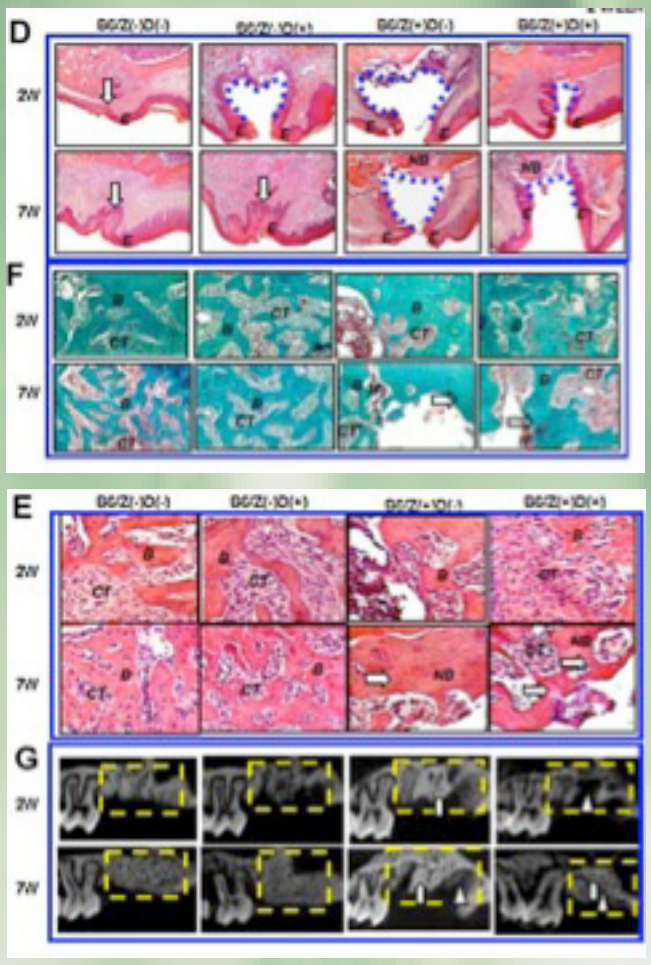

Figure 1. *Development of BRONJ-like lesions in C57BL/6J mice.* Mice were intravenously injected with Zoledronate and Dexamethasone (5 mg/kg) twice weekly for 1 week before surgical extraction of the left maxillary first molar and continuous injection of Zol and Dex twice weekly for 2 or 7 weeks. D) Histologic images of extraction sockets showing open sockets without epithelial lining (blue dot line) and healed gingival mucosa with complete epithelial coverage (open arrow). NB = necrotic bone. (E, F) H&E (E) and trichrome (F) staining of extraction socket areas displaying newly formed bone (B), connective tissues (CT), necrotic bone (NB), and inflammatory cell infiltrates (IF); open arrows point to the necrotic bones.

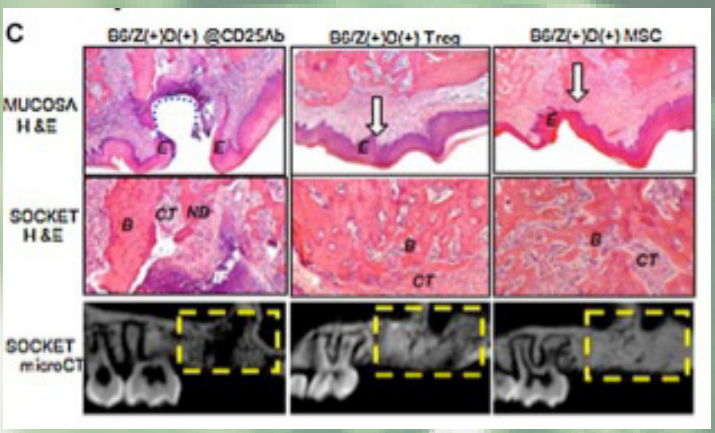

Figure 2. *Treg and MSC treatment prevents development of BRONJ-like lesions and enhances new bone formation in the C57BL/6J mouse model.* Treg and MSC infusions were initiated 2 days after tooth extraction.(C) Histologic analysis showing an open socket without epithelial lining (blue dot line), healed gingival mucosa with complete epithelial coverage (open arrow) at the extraction sites (upper panel), and newly formed bone (B), connective tissues (CT), necrotic bone (NB), and inflammatory cell infiltrates (IF) (middle panels); open arrows point to the necrotic bones; mCT analysis (lower panel) showing necrotic bone and reduced bone formation in Zol/Dex treated mice receiving ip injections of CD25 antibody but not in mice treated with systemic infusion of Tregs or MSCs.

bone or sequestra, increased inflammatory infiltrates, osseous sclerosis and radiopaque alveolar bone in the jaw. The translational animal model allows direct evaluation of clinical identified risk factors in the development of BRONJ, and also allows researchers to develop preventive and therapeutic tools for the management of human BRONJ.

Upon histological examination of BRONJ animals, the majority of the necrotic bone was located adjacent to areas of intense local inflammatory infiltrates, suggesting an association between inflammation and tissue degeneration. Taking the cue to explore host immunity, the team discovered zoledronate (aminobisphosphate) and dexamethasone (immunosuppressive) causes BRONJ in part by suppressing adaptive regulatory T-cell, Tregs, and increasing the inflammatory T-helper subset cells, Th17, producing interleukin 17 (IL-17) in peripheral blood. Experiments carried out on immune-compromised mice demonstrated that an alteration in balance between Treg/Th17 (observed in Zol/Dex – treated mice) can be restored by undergoing salvage therapy to replenish Tregs which results in normal post extraction healing. Extrapolating on immunotherapy to prevent BRONJ in mice and the immunomodulating role of mesenchymal stem cells (MSCs), researchers transplanted MSCs from the femur and tibia to mice tail veins. In both treatment attempts, Treg and MSCs infusion resulted in successful healing of the extraction site with complete soft tissue and bone regeneration. This compelling evidence confirms the hypothesis that altered immune homeostasis, specifically a lack of functional T-cells in immunocompromised mice, renders the mice more susceptible to BRONJ-like lesions.

The Ostrow School of Dentistry of USC is at the forefront of BRONJ research both on the bench top and in the clinic. The creation of a translational animal model is paramount in indentifying BP suppression of angiogenesis and bone remodeling which leads to accumulation of necrotic bone at the site of injury. The model also opens the avenue to discover the pathogenesis of BRONJ and to develop better diagnoses, prevention and treatment. Clinically, through grants awarded by the Clinical and Translational Science Institute, Zumberge, California Institute for Regenerative Medicine and NIDCR, a human study was designed to build a database of immunological records to study T-cell ratios and cytokines in BRONJ patients. Already underway since 2010, over 40 BRONJ patients have been identified through the screening process at the Ostrow School of Dentistry of USC Oral Medicine Center and the Norris Cancer Center. Once BRONJ is identified, the patient's immune panel is collected and used to confirm trends elucidated from the animal model. With the successful prevention of BRONJ-like disease in mice utilizing immunotherapy in restoring Treg function, Dr. Anh Le and our group of clinical researchers hope that cell-based immunotherapy can potentially offer a safe and effective therapeutic modality to prevent the development of BRONJ in humans.

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THE ROLE OF RESEARCH IN SHAPING CURRICULUM: A MOMENT WITH DR. NAVAZESH

WORDS: STEVEN JOHNSON, DDS 2013

Mahvash Navazesh, D.M.D
Associate Dean
Academic Affairs and Student Life

During the first ten minutes of my interview with Dr. Mahvash Navazesh, Associate Dean of Academic Affairs and Student Life, all of the surveys that I didn't fill out after each trimester at the Ostrow School of Dentistry of USC came to mind. I realized that the quickest and most direct route to creating change in the curriculum at the Dental School is simply to provide feedback in the surveys at the end of each trimester. While surveys are thrown at people every day, either on the internet or while out shopping, people have a tendency to believe that no one reads survey results. I found evidence that this is not the case with Dr. Navazesh. She reads student feedback and the new curriculum appears to be evidence of this.

Another realization that I had while interviewing Dr. Navazesh is that she and many others put in a lot of hard work to introduce the changes that are affecting the new entering classes. I was curious to know how the curriculum changes are decided and what factors are taken into account. What I found was that research has a number of roles in shaping the learning environment as well as the content and sequence of the curriculum here at the Herman Ostrow School of Dentistry. Research greatly affects the creation of the curricular content as well as the intended outcomes. A main goal for education at the Herman Ostrow School of Dentistry is to create lifelong learners. If not just out of duty to our profession, but out of duty also to our patients, we should be up to date on the latest information and technology in our field.

Our curriculum, as designed, is meant to play a significant part in shaping us to be this type of learner. The intention is that environment and the teaching methodology at Ostrow SOD will have an impact on the way we learn to look for information and how we decide how to apply existing and emerging information to the everyday practice of dentistry. The majority of students who graduate from dental schools nationwide end up spending most of their career service in patient care. While a small percentage of students choose to pursue full-time careers in research with the potential to become innovators, the majority of students will play a significant role as basic consumers of research.

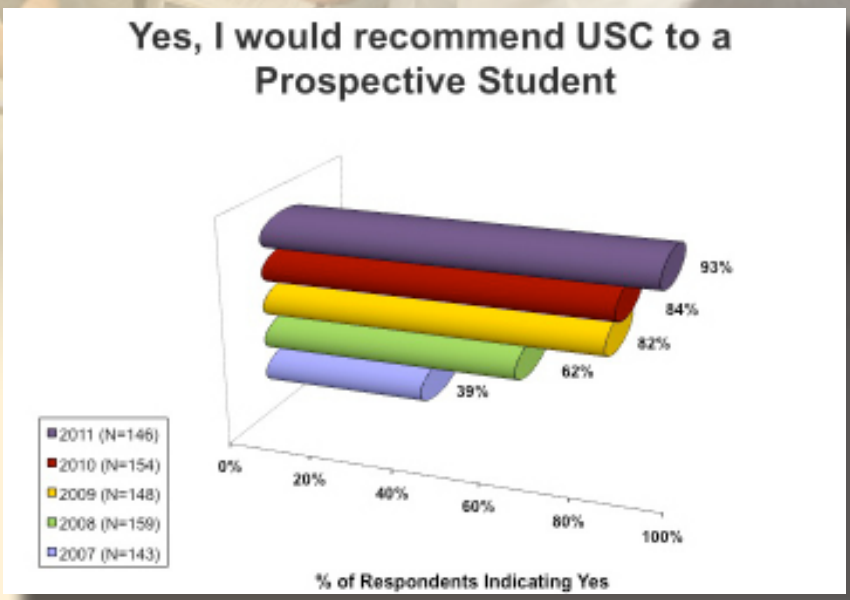
As health care providers, every day we will be faced with different patients with different presenting problems in need of our help. How do we decide what to do? What to recommend? What reasoning to use to help patients to arrive at a final decision from the available treatment options? Whether the problem-solving is as simple as recommending an appropriate toothbrush or toothpaste, or as complicated as providing full mouth rehabilitation, the success or failure of advice and treatment depends on a dental professional who is a committed consumer of available scientific information. The bottom line is that one needs to be familiar with evidence-based decision-making to appropriately serve the needs of patients.

Dr. Navazesh explained that learning is best facilitated when the learner is actively engaged in the learning process, and the curricular content is integrated and dynamic. She explained that this concept can be likened to water, a source of life and healing if it is flowing and fresh. But if water is stagnant it can be a breeding ground for bacteria and a source of infection. This is where the feedback from students and faculty comes into play. Dr. Navazesh assumed the role of Academic Dean in 2006. Since 2007 she has collected data from students regarding their experiences at the dental school. These surveys can be one guide for choosing topics to be covered in the curriculum. One example of this is the new preclinical course on how to place implants. There are many reasons why this portion of the curriculum was added, but Dr. Navazesh explained that student input and data was an important factor. Of the students leaving the dental school

in 2007, only 39% responded "yes" to the question "Would you recommend USC to a prospective student?" In 2011, 93% of the graduating class responded "yes" to the same question. This significant increase in consumer satisfaction is one of the measurable outcomes of the hard work of faculty, students and staff. The new curriculum that has been implemented with the D.D.S. class of 2014 gives students access to patient care one trimester earlier than before. Along with a preclinical implant module, there are many other curricular changes instituted or in the making that include, but are not limited to:

- Enhanced Removable Prosthodontics Module
- Research and Evidence-Based Decision-Making Module
- Diagnosis and Treatment Planning Modules
- Ethics and Professionalism Modules
- More feedback opportunities through faculty evaluations

Navazesh believes in creating an environment where we can explore opportunities for best answers to our patient's presenting conditions without bias from previous experiences, to reevaluate our thought processes, to look at a given problem from different angles, and to critically evaluate available information. All will help us to practice behaviors that are expected from a health care provider. She said "At a time when the information is so readily available, and at the same time changing so rapidly, the key to success is to learn how to solve a problem by critically analyzing a situation, utilizing the most reliable resources and measuring the outcomes." Understanding the students' academic needs as well as gaining student feedback helps to allow the curriculum to produce its end goal: independent, competent, and confident graduates. When the graduating class of 2007 was asked "Do you believe that you have the essential knowledge, skills and values to begin practicing dentistry?" 90% responded "yes" as compared to 97% for the D.D.S. class of 2011. Community health programs, high clinical expectations to ensure preparedness, extensive depth and breadth of clinical exposures, high-caliber and knowledgeable faculty and comprehensive patient care were among the top five greatest assets of education at USC identified by the D.D.S class of 2011. 44% of those graduates were accepted in postgraduate programs including AEGD, GPR and Advanced Specialty programs as compared to 18% in 2007.



To shape the future we must look at the past, learn from our experiences, take advantage of available information, have an analytic mind, examine the validity of the emerging resources, apply the solid information or evidence to a given problem and measure and monitor the outcomes. Our Learner- Centered Pedagogy at the Ostrow School of Dentistry will give us the opportunity to practice these traits under the supervision of our expert faculty. Dr. Navazesh said, "I often tell people don't bother to implement any changes if you can't measure the outcomes." She added, "As we strive for excellence, we use our educational outcomes as our guiding light in shaping the future. We have to ask: How are we doing? How can we do a better job? What is the evidence? Where is the data?"

COMMUNITY OUTREACH PROGRAM: USC MOBILE CLINIC

WORDS: SWATI AGARWAL, DDS 2013

The core aspect of Mobile Clinic has always been access to care for those who cannot afford it. Mobile Clinic strives to improve and sustain oral health of children in remote and underserved communities. It is the only modality of its kind where by the end of the week-long clinic, all of the children are disease free.

HISTORY

The USC Mobile Clinic began in 1965 when a small group of students and faculty traveled to Mexico to provide emergency dental care and information on prevention of dental disease. In 1968, the program was officially founded to serve migrant farm workers in central and southern California. Being stationed in remote areas prompted students to devise creative methods such as the octopus—using a paint compressor to power air-turbine handpieces.

In 1969, the success of the program attracted the attention of USC alumnus and president of the Condor Coach Company, Walter Kiefer. Kiefer donated a Condor Coach to the program that was equipped using a grant provided by the Doris Duke Foundation. The following year, faculty member Dr. Charles Goldstein became advisor to the student-run mobile clinic. Along with the students, Goldstein decided to limit the focus of Mobile Clinic to children in need rather than the entire population to make logistics more manageable.

In 1971, the Mobile Clinic expanded to include Ventura County resulting in an increase from 20 to 30 weekend clinics per year. To meet the increased demand, dental students from UCLA joined USC's Mobile Clinic program and have participated in weekend clinics ever since. Mid-week clinics were added in 1975. A year later, the service area was expanded to include local elementary schools.

MOBILE CLINIC CORE

It is a running joke among faculty and students that, "there are only two reasons to miss mobile clinic: 1) If anyone in your immediate family is dying or dead and, 2) if you are dying or dead." But this motto is taken to heart by the students as evidence of their great dedication. Without fail, the core group of mobile clinic students devotes their time and efforts to attend each clinic. After working with each other over multiple clinics, the students have become a close-knit family. These students are the backbone of Mobile Clinic.

Students volunteer their time to be at clinics knowing it is a privilege to be invited there. The experience and knowledge gained during one session of Mobile Clinic is irrefutable. Each clinic sees over a hundred children ranging from ages six to eighteen. Each student sees at least three patients each day and provides diagnostic, preventative, and restorative care. Along with the students, most of the faculty present also volunteer their time at the clinic.

Upon asking volunteer faculty, Dr. Juan Camarena, what his motivation is for returning to Mobile Clinic, he replied "You can't choose where you are born, but you can use what you have to help other people that are not as fortunate as you." As a returning volunteer myself, I can personally attest to Dr. Juan's sentiment. It is not only the experience I gain but also knowing the impact I have made on some of these children's lives and oral health that brings me back to Mobile Clinic every time.

THE FUTURE

Dr. Santosh Sundaresan, director of USC Mobile Clinic and assistant professor of clinical dentistry, plans to further spread the reach of Mobile Clinic. He would like to provide for those living in remote areas that have DentiCal but have no access to care. Since Mobile Clinic has begun holding clinics in San Diego area, Sunderesan intends to travel further south and east and serve the economically impoverished population there.

As it further expands its reach, it is clear to see that the USC Mobile Clinic has a bright future. Its legacy continues on as each year brings a fresh batch of enthusiastic and eager students looking to make a difference.

DIAGNOSIS OF PERIAPICAL LESIONS WITH CONE-BEAM CT

WORDS: NIKI KATOOZI, DDS 2013

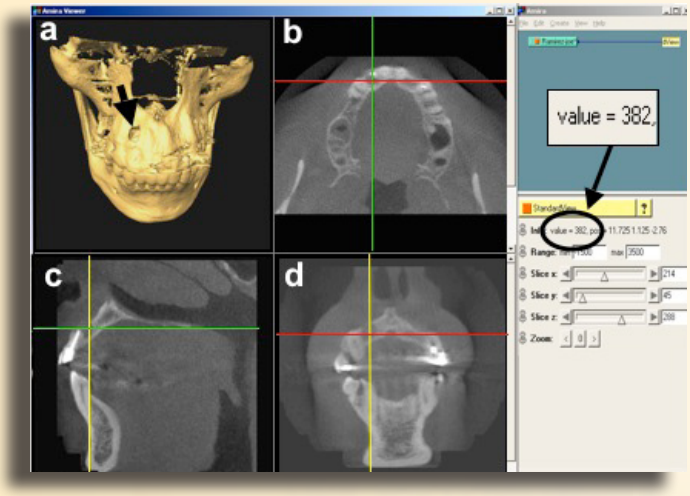


Figure 1: (a) 3-dimensional visualization of the jaws showing bone loss over the apex of the upper right lateral incisor. (b,c,d) Axial, sagittal and coronal views of the lesion all cut at the same point as shown by the lines crossing. (e) Positive gray value reading at the epicenter of the lesion.

Periapical lesions are highly prevalent and may affect 41-47% of the population in the U.S. according to a 1993 study and 60-72% of the older population. Standard differential diagnosis of periapical lesions is performed by surgically removing the lesion and performing a histopathologic evaluation. This treatment is irreversible and invasive. Benign periapical granulomas may account for as high as 85% of all periapical lesions and they are assumed to heal after endodontic root canal treatment. However, the only definitive differential diagnosis of periapical lesions entails surgical excision of the lesion for histopathologic evaluation, which precludes the non-surgical treatment.

Dr. Raaed Batniji who specializes in the field of endodontics at Herman Ostrow School of Dentistry is currently attempting to diagnose the lesion prior to surgery with three dimensional low beam radiation Cone Beam CT (CBCT). Dr. Batniji explains that non-surgical diagnosis of periapical lesions is a heavily researched area. Current research attempts include: periapical radiographs, roentgenographic contrast media, Papanicolou smears, ultrasound real-time imaging and albumin tests which have all given inconclusive results. Dr. Batniji is currently working on analyzing clinical, radiographic and histopathologic findings for significant correlations and developing a predictive model for the differential diagnosis of cystic versus solid lesions.

A typical Cone-beam CT scan for periapical lesions can include multiple factors. First, Cone-beam CT gray scale values are correlated to Hounsfield units. This is done on a phantom calibration at the beginning of the day with medical CT providing readings in Hounsfield units (HU) which correlate with material densities. This is very convenient for distinguishing different tissues based on the gray values provided by the CT images. Water density by convention corresponds to 0 HU and air density is -1000HU. Therefore, a gray value correction factor must be computed from the patient's scan to HU.

Dr. Batniji has designed a calibration tool (Figure 1C) with known densities to be present in the patient's mouth during the CBCT scan. First a mould in silicone from 4 metal spheres 5mm in diameter was fabricated (Figure 1A and B). Next, common dental materials with known densities were modeled into 5mm diameter spheres. Then, the spheres were imaged to calculate their Hounsfield units using a calibrated medical CT. These spheres can be used as reference and will help us to differentiate cysts (fluid-filled) from granulomatous tissue in a calibrated standard fashion.

The next step in data collection includes the surgical removal of the lesion by an Endodontics resident to be sent for routine biopsy to a commercial blinded oral pathology laboratory for hematoxylin and eosin (H&E) staining and analysis.

The research results show that CBCT has been proven to be useful to differentiate fluid-filled cysts from solid granulomas, both of which are benign periapical lesions. The analysis of malignant lesions such as lymphoma, carcinoma, and sarcoma has also been reported. Dr. Batniji is hoping that the use of 3D CT may be a differential and important factor for expanding options regarding the localization, dimension and clarification of lesion components. CT is currently used for differentiating benign and malignant lesions in the brain, stomach, liver, and lungs to name a few. The goal of this research project is to make the use of Cone Beam CT more prevalent since it lowers the absorbed radiation dose compared to medical CT, and it is more economical and practical than Magnetic Resonance Imaging. CBCT is cheap and will be in the near future readily available at the dentist's office.

A TASTE OF SUCCESS AS SWEET AS XYLITOL

WORDS: JOHN MIZUKAWA, DDS 2013

What could be sweeter than gaining national recognition for excellence in research? Doing it over, and over, and over again.

That is precisely what students in the Ostrow School of Dentistry of USC Dental Hygiene program have been doing for years. Last June, students Cristy Bentley, Robin Nanda, and David Tran represented USC at the American Dental Hygienists' Association (ADHA) Annual Session in Nashville, TN, and won 2nd place for their table clinic presentation "Xylitol Syrup Never Tasted So Sweet". Their research explored the advances in and use of xylitol syrup for the prevention of dental decay in infants and children.

Xylitol is a naturally occurring sweetener found in birch trees, corn, strawberries, plums and even the human body since we generate a few grams of xylitol daily during normal metabolism. It has been approved for use in foods by the FDA since 1963, but its dental protective properties weren't elucidated until recent years. Now we see xylitol commonly used as a replacement for sugar in gumdrops, hard candies, and chewing gum. These sugar-free alternatives to traditional sweets enjoyed by children and adults alike have been shown to significantly decrease the incidence of caries.

Everybody knows if you eat too much candy, you're bound to get cavities. The reason for this is that the main culprit in developing dental caries is bacteria that love candy even more than we do. These bacteria known as Streptococcus mutans like to colonize on our teeth and feed off the sugar we eat, especially sucrose. Normal table sugar, a.k.a. sucrose, is used by S. mutans to form a sticky substance called dextran that helps the bacteria adhere to our hard tooth surfaces. Furthermore, S. mutans digests the glucose and fructose that is found in sucrose to produce lactic acid, which results in a significant decrease in the pH of the oral cavity. This highly acidic environment begins to demineralize the extremely hard hydroxyapatite crystals that make up tooth enamel, and demineralization can progress to form holes or cavities in your teeth.

Because xylitol exhibits a sweetness similar to that of sucrose without the deleterious effects on teeth., it is now considered an acceptable substitute for sugar in many sweets, and is palatable to even the mouths of children with finicky taste buds. S. mutans is unable to metabolize xylitol, and therefore cannot produce the lactic acid that demineralizes teeth. It also inhibits growth of S. mutans through their inability to use xylitol to produce enough energy for proliferation.

In addition to xylitol gum and candies, xylitol syrup has been produced for use in children. A once daily dose of oral xylitol syrup provides an easier regimen for patients to follow than more traditional xylitol gum and lozenges multiple times per day- especially in infants and children. General recommended daily intake of xylitol is between 4-10 grams. Regimens that include less than 4 g do not provide dental protection, but regimens over 10 g do not provide significantly greater dental protection than the optimum. Fortunately, xylitol has very few side effects and therefore, has a minimal danger for overdosing. The most common side effects associated with xylitol consumption are increased bloating and diarrhea.

The use of xylitol syrup, especially in pediatric dental practices, is at the forefront of the dental community's fight against tooth decay. The extensive review of current literature on xylitol provided by this outstanding group of Trojan hygienists also keeps our hygiene school at the cutting edge of dental hygiene research. Diane Melrose, RDH, BSDH, MA, chair of the dental hygiene program at the Ostrow School of Dentistry, said of these students, "The dental hygiene faculty is very proud of their accomplishment, their representation of USC, and their dedication to upholding the Gold Standard of the USC Dental Hygiene program!"

Pictured: David Tran (left), Robin Nanda (second from right) and Cristy Bentley (right)

In addition to last year's success, in 2010, fellow Trojans Risa Regalado and Kristen Wong, members of the Dental Hygiene class of 2011, also won second place with their project, "The Cherry on Top of Scaling and Root Planing: The Added Benefits of Bacteremia", which highlighted the benefits of a robust immune response to bacteria introduced into the blood stream following routine scaling and root planing. Karen Gal, Benjamin Pinto, Natalia Pinto, and Arieanne Santos, also members of the DH class of 2011, took fourth place with their project, "Earth's New Treatment".

In fact, the dental hygiene has enjoyed similar success since 2007 when, after a long hiatus of not participating in the table clinics at the national conference, they decided to submit an entry. Dental Hygiene class of 2007 students Candice Lazaro, Derrick Pham and Michael Yap (who is now a DDS class of 2012) earned 1st place for their project "Implant Maintainance: A Dental Hygiene Practice Guideline".

When asked why USC's hygiene program has soared to the top of national recognition for their research, Mrs. Melrose was quick to credit the high quality of dedicated students we have. Ostrow's hygiene students volunteer to do research in their first semester of classes. Roughly 30% of hygiene students participate in research, which is astonishingly high compared to dental student participation. These students dedicate upwards to 10-12 hours per week working on their research projects.

When I asked the same question, the students readily recognized the high level of support they receive from faculty. Groups of 2-4 students receive private mentoring from assigned faculty who help them develop ideas and perform their research. Furthermore, the hygiene school enjoys close association and access to some of the premier dental researchers at USC's dental school.

This model has proven to be so successful that Mrs. Melrose aims to expand the dental hygiene program's role in research. "To this point, our role in research has been limited to literature review, but we would like to be able to provide our students with clinical research experiences as well," she said. Recently, the hygiene program has participated in a study looking for biomarkers in saliva samples with USC's own Dr. Paul Denny and Dr. Joyce Galligan. The students collected saliva samples from patients they saw in clinic for analysis of these biomarkers. With their history of achievement, access to facilities, and the support they receive from faculty and administration, the sky's the limit for research at the Ostrow School of Dentistry's Dental Hygiene program.

THE DDS/Ph.D OPTION: IS IT FOR YOU?

WORDS: CYNTHIA YOUNG, DDS 2014

Right before my eyes, the clear, glowing, star-like cells swirling just minutes before begin to settle in the pale pink-orange medium. I can just imagine the tiny molecule size proteins that allow the cell to plant itself on the floor and spread out its body, which is not dissimilar to a bonding agent with a low wetability angle. Looking at the uniform pattern of cells spread across the floor of the 6-well plate, I can only imagine the molecular processes that are going on like clock-work. As I put the cells back into the toasty incubator, I glance at the date to take mental note on when to change the media next. Walking back to my lab bench, I open up Microsoft Word to write this article on the option for dental graduates to pursue a career in dental academia.

Research is predominantly seen as a key ingredient in a well-balanced CV or resume. It looks good on a paper application when applying to graduate school and on a paper application when applying to a specialty program after graduate school. For the majority of students, that is where research ends. Especially in the field of dentistry, there is a high demand for students who wish to pursue academia because there are very few dentists who would choose to pursue a Ph.D. after dental school. Why is it then, if there is a high demand, that there is a struggle to fill the needs? I spoke to Dr. Michael Paine, B.D.S., Ph.D., Director of the Graduate Program in Craniofacial Biology at the Center for Craniofacial Molecular Biology to get his take on the issue.

Q: "Why do you think a lot of students choose not to pursue a Ph.D. after receiving their D.D.S/D.M.D.?"

A: "I think probably the biggest obstacle is the cost of dental school tuition, whether it is USC or any other dental school, [students] have to pay a large amount of tuition and the by the time they finish, going into a Ph.D. program or pursuing an academic career just doesn't seem to be an option for them. It's probably unfortunate, but I think that tuition is the biggest obstacle. Harold Slavkin pointed out to me that the American Dental Education Association (ADEA), published that the average dental student today in America is in debt about $250,000.00. If you were to do a Ph.D., the stipends offered are tiny compared to the salary a typical dentist earns. It's just not an attractive career just based on that. "

Q: "What about the incentives or options you have as a Ph.D. that could help relieve this financial concern?"

A: "There are dental schools who are serious about repopulating the dental academic world and are offering financial incentives for students to do their Ph.D. Quite often these combined programs are structured as seven or eight year programs to allow students to do both clinical training and then the Ph.D. program. But it is typically an eight year commitment for the student and a financial commitment to the school where they pay the entire dental school tuition or a large part of the tuition. Then, these positions become very competitive because there is a population of students who will consider this career provided they don't have, at the end of their dental training, huge debts to worry about repaying. Bottom line is I think it's more a financial thing than anything else."

"There are dental schools who are serious about repopulating the dental academic world and are offering financial incentives for students to do their Ph.D."

Q: "If these options exist, why do you think more incoming dental students don't apply?"

A: "Perhaps students aren't made aware in their undergraduate years that those options exist. But I think any student in an undergraduate degree is thinking about their careers and an academic career has to be something that they have thought about, just like dentistry is thought about. People are probably aware that these options are there, they just don't see how they can realize it based on the costs that are associated with them."

Dr. Paine and I went on to discuss the personal reasons why he decided to go into research and stay in academia rather than to practice dentistry and in the end, what it boiled down to was what makes you the most happy. Thinking about the entire interview, there were several key points that I took away from it, two of the most important ones being: 1. Understand the financial burden that comes with pursuing a Ph.D. after dental school, 2. Academia is not for everyone but should be pursued if you truly enjoy research.

Doing a little more investigating, I found that there are other options for potential D.D.S./Ph.D. candidates funded by the National Institutes of Health (NIH) called the National Research Service Awards (NRSA) Institutional Research Training Grants (T32). Of which 21 U.S. dental schools (including USC) each received about $1.6 million over a four year time period for training predoctoral and postdoctoral students. A complete list of the institutions can be found at training predoctoral and postdoctoral students. A complete list of the institutions can be found at *National Research Service Award Institutional Research Training Grants* (T32, T90/R90) (http://www.nidcr.nih.gov/CareersAndTraining/Fellowships/Institutions/ParticipatingInstitutions/).

In addition to this, there are other forms of government assistance for loan repayment for health professionals and can be found at *Training Grants Sponsored by NIDCR* (http://www.nidcr.nih.gov/CareersAndTraining/FellowshipsInternshipsSorted/TrainingGrantsSponsoredbyNIDCR/) and *The U.S. Department of Health and Human Services Loan Repayment Programs* (http://www.lrp.nih.gov/).

For me, as a potential Ph.D. candidate, the interview gave me a lot to think about and made me question where I wanted to be in the next five to ten years. I know in my heart that I am in love with the pursuit of knowledge. I love learning and the idea of paving the way for a better understanding of the cellular processes that go on it our bodies. Romantic, though it may be, I feel that somewhere down the line, I will find myself in the field of academia.

As the beeping of my timer goes off, I glance at the date. It has been two days since I started this article and it is time to check and change the media to my cells.

BIOFILM TRANSLATIONAL RESEARCH WITH DR. MARCELO FREIRE

WORDS: ANDREW YOUNG, DDS 2014

RESEARCH IS VITAL TO GROWTH AND KNOWLEDGE. IN A PROFESSION SUCH AS DENTISTRY ADVANCEMENT MADE POSSIBLE THROUGH RESEARCH TRANSLATES RATHER SIMPLY INTO BETTER PATIENT CARE. WHILE THE IMPORTANCE OF INDIVIDUAL RESEARCH EFFORTS IN DENTISTRY WILL ALWAYS BE SIGNIFICANT, COLLABORATIVE EFFORTS HAVE THE POTENTIAL TO BRING GOALS OF INDIVIDUALS TO NEW AND SOMETIMES UNEXPECTED LEVELS.

Dr. Marcelo Freire, periodontist and award-winning researcher, is one of many individuals at the Herman Ostrow School of Dentistry of USC who understands the power of collaborative research. As a recent graduate of USC Ph.D. Craniofacial Biology Program, Dr. Freire has been instrumental in orchestrating the integration of various subcategories of expertise within the Oral Biology and Periodontology Department. His promotion of collaboration contributes to the knowledge and project-generation processes, which are key to developing opportunities for student participation.

It began 4 years ago, when Dr. Freire and collaborators recognized the inability of current animal models in the replication of periodontal disease. The proposed research was to develop an animal model for a biofilm mediated osteolytic infection (BOMI). Titanium micro-implants were utilized as a carrier for biofilm form of the bacteria. It was observed that upon placement of treated implants in the oral cavity of animals (rats) Aggregatibacter actinomycetemcomitans biofilm was able to affect not only surrounding mucosa but also mechanisms of bone resorption (as seen in the Journal of Periodontology) .

This study is “extremely innovative,” according to Dr. Freire, “because the model mimics the etiopathology of periodontal diseases.”

This project birthed a special collaboration in the Periodontology Department at the Ostrow School of Dentistry of USC focused on utilizing the expertise of numerous labs to comprehend the role of biofilm in disease progression and study therapies. Each faculty and their lab members provided unique approaches to research collaboration through various pedagogies.

In collaboration with Dr. Casey Chen, Chair of Periodontology, Diagnostic Sciences & Dental Hygiene, Dr. Freire explored genetics and genomic comparisons between oral bacteria and their response in vivo. Dr. Chen’s group was able to identify genomic regions functioning in bacteria virulence for the first time. Concurrently, pathology assistant professor Dr. Parish Sedghizadeh addressed systemic responses against bacterial biofilms; by reviewing tissue necropsy, his group investigated organ pathology and systemic health effects. Dr. Steven Goodman’s group, on the other hand, focused on using this model to study novel therapeutical approaches to disperse oral biofilm. And lastly, associate professor Dr. Homayoun Zadeh studied gene expression of immune response modulators of disease establishment and progression.

Consequently, this animal model made many breakthroughs. “In the future, we have to continue to investigate proposed questions and observe and learn from our results,” Dr. Freire insists. “I believe all these projects and collaborations are just an illustration of what good scientific questions can promote.” In the future, this model will be used to examine how immune response is regulated by microbial molecules. Ultimately, Dr. Freire plans to utilize “this understanding not only to develop a solid biological background of disease regulation, but also to translate this knowledge for the development of therapies.”

Oftentimes, as individuals, we may not always have a solution to our problems. "As we join knowledge and expertise, however, we are able to gain a better understanding so that we may answer questions that are important to public health,” says Dr. Freire. Collaboration recognizes strength in others and provides us with the capabilities needed to develop networks. As Dr. Freire points out, “collaboration and formation of research teams create opportunities not just for faculty, but perhaps even more importantly, for students at USC to learn and participate to their fullest potential.”

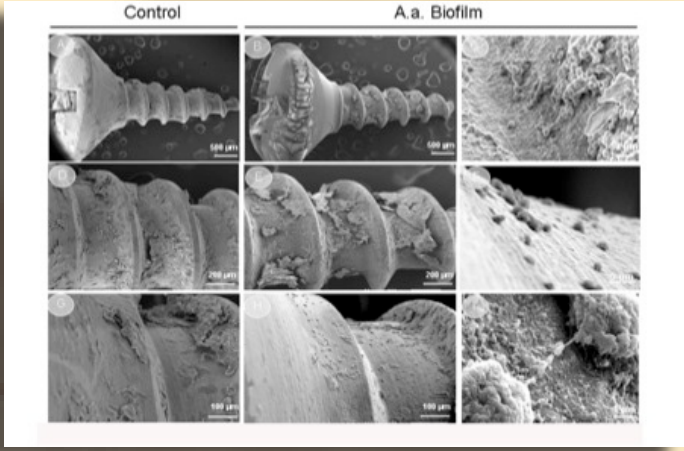


Figure 1. Scanning Electron Microscopy (SEM) of surgically removed implants after 6 weeks. Control (left) and biofilm (right) implants were surgically placed in the oral cavities of rats. After 6 weeks implants were recovered. SEM image alanysis showing control (A, D, G) and A. actinomycetemcomitans-biofilm implants (B, C, E, F, H, I). A. actinomycetemcomitans-biofilm persistence is shown on implant surfaces after 6 weeks in oral cavity of rats (C, F, H, I) and not in control samples (D, G).

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RESIN INFILTRATION: A TREATMENT MODALITY FOR INTERPROXIMAL CARIES

WORDS: RONALD CHUNG, DDS 2014

PICTURED: **JIN-HO PHARK, D.D.S**

NONINVASIVE MEASURES IN TREATING INTERPROXIMAL CARIES INCLUDE THE APPLICATION OF FLUORIDES COUPLED WITH THE IMPROVEMENT OF A PATIENT'S ORAL HYGIENE AND DIETARY CONTROL IN ORDER TO PREVENT PROGRESSION OF CARIES LESIONS AND SURFACE BREAKDOWN. When noninvasive measures are ineffective, however, invasive methods ensue and as a result, large areas of sound enamel are removed even with the most minimally invasive preparations.

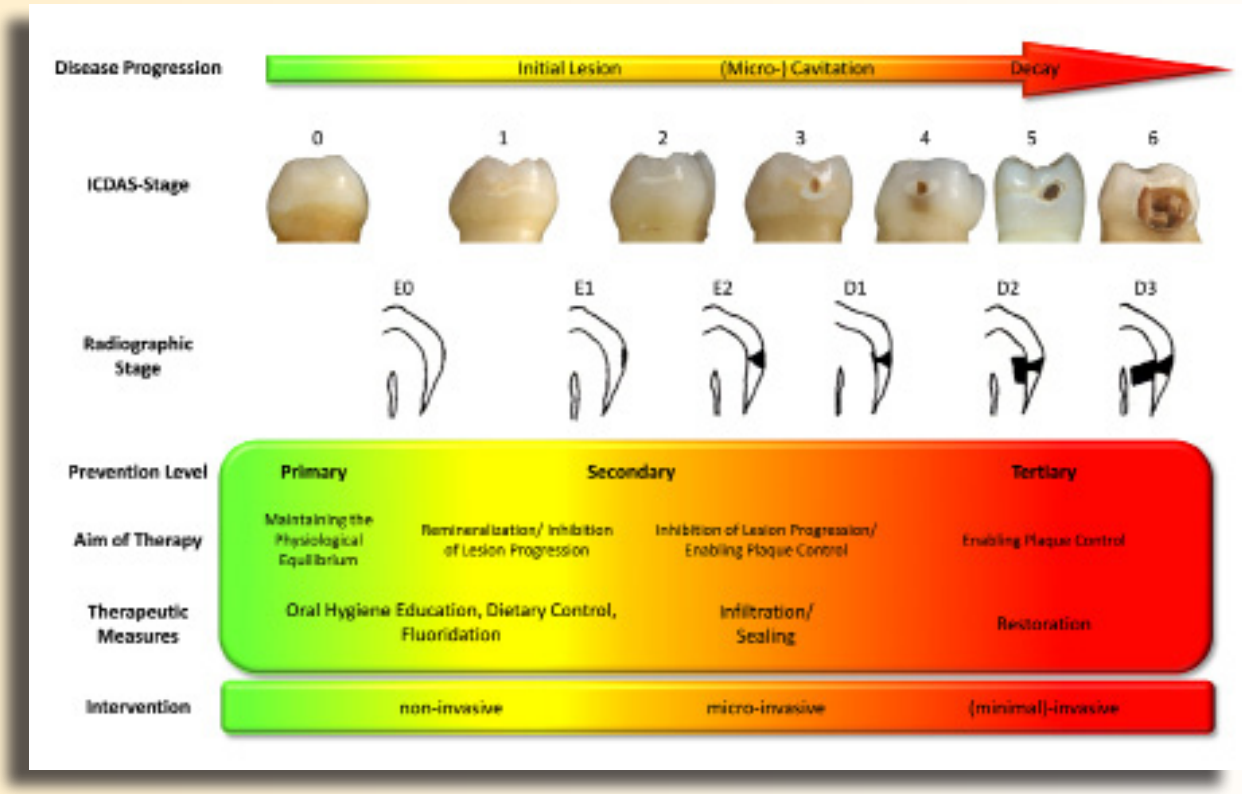

Figure 1. The relationship between caries progress and therapeutic options. Resin infiltration shown as an additional treatment modality, bridging the gap between noninvasive and invasive treatment options.

The time of first invasive intervention has an important role in the longevity of a tooth. Furthermore, different treatment modalities and philosophies make the decision between preventive and restorative treatment methods a difficult one, especially for lesions that extend radiographically just to the dentoenamel junction or are still within enamel. "So far, to avoid overtreatment of such shallow or not yet cavitated enamel lesions, we often wait and send the patient home with instructions to fluoridate and floss better. However, in many cases it is just a matter of time until these lesions progress and cavitate so that they require invasive treatment," Phark says.

On the contrary, invasive procedures are performed too early simply because intermediate treatment options, similar to pit-and-fissure sealing on occlusal surfaces, have not yet been established for interproximal surfaces. Recently, the application of clear, unfilled, resin materials which can infiltrate carious lesions and thereby slow caries progression has been studied by Dr. Jin-Ho Phark, restorative faculty member and biomaterials researcher at the Ostrow School of Dentistry of USC. Clinical data shows that this new technique delays the immediate need for a restoration and thus creates an intermediate treatment option for interproximal caries.

"The enamel is porous because it has been demineralized by caries, which dissolves some of the enamel crystals. So we're basically filling those pores again, but this time with resin, creating a physical diffusion barrier within the tooth. This is slightly different than a conventional occlusal sealant, which lies on top of the tooth," says Phark. He describes possibly delaying invasive treatment for several years with this microinvasive approach by infiltrating non-cavitated caries lesions with a low-viscosity resin. "Rather than drilling into these lesions, we allow the resin to penetrate into these lesions and seal them," he says. "The material needs to be hard enough after light curing to withstand mechanical challenges and not be too porous to allow the diffusion of acids and bacteria into the enamel. It must also be able to penetrate fairly deeply."

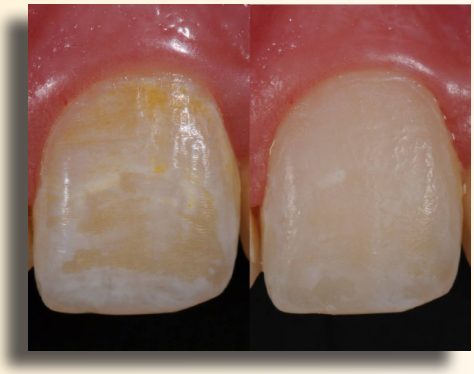

Figure 2. Resin infiltration on white spot lesion before (left) and after (right) treatment.

When applying the resin over the lesion, the enamel is etched, pores are exposed, and the resin is pulled into the pores by capillary forces. Though this material can be used to prevent carious lesions and progression, there is also an esthetic component as well. Dr. Phark uses post-orthodontic white spots to further illustrate this point.

"In sound enamel, light will mostly go through; only a small part will be reflected off the surface. When you have porous enamel, for example, in a post-orthodontic white spot, the lower refractive index (RI) of the air and water in the pores compared to the RI of the surrounding hydroxyapatite will cause the light to scatter within the lesions and reflect back, which is why we see a white spot. When you infiltrate these pores with the resin, which is clear and has no pigments or filler particles but rather a higher refractive index closer to that of the enamel, the scattering stops. The light is not deviated at the interface of the pore and the enamel anymore. The light will go through like it does in healthy enamel so that the white spots virtually disappear without drilling."

Thus, for caries lesions on interproximal and facial surfaces, the application of infiltrating resins may significantly postpone invasive treatment and might have positive esthetic outcomes as well. These fairly new techniques create an intermediate treatment option for interproximal caries, further preventing the progression of decay.

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A REVIEW OF PULPOTOMY MEDICAMENTS: Q&A WITH DR. BEALE AND DR. JENKS

WORDS: PETER LEE, DDS 2013

Medicaments used in pulpotomies for primary teeth are continuously under debate. The USC Division of Pediatric Dentistry at the Herman Ostrow School of Dentistry advocates the use of formocresol among the many medicaments available today. Formocresol has a long history of clinical success and research relating to its use. Pulpotomy medicaments are used to kill bacteria remaining in the pulp and to preserve vital radicular pulp. This article explores the advantages and disadvantages of the medicaments used in pulpotomies and interviews Dr. Beale and Dr. Jenks, the co-directors of the pediatric division.

Table 2.

Pulpotomy Medicament	Advantage	Disadvantage	Notes
Formocresol	-High clinical success (97% at 36-48 months) -High radiographic success (78-94% at 36-48 months) -Easy technique to teach -Cost efficient	-Toxicity -Chronic inflammatory response seen in histology -Internal resorption common	-Oldest medicament, introduced in 1904
Ferric Sulfate	-High clinical success (90-96% at 36-48 months) -High radiographic success (67-92% at 36-48 months)	-Chronic inflammatory response seen in histology -Internal resorption common	
MTA (Mineral Trioxide Aggregate)	-High success rate (94-100%) -Little or no inflammation seen in histology -Normal pulp architecture seen -No internal root resorption found	-Expensive	-Relatively new -Developed at Loma Linda University in 1993
Sodium Hypochlorite	-High clinical success rate (95% at 21 months) -Fairly high radiographic success rate (82% at 21 months)	-External root resorption is the common pathologic finding -Pulpotomy success diminished over time	-Relatively new medicament under research
Triple Antibiotic Paste (ciprofloxacin, metronidazole, and minocycline)	-Effectively disinfects the infected tooth -Revascularization potential -Well tolerated by vital pulp tissue	-Sensitivity to antibiotics -Due to the use of tetracycline, potential localized discoloration -Time frame of antibiotics (only good for couple of weeks) -Must be stored separately in	-Established in Japan (first done in necrotic teeth).

According to the 1997 survey by Promosch et al., the pulpotomy medicament of choice was formocresol, as 94% of dental schools in the U.S. used some form of formocresol. However, in the same survey done in 2005 by Dunston et al., formocresol was still the preferred medicament, but its use was decreased from 94% to 76%. The decrease in formocresol use is reflected in the increase in ferric sulfate use, as 13 of 54 (24%) schools used it.

While the use of formocresol and ferric sulfate has long been established, other fairly new medicaments such as MTA, sodium hypochlorite, and triple antibiotic paste have been the focus of research as potential medicaments. Table 2 compares the advantages and disadvantages of the medicaments mentioned above and summaries of interviews with Drs. Beale and Jenks follow.

What is considered an ideal medicament?

Ideal medicaments are bactericidal, harmless to pulp and surrounding structures, able to promote healing of the radicular pulp, and non-interfering with the physiologic process of root resorption

Why does USC advocate the use of formocresol, and why is USC not one of the dental schools that made a switch to ferric sulfate according to the 2005 survey?

Formocresol is considered to be the gold standard of pulpotomy. Back in 1997, all the schools taught the use of formocresol, because it is an easy technique and is cost-efficient. It has the longest track record of success. USC continues to use it, because when you compare the success rates of formocresol, it is still very good. Ferric sulfate success rates are close to formocresol, but it is not necessarily a good altennative based on our studies done at USC. There is still some concern about the success of ferric sulfate in terms of what we saw in tissue response to ferric sulfate. Histologically, we saw a lot of chronic inflammation, which was similar to what we see with formocresol. Therefore, we did not make a switch to ferric sulfate from formocresol.

What other pulpotomy medicaments has USC used?

USC's done some studies on triple antibiotics and has gotten good results. The problem with triple antibiotic paste is that you mix up the medicament, and it's good for two weeks. You have to use this medicament within that time frame and have to mix up another set. With formocresol or MTA, it is less of an issue. However, with MTA, once you open up the packet and you don't use it, you have to store it so that it doesn't become contaminated.

What is triple antibiotic paste?

Triple antibiotic paste was established in Japan, and it was used on necrotic teeth. When we were doing studies here, we were first doing it on teeth that were not necrotic as a vital pulp therapy. Then we used it on teeth that had periapical radiolucencies and actually saw some bone healing in those areas. What you need to be careful of is sensitivity to those drugs, and tetracycline may cause localized discoloration that should be taken into consideration.

What do you think about MTA as being the pulpotomy medicament of the future?

MTA is a highly discussed medicament for pulpotomies today. There have been multicenter studies for MTA that have shown great clinical and radiographic success that was even greater than formocresol and ferric sulfate. It is important to see the follow up studies in terms of histologically and the effects on the permanent dentition. As further research comes out and the evidence becomes stronger, it will possibly lead to that change. Within the dental school setting, however, important factors are the cost and ease of use.

In summary, the search for alternatives to formocresol as a pulp dressing in primary tooth pulpotomies has yet to reveal an agent or technique that has long-term clinical success rates better than those of formocresol. Until such agent is found, formocresol, ferric sulfate, or MTA can be used.

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CONE-BEAM CT IMAGING: AN INTERVIEW WITH DR. SAMESHIMA AND DR. TONG

WORDS: MYAT HTUT, DDS 2013

The orthodontic research activities at Herman Ostrow School of Dentistry of USC are focused on several areas: true three-dimensional images to determine the exact location of teeth in the alveolar bone before and after orthodontic treatment, root resorption caused by orthodontic tooth movement, accuracy of three-dimensional model scanning, and evaluating treatment claims.

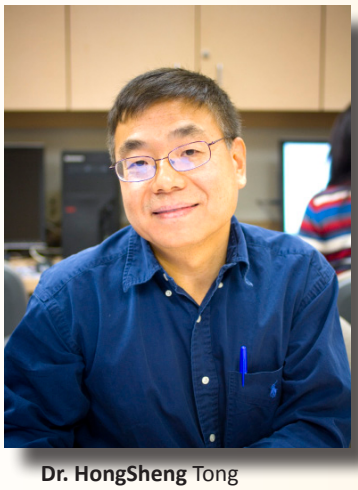
Dr. Glenn Sameshima, director of the Advanced Orthodontic Program, emphasizes that the research currently being headed by Dr. HongSheng Tong, a graduate of both the orthodontic and craniofacial PhD programs at USC, is the most active area right now. Dr. Tong has a visiting scholar from Peking, Dr. Maria Xin, working with him, orthodontic residents (Dr. Garrett Fong, Dr. Thao Nguyen, Dr. Nathan Coughlin, Dr. Bita Moalej), as well as a few pre-doctoral students. They are using what is called a DICOM image that is generated by our cone-beam CT machine. (Herman Ostrow School of Dentistry of USC was one of the first in the nation to acquire a CBCT machine.) The images generated by the CBCT not only show us where the teeth are located but also the exact location of the root for all the teeth in occlusion. The accuracy of CBCT is very high and it can adequately provide vital information such as temporomandibular joint disorders, skeletal problems, periodontal disease and other pathologies. With an advanced technology, radiation generated by CBCT are becoming lower and are within a therapeutic range, while providing higher resolution images.

Dr. Sameshima explains that Dr. Tong's short term goal as in any new methodology, is to prove the CBCT method is valid. This has involved testing the method on data that was generated from an in-vitro static model created by Dr. Carlos Flores Mir at Alberta. Two publications are pending proving the method is valid for both research and clinical applications. Also, according to Dr. Sameshima, this method has already been adopted for consideration by the major imaging company for orthodontics -- Dolphin Imaging.

Dr. Tong's laboratory is currently applying his methods in order to study different types of malocclusion and ethnic groups. The method will also be used to study current American Board of Orthodontics standards. Another application for clinical orthodontics will be the merging of this project with our long history of investigating orthodontic root resorption. Dr. Tong's three-dimensional images will finally allow us to see how far the root apices moved during treatment; this will integrate with our model scanning / root resorption study currently headed by second year resident Dr. Scott Morita under the supervision of Dr. Sameshima.

"There are a lot of questions still unanswered in orthodontics," said Dr. Tong, "as an orthodontist, the fundamental question we are trying to ask is where exactly you want to put the teeth." He explains that previously root position was not a major consideration in orthodontic treatment. Perhaps one of the reasons is that orthodontists are accustomed to not being able identify the exact location of the roots. He also gives an analogy on the importance of the root position. "If the foundation is not in the right place, the building is not going to stay. The way we have been doing orthodontics is by putting

Dr. Glen Sameshima



Dr. HongSheng Tong

the crown in sort of a right location to get a good bite, but we are not paying attention to the root. The root may be the foundation of where the tooth needs to be. If you are not putting the roots in a right position, you are creating the situation that is more likely to have relapse after wearing braces." He states that the only way to manage the relapse problem is to instruct the patient to wear a retainer for possibly a life-time. Despite the importance of positioning of the roots, there are unquestionably many other factors that can dictate the occlusion. Placing the root in the right position doesn't necessarily resolve the relapse issue, but it will certainly facilitate and maximize the retention to result better treatment outcomes.

Most conventional 2-D radiographs are insufficient in providing precise position of the teeth. We now have the CBCT to solve this very problem by generating 3D images of the teeth, allowing us to see the exact place of both crowns and roots. With the help of this new technology and 3-D imaging software, diagnosis and treatment planning can be achieved in a fashion that was not possible before. Dr. Tong mentions that CBCT could eventually replace panoramic radiograph in orthodontic diagnosis and treatment planning due to its ability to provide detail and precise 3-D information without distortion. By utilizing this information, ideal positioning for every single tooth can be achieved, eventually leading to a good occlusion.

CBCT not only can provide a great diagnostic tool but also can eliminate the need to taking impression to create diagnosis models. Coupled with imaging programs, you can now have several digital models that you can access anytime without needing an extra space in your office to store the stone models. It will become a lot easier to do comparisons when doing research without going through all the hurdles. By using digital models, you can easily segment the teeth apart and put them into a desired occlusion, simulating the entire process prior the beginning of the treatment and allowing you to envision the end result.

The objective of Dr. Tong's research is to clarify where the ideal position of the whole tooth, not just a crown but the root as well. Dr. Tong's current research is based upon the data obtained from 2000 cases within 5 years span from 2004 to 2009. Via collaboration with a programmer from Dolphin imaging company, a customized subprogram was created within the 3D imaging module, which allows him to carry out the crucial angular measurements for his project. Among those measurements, specific attention was paid to two parameters: the mesiodistal angulation and buccolingual angulation, which were recorded for every tooth from each case, and statistical analysis was formulated.

Dr. Tong has submitted two papers on this project and they are currently under review. In the future, Dr. Tong envisions his method of seeing all the roots and crowns in occlusion will be useful to other areas of dentistry, including implantology, oral surgery, and restorative dentistry.

Photographs by Alice Yoo, DDS 2013

STUDENT PERSPECTIVE: DENTAL SERVICE CLOSE TO YOUR HEART

WORDS: SEAN GARDNER, DDS 2013

For the past four years I've visited Rosarito, Baja California, Mexico to go surfing. Rosarito is a close, relaxing, safe community with a great surf break called Las Gaviotas that has kept me coming back with great frequency over the last few years. During the last year I have noticed a lack of tourism in Rosarito which has had an effect on their economy. Many of the people in the community depend on tourism as their sole source of income and while I do spend a lot of time visiting this area, I eventually realized that my contribution to the tourist economy was not enough. As a dental student at Ostrow School of Dentistry of USC I have had the pleasure of being involved in an organization called AYUDA Inc, which organizes dental humanitarian trips. As a member of AYUDA I now have the opportunity to provide far more service to this community.

On AYUDA's last international dental humanitarian trip to Belize student leaders of AYUDA (Pehrson Hawkley and Esther Schara) were discussing future service trips and I suggested Rosarito. Both loved the idea that we would be able to serve a foreign community that was only three hours from the University of Southern California (USC). Pehrson and Esther set out to gain the approval of our faculty advisers and I was charged with the task of making contacts in Mexico. Our proposal to organize a trip had never been done before in AYUDA; students had never been responsible for planning a humanitarian trip.

After gaining approval for the trip I traveled to Mexico with my wife and friends over Memorial Day weekend 2011. While on vacation, I attempted to make contacts so that we could set up an AYUDA trip. Our initial efforts failed, but our luck was about to turn. We went to a barbeque in Las Gaviotas, the housing community where we stayed and at the barbeque my wife began talking to one of the residents of Las Gaviotas and she mentioned I am a dental student at the University of Southern California (USC). The resident, Mrs. Johnson immediately lit up and told my wife that she and her husband both went to USC 40 years prior. We explained that we were trying to bring AYUDA down to Rosarito for a dental humanitarian trip, and then she introduced us to Joanne Pena who is the property manager of Las Gaviotas, the housing community. Joanne, the property manager, passed our information to the Mayor's wife, who oversees social services in Rosarito.

A few weeks later I received a phone call from Jorge Crosthwaite, the director of D.I.F. in Rosarito (Mexico's social service). Jorge was very excited that a dental humanitarian club wanted to come to his community. I explained our mission and our goals for the trip. I told him that we normally treat under-privileged children in need of dental care and that we would be able to do a two day clinic in which we would treat 175 to 200 children. Jorge was very enthusiastic about our desire to bring an AYUDA clinic to his city and began to work on his end to turn the clinic from a dream to a reality.

In a matter of two months we went from a poolside dream of setting up a clinic in Mexico, to actually having made contacts, set a date, and gained approval from the school and faculty. Although we were fortunate enough to speedily set up the clinic in Rosarita, we were unfortunate in the sense that we did not have time to raise any money through our usual donors. If we involved 40 students and 5 faculty members we determined we would be able to pay for the trip with two hundred dollars per person. When students were invited to join the AYUDA trip they were informed that their two hundred dollars would pay for their housing and food, as well as supplies for the clinic. Prior to this trip, dental students were only donating time. For the Rosarita trip, students not only donated their time, but donated money to supply the clinic.

"This was my favorite AYUDA trip because I knew that every composite I did, every amalgam, the anesthetic I used, I paid for it and that gave my service an extra special place in my soul."(Bridger Jensen, class of 2012)

The people of Rosarito were so gracious and excited that our group came to serve their community. When I was asked why we chose Rosarito, I answered that we wanted to help out our neighbors. As part of our dental work we brought with us a plethora of toothbrushes and toothpaste for the children.

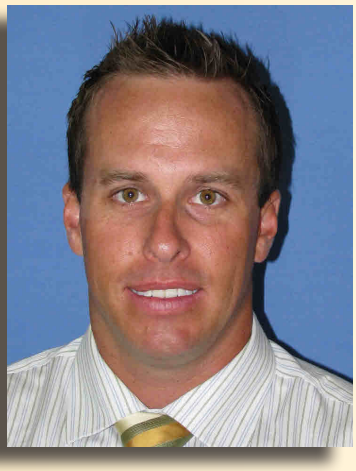
"One thing that stood out to me was after we gave out 300 or so toothbrushes, I looked out back at the sink and there were 15 kids brushing their teeth. I know that for some of them it was probably the first time that they had ever used a toothbrush and for others it had just been a very long time. Either way it was nice to see some immediate response to our efforts." (Andrew Ricci, Ostrow School of Dentistry of USC, class of 2014)

In all we were able to see 170 patients and place 35 composites, 80 amalgams, 70 sealants, 3 stainless steel crowns, 59 fluoride varnishes, we performed 70 extractions, 10 direct/indirect pulp caps, and 7 prophies. The positive response from the community and all who participated in the clinic has led to establishment of an annual externship to Rosarito, Mexico. As we have after other AYUDA trips, such as the trips to Terra Bella, California, we plan on tracking the oral health of this community. After this experience we will also be able to compare the oral health of children in Mexico to children in Los Angeles, Terra Bella, and other foreign countries AYUDA visits. We hope to see a gradual improvement in the oral health of the communities we serve as awareness of proper oral hygiene increases and access to care improves.

I am thankful for the experience I had serving the community through AYUDA in Rosarito, Mexico. The experience was important to me because it was a dream of mine to help a community I visited several times before. . Not only was the trip a success, we were able to make the first ever completely student-organized and paid AYUDA trip happen. To the entire faculty who came with us on the trip we thank you, a special thanks to Dr. Harris Done for supporting our dream and to Dean Abelson for allowing us to create this externship.

MAXILLOFACIAL PROSTHETICS: A COVERT SPECIALTY

WORDS: SAM SAAB, DDS 2015



Jesse Duncan, D.D.S

While on a mission trip to Ensenada, Mexico last summer, I listened to a conversation between Dr. Jesse Duncan and Dr. Hadi Al-Meraikhi, prosthodontics residents at the Ostrow School of Dentistry of USC, about the advancements in dental prosthetics. They were discussing a specialty that I was not familiar with at the time, Maxillofacial Prosthetics. Intrigued by their conversation, I wanted to further inquire about Maxillofacial Prosthetics. I gained valuable insight about the specialty after perusing the website of the American Academy of Maxillofacial Prosthetics. Maxillofacial Prosthetics is a subspecialty of Prosthodontics that focuses on the recovery of patients with defects that are congenital or developed due to disease or trauma. Maxillofacial prosthodontists work on replacing missing areas of bone or tissue, in order to restore the different functions of the oral and maxillofacial region and improve patients' quality of life. They are trained to replace facial structures such as eyes, ears, noses, fingers, and portions of the jaws with prostheses. They also work closely with oral surgeons, ENTs, plastic surgeons, neurologists, radiation oncologists, and speech pathologists.

To further introduce our student body to this specialty, I decided to interview Dr. Jesse Duncan. Dr. Duncan obtained his DDS degree from the University of the Pacific in 2008, and is currently a prosthodontics resident here at the Ostrow School of Dentistry. Dr. Duncan's plan was to pursue Maxillofacial Prosthetics after his residency, but due to family circumstances his plan is now put on hold.

Q: "What attracted you to maxillofacial prosthetics while in dental school?"

A: "Originally, I was inspired by one of my instructors, named Dr. Ian Zlotollow, whose whole career was Maxillofacial prosthetics. Then, during dental school, I had an extensive case where we did four zygoma implants, a hip graft, and other implants in the anterior maxilla for a fixed prosthesis. After that case, Maxillofacial Prosthetics caught my attention, and throughout my prosthodontics residency, I have been working at the children's hospital with babies born with cleft lips and cleft palates."

Q: "What do maxillofacial prosthodontists do in the cleft lip/cleft palate cases?"

A: "A lot of communication has to go on with the surgeons. It is a real team approach. The final result in a lot of these cases is a prosthetic result, so we need to guide the surgeon to what's going to give us the best prosthetic outcome. Of course, initially if it is a cancer defect, we have to get rid of the cancer first. However, sometimes we need to take a little more than just the cancerous tissues, in order to get a better prosthetic outcome. So if we are working with really conservative surgeons, we have to communicate our plans and suggestions to them to get the best result for the patient. So it is a lot of communication between the surgeons, physicians, oncologists, and the maxillofacial prosthodontist to get to the final result."

Q: "So the maxillofacial prosthodontists are responsible for making the artificial substitutes for jaws, noses, ears, and other structures?"

A: "Yes, for the facial prostheses, with the help of an anoplastologist, they work on making and painting the silicon ear or nose or any of the other facial prostheses. It is a lot like dentistry, where you are making impressions to make these prostheses, and a lot of times they use implants to retain the prostheses. Like I said, with guiding the surgery, they have to let the surgeons know much more tissue to remove in order to best hide the transition between the prosthesis and the natural tissue."

Q: "How do you become a maxillofacial prosthodontist?"

A: "After completing dental school, you have to finish a three-year residency in prosthodontics and following that you do a one year Maxillofacial Prosthetics residency. Here, in California there are two programs, one at UCSF and the other at UCLA. Maxillofacial Prosthetics deals with acquired defects from cancer, trauma from gunshot wounds or car accidents, and they also work a lot with cleft lip and palate patients."

Q: "Does that mean they work more in a hospital setting as opposed to private practice?"

A: "Yes, definitely, and it has to be a large group of patients. So a lot of times it is at cancer centers, since those are the types of defects (cancer defects) that need maxillofacial prosthetics. To do it as a career, you have to be associated with a hospital and usually it is a couple of days a week, and the rest of the week you can work as a general prosthodontist."

Q: "What were some of the breakthroughs in the maxillofacial prosthetics profession recently?"

A: "Yes, nowadays, with a lot of stem cell research and tissue engineering, instead of doing grafts, they are able to grow skin tissue in a dish and use that rather than taking skin off of someone's leg and grafting it onto their face. They are also incorporating implants with medical imaging, where with the help of CT scan, they can create a plastic duplicate of the patient's skull that shows where the tumor is. They can then do a surgery on the plastic model of the patient's skull that was taken from the CT scan, and have the graft ready to fit perfectly on the patient's skull ahead of time. That way, the implants of those prostheses can be placed right after surgeries without any delay. This helps expedite the process and make it more affordable for the patients, since the insurance companies only cover implants that are done at the time of the surgery."

After this interview, I realized that becoming a maxillofacial prosthodontist is tremendously rewarding. As a maxillofacial prosthodontist you are able to significantly improve patients' appearances and their quality of life. I recommend that all dental students explore maxillofacial prosthetics and all the other outstanding specialties that our profession has to offer. Exploring the different specialties is the only way to find where our true passion in this profession lies.

PROSTHETICS

The core mission of the 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 Explorer, we highlight two of our newest faculty, Dr. Christina M. Dieli-Conwright and Dr. Jason Kutch. Their research is noteworthy because of the potential impact on clinical practice and human health challenges. In addition, the goals of their research align with the USC's recently announced Strategic Vision calling for translational research that addresses societal challenges and creates scholarship with consequence.

James Gordon, EdD, PT, FAPTA
Associate Dean and Chair

Dr. Dieli-Conwright joined the faculty of the USC Division of Biokinesiology and Physical Therapy in December 2011. Dr. Dieli-Conwright was previously a postdoctoral fellow at the Beckman Research Institute at the City of Hope National Medical Center in Duarte, CA. Dr. Dieli-Conwright's research is focused on the following goals: 1) To determine underlying physiologic mechanisms causing cancer treatment-related weight gain/loss in cancer patients; 2) To design and execute exercise interventions to improve co-morbid disease outcomes in cancer survivors; and 3) To disseminate effective lifestyle interventions to cancer survivors to alleviate the presence of co-morbid diseases to improve survivorship.

To determine health-related survivorship concerns of breast cancer patients, Dr. Dieli-Conwright is currently the Principal Investigator on an observational study to investigate the impact of neoadjuvant and adjuvant chemotherapy on metabolic syndrome components, including waist circumference, blood pressure, serum levels of glucose, triglycerides, and C-reactive protein in breast cancer patients. Metabolic syndrome is a cluster of risk factors that predispose an individual to developing diabetes and cardiovascular disease. This study is in collaboration with Joanne Mortimer, MD and Leslie Bernstein, PhD at the City of Hope and is funded by the City of Hope Women's Cancers Program.

Epidemiologic evidence suggests that the risk of breast cancer recurrence is strongly reduced in individuals who are physically active before and after diagnosis. Dr. Dieli-Conwright focuses her expertise in exercise physiology on designing and implementing clinical exercise interventions to improve co-morbid disease outcomes during cancer survivorship. Recently, Dr. Dieli-Conwright received a 5-year Career Award from the National Cancer Institute, titled "Metabolic Syndrome and Breast Cancer: Effects of a Combined Exercise Intervention" (K07 CA160718). This grant provides funding to support an investigation examining the effects of a 16-week clinical exercise intervention on metabolic syndrome components in 100 early stage breast cancer survivors. Study recruitment and enrollment is set to begin in Spring 2012 and the exercise intervention will take place in the Division's Clinical Exercise Research Center.

As a postdoctoral research fellow (2009-2011) in the Division of Cancer Etiology at the City of Hope, under the mentorship of Dr. Bernstein, Dr. Dieli-Conwright investigated the impact of lifetime participation in physical activity on endometrial and breast cancer risk in a cohort of 133,479 women enrolled in the California Teachers Study (CTS), a multi-center study funded by the National Institutes of Health, initiated in 1995. In addition, utilizing the CTS, Dr. Dieli-Conwright investigated the effects of obesity on breast cancer mortality and determined that obesity increases one's risk of breast cancer mortality. This investigation received national press recognition at the 2011 Endocrine Society Annual Meeting in Boston. Recent publications of Dr. Dieli-Conwright include "Does hormone therapy counter the beneficial effects of physical activity on breast cancer risk in postmenopausal women?" (Cancer, Causes, and Control, 22:515-22, 2011).

In addition to cancer research, Dr. Dieli-Conwright is interested in the impact of hormone therapy use on skeletal muscle hypertrophy mechanisms in women. She recently submitted an R01 application with Fred Sattler, MD, Professor at the USC Keck School of Medicine, to the National Institute of Aging to examine the effects of estrogen therapy use on skeletal muscle hypertrophic pathways before and after high-velocity resistance training.

Dr. Dieli-Conwright earned a BS in Biology from Cal Poly San Luis Obispo in 2002, a MS in Kinesiology from California State University Northridge in 2005, and a PhD in Biokinesiology from USC in 2009.

Dr. Kutch joined the faculty of Biokinesiology and Physical Therapy in August 2011. He will direct the Division's Applied Mathematical Physiology Laboratory (AMPL). Dr. Kutch was previously Research Assistant Professor in the USC Department of Biomedical Engineering.

Dr. Kutch's research is focused on three goals: 1) To understand how the complex networks in the central and peripheral nervous systems produce coordinated activity in muscle fibers; 2) To engineer practical, non-invasive systems to study these networks in humans; and 3) To apply the findings and technology to improve the lives of people with neuromuscular disorders, particularly chronic pain.

To locate the central and peripheral sites of impairment in individuals with chronic pain, Dr. Kutch is using electrophysiology and brain imaging. His previous research has shown that micro-fluctuations in human muscle force contain a wealth of information about how the nervous system controls multiple muscles. Dr. Kutch has also developed mathematical algorithms to associate these fluctuations with electrical activity in muscles, which may reveal how the CNS is regulating the activation of neurons in the spinal cord. These two findings form the basis for noninvasive technology that can assess whether the CNS is properly controlling muscle at the spinal level, and Dr. Kutch is currently using these approaches to identify new avenues for treating chronic pain disorders.

At the Dana & David Dornsife Cognitive Neuroscience Imaging Center at USC, Dr. Kutch is also currently looking at how changes in the brain might affect muscle contraction in patients with chronic pain. His study, "Pathological insula connectivity and neural control of muscle in Chronic Prostatitis/Chronic Pelvic Pain Syndrome (CP/CPPS)" may identify the neural circuitry that causes pelvic muscles to contract involuntarily during periods of stress. Studies have shown that CP/CPPS is the most frequent urological diagnosis for men under 50, with quality-of-life scores consistently lower than congestive heart failure, diabetes, and Crohn's disease.

Physical therapists are at the front lines treating this perplexing disorder. In collaboration with Daniel Kirages, DPT, PT, OSC, FAAOMPT, Instructor of Clinical Physical Therapy, Dr. Kutch recently received Division funding for a pilot study, "A critical evaluation of physical therapy for Chronic Prostatitis/Chronic Pelvic Pain Syndrome (CP/CPPS)." The goal of the study is to classify patients with CP/CPPS according to pelvic pain and muscle activity changes in response to manual physical therapy and body-awareness relaxation training to determine whether treating muscles with physical therapy is actually effective for reducing muscle over activity and reducing pain in CP/CPPS patients.

As a Postdoctoral Research Associate (2008-2010) in the USC Brain-Body Dynamics Lab of Dr. Francisco J. Valero-Cuevas, Dr. Kutch investigated the necessity of particular muscles and the biomechanical basis for muscle synergies. With Dr. Valero-Cuevas as Principal Investigator, Dr. Kutch co-authored "Control of Finger Motion and Force for Precision Pinch," supported by a National Institutes of Health R01 grant. Dr. Kutch's recent publications include "Muscle redundancy does not imply robustness to muscle dysfunction" with Dr. Valero-Cuevas (Journal of Biomechanics 44:1264-1270, 2011).

Dr. Kutch earned a BSE in Mechanical Engineering from Princeton University in 2001 with minors in Engineering Biology, and Robotics and Intelligent Systems, and a PhD in Applied and Interdisciplinary Mathematics in 2008 from the University of Michigan in collaboration with The Rehabilitation Institute of Chicago.

DIVISION OF OCCUPATIONAL SCIENCE AND OCCUPATIONAL THERAPY

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

Health care in the future will put patients, not providers, at the center of care delivery. It will emphasize preempting illnesses through healthy behaviors and lifestyles just as much as it currently focuses on healing them subsequently. It will demand cost-effective therapeutic interventions beyond the pharmacological variety. It will consider patients' contexts—personal, social, and environmental—to be as important as their clinical signs and symptoms.

In many ways, each of the research programs at the USC Division of Occupational Science and Occupational Therapy is contributing to this future vision of health care. 2011 was a watershed year in the nearly quarter-century history of Occupational Science at USC. This past year alone, our faculty garnered over four dozen peer-reviewed publications. We also witnessed the operation of ten separate extramurally-funded research grants, a majority of which were administered by the National Institutes of Health. Combined, these projects represent a record research portfolio totaling over eight million dollars. Never before has USC occupational science maintained such a robust and wide-ranging research program.

At the 2012 Herman Ostrow School of Dentistry of USC Research Day I am especially pleased to introduce the most recently awarded of our research programs, Sensory Adapted Dental Environments (SADE) to Enhance Oral Care for Children with Autism. The goal of the SADE project is to collect information that will support a later clinical trial on the effectiveness of a specially adapted dental environment for children, including children with autism spectrum disorders (ASD) and typically developing children, who have difficulty tolerating oral care in the dental clinic. This project pilot tests a sensory adapted dental environment that has a strong potential to reduce anxiety and behavioral problems among the targeted population. This study is such a poignant reminder of the synergy between our Division and the Ostrow School of Dentistry and our mutual pursuit to improve holistic and systemic health.

For over twenty years, Occupational Scientists at the University of Southern California have been successfully conducting interdisciplinary research that generates critical knowledge about the impact of everyday activities ("occupations") on peoples' health, function, and well-being. In a world rapidly shifting from the compartmentalized to the convergent, ours is a discipline that has always been positioned at the intersection of the biological and social sciences. By generating relevant, valuable, and rigorous research about the ways in which activities contribute to healthy, satisfying, and productive lives, the faculty and students at the Division of Occupational Science and Occupational Therapy at the Herman Ostrow School of Dentistry of USC are helping make the future of health care a reality today.

Sensory Adapted Dental Environments to Enhance Oral Care for Children with Autism

Principal Investigator: Sharon Cermak, EdD, OTR/L, FAOTA

The goal of this project, funded by the National Institute of Dental and Craniofacial Research, is to collect information that will support a later clinical trial on the effectiveness of a specially adapted dental environment for children, including children with autism spectrum disorders (ASD) and typically developing children, who have difficulty tolerating oral care in the dental clinic. This project pilot tests a sensory adapted dental environment (SADE) that has strong potential to reduce anxiety and behavioral problems among the targeted groups of children, including such adaptations as dimmed lighting, exposure to soothing music, and application of a special vest which provides deep pressure sensations

that are calming. Because the planned research will contribute to safer, more efficient, less costly treatment, it has the potential to revolutionize clinic-based dental care for the growing population of children with ASD, as well as for typically developing children who have dental anxieties.

Lifestyle Redesign® for Pressure Ulcer Pre-

VENTION IN SPINAL CORD INJURY
Principal Investigator: Florence Clark, PhD, OTR/L, FAOTA

Advanced pressure ulcers, a common and medically serious complication of spinal cord injury (SCI), are associated with extremely high treatment costs and reduced quality of life. This randomized controlled trial funded by the National Institutes of Health is investigating the efficacy of a promising lifestyle intervention aimed at preventing pressure ulcers in at-risk members of the SCI population, and diminishing the heavy healthcare burden with which they are associated. The five-year study, now in its fourth year of operation, is a collaboration between researchers from the University of Southern California and Rancho Los Amigos National Rehabilitation Center. As of December 2011, 170 participants have enrolled in the study, exceeding the original target sample size of 160. This increased recruitment capacity was facilitated by an NIH Administrative Supplement Grant through the American Recovery and Reinvestment Act. Of the 170 participants, 83 were assigned to the intervention condition. Currently, 20 participants are being seen by one of four occupational therapists on the intervention team and 56 participants have completed the one-year Lifestyle Redesign® program.

AUTISM IN URBAN CONTEXT: LINKING HETEROGENEITY WITH HEALTH AND SERVICE DISPARITIES
Principal Investigator: Olga Solomon, PhD

This multi-method, ethnographic project funded by the National Institute of Mental Health examines health and service disparities in Autism Spectrum Disorders (ASD) diagnosis of African American children living in Los Angeles. The project is documenting the trajectories to an ASD diagnosis and services for a cohort of 25 children. The analysis focuses on patterns of communication among African American caregivers and practitioners during clinical encounters that are vital for developing partnerships and that are vulnerable to misunderstanding; on structural barriers to and opportunities for African American children receiving timely and accurate diagnosis and appropriate services; and on African American caregivers' knowledge about ASD and the social networks relevant to information about diagnostic evaluations, interventions and services. The project is conducted by an interdisciplinary team of researchers and clinicians from the Division of Occupational Science and Occupational Therapy, Herman Ostrow School of Dentistry; USC University Center for Excellence in Developmental Disabilities at Children's Hospital Los Angeles; and the Department of Preventive Medicine, Keck School of Medicine of USC. A group of postdoctoral researchers and graduate students continue to be mentored on the project to become future career research scientists. The project's Principal Investigator, Olga Solomon, sees the impact of the project in three areas: enhancing health professionals' awareness of social interaction dynamics and communication skills critical for clinical evaluation of African American children and for interaction with their families in urban clinical settings; supporting African American families' communication and partnership with clinicians when their children are being evaluated because of developmental concerns; and promoting timely and accurate ASD diagnoses and access to efficacious interventions.

THE MIRROR NEURON SYSTEM (MNS) AND ACTION OBSERVATION AFTER STROKE AFFECTING CORTICAL MOTOR REGIONS
Principal Investigator: Lisa Aziz-Zadeh, PhD

The mirror neuron system (MNS)—motor brain regions that respond when we perform an action and when we observe similar actions being performed by others—may be engaged to promote motor recovery after stroke in patients with limited voluntary movement ability. By studying how the brain perceives actions after stroke, the National Institute of Child Health and Human Development-funded research project will afford a better understanding of how to use methods that engage the MNS for stroke rehabilitation, for example, action observation. By asking how the brain perceives actions that use the counterpart to the paretic limb, the researcher team, led by Principal Investigator Lisa Aziz-Zadeh, will better understand the role of the MNS and the mentalizing system for action perception, imitation, and social cognition.

THE MIRROR NEURON SYSTEM: A NEURAL SUBSTRATE FOR METHODS IN STROKE REHABILITATION
Principal Investigator: Lisa Aziz-Zadeh, PhD

A great deal of research has shown that human motor systems process other people's actions utilizing what is called the mirror neuron system (MNS). However, how does this system work following stroke and subsequent motor disability? Can the mirror neuron system be engaged to promote recovery from stroke in patients with limited voluntary motor ability? In a two year study funded by the American Heart Association, Principal Investigator Lisa Aziz-Zadeh aims to explore how the brain perceives actions after stroke, and thereby have a better understanding of how to apply methods that engage the MNS for stroke rehabilitation. There is evidence to suggest that action observation may be used in stroke rehabilitation to promote recovery by engaging similar neural circuits to action execution. This study evaluates how stroke and post-stroke motor deficits affect activity in cortical motor regions during action observation. By asking how the brain perceives actions that are not possible for participants with stroke to perform, this project will also provide a better understanding of the role of the MNS within the whole brain for action understanding, imitation, and social cognition.

OSTROW SCHOOL OF DENTISTY OF USC RESEARCH DAY SCHEDULE

USC GALEN CETNER, FOUNDER'S CLUB

08:00am – 09:00am	Poster Set Up
09:00am – 12:00pm	Poster Judging
12:00pm – 12:30pm	Lunch
12:30pm – 12:45pm	Opening remarks
	RANDOLPH HALL Vice President, Research USC Office of Research
	AVISHAI SADAN Dean Herman Ostrow School of Dentistry of USC
	YANG CHAI Associate Dean of Research Herman Ostrow School of Dentistry of USC
12:45pm – 01:30pm	**LOUIS TERRACIO – Keynote Address** Professor, Basic Science and Craniofacial Biology Vice Dean for Research College of Dentistry, New York University "Tissue Engineering of Cardiac and Skeletal Muscle: Lessons Learned from Tissue Structure and Microgravity"
01:30pm – 02:15pm	**MARKUS BLATZ – Keynote Address** Professor of Restorative Dentistry Chairman, Department of Preventive and Restorative Sciences School of Dental Medicine, University of Pennsylvania "Contemporary Clinical Applications of Silica and Oxide-based Ceramics- Where Biomaterials and Technologies Intersect"
02:15pm – 02:50pm	**BETH FISHER** Associate Professor of Clinical Physical Therapy Division of Biokinesiology and Physical Therapy Herman Ostrow School of Dentistry "Central and Behavioral Effects of Exercise in the MPTP-lesioned Mouse and in Patients with Parkinson's Disease"
02:50pm – 05:00pm	Poster Viewing
05:00pm	Award Presentations

KEYNOTE SPEAKERS: BIOGRAPHIES AND FEATURES

FEBRUARY 15, 2012

Louis Terracio, PhD – Dr. Terracio is Vice Dean for Research, Professor in the Department of Basic Science and Craniofacial Biology at New York University College of Dentistry. He is also a Professor of Pediatrics at the School of Medicine. Dr. Terracio's research interests center on Cell-Extracellular Matrix (ECM) interaction during development and in disease and he has a very ambitious and productive lab. In particular, they investigate the role of integrins in the formation of normal muscle. They also study the role of stretch as a potential morphogenic signal using a tissue culture model of aligned myocytes. His lab has developed a cardiac patch that has many of the features of intact cardiac muscle. The patch has proven to have utility as a model system for the study of cardiac muscle in vitro. Dr. Terracio's lab was the first to tissue engineer a skeletal muscle construct that has structure and function similar to intact muscle. They are currently transplanting the constructs into animals to determine the feasibility of this system to replace lost skeletal muscle. Dr. Terracio has extensive teaching experience in both biomedical and PhD graduate programs. He has served on numerous graduate student committees and has mentored scores of students ranging from high school through Surgery and Cardiology Fellows.

Markus Blatz, DMD, PhD – Dr. Blatz is a Professor of Restorative Dentistry and Chairman of the Department of Preventive and Restorative Sciences at the University of Pennsylvania School of Dental Medicine in Philadelphia, Pennsylvania, where he also founded the University of Pennsylvania CAD/CAM Ceramic Center. Dr. Blatz graduated from Albert-Ludwigs University in Freiburg, Germany and was awarded an additional Doctorate Degree, a Postgraduate Certificate in Prosthodontics and most recently, his Habilitation ("Privatdozent") from the same University. Dr. Blatz is a board-certified Diplomate in the German Society for Prosthodontics and Biomaterials and a member of multiple professional organizations, including the European Academy of Esthetic Dentistry, the American College of Prosthodontics, and OKU Honor Dental Society. He serves on the editorial boards of numerous scientific dental journals and is former Associate Editor of Quintessence International and Quintessence of Dental Technology. Dr. Blatz is the recipient of multiple teaching and research awards and has published and lectured extensively on dental esthetics, restorative materials and implant dentistry.

Beth Fisher, PhD, PT – Dr. Fisher is an Associate Professor of Clinical Physical Therapy in the Division of Biokinesiology and Physical Therapy at the University of Southern California. She holds a joint appointment in the Department of Neurology, Keck School of Medicine as well. Dr. Fisher is the director of the Neuroplasticity and Imaging Laboratory primarily using Transcranial Magnetic Stimulation (TMS) to investigate brain-behavior relationships during motor skill learning and motor control in both non-disabled individuals and individuals with neurologic disorders. She is also the director of the USC/Rancho Los Amigos National Rehabilitation Center Residency Program in Neurologic Physical Therapy. She previously worked at Rancho Los Amigos Medical Center on the Adult Neurology and Brain Injury Services and continues to consult and teach nationally and internationally on current concepts for the treatment of adults with neurological disorders. Dr. Fisher is currently studying the effects of high-intensity exercise on functional recovery and brain repair in Parkinson's disease using TMS and Positron Emission Tomography as markers of neuroplasticity. She is also studying brain changes using TMS in individuals with stroke undergoing skilled rehabilitation; healthy individuals learning complex motor skills and individuals undergoing ankle manipulation as part of a physical therapy program for ankle sprain.

RESEARCH DAY 2012

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

Dean's Research Award:

Awarded to the most outstanding project poster overall

USC Stevens Institute for Innovation Award:

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

The USC Stevens Institute for Innovation is a university-wide resource in the Office of the Provost at the University of Southern California designed to harness and advance the creative thinking and breakthrough research from USC for maximum societal impact. As the first institute of its kind, the USC Stevens Institute empowers USC innovators university-wide to make broader impact with their ideas.

The USC Stevens team prepares USC faculty and students for a lifetime of innovation, supporting innovators from USC's College and all 17 professional schools by integrating intellectual property management and licensing functions with educational programs, community-building, and events designed to stimulate innovation across the university.

The USC Stevens Institute for Innovation was established through a generous $22M naming gift from USC alumnus and trustee Mark A. Stevens, a partner at the legendary Sequoia Capital venture capital firm, and his wife, Mary.

Faculty

Poster #: 1
Title: Immediately Restored and Loaded Dental Implants: Clinical Evaluation
Name: Alena Knezevic
Faculty Advisor: Tae H. Kim

Background: With the trend of shortening treatment time and reducing patient discomfort and anxiety, improved function and esthetics, immediate loading implants have re-emerged as an alternate approach to the previous clinical protocols. Purpose: The purpose of this study is to evaluate prosthodontic, aesthetic peri-implant mucosal outcomes and patient satisfaction of immediately restored, Superline dental implants (Dentium, USA) during 6-24months observation. Methods: 20 patients fit the established criteria and received Superline dental implants. Implants are stabilized at 35Ncm of torque or more and restored immediately after surgery with provisional restoration. Provisional restorations were adjusted to light contact in maximal intercuspal position avoiding excursions where possible. Clinical measurements were preformed during each visit: resonance frequency analysis, radiographic evaluation of interproximal bone level, evaluation of the patient's oral health (gingival, plaque and papilla index), subjective patient overall evaluation and evaluation of the placed restoration. Results: All 20 cases are successfully loaded and functioning without complication during the limited observation period. Type II(normal) bone was recorded in 14 patients with ISQ value of 76.0 while type III(soft) bone was recorded in 6 patients with average ISQ value of 78.3. The bone stability increased during the observed period: 76.0(baseline)-81.0(3 months)-86.0(6 months). Conclusion: In this study immediate loading of provisional restoration did not adversely affect the implant bone stability. In all 20 patients the implants are loaded successfully. Results of this study are comparable to the already published data using immediate or conventional loading protocols.

Poster #: 2
Title: Translational Approaches for Understanding Neurodevelopmental Disorders
Name: Barbara Thompson
Faculty Advisor: N/A

Background: There is significant heterogeneity in the genetic underpinnings and behavioral characteristics 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. Purpose: 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. Methods: 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. 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). In parallel, our mouse studies will aim to uncover the neural circuitry and genetics underlying these behaviors. 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. 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 #: 3
Title: Lifestyle Barriers to Diabetes Management in Urban Latino Young Adults
Name: Beth Pyatak
Faculty Advisor: N/A

Background: Young adults (YAs) with type 1 or type 2 diabetes (T1D/T2D) are at high risk for poor health outcomes. Reasons for low-SES Latino YAs may include significant lifestyle barriers to diabetes self-management (DSM) adherence. Purpose: Study aims were to:(1) Characterize lifestyle barriers to successful diabetes self-management (DSM) among low-SES Latino young adults (LYAs) age 18-30 with type 1 diabetes (T1D) or type 2 diabetes (T2D); and (2) examine differences in lifestyle barriers to successful DSM among LYAs with T1D as compared to T2D. Methods: Participants, as part of two clinical studies, were recruited from diabetes or primary care clinics and completed semi-structured interviews on their lifestyles and DSM adherence. In Study 1, 20 YAs with T1D were interviewed upon enrollment in a diabetes transition clinic. In Study 2, 10 purposively sampled YAs with T2D completed a series of interviews until data saturation was achieved. Chart reviews were conducted to verify diagnoses and medical histories. Interviews were audiotaped and transcribed for narrative thematic analysis using N*Vivo software. Rigor was achieved through member checking, peer review of themes, and an audit trail of analytic memos. Results: Preliminary findings indicate that barriers identified by YAs included logistical challenges in accessing care; view of DSM as incompatible with life goals or activities; lack of health literacy and self-advocacy skills; and lack of social support. YAs with T2D, versus T1D, had more shame and responsibility, a more fatalistic view of diabetes, and perceived diabetes as less severe. Conclusion: This study identified lifestyle areas to address in an intervention for DSM adherence. Behavioral and contextual barriers were similar in YAs with T1D and T2D, but differences in attitude and motivation for DSM will need to be accounted for in an intervention aimed at both groups.

Poster #: 4
Title: Meaningful Activity Participation in Independent-Living Older Adults
Name: Cheryl Vigen
Faculty Advisor: N/A

Background: Academic literature says little about activities common among seniors, including which are most associated with well-being. Purpose: To characterize and assess the benefits of a broad range of activities among elders. Methods: Baseline data were collected from 459 Well Elderly Study 2 participants using the Meaningful Activity Participation Assessment (MAPA) questionnaire to rate recent participation in 29 different activities. Thirteen well-established instruments were used to assess well-being in various domains. Differences in activity frequencies by demographic factors and correlations with well-being were statistically tested. Exploratory factor analysis was used to examine the factor structure of activity frequency. Results: Most participants reported daily activity in radio/TV, telephone, and reading, but no activity in driving, gardening/plant-care, taking/teaching classes, sexual/intimate activities, pet-care, e-mail, or other computer use. Total and individual-item activities differed considerably by demographics. Total activity frequency was significantly associated with better well-being in 12 of 13 measures ($p<.0001$). Exploratory factor analysis identified 3 activity factors, which we characterized as cultural, cognitive and social. After adjustment for total activity, cultural activity was associated with reduced well-being. Conclusion: Activity was associated with well-being assessed over a broad range of well-established measures, although causality cannot be assumed. Results

suggest that cognitive and social activities are more highly associated with well-being than cultural activity. Cultural activity may be more passive than cognitive/social activities and therefore may not promote the development of skills that improve well-being. Alternatively, cultural activity may be accessible to people regardless of current state of well-being.

Poster #: 5
Title: Reducing Oral Health Disparities in Children
Name: Harold Slavkin
Faculty Advisor: N/A

Background: Just over 4 million babies are born each year in the USA. By the preschool age (3-5 years), more than 20% of American children present rampant tooth decay, and more than 60% of children living in poverty present tooth decay. It is established that tooth decay is the #1 chronic disease of children. It is further established that the bacteria associated with tooth decay are vertically transmitted from caregiver to infant during the first 28 months of postnatal life. Fluoridated drinking water, fluoride varnishes, 4 mg/day xylitol, and dental sealants are well-established modalities to reduce tooth decay. Purpose: The hypothesis is that tooth decay in children can be significantly reduced and possibly eliminated or irradicated. Methods: To test the hypothesis, a collaboration will be created between oral health professionals and OB/Gyn professionals to provide comprehensive oral health care to the pregnant mother during the last trimester, with an emphasis on early childhood preventive strategies termed "anticipatory care." Pregnant mothers will receive extensive education and training in various prevention issues such as diet, fluids, feeding, and general hygiene principles and practices. At 1 year, pediatric visits to physician and dentist will be coordinated, integrated, and optimized to provide redundancy around optimal prevention strategies and methods. All mothers and children will then be followed with 6 month check-ups until children reach 4 - 5 years of age. A comprehensive dental pediatric examination will then be provided for all children. Results: If and when this hypothesis is tested, expected findings will clearly demonstrate a statistically significant reduction in tooth decay in at risk children, and thereby illustrate an approach to eliminate or reduce oral health disparities in at risk children. Conclusion: This approach is being implemented in the State of Maryland through the Maryland Oral Health Coalition. The presenter serves as a consultant to the State of Maryland. It is further anticipated that this approach will be used by the community outreach faculty, students, and staff at the Herman Ostrow School of Dentistry.

Poster #: 6
Title: Ectopic Eruption of a Permanent Canine into Maxillary Sinus: A case report.
Name: Jose Polido
Faculty Advisor: N/A

Background: This is a case in which a 10-year-old female presents with facial cellulitis secondary to perforation of the left maxillary sinus by the left maxillary permanent canine.: The patient presented to the Children's Hospital of Los Angeles with a history of left facial swelling for two days with pain and fever. Dentistry and Plastics/Maxillofacial Surgery consultations were requested and Panorex and CT scan were ordered. Examination revealed significant soft tissue swelling and tenderness of the left maxilla, cheek and periorbital area. Tenderness of the left maxillary permanent central incisor and overretained primary canine was noted, with no obvious caries lesion. Radiographic analysis revealed missing permanent maxillary left lateral incisor and the presence of a cyst associated with the crown of the impacted left permanent canine with its roots perforating the left maxillary sinus. Treatment included incision and drainage, excision of the dental cyst, and extraction of the impacted left permanent

Poster #: 7
Title: Does Intensity Matter? An Examination of Rehab Intensity after Hip Fracture
Name: Natalie E. Leland
Faculty Advisor: N/A

Background: There is a positive relationship between patient volume and clinical outcomes. Specifically, high volume skilled nursing facilities (SNFs) have been associated with getting home faster after hip fracture. Purpose: To examine the variation in intensity of rehabilitation among high and low volume SNFs and the relationship to patient outcomes. Methods: SNF volume was defined as the average number of hip fracture patients admitted annually over the study period. Therapy intensity was defined as the number of minutes of combined rehabilitation received during the first assessment period of the SNF stay, completed within 7 days of admission. The outcome was the time to get home and remain home at least 30 days, which was adjusted for demographic, comorbid illness, and index hospitalization characteristics of the patient. Results: Between 1999 and 2007, 542,542 community-residing individuals were discharged to a SNF for post-acute care. High volume SNFs provided on average one additional day of therapy (3.7 vs. 4.5, $p<0.001$) in the first week, were discharged on average 15 days sooner (total length of stay 24 vs. 39 days, $p<0.001$) and had a higher proportion of patients who were able to get home and remain at home at least 30 days in the first sixty days (61% vs. 33%, $p<0.001$), compared to individuals discharged to the lowest volume SNFs. Conclusion: High volume SNFs provide higher intensity rehabilitation than low volume SNFs. Rehabilitation processes of care contribute to the understanding of differences in patient outcomes between high and low volume SNFs.

Poster #: 8
Title: Dog-walking as a Physical and Social Activity: Implications for Health and Well-being of Children with ASD and their Families
Name: Olga Solomon
Faculty Advisor: N/A

Background: Dog-walking has been under increased scrutiny in health and rehabilitation research due to the urgent need to address physical decline in aging populations, decreased physical activity due to sedentary lifestyles, and increased obesity and overweight across age groups in post-industrial societies (Johnson, 2003; Reeves et al., 2011). Purpose: The study examined dog-walking and its potential to promote health and well-being through enhanced social engagement and participation of children with ASD in everyday activities with other people. The focus on dog-walking as a site for engagement in social and physical activity is consistent with the interest in occupational science for ways in which children and families actively participate in the construction of their own experiences and social worlds through engagement in occupations. Methods: Data corpus consisted of approximately 60 hours of video-recorded interactions involving five children and youth (4 boys and 1 girl, ages four to fourteen) diagnosed with ASD, their parents, siblings and peers, and six specially trained therapy dogs and their trainer. Data analysis focused on identifying dimensions of the dog-walking activity, its sequential organization, and ways in which dog walking supported the children's engagement and participation in everyday activities with other people. Results: Children with ASD responded to dogs with a marked increase in sociality. Dog-walking involved both social and physical engagement of the child with ASD with the dog and with other people. Dog walking activity enhanced the children's participation and engagement with family members and peers. Conclusion: Although dog-walking may be challenging for children with ASD because of gross motor impairments (Baranek, 1999), it may also afford increased physical activity and participation in family, peer and community contexts. Further studies are needed to examine how health and well-being of children with ASD and their families may be enhanced by dog-walking, and whether and how dog-walking may have a positive impact

on children and families' physical activity, stress-reduction, and participation across social contexts.

Poster #: 9
Title: Understanding African American Mothers' Experiences of Their Children's ASD
Name: Olga Solomon
Faculty Advisor: N/A

Background: Research on the impact of a child's developmental disability on the family has focused on parental functioning and psychological well-being, and perceived parental stress (e.g. Abbeduto et al., 2004). While the group design of these studies provides important information about commonalities of parental experience, there is a need for a nuanced, socio-culturally situated understanding of family experiences (Lawlor & Mattingly, 2009) of raising a child with ASD. This study addresses a paucity of research on African American families' experience of ASD in the context of everyday life, especially in light of health and service disparities related to ASD diagnosis and services (Lord & Bishop, 2010; Mandell et all.,2009). Purpose: To provide a socio-culturally situated account of African American mothers' experience of ASD diagnosis; 2) To analytically capture diversity in the family life and experience of ASD while identifying themes and issues that hold across families. Methods: Narrative interviews with 22 mothers were collected as part of an urban ethnographic study "Autism in Urban Context: Linking Heterogeneity with Health and Service Disparities" " (1 R01 MH089474-05, Olga Solomon, P.I.). Narratives were analyzed chronologically, beginning with first concerns and ending with the child's diagnosis of ASD; epistemically, following the mothers' understanding about their child's condition and their engagement with educational and clinical institutions; and thematically, identifying developing and recurrent themes within and across a mother's narratives, and across narratives of different mothers. Results: Chronologically, mothers narrated the experiences based upon a timeline of remembered noticings and the dates of clinical evaluations that led to an ASD diagnosis. Epistemically, the mothers evinced understanding of their child's particular kind of ASD. Thematically, sources and nature of evidence, clinicians' and mothers' partnering up, and views of the child's abilities relevant to the future were present across the data. Conclusion: African American mothers' 'autism stories' provide a lens on their experience of how, when and by whom a child's atypical development was noticed, interpreted and identified, offering a valuable perspective on the barriers to and opportunities for African American children receiving timely and accurate diagnosis and appropriate services.

Poster #: 10
Title: The Third Shift: Family Experience of Autism, Work and Family Life
Name: Olga Solomon
Faculty Advisor: N/A

Background: Working parents have a "second shift" when they return home from work, i.e. housework and childcare (Hochschild, 1989). A child's developmental disability such as Autism Spectrum Disorders (ASD) adds a "third shift" related to locating, negotiating and accessing services; transporting the child to receive these services; attending parental training that is prerequisite for these services, and attending other events such as Individualized Educational Plan meetings. Although parenting stress has been one of the most frequently researched aspects of family life among families of children with ASD (Davis & Carter 2008), little is known about the real life experiences of families that contribute to this phenomenon. Purpose: The urban ethnographic study "Autism in Urban Context: Linking Heterogeneity with Health and Service Disparities" (1 R01 MH089474-05, Olga Solomon, P.I.) examines health and service disparities in ASD diagnosis of African American children living in Los Angeles. One of the study's major analytic foci is ways in which accessing autism interventions and services impacts parents' engagement in work and family life. Methods: Data corpus consisted of narrative interviews, observations and clinical records of 22 African American families with a child or children with an ASD. Within- and across-case thematic analyses were conducted to identify themes of autism services, work and family life. Results: The "third shift" had a broad impact on work and family life. Some parental strategies of meeting the demands of the "third shift" included having flexible and interlocking work schedules. Some of the costs of the "third shift" were vulnerability of employment and decreased opportunities for financial rewards and promotion. Conclusion: The demands of ASD may impact parents' workplace participation as well as family life. This study sheds light on factors leading to disparities in income and increased levels of stress for parents of children with ASD.

Poster #: 11
Title: Relationship of Tissue Morphology to Symptoms of Carpal Tunnel Syndrome
Name: Shawn C. Roll
Faculty Advisor: N/A

Background: There is significant evidence detailing the personal, environmental and occupational risk factors for carpal tunnel syndrome. Little data exists to explain the interrelationship of tissue morphology to these factors in patients with clinical presentation of median nerve pathology. Purpose: The primary objective of this study was to examine the relationship of various risk factors that may be predictive of subjective reports of symptoms or functional deficits, accounting for median nerve morphology. Methods: Utilizing diagnostic ultrasonography, real-time median nerve morphology was observed in 88 subjects with varying reports of symptoms or functional limitations due to median nerve pathology. Numerous person, environment, and occupational data were collected to evaluate the interrelationship of these potential risk factors to reported symptoms. Results: Body mass index, educational level, and nerve morphology were primary predictive factors of subjective complaints of symptoms or functional limitations in an exploratory logistic regression model ($r2=0.281$, $p=0.002$). Previously studied risk factors (i.e. gender and wrist ratio) were not noted to be significant predictors in this subject sample. Conclusion: Monitoring median nerve morphology with ultrasonography may provide valuable information for clinicians treating patients with symptoms of median nerve pathology. Sonographic measurements may be a useful clinical tool for improving treatment planning and provision, documenting patient status, or measuring clinical outcomes of prevention and rehabilitation interventions.

Poster #: 12
Title: The Effect of Pre-treatment Fluoride on the Microleakage of Sealants.
Name: Thomas Tanbonliong, DDS
Faculty Advisor: N/A

Background: A determinant of sealant effectiveness is its marginal integrity to resist microleakage. If a practitioner elects to place a sealant on a tooth following the patient receiving flouride treatment, would marginal integrity be effected by the presence of the flouride? Purpose: To evaluate the effect of various pre-treatment topical fluoride applications on the microleakage of sealants. Methods: 60 caries free extracted human molars and premolars were assigned to one of four experimental pretreatment groups: 4 minute application of 1.23% non-acidulated topical fluoride gel (Group I); 1 minute application of 1.23% acidulated phosphate topical fluoride foam (Group 2); 2 minute application of 5% sodium fluoride varnish (Group 3); standard sealant application only, no fluoride pre-treatment (Group 4). All teeth were then thoroughly pumiced and etched with 35% phosphoric acid for 15 seconds, rinsed, then a coat of PrimaDry drying agent was applied. UltraSeal XT Plus sealant was placed on the occlusal surfaces. All specimens were thermocycled and then immersed in 1% methylene blue. The teeth were rinsed thoroughly, embedded in acrylic

and sectioned longitudinally. The specimens were examined under 10x magnification for dye penetration. Two scores were recorded for each sample, yielding a total of 120 surfaces examined. The margins were evaluated and scored according to the degree of dye penetration using 0-4 scale (0=no dye penetration; 4=dye penetration around the sealant). A Kruskal-Wallis test was used to compare dye penetration between the four treatment groups. A Mann-Whitney test was used to compare dye penetration between treatment pairs. Results: There was a statistically significant difference in dye penetration scores between the four groups tested (P<.001). There was no statistical difference in median microleakage scores between group 4 vs. group 1 (P=.546) and vs. group 2 (P=.113). However, a statistically significant difference was found between group 4, 1 and 2 versus group 3 (P<.001). Conclusion: The pre-treatment use of 1.23% non-acidulated fluoride gel and 1.23% APF foam had no effect on sealant microleakage. However, pre-treatment use of 5% sodium flouride varnish resulted in significant sealant microleakage.

Poster #: 13
Title: Adjusting Neurobehavioral Measures of Coma Recovery for Rater Severity and Leniency.
Name: Trudy Mallinson, PhD, OTR/L
Faculty Advisor: N/A

Background: Recovery from Severe Traumatic Brain Injury (sTBI) typically progresses from coma to vegetative state (VS) through minimally conscious states (MCS) to full consciousness. Existing assessments of consciousness are all based on ratings assigned by clinicians following observation of patient behavior. To the extent that raters differ in severity/leniency, measures of recovery of consciousness will be inaccurate. Purpose: To examine the impact of rater severity/leniency on measures of neurobehavioral functioning derived from the Disorders of Consciousness Scale (DOCS). We hypothesized that raters would be sufficiently uniform in severity/leniency such that a patient's DOCS measure would not require adjustment for rater variation. Methods: Prospective cohort study. 57 acute rehabilitation clinicians administered the DOCS in pairs to patients (n=174) who were unconscious after incurring sTBI. Clinicians administered DOCS tests together, but scored elicited responses independently. DOCS Sensory items (n=13) were examined using the Many-Faceted Rasch Model (MFRM). Analyses were conducted to examine the effect of rater severity and leniency on patient measures. Results: Six raters were unacceptably severe. Patients scored by these raters appear to have less functioning than they actually do. Three raters were unacceptably lenient. Patients scored by these raters appear to have more functioning than they do. Comparing DOCS patient measures obtained with a 1-facet Rasch model (unadjusted for rater severity/ leniency) and MFRM (adjusted for rater severity/leniency) indicated 42% of patient measures were over- or under- estimated because or rater severity/leniency. Conclusion: Accounting for rater severity/ leniency is important in clinical assessment. DOCS measures should be adjusted for rater severity to avoid influence of variations in severity/ leniency.

Advanced Specialty Program Resident

Poster #: 14
Title: Non-Exposed Bisphosphonate-Associated Osteonecrosis of the Jaws.
Name: Seena Patel
Faculty Advisor: Anh Le

Background: Bisphosphonates are used across many disciplines. Osteonecrosis of the jaw (ONJ) is a serious side effect with high morbidity and a challenging clinical management. As proposed by the American Association of Oral and Maxillofacial Surgeons and the American Society for Bone and Mineral Research, ONJ is defined as the persistence of exposed necrotic bone in the oral cavity for 8 weeks, despite adequate treatment, with current or previous history of bisphosphonate use, without local evidence of malignancy, and no prior radiotherapy to the affected region. A key point in the case definition is the presence of exposed necrotic bone. However, bone exposure is not always observed in a subset of cases that otherwise have characteristic hallmarks of BRONJ. Purpose: The purpose is to determine the prevalence of BRONJ occurring without bone exposure in the Oral Medicine clinic from 2004-2011, and to propose a modification to the current staging guidelines for BRONJ. Methods: All patients diagnosed with BRONJ from 2004-2011 in the USC Oral Medicine clinic were reviewed. Based on the medical record, the presence or absence of bone exposure at the initial visit was evaluated. Results: The prevalence of non-exposed BRONJ was 15.6%. To more accurately diagnose these lesions, we propose to adapt the current staging terminology with the addition of the term "non-exposed (NE)" to each stage in order to accurately reflect the clinical presentation of the ONJ. For example, stage 2 or 3 symptomatic BRONJ patients without clinically exposed necrotic bone will be classified as stage 2NE or stage 3NE. Conclusion: BRONJ can occur without clinical exposure of bone. The modification to the current staging guidelines is important to because it includes the non-exposed variant and it will allow clinicians to more accurately diagnose and treat BRONJ.

Poster #: 15
Title: Allogenic Demineralized Dentin Matrix (DDM): An Ideal Bone Graft
Name: Neema Bakhshalian
Faculty Advisor: Bahram Arjmandi

Background: There are different kinds of grafts and biomaterials being used for bone regeneration that are neither cost effective nor free of complications. Therefore, it would be ideal to utilize teeth that are extracted from other individuals (due to orthodontic treatments or wisdom teeth extractions, which are routinely discarded) to make an appropriate bone regenerative material. Purpose: The objective of this study was to evaluate the osteopromotive property of allogenic demineralized dentin matrix. We hypothesized that allogenic DDM has bone regenerative properties. Methods: To test this hypothesis 30 New Zealand White rabbits were used. The rabbits were divided into four groups and sacrificed after 15, 30, 60, and 90 days. The thickness of bone specimens were measured before utilizing for micro-CT. Blood samples were collected from all rabbits at each time point. Results: Average bone thickness was increased by 54% in experimental group and was significantly higher at all points in time. Moreover, microstructural properties showed superior bone quality in experimental group. White blood cell count was numerically higher in control rabbits compared to experimental rabbits ruling out any inflammation or infection due to allogenic DDM. Conclusion: The results of the present study indicate that allogenic DDM significantly improves both bone quantity and quality through its osteoinductive and osteoconductive properties.

Poster #: 16
Title: Surface Treatment of Polymethylmethacrylate Provisional Materials to Improve Color Stability
Name: Dolores Galvan
Faculty Advisor: George Cho, Jin-Ho Phark

Background: The use of long-term provisional restoration may cause significant unaesthetic discoloration. Techniques and materials are needed to help maximize color stability. Purpose: The purpose of this study is to compare color stability of polymethyl methacrylate (PMMA) discs subjected to different surface treatments and immersed in different solutions for 2 months. Methods: 40 specimens of PMMA (Lang Dental) were fabricated. Specimens were manually polished using sand paper, pumice and diamond paste. Half of them were coated with a light curing sealing agent (Palaseal, Heraeus Kulzer). Specimens were immersed in different solutions (water, coffee, tea,

red wine) for 5 minutes 2 times a day and in distilled water for the remaining time of the day. Lab values were measured using a spectrophotometer (CrystalEeye, Olympus) were performed at baseline, 1 week, 2 weeks, 1 month and 2 months. Delta-E values were calculated. Kruskal-Wallis and Mann-Whitney tests were performed at α=0.05. Results: ΔE values for water 1.64±0.16 < coffee 3.79±0.42 < tea 4.69±0.55 < wine 14.42±1.75 (p=0.000). ΔE for polished PMMA was significantly lower than for Palaseal coated specimens (p=0.001). ΔE increased significantly after extended immersion, regardless of storage medium. Conclusion: Long-term provisional restorations made of PMMA should be polished with pumice and diamond paste. Additional coating with light curing Palaseal is not recommended due to increased discoloration regardless of storage medium.

Poster #: 17
Title: Utilizing Voxel-Based Superimposition to Assess Orthognathic Surgical Treatment
Name: Emanuel Stefan Alexandroni
Faculty Advisor: Glenn Sameshima

Background: Inherent errors associated with current three-dimensional superimposition techniques detract from their usefulness in evaluating surgical treatment planning error. A recently developed superimposition method involves a regional voxel-based approach. Purpose: The aim of this study was to evaluate the accuracy of model surgery prediction using this new superimposition technique. Methods: Transverse, anteroposterior, and vertical changes in maxillary and mandibular landmarks were measured on superimposed pre- and post-treatment cone beam computed tomography (CBCT) records (n=44). These surgical changes were compared with the prediction measurements from the model surgery, and a statistical analysis was undertaken. Results: We were able to successfully use the voxel-based superimposition technique to evaluate the accuracy of model surgery predictions. None of the predicted transverse, anteroposterior, and vertical surgical movements were significantly ($p < 0.05$) different from the actual surgical changes. Conclusion: Face bow transfer, model surgery measurements, and surgical wafer fabrication are examples of errors that practitioners can mitigate to obtain accurate surgical predictions. Evaluating the accuracy of these predictions is best accomplished via volumetric analysis that uses the voxel-based superimposition technique described in this study.

Poster #: 18
Title: Comparison of Premolar Extraction Rates Between One-Phase and Two-Phase Class II Malocclusion
Name: Laura Harshbarger
Faculty Advisor: Glenn Sameshima

Background: The timing of treatment for Class II malocclusion has been heavily studied yet still remains to be a controversial clinical issue. This study specifically evaluates the ability of Class II growth modification to prevent the need for premolar extraction and the effect it has on cephalometric measurements. Purpose: 1. Compare premolar extraction rates between single- and two-phase treatment of Class II malocclusions. 2. Compare final cephalometric outcomes between single- and two-phase treatments of Class II malocclusions. Methods: Patient records from the private practice office of an American Board of Orthodontics diplomat in Southern California were evaluated for this study. A total of 106 patient records were examined, 36 were treated in two-phases and 70 were treated in a single-phase. The complete records of each patient were analyzed to compare premolar extraction rates between the two treatment groups and their resulting cephalometric measurements. Results: There was no significant difference in extraction rate between two-phase and single-phase treatment. The single-phase treatment group had an extraction rate of 18.6% (13 out of 70 patients) while the extraction rate for the two-phase group was 13.9% (5 of the 36 patients)(p-value 0.543). The change in ANB was the only significant cephalometric difference between two-phase and single-phase treatment with more change occurring in two-phase treatment. Conclusion: The results of this study conclude that two-phase Class II treatment does not reduce the rate of premolar extraction by a significant amount. In addition, early orthodontic treatment does not affect cephalometric outcomes, with the exception of ANB.

Poster #: 19
Title: Interactive Orthodontic Oral Hygiene iPad Application
Name: Michael Meru
Faculty Advisor: Glenn Sameshima

Background: Current methods of oral hygiene instruction include face-to-face presentations, printed materials, and videos. In an orthodontic setting where the majority of patients are in their adolescence, these methods tend to bore them and it is hard to keep their attention for a sufficient amount of time to properly instill good oral hygiene techniques and principles. This project seeks to use methods and technologies familiar and liked by them in order to have a more lasting effect of oral hygiene instructions. Purpose: To create a novel method to teach oral hygiene instructions using methods familiar and liked by adolescents, with the goal of aiding them in the internalization of the principles that results in better hygiene practices by these patients. Methods: An iPad application was created using a team of dentists, designers and computer programmers. Surveys and brainstorming sessions done with experts in the field to determine which principles to be essential, as well as the types of modules to place into the application. Results: Data forthcoming. Conclusion: The application created is the first of its kind in the world and teaches adolescents in an interactive manner how to better care for their teeth. Final data to follow.

Poster #: 20
Title: Histological Analysis of Autogenous Block Grafts in Humans: A Case Series
Name: Andrew Kim
Faculty Advisor: Hessam Nowzari

Background: Implant dentistry is a well-established clinical modality that has been used to replace missing teeth. Successful implant therapy requires sufficient bone to support the implant that is placed. However, clinicians often encounter cases where the patient does not have adequate bone for implant therapy and must consider ridge augmentation procedures. Mandibular autogenous onlay block grafting is a treatment option that can be used to treat ridge defects. However, very few studies have investigated the resulting histological nature of the grafts. Currently, the histological outcome and vitality of mandibular onlay grafts in humans is not well documented. Purpose: The purpose of this case series is to assess the histology and vitality of the bone graft in patients who have been treated with autogenous mandibular onlay ridge augmentation in preparation for implant placement. Methods: Four patients were consecutively selected at the Advanced Periodontology Clinic at Ostrow School of Dentistry of USC who were treatment planned for dental implant placement four months following bone grafting. At least four months following augmentation, patients were to be treated with implant surgery. At the time of site preparation for implant placement, discarded bone was prepared for histological evaluation. A core of approximately 2x3mm was taken from the site with dental burs and drills during the process of implant site preparation. Discarded bone core taken from the site was stored in 10% neutral buffered formalin (NBF). Histological sections were prepared with hematoxylin and eosin stain (H&E stain). The histological samples will be assessed for grafted bone vitality (presence of osteocytes inside lacunae), re-organization of haversian systems, angiogenesis, and osteoblastic/osteoclastic activity. Results: The samples demonstrated varying degrees of angiogenesis and cellular activity within the lacunae in bone grafts. Two out of four

cases showed almost complete presence of osteocytes in the lacunae. One case demonstrated partial angiogenesis and cellular activity within the bone grafts, and one case showed minimal bone remodeling characterized by limited angiogenesis and osteocytes. Conclusion: The histological samples demonstrated varying degrees of bone vitality and turnover (presence of osteocytes inside lacunae, angiogenesis, and re-organization of haversion systems). Further studies should investigate the mechanisms of the healing process and factors that influence graft remodeling associated with onlay bone.

Poster #: 21
Title: Cone Beam Computed Tomographic Measurements of Buccal Alveolar Bone Widths of Maxillary Premolars
Name: Marwa B. Abulhasan
Faculty Advisor: Hessam Nowzari, Sandra Rich

Background: Maxillary bone thickness is critical in determining bone and soft tissue response after extraction. Two millimeters of buccal bone may be optimal for proper hard and soft tissue healing for immediate implant placement. Purpose: The purpose of this study was to measure the horizontal width of buccal alveolar bone overlying healthy maxillary first and second premolars using cone beam computerized tomography (CBCT). Methods: Tomographic data from 67 (F=40, M= 27) consecutively selected patients (age range: 10 - 64 y/o) were evaluated twice by one examiner. Buccal bone width was assessed at levels 1.0 -10.0 mm apical to the bone crest. Results: 268 premolars were evaluated. The percent of teeth with buccal bone ≥ 2 mm at levels 1,2,3,4 and 5 mm from the bone crest was 6, 6.73, 11.95, 19.4 and 20.14% for the first premolars respectively, and 19.41, 30.6, 41.05, 51.50 and 46.27% for the second premolars respectively. The overall mean thickness of bone was 1.58 mm for the first premolars and 1.94 mm for the second premolars. Percentage widths (≥ 2 mm) observed at levels 1 to 5 mm were 12.87% (first premolars) and 37% (second premolars). The overall (levels 1 to 10 mm) percentages were 21% and 40% for the first and second premolars respectively. Fenestrations were found in 3% of the first premolars and in 1.5 % of the second premolars. Conclusion: Statistics gathered suggest that there are possible consequences to immediate implant placement especially in the first premolar sites. They may also infer less need for post extraction bone grafting in the second premolar sites.

Poster #: 22
Title: Relationship Between Key Cephalometric Parameters And Individual Tooth Tip And Torque
Name: Garrett Fong
Faculty Advisor: Hongsheng Tong

Background: Orthodontics is the specialty of dentistry dedicated to the diagnosis and treatment of malocclusions, resulting from dental or craniofacial irregularities. Treatment goals consist of achieving optimal occlusion, esthetics, and stability. Proper tooth angulation(tip) and inclination(torque) are key in attaining these goals. Previous research has provided data regarding ideal tooth angulation and inclination values in "normal" and "near-normal" patients. This data has been used to design orthodontic appliances with the goal of moving teeth into these ideal positions. However, normal biologic variation exists between patients, and it should not be assumed that one appliance is appropriate for all cases. Optimal tip and torque for individual teeth may vary depending on the type of skeletal growth pattern. Purpose: The objective of this study is to determine the effect that key cephalometric parameters (ANB, SN-GoGn) representing different skeletal patterns have on individual tooth tip and torque. Methods: 101 patients with "near-normal" dental occlusion were selected for this study. CBCT X-rays from their initial orthodontic records were used to generate lateral head films. Cephalometric tracings were performed to determine values for parameters related to skeletal growth patterns (ANB, SN-GoGn). These values were compared with ideal tooth tip and torque data from a previous study of the same patient sample to evaluate existing correlations. Results: To be determined. Conclusion: To be determined.

Poster #: 23
Title: Implementation of a New Protocol for Radiation Caries Management Using the CAMBRA System
Name: Franklin Chu
Faculty Advisor: Richard Green

Background: Head and neck radiation therapy has severe side effects on a person's dentition and oral health including alteration of tooth structure and decreased function of salivary glands. This leaves the patient highly susceptible to the development of rampant caries and severe fungal infections causing oral health to be difficult to establish and maintain for both dentist and patient. Purpose: The purpose of this study was to implement a new protocol that applies the principles of CAMBRA in the treatment of the radiation compromised patient. Methods: Patients with varying levels of oral health were monitored throughout the study. Thorough clinical treatment and intensive oral hygiene instruction were combined with "CariFree" products in an attempt to lower caries rate and increase the patients' oral health. Results: The results of treatment showed a varying degree improvement in each patient. Patient compliance seemed to be the most significant variable. Conclusion: In conclusion, the new protocol appears to be beneficial for the head and neck radiation patient but more studies are needed to verify its effectiveness.

Poster #: 24
Title: Congenital Varicella Zoster: A Case Report.
Name: Kenneth Zamora, Christian Yee
Faculty Advisor: Thomas Tanbonliong
Background: A 7 year-old Hispanic female with a history of Congenital Varicella Zoster presented to the USC pediatric dental clinic with her adopted parents. Extraoral findings revealed unilateral facial and ocular scarring, blindness, paralysis, auricular malformation and partial deafness on the right side of her face. Intraoral exam revealed early mixed dentition, severe early childhood caries and right posterior crossbite. Dental treatment consisted of multiple dental restorations and extractions with nitrous oxide and oxygen analgesia. Regular follow-up is planned for this patient.

Poster #: 25
Title: Pyogenic Granuloma in a Two Year Old Patient: A Case Report
Name: Ray Klein, Patrice Espinosa
Faculty Advisor: Thomas Tanbonliong

Background: This report is about a two year old Caucasian male who presented to the University of Southern California Pediatric Dental Clinic with his mother complaining of a growth on the palate. Clinical exam showed mixed soft and hard sessile lesion, located on anterior hard palate between #E and #F. The lesion is accompanied by a tooth like hard tissue. Treatment included surgical excision of the lesion under general anesthesia. Biopsy of the lesion is consistent with pyogenic granuloma.

Poster #: 26
Title: Encapsulated PDL and Gingival Mesenchymal Stem Cells in 3-D Injectable Biodegradable Scaffold: A Unique Platform for Bone Tissue Engineering
Name: Alireza Moshaverinia
Faculty Advisor: Winston Chee

Background: The need for bone and soft tissue regeneration has increased tremendously in maxillofacial prosthodontics. Stem cell-scaffold systems seem to be promising approaches for hard and soft tissue engineering and bone regeneration. Purpose: The objectives of this study were to: (1) develop an injectable scaffold based on oxidized alginate microbeads encapsulating PDL (PDLSCs) and Gingival mesenchymal stem cells (GMSCs); and (2)

investigate microsphere degradation profile, cell viability, and osteogenic differentiation of the stem cells (in vitro and in vivo). Methods: Stem cells were encapsulated using alginate hydrogel. The stem cell viability, proliferation and differentiation to adipogenic and osteogenic tissues were studied. To investigate the expression of both adipogenesis and ontogenesis related genes, the RNA was extracted and RT-PCR was performed. The degradation behavior of hydrogel based on oxidized sodium alginate with different degrees of oxidation was studied in PBS at 37°C as a function of time by monitoring the changes in weight loss. Microspheres containing PDLSCs, GMSCs and hBMMSCs were further implanted subcutaneously and ectopic bone formation was analyzed by μCT and histological analysis at 8 weeks post-implantation. Results: Alginate a promising candidate as a non-toxic scaffold for GMSCs. It also has the ability to direct the differentiation of these stem cells to osteogenic and adipogenic tissues as compared to the control group (hBMMSC) in vitro. The encapsulated stem cells remained viable in vitro and both osteo-differentiated and adipo-differentiated after 4 weeks of culturing in the induction media. It was found that the degradation profile of alginate hydrogel strongly depends on the degree of oxidation showing its tunable chemistry and degradation rate. In the animal study ectopic mineralization was observed inside and around the implanted microspheres containing the immobilized stem cells. Conclusion: These findings demonstrate for the first time that immobilization of PDLSCs and GMSCs in the alginate microspheres provides a promising strategy for bone tissue engineering.

Dental Hygiene

Poster #: 27
Title: Silver Diamine Fluoride: The Silver Bullet
Name: Courtney Mason
Faculty Advisor: Karen Lem

Background: In a time when scientific breakthroughs are happening rapidly, healthcare professionals are seeking alternative therapies to provide the quickest, safest, and most economically feasible ways to advance oral health. Purpose: Recent studies demonstrate Silver Diamine Fluoride (SDF) to be 2 to 3 times more effective than other fluoride types (NaF-PO4, NaF, and SnF2) in arresting and preventing dentinal caries. Methods: Specifically, when SDF is administered in concentrations of 38%, it acts as a cariostatic agent—inhibiting caries formation in primary teeth, and impeding the development of carious lesions in permanent teeth. Results: Research shows that when SDF is applied to decayed teeth it reacts with hydroxyapatite to form fluoraptite—retarding caries formation and halting the growth of S.mutans as silver fluoride alters the metabolic activity of dental plaque. Conclusion: In the field of dental hygiene where disease prevention is paramount, SDF can effectively and noninvasively treat patients, contributing to caries-preventive intervention.

Poster #: 28
Title: CAMBRA: Catch The Cause, Not Just The Caries
Name: Jonathan Galvez, Lalita Paul, Jenny Tsang
Faculty Advisor: Karen Lem

Background: The new model for managing caries is called Caries Management by Risk Assessment or CAMBRA. This program was founded by a group of experts on evidence-based research, as well as, scientific literature. The primary purpose of CAMBRA is to assess a patient's risk for caries and determine a patient's appropriate preventative treatment. CAMBRA analyzes Early Childhood Caries, ECC, which is five times more common than asthma and seven times more common than hay fever in the U.S. In recent years ECC has increased among children. CAMBRA identifies the patient's risk for for decay and implements a unique treatment plan for each patient. CAMBRA has been proven effective in reducing and preventing the formation of future caries; however, the success of this program lies solely on the patient's ability to effectively maintain proper dental home care. It has been documented that CAMBRA is greatly beneficial to both patients and dental practices. Purpose: Providing preventative dentistry, is not only an obligation to the patients, it is a sound business model. By having the patient enrolled in the CAMBRA program, appointments will be dedicated to OHI, which is one of the most important services we can provide as dental professionals. Methods: N/A Results: Conclusion: CAMBRA offers a new realm of dentistry where the prevention of decay is the focus. A concept of overall comprehensive care, not just drilling and filling, is beginning to take a stronghold on dental offices nationwide – the concept of catching the cause, not just the caries.

Poster #: 29
Title: Xylitol Syrup Never Tasted So Sweet
Name: Robin Nanda
Faculty Advisor: Karen Lem

Background: A variety of clinical studies have suggested that xylitol is an effective and natural anti-cariogenic polyol sugar substitute. Many products currently on the market contain xylitol. However, none of these products are deemed safe for infants and very young children. In a syrup form, xylitol can be safe and effective for use with infants and young children, where poor dental hygiene and rampant caries are prevalent. Purpose: We believe that xylitol in syrup form can be a safe and effective way to reduce the incidences of Early Childhood Caries (ECC) in infants and toddlers. Furthermore, we wanted to gain an understanding of the ideal dosage and frequency for xylitol syrup in this demographic as well as their acceptance toward using this product. Methods: We compiled some existing research on how xylitol works, dosage and frequency studies of xylitol in adults and children, and also studies on usage, acceptance, and versatility of xylitol in different products. Results: The results showed that the minimum effective amount and frequency of xylitol syrup is at an average of 8 grams per day divided into at least 2 times per day. Also, children seem to be very accepting of xylitol syrup and xylitol based products. Conclusion: Dental hygienists have the opportunity to make significant strides in eliminating ECC in infants and toddlers by educating parents on the benefits of xylitol syrup and on how to find and select products for their children that contain significant amounts of xylitol. The dental community should push for the increased use of xylitol syrup in commercial products as well as in CAMBRA programs and as part of their practice's armamentarium.

Graduate Post-Doctoral Trainee

Poster #: 30
Title: When the Ordinary becomes Extraordinary: French Fries, Pizza, and Feeding Kids with Autism Spectrum Disorders
Name: Kimberly Wilkinson
Faculty Advisor: Mary Lawlor

Background: Participation in family mealtimes is consistently linked with indicators of health and well being for children (Fiese & Schwartz, 2008). Children with autism often exhibit differences in their eating and mealtime behaviors including food selectivity (Ahearn, 2001; Bandini et al., 2010). Feeding children is an important part of mothering and these differences with eating and mealtime behaviors can significantly impact a mother's experiences and perspectives. Purpose: Understanding the reasons parents choose the foods they feed their children can help those who work with families with children with feeding challenges. Methods: Narratively focused interviews were done with five mothers of four- and five-year-old boys diagnosed with autism and feeding difficulties. The interviews focused on their stories about mealtime and mothering a child who had difficulty eating. Data collection took place over a six-month period during which each mother participated in two to four

interviews and each family was observed at least once during mealtime. Results: The mothers in this story had many reasons for choosing different foods. Two foods that had particular significance were French fries and pizza. Their reasons for choosing these foods were illuminated by their stories about their children and families. Conclusion: The stories of why these two foods, commonly thought of as "junk food" became significant to these parents can help us to understand why parents may choose the foods they do to give their children and may assist in offering meaningful interventions to parents of children with autism spectrum disorders and feeding challenges.

Poster #: 31
Title: A Digital Clinical Tool for O.M.E.N.S. Classification of Hemifacial Microsomia.
Name: Wendy Moh
Faculty Advisor: Stephen Yen

Background: The O.M.E.N.S classification system was developed to systematically describe the facial features of hemifacial microsomia(HFM). The acronym is based on the orbit, mandible, ear, facial nerve and soft tissue, and can provide clinicians with an index of severity and researchers with a database of phenotypic variation. Purpose: We propose to create a digital form of the OMENS Classification for use in the clinic on PC, Mac and iPad formats. Methods: Two popular software programs, Microsoft Powerpoint and Filemaker Pro/Filemaker Go, were used to create a database for recording OMENS scores. The digital classification system was tested with published photographs of HFM with known OMENS scores. Results: Programming in Filemaker Pro can create a usable, cross-platform, visual classification system for patients with HFM in the hospital clinic. The OMENS classification can be useful for judging treatment severity but is less useful for defining HFM phenotype as the phenotype can change with age and treatment. A photograph is inadequate for defining a HFM phenotype. The patient records(clinical examination, history and radiographs) are needed for information on hearing, sight, facial animation, bony anatomy, growth changes and associated minor anomalies. Conclusion: We are testing the inter rater reliability among lay, student clinician and expert clinician OMENS classification scores.

Poster #: 32
Title: Investigating Amelogenin-bound Micelles: A Model for Amelogenin-cell Membrane Interaction.
Name: Balakrishna Chandrababu Karthik
Faculty Advisor: Janet Oldak

Background: The proline rich amelogenin which is classified as an intrinsically disordered protein is the major (>90%) extracellular enamel matrix protein. Amelogenin self assembly to form nanospheres is an important phenomenon for its crystal growth control mechanisms. As this disordered protein is synthesized by the ameloblast cells at the early stage of enamel development the study of its structure in the presence of cell membrane or membrane mimicking models can give more insight into its function. Purpose: To analyze the structural changes involved in amelogenin upon its binding to membrane models, and address the transformation between its disordered and ordered conformation. Methods: The techniques used for this study were Circular Dichroism, Fluorescence quenching studies and Dynamic Light Scattering. Results: The binding of amelogenin with SDS micelles was confirmed by the increase in hydrodynamic radius of micelles upon the addition of amelogenin. Further, the change in the secondary structure also revealed that rP172 coils to form alpha helix following its interaction with SDS. The fluorescence quenching of SDS-bound rP172 shows that the tryptophan is buried inside the hydrophobic core of SDS micelle. When added with the zwitterionic dodecylphosphocholine (DPC) micelles amelogenin did not show any structural changes and proves that its electrostatic interactions are more specific. Conclusion: Amelogenin binds strongly with negatively charged SDS micelles and adopts an alpha helix conformation while no structural changes occur upon interactions with zwitterionic DPC micelles. Since SDS micelles can mimic the negatively charged outer membrane of the ameloblast cells, we can address the significance of charge and hydrophobicity distribution of amelogenin responsible for its ameloblast membrane-bound form.

Poster #: 33
Title: Interaction of Amelogenin with Ameloblast Membrane Mimicking Phospholipids
Name: Sowmya Bekshe Lokappa
Faculty Advisor: Janet Moradian-Oldak

Background: Enamel extracellular matrix (ECM) constitutes phosphorylated and glycosylated proteins, proteinases, sulphated proteins, serum albumins and lipids. Due to this heterogeneity, complex protein-protein, protein-mineral and protein-lipid interactions can be envisaged in enamel ECM. Lipids have been shown to represent 0.2% of the developing enamel matrix. A large body of evidence has accumulated which indicates that the phospholipids extracted prior to enamel demineralization are associated with cell membranes, while the second group of phospholipids extracted after demineralization are associated with the extracellular matrix. Purpose: To investigate interaction of intrinsically disordered porcine enamel matrix protein, amelogenin (rP172) with model membranes mimicking phospholipids present prior and after demineralization. Methods: Fluorescence binding and quenching studies, Circular Dichroism Spectroscopy, Transmission Electron Microscopy, Dynamic Light Scattering, Sonication of Synthetic Phospholipids to obtain model membranes. Results: rP172 is peripherally bound to the zwitterionic model membranes mimicking phospholipids extracted prior to demineralization but associated strongly with model membranes mimicking phospholipids extracted after demineralization. rP172 was also able to penetrate into hydrophobic core of anionic liposomes. rP172 exhibits helical structure in membrane mimicking environment. Conclusion: We have shown that full-length recombinant porcine amelogenin associates strongly with model membranes mimicking phospholipids present in enamel extracellular matrix that is associated with the mineralized phase. Membrane bound structure of amelogenin might play an important role during mineralization. As discrete protein segments have the ability to modulate a variety of biological activities, in the future we plan to dissect different regions of amelogenin and study their interaction with lipid bilayer. Interaction of membrane-bound amelogenin with hydroxyapatite will also be investigated.

Poster #: 34
Title: Effect of 32 kDa Enamelin on Amelogenin Self-assembly
Name: Xiudong Yang
Faculty Advisor: Janet Moradian-Oldak

Background: Interactions among the macromolecules in the enamel extracellular matrix (i.e. amelogenin and enamelin) and their structures play vital roles in regulating hydroxyapatite crystals nucleation and maturation during enamel formation. Purpose: Our aim was to investigate the effect of enamelin on amelogenin assembly at physiological pH condition (pH 7.4) and at 25□. Methods: We used dynamic light scattering, circular dichroism, fluorescence spectroscopy and transmission electron microscopy to evaluate the effect of enamelin on amelogenin self-assembly. Results: The assembly of amelogenin (rP148) was altered following addition of the 32kDa enamelin. Dynamic light scattering revealed a trend of decrease in particle size in the solution following the addition of enamelin to amelogenin. Upon the addition of the 32kDa enamelin, the shift decrease and intensity increase of the ellipticity minima of rP148 in the circular dichroism spectra hinted a direct interaction between the two proteins. In the fluorescence spectra, the maximum emission of rP148 was

red-shifted from 335 to 341nm with a markedintensity increase in the presence of enamelin as a result of complexation of the two proteins. TEM imaging showed that the 32kDa enamelin dispersed the amelogenin aggregates into oligomeric particles and stabilizing them. Conclusion: We suggest that at physiological pH, by co-assembling with amelogenin, enamelin functions to increase stability of the oligomers preventing them from further aggregation. This data highlights the possible function of enamelin in controlling amelogenin oligomerization prior to assembly of the extracellular mineralized matrix in vivo. Our present study provides novel insights into understanding possible cooperation between enamelin and amelogenin in macromolecular co-assembly and in controlling enamel mineral formation.

Poster #: 35
Title: Characterization of Metastable Oligomers as Subunits of Amelogenin Protein Nanospheres
Name: Keith Bromley
Faculty Advisor: Janet Oldak

Background: The tooth enamel protein amelogenin forms large assemblies encompassing a different number of monomers ranging from tens (nanospheres) to hundreds (nano-chains). The question of whether smaller oligomeric structures can be formed and studied is important as it may provide insight into the mechanism of nanosphere formation. Purpose: To establish whether stable amelogenin oligomers can form and to create a model of amelogenin self-assembly. Methods: Recombinant porcine amelogenin (rP172) was analyzed in the range of: temperature 5 to 37 ºC, pH between 3.5 to 9 and protein concentrations of 0.2 to 10 mg/mL. We used circular dichroism spectropolarimetry (CD), intrinsic tryptophan fluorescence (ITF), fluorescence anisotropy (FA), nuclear magnetic resonance (NMR) and dynamic light scattering (DLS). Results: ITF and FA were used to identify the pH range in which oligomers appeared to be forming. CD analysis over this range revealed that there was very little change in secondary structure helping to confirm the ITF findings. DLS and FA showed a concentration dependence on the formation and size of the oligomers. At pH 5.5, the maximum hydrodynamic radius was 7.5 nm. Thermovariable experiments established that the oligomers were metastable as their formation was reversible on cooling. ITF experiments with single-tryptophan double mutants of amelogenin revealed that the C terminus is located at the edge of the oligomers, while the N-terminus is buried in the core. NMR experiments revealed the peptide backbone became more rigid upon oligomer formation. Conclusion: We created conditions under which metastable amelogenin oligomers could be formed. Amelogenin oligomerization was not concomitant with a large change in folding. A critical concentration is required before large oligomers (RH ≈ 7.5 nm) can be formed. Studies with single-tryptophan double mutants allowed us to create a model for oligomer and nanosphere assembly.

Poster #: 36
Title: Epithelial-specific Knockout of the Rac1 Gene Leads to Enamel Defects.
Name: Zhan Huang
Faculty Advisor: Malcolm L. Snead

Background: Cell-cell and cell-matrix interactions play important roles in the development of mineralized tissues. Rac1, a 21kDa small GTP-binding protein, belongs to the RAS superfamily, whose members play important roles in manipulating cell proliferation, adhesion, migration and differentiation. They are also crucial in controlling focal adhesion complex formation and cytoskeletal contraction. Deletion of Rac1 in neural crest cells results in abnormal craniofacial development.(Dev. Biol. 340:613 2010) Purpose:To investigate the role played by Rac1 in cell-matrix interactions and in subsequent matrix biomineralization during tooth enamel formation. Methods: Mating between mice bearing the floxed rac1 allele with keratin14-Cre mice generate rac1 conditional knockout mice. Enamel matrix protein expression could be detected by Western blotting. The enamel of wild type (referred to as rac1+/+), and conditional knockout (referred to as rac1-/-) was characterized by micro-computed tomography, light microscopy, histochemistry, and back-scattered electrons scanning electron microscopy. Results: The major findings, showed that, the apical sides of enamel-secreting ameloblasts in the rac1-/- mice failed to adhere to or interact with enamel matrices in unerupted teeth, the major enamel matrix proteins, amelogenin and ameloblastin were remarkably reduced. After eruption, the rac1-/- mice teeth have compromised enamel structure, displayed severe enamel defects or complete loss of enamel. Conclusion: These results suggest rac1 is essential for enamel formation through the regulation of cell-matrix interaction and matrix biomineralization. The Rac1 signaling pathway and the mechanisms involved in enamel development need to be further explored.

Poster #: 37
Title: Role of the Transcription Factor NFI-C in Root Development.
Name: Fumiko Harada
Faculty Advisor: Margarita Zeichner-David

Background: The transcription factor NFI-C is essential for root development. Previous studies have shown that mice lacking NFI-C (KO) form abnormal short roots and teeth are lost prematurely due to lack of root attachment. Studies have also indicated that there might be a problem with odontoblast cell polarization, secretion of the extracellular matrix and dentin mineralization. To further understand the role of NFI-C in root development, we followed the expression of 3 markers for odontoblasts, periodontal ligament and neuronal function in developing roots of normal mice molars as well as mice lacking NFI-C. Purpose: The purpose of this study is to understand the role of NFI-C on the development of the root and the attachment apparatus. Methods: Development of the root was followed in molars obtained from normal mice (WT) and mice lacking NFI-C (KO). Samples were obtained at different postnatal days of development ranging from 12d to 20d. Tissues were dissected, decalcified and embedded in paraffin for immunohistochemistry. Antibodies for Collagen VI, Asporin and PGP9.5 were used. Results: Differences for the expression of each antibody were found depending on the developmental stage as well as the presence of absence of NFI-C. Some examples are the 14d WT mice, the expression of Collagen VI were observed in the periodontal ligament, which the high expression regularly lined along the cervical region to middle of the root not involving apical region. In contrast, in the 14d KO mice, the expression was detected in the periodontal ligament and irregular formed odontoblast including the apical region. Asporin expression in the WT mice was highly detected in the odontoblast cervical region of the root, lacking in the apical region, while the Asporin expressed in the NFIC- KO mice was present in odontoblasts at the apical region from 12d to 18d. Conclusion: The data suggested that NFI-C might regulate function of cells involved in root development by affecting the expression of protein characteristics during root development. Furthermore, this data suggests that lacking NFI-C affected collagen VI and Asporin distribution. Asporin is reported as a negative regulator of periodontal ligament mineralization. Further studies are required to fully understand the mechanism of NFI-C regulation on these genes and their effect on root development.

Poster #: 38
Title: The Circadian Clock Modulates Enamel Development.
Name: Rodrigo Lacruz
Faculty Advisor: Michael Paine

Background: Fully mature enamel is about 98% by weight mineral and while mineral crystals appear very early during its formative phase, the newly secreted enamel is a soft gel-like matrix containing several enamel matrix proteins of which the most

abundant is amelogenin (Amelx). Histological analysis of mineralized dental enamel reveals incremental markings called cross-striations associated with daily increments of enamel formation. Incremental genesis is further evidenced by injections of labeling dyes at known time intervals. The daily incremental growth of enamel has led to the hypothesis that the circadian clock might be involved in the regulation of enamel development. Purpose: The purpose of this research is to investigate the possibility that the circadian clock is involved in the development of enamel. Methods: Ameloblast LS8 cells were serum synchronized and harvested every 4hr for a period of 48hrs for qPCR analysis. Mouse dental tissues were used for immunostaining of clock proteins. We also isolated mouse molars from the same litter, every 4hr, for 48hrs to analyze Amelx expression by qPCR. Finally we analyzed the enamel phenotype of mice lacking Per2 by backscattered SEM. Results: Per2 and Bmal1 are expressed in synchronized murine ameloblast cell cultures and their expression profile follows a circadian pattern, showing acrophase and bathyphase for both gene transcripts in antiphase. Immunohistological analysis confirms protein expression of Bmal and Cry in enamel cells. Amelx expression in 2-day post natal mouse molars dissected every 4 hours for a duration of 48 hours oscillated with a ~24hr rhythm with a significant ~2 fold decrease during the dark period compared to the light period. The enamel of Per2 mutants showed mineralization differences when compared to WT mice. Conclusion: Taken together, our data supports the hypothesis that the circadian clock temporally regulates enamel development.

Poster #: 39
Title: Inhibitory effects of Mesenchymal Stem Cells for Myeloma Cells via Fas/Fas-L Pathway
Name: Ikiru Atsuta
Faculty Advisor: Songtao Shi

Background: Cellular therapies represent a new frontier in the treatment of many diseases. Mesenchymal stem cells (MSCs), which can be harvested from bone marrow, adipose tissue, and umbilical cord blood, among many other sources, possess several qualities that may be used to treat many kinds of Cancer. However, the mechanism of MSC treatment for cancer remains to be elucidated. Purpose: Here, the effects of MSCs on the multiple myeloma (MM) cell lines apoptosis were studied in vivo and in vitro. Methods: We investigated as the following to show the treatment effect of isolated MSCs from mouse bone marrow for MM cells. In vivo, using the MM mouse model, we evaluated the change of mouse survival and MM indenization with MSCs administration. In vitro, we checked the proliferation and apoptosis rate of MM cells in co-culture with MSCs. Results: In vivo, the treatment of MMs with MSCs showed the remarkable inhibitory effect on MMs indenization by histological data and the extension of mouse survival by statistical. On the other side, in vitro, the decrease of proliferation and the increase of apoptosis in the MMs were showed clearly in the co-culture with MSCs. Furthermore, the preliminary evaluation of the mechanism for these effects revealed that the binding between Fas and Fas Ligand (Fas-L) significantly induced apoptosis of MMs, as evidenced by increases in the expression of apoptosis marker and Fas in MMs. Conclusion: The results of these studies strongly suggest that MSCs could induce the MMs apoptosis directly via Fas/Fas-L pathway and might be considered in the treatment of multiple myeloma in the future.

Poster #: 40
Title: Mesenchymal Stem Cell-Induced Immunoregulation Involves Fas Ligand/Fas-Mediated T Cell Apoptosis
Name: Kentaro Akiyama
Faculty Advisor: Songtao Shi

Background: Systemic infusion of bone marrow mesenchymal stem cells (BMMSCs) shows therapeutic effects on a variety of autoimmune diseases, but the underlying mechanisms of BMMSC-based immunoregulation are not fully understood. Purpose: To determine the mechanism by which BMMSC-mediated immunotolerance provides appropriate therapy for immune disorders. Methods: The immune therapeutic effect of BMMSCs derived from Fas-/-, FasL-/- or C57BL6 mice was examined in systemic sclerosis (SS) and induced experimental colitis model mice. Results: Systemic infusion of BMMSCs induced a transient T cell apoptosis via the Fas Ligand (FasL)-dependent Fas pathway by which diseased phenotypes in SS and induced experimental colitis model mice were ameliorated. FasL-/- BMMSCs were incapable of ameliorating SS and colitis due to their failure of inducing T cell apoptosis in the recipients, which was recovered by overexpression of FasL in FasL-/- BMMSCs. Moreover, Fas-/- BMMSCs, with normal FasL expression, also failed to induce T cell apoptosis and offer therapeutic effect for SS and colitis mice. Mechanistic study revealed that Fas regulated monocyte chemotactic protein 1 (MCP-1) secretion in BMMSCs, which plays a crucial role in the recruitment of T cells to BMMSCs for FasL-mediated apoptosis. The apoptotic T cells subsequently triggered macrophages to produce high levels of transforming growth factor beta (TGF-b) that in turn led to up-regulation of Tregs and, ultimately, immune tolerance for BMMSC-mediated immunotherapies. Conclusion: FasL and Fas are coupled to govern BMMSC-based immunotherapy through recruiting activated T cells by Fas-controlled MCP-1 secretion and inducing T cell apoptosis, leading to an immunotolerance condition for immunotherapy. These data demonstrate a previously unrecognized role of BMMSCs in terms of inducing T cell apoptosis through coupling effect of Fas and FasL in BMMSC-based immunotherapies.

Poster #: 41 Title: Osteogenic Cell Deficiency in Ovariectomized Mice Contributes to Osteoporotic Phenotype via NFkappaB-Mediated Smad7 and FasL Signaling
Name: Lei Wang
Faculty Advisor: Songtao Shi

Background: Osteoporosis is a common bone disease prevalent among the aged population. It is characterized by reduced bone mineral density (BMD), deteriorated bone microarchitecture, and increased risk of fracture. It is well known that the balance between osteoblasts and osteoclasts determines osteoporotic phenotype in ovariectomy (OVX) mice. However, the mechanism of OVX-induced osteogenic cell deficiency is unclear. Purpose: To explore the underlying mechanisms of osteogenic cell deficiency in estrogen deficiency-induced osteoporosis. Methods: Morphometric and immuno-profile analyses were performed in OVX mice with or without administration of interferon γ (IFN-γ) and tumor necrosis factor α (TNF-α) neutralizing antibodies and systemic infusion of mesenchymal stem cell (MSC), respectively. Bone marrow MSCs were harvested to determine their osteogenic property and capability to interplay with osteoclasts. Results: Elevated levels of type 1 helper T cells (Th1) proinflammatory cytokines IFN-γ and TNF-α in OVX mice results in osteogenic and immunomodulatory deficiency of bone marrow MSC/osteoblast lineage via nuclear factor κB (NF-κB)–mediated activation of smad 7 and NF-κB–mediated inhibition of Fas ligand (FasL), respectively. We further reveal a previously unrecognized mechanism by which MSCs/osteoblasts induce osteoclast apoptosis via FasL/Fas signaling to regulate osteoclast number. Interestingly, systemic administration of bone marrow MSCs significantly reduces the levels of IFN-γ and TNF-α in OVX mice, resulting in improvement of BMD by elevating MSC/osteoblast–mediated bone formation via rescuing NF-κB/smad 7 pathway and improvement of MSC/osteoblast-mediated osteoclast apoptosis via rescuing NF-κB/FasL signaling. Conclusion: NF-κB–regulated smad 7 and FasL pathway may play a critical role in physiopathological mechanism of osteoporosis in OVX mouse model.

Poster #: 42
Title: Adolescent Maxillary Protraction in

Patients with Cleft Lip and Palate (CLP).
Name: Ali Borzabadi-Farahani
Faculty Advisor: Stephen Yen

Background: Children with cleft lip and palate frequently have a Cl III malocclusion requiring orthoganthic treatment to advance the short maxilla. Purpose: The purpose of this retrospective study is to evaluate an alternative, non-surgical treatment for correcting the Cl III malocclusion in CLP patients. Methods: Twenty UCLP or BCLP patients with Cl III malocclusion were treated by maxillary protraction at ages 13-14. Maxillary protraction applied 8 weeks of maxillary sutural loosening using Hyrax maxillary expander, with alternate rapid maxillary expansion and constriction protocol, followed by Class III elastics and reverse-pull headgear use. Cephalometric radiographs were taken before treatment and at the time of braces removal for comparisons using equality of variance, paired-t-test and Fisher exact test for testing for defined changes. Results: Significant differences were found for the following cephalometric variables (T2-T1): ANB Angle [95% Confidence Interval (CI) of Mean Difference (MD)=1.36-5.00], Wits Appraisal (95% CI of MD=4.38-9.52), Palatal Plane to Mandibular Plane Angle (95% CI of MD=0.37-8.79), Anterior Facial Height (95% CI of MD=0.94-9.69), Overjet (mm) (95% CI of MD=3.51-7.61), Upper Incisor Angle to SN (95% CI of MD=0.44-12.75), Lower Incisor to Mandibular Plane Angle (IMPA) (95% CI of MD=1.26-10.93), Lower Incisor to APo line (mm) (95% CI of MD=3.64-12.98). Conclusion: Adolescent maxillary protraction can correct a Cl III malocclusion by a combination of skeletal changes (increase in lower facial height, clockwise rotation of mandible), dental compensation (proclination of maxillary incisors, retroclination of mandibular incisors), and rotation of occlusal plane.

Poster #: 43
Title: Deregulation of Specific Genes of Marrow Stem Cells Stimulated by LLLT
Name: Jie Guo
Faculty Advisor: Stephen Yen

Background: Conflicting reports have questioned whether low level laser treatment can have an effect on orthodontic tooth movement. Purpose: The purpose of this study was to examine how light effects gene expression. 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: Light stimulated some cultures to proliferate up to 40% faster depending on the type of light stimulation using BrdU markers. For the light-stimulated cultures, western blot data for osteocalcin, alkaline phosphatase and RUNX 2,did not show a pattern of increased or early gene expression compared to control cultures. 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 involving dose response and silencing of inhibitor genes for candidate genes. Pathway analysis showed the top VR biological gene networks were skeletal and muscular system development and function, tissue development and amino acid metabolism, consistent with bone turnover. The top biological functions associated with IR stimulation are skin condition, genetic disorders, cancer, immune response. Conclusion: This study provides strong evidence for light stimulating different sets of genes according to wavelength and energy level that can alter bone turnover. The data provides a molecular explanation for the confusing and conflicting reports in the current literature.

Poster #: 44
Title: TGF-b-Smad4-FGF6 Signaling Cascade Controls Myogenic Differentiation and Myoblast Fusion During Tongue Development
Name: Dong Han
Faculty Advisor: Yang Chai

Background: The tongue is a muscular organ and plays a crucial role in speech, deglutition and taste. Despite the important physiological functions of the tongue, little is known about the regulatory mechanisms of tongue muscle development. TGF-beta family members play important roles in regulating myogenesis during skeletal muscle development, but the functional significance of Smad-dependent TGF-beta signaling in regulating tongue muscle development remains unclear. Purpose: In this study, we investigated Smad4-mediated TGF-beta signaling in the development of occipital somite-derived myogenic progenitors during tongue morphogenesis. Methods: We use the mesoderm specific Cre, Myf5-Cre, through tissue-specific inactivation of Smad4 (Myf5-Cre;Smad4flox/flox mice0, to investigate the function of Smad-dependent TGF-beta signaling in regulating myogenic cells differentiation in tongue. Results: During the initiation of tongue development, cranial neural crest (CNC) cells occupy the tongue buds before myogenic progenitors migrate into the tongue primordium, suggesting that CNC cells play an instructive role in guiding tongue muscle development. Moreover, ablation of Smad4 results in defects in myogenic terminal differentiation and myoblast fusion. Despite compromised muscle differentiation, tendon formation appears unaffected in Myf5-Cre;Smad4flox/flox mice, suggesting that the differentiation and maintenance of CNC-derived tendon cells are independent of Smad4-mediated signaling in myogenic cells in the tongue. Furthermore, loss of Smad4 results in a significant reduction in expression of several members of the FGF family, including Fgf6 and Fgfr4. Exogenous FGF6 partially rescues the tongue myoblast fusion defect of Myf5-Cre;Smad4flox/flox mice. Conclusion: Our study demonstrates that a TGF-beta-Smad4-FGF6 signaling cascade plays a crucial role in myogenic cell fate determination and lineage progression during tongue myogenesis.

Poster #: 45
Title: Arterioles Provide a Niche for Quienscent Dental Mesenchymal Stem Cell
Name: Hu Zhao
Faculty Advisor: Yang Chai

Background: First study to localize the dental mesenchymal stem cell. Provide a solid evidence against a previous hypothesis on the source of the mesenchymal stem cell. Purpose: Tooth pulp has long been known to contain stem cells population which are able to regenerate the dentin upon physiological attrition or injury. However, its localization within the tooth pulp has been poorly understood. In the current study, we used transgenic mice incisor as the model to localize the niche for maintaining the quiescent dental mesenchymal stem cell. Methods: The H2BGFP based label retaining analysis was conducted by using Wnt1-Cre;rtTA flox/+; tetO-H2BGFP triple transgenic mice. The mice were fed with Doxycyclin containing food for over a month before changing to the Dox free regular food. Retraction of Doxycyclin eliminates the synthesis of new H2BGFP in the incisor mesenchymal cells. Therefore, any fast dividing cell will dilute their H2BGFP through rapid cell division and the end of the one-month chasing period, only slow cycling stem cell will retain H2BGFP which can be detected under fluorescent microscopy. FACS was used to osolate these label retaining cells and immunostaining was conducted to analyze the surface markers expression. Results: Label retaining cells were seen exclusively around the proximal end of arterioles within the incisor tooth pulp. They are negative for NG2, CD146, CD105 and Sca1. Sorted label retaining cells are able to form clone in vitro. Upon injury, these label retaining cells can be activated into proliferation. Conclusion: The proximal end of the arterioles within the incisor provide a niche for the quiescent dental mesenchymal stem cell. It has

been proposed that all the mesenchymal stem cells are indeed pericytes. Our study indicated that DPSC are peri-vascular cells but not pericytes.

Poster #: 46
Title: CTGF Acts as Mediator of the Smad-dependent Pathway of TGFb Signaling in the Regulation of Mesenchymal Cell Proliferation during Palate Development
Name: Jingyuan Li
Faculty Advisor: Yang Chai

Background: Transforming growth factor b (TGFb) signaling pathway plays a crucial role during palatogenesis. Although TGFb signaling has been extensively studied in craniofacial development, the downstream mediators of its function in the developing palate are still unknown. Connective tissue growth factor (CTGF, also known as CCN2), a matricellular protein, is a potential candidate to mediate TGFb signaling during palatogenesis. Purpose: To analyze the regulation of Ctgf expression by TGFb signaling in the developing palate and its impact in the control of crucial cellular activities such as mesenchymal cell proliferation. Methods: We analyzed different mutant mice models including Wnt1-Cre;Tgfbr2fl/fl and Osr2-Cre;Smad4fl/fl mice. In vivo and in vitro approaches were used. Results: Expression profiles of Ctgf/CTGF suggest specific functions during palatogenesis. Knockout of Tgfbr2 and Smad4 in palatal mesenchyme cause obvious downregulation of Ctgf expression, indicating that the Smad-dependent TGFb signaling is required for Ctgf expression. Previous studies have shown that p38 MAPK is overactivated in Wnt1-Cre;Tgfbr2fl/fl palates. Treatment of MEPM cells from control embryos were treated with TGFb1 in combination with an inhibitor of p38 MAPK and compared with control cells treated with TGFb1 alone. The expression of Ctgf in both conditions was similar, suggesting that induction of Ctgf expression by TGFb is not dependent on p38 MAPK. Additionally, treatment of Wnt1-Cre;Tgfbr2fl/fl MEPM cells with SB203580 caused upregulation of Ctgf when compared to non-treated Tgfbr2 mutant cells. This indicates that in pathological conditions, p38 MAPK inhibits Ctgf expression. Substantial evidence suggests that CTGF enhances TGFβ pathway transduction. Wnt1-Cre;Tgfbr2fl/fl and control MEPM cells were treated with CTGF recombinant protein and Ctgf expression was analyzed. Control cells treated with CTGF displayed upregulation of Ctgf expression. However, the treatment of Tgfbr2 mutant cells with CTGF did not cause any effect in Ctgf expression. This indicates that TGFβ signaling is required by CTGF to regulate its own expression. We found that mutation of Smad4 in Osr2-expressing cells phenocopies the defect in cell proliferation observed in Tgfbr2 mutant developing palates and palatal mesenchymal cell proliferation defect in Osr2-Cre;Smad4fl/fl mutants occurs by alteration of TGFb signaling and not that of BMP. Furthermore, we asked whether CTGF might be able to rescue the proliferative defect observed in Wnt1-Cre;Tgfbr2fl/fl and Osr2-Cre;Smad4fl/fl palates. A high number of BrdU-positive nuclei was observed close to CTGF-embedded beads compared to the BSA ones in Wnt1-Cre;Tgfbr2fl/fl and Osr2-Cre;Smad4fl/fl palates. These results suggest that Ctgf acts as a TGFb mediator to regulate cell proliferation during palate development. Conclusion: Our study demonstrates that CTGF acts as mediator of the Smad-dependent pathway of TGFb signaling in the regulation of mesenchymal cell proliferation during palate development. Altered Ctgf expression can be used as an indicator for loss of TGFb signaling. Also, CTGF might be a potential therapeutical target to prevent not only cleft palate but also other malformations affecting the craniofacial complex.

Poster #: 47
Title: Cooperation between SMAD4 and IRF6 is Crucial for Medial Edge Epithelium Disappearance during Palate Formation
Name: Junichi Iwata
Faculty Advisor: Yang Chai

Background: Non-syndromic cleft lip with/without cleft palate (NSCL/P) is one of the most common human birth defects, with genetic and environmental risk factors. Although transforming growth factor beta (TGF-b) signaling and interferon regulatory factor 6 (IRF6) have been identified as genetic risk factors for isolated NSCL/P, little is known about the interaction between TGF-b signaling and IRF6 during palate formation. Purpose: To identify the interaction between TGF-b signaling and IRF6 during palate formation. Methods: We performed both in vivo and in vitro experiments to test our hypothesis that TGF-b signaling-mediated Irf6 expression is responsible for causing cleft palate in Tgfbr2 mutant mice. Results: A haploinsufficiency of Irf6 (Arg84 to cysteine; Irf6+/R84C) results in medial edge epithelium (MEE) persistence in epithelial specific Smad4 mutant (Smad4fl/fl;K14-Cre;Irf6+/R84C) mice, a phenotype similar to that of epithelial specific Tgfbr2 mutant (Tgfbr2fl/fl;K14-Cre) mice. In contrast, palates in Irf6+/R84C or Smad4fl/fl;K14-Cre mice form normally. Strikingly, over-expression of Irf6 rescued MEE persistence in Tgfbr2fl/fl;K14-Cre mice, indicating that gene expression of Irf6 regulated by TGF-b signaling is responsible for MEE disappearance during palate formation. Conclusion: TGF-b signaling regulates gene expression of Irf6 and the fate of the MEE during palate formation in mice. Thus, TGF-b signaling may influence the risk of NSCL/P through inactivation of the IRF6 pathway.

Poster #: 48
Title: Developing Developmental Bioinformatics
Name: Richard Pelikan
Faculty Advisor: Yang Chai

Background: The field of developmental biology is rapidly gaining complex tools to target and analyze potential causative genetic factors for many diseases. ChIP- and RNA-Seq are two examples of such tools. The nature of analyzing developing embryos results in limited but valuable data. Purpose: It is not simple to gain complete coverage of all developmental stages of an organism and determine every possible genetic influence. However, several possible methods may be applicable to help us derive as much value out of data as possible. Looking at genetic expression is not enough - we must also look at timing of expression, and ask questions about which changes influence cell fate at what time. Methods: To this end, we are developing several bioinformatic tools to address the tasks most commonly facing developmental biologists. A querying tool combines information about genomic regions of interest in the DNA, and ties it to changes in expression. Visualization techniques allow us to track the progression of developing cells while understanding the roadway of development. And evolutionary genomic analysis adds insight and prior knowledge when additional data is unavailable. Results: The results are preliminary, but the future role of these tools can already be seen. The usage of our tools has helped guide our understanding of the role of Neural Crest Cells in development and disease, such as cleft palate. Conclusion: The continuing development of these tools is beginning to flesh out specialized methods for developmental biology. As data continues to improve, so must the need for developmental bioinformatics.

Poster #: 49 Title: Prenatal Exposure to Alcohol Causes
Craniofacial Defects
Name: Zhe Zhong
Faculty Advisor: Yang Chai

Background: Children born to chronic alcoholic women demonstrate Fetal alcohol syndrome (FAS). Purpose: In our project, we aim to investigate the mechanism of maternal alcohol consumption caused FAS. Methods: Pregnant C57BL/6J mice were divided into two groups: group 1 was supplied with 10% ethanol from E7.5 in one test tube; group 2 was supplied with 20% ethanol from E7.5 in one test tube; group 3 was supplied with 40% ethanol from E7.5 in one test tube. Histology analysis was performed with HE staining on group 3

newborns. Results: For 10% ethanol group, no embryos demonstrated palatal cleft after prenatal ethanol exposure. For 20% ethanol group, one out of 39 embryos showed severe craniofacial defects including palatal cleft. For 40% group, 3 out of 48 newborns presented primary palate cleft. After prenatal ethanol exposure, the enamel shape is irregular and immature in the incisors. In molar region, the odontoblasts formed non-polarized cuboidal cells and the layer of odontoblasts could not be clearly distinguished from the adjacent mesenchymal cells. Compared with the control, the palatal shelves were much thinner. Conclusion: The penetrance of recognizable craniofacial defects caused by prenatal 40% ethanol exposure is 6.25% which is close to FAS penetrance in human beings. The ameloblasts, odontoblasts and palatal development were compromised after prenatal exposure.

Poster #: 50
Title: Technetium-99 Conjugated with Methylene Diphosphonate Ameliorates Ovariectomy-induced Osteoporosis without any Risk of Osteonecrosis in the Jaw
Name: Yinghua Zhao
Faculty Advisor: Songtao Shi

Background: Bisphosphate therapy has been widely utilized in clinical treatment, but concerns have been raised by the emergence of bisphosphonates-related osteonecrosis of the jaw (BRONJ). We recently found that BRONJ is a disease due to immune dysfunction triggered by solely administration of bisphosphonates. Therefore, it is important to develop a drug with immunomodulatory properties to cure osteoporosis without causing BRONJ. Purpose: The aim of this study was to evaluate the therapeutic effect of 99Tc-MDP to ovariectomy-induced osteoporosis, and the mechanism of avoiding the onset of BRONJ. Methods: C3H mice underwent OVX and were administered with 99Tc-MDP or Zometa, followed by MicroCT and histological analyses in femurs. The characteristics of cultured BMMSC were verified. C57BL/6J received intravenous 99Tc-MDP/dexamethasone (Dex) or Zometa/Dex, followed by maxillary first molar extractions. Untreated mice with tooth extraction were used as controls. The maxillary bones were harvested to evaluate clinical signs of BRONJ lesions, and spleens were collected for Th17/Tregs analyses. Results: MicroCT and histological analysis showed that 99Tc-MDP administration at 2 weeks post-OVX procedure significantly increased bone mineral density (BMD), and improved trabecular bone structures in comparison to the untreated OVX group. 99Tc-MDP could inhibit colony forming units-fibroblast (CFU-F) and proliferation rate of BMMSCs from OVX mice, and reduce osteoclast number, whereas enhanced osteogenic differentiation and decreased the adipogenic differentiation capacity of BMMSCs. On the other hand, OVX mice treated with 99Tc-MDP/Dex showed minimal BRONJ risk. Conclusion: 99Tc-MDP administration provides a promising approach in the treatment of OVX-induced osteoporosis 99Tc-MDP without risk of causing BRONJ.

Poster #: 51 Title: Alternative TGF-b Signaling Causes Cleft Palate in Tgfbr2 Mutant Mice
Name: Akiko Suzuki
Faculty Advisor: Yang Chai

Background: Mutations in transforming growth factor beta (TGF-b) type II receptor (TGFBR2) are associated with cleft palate and other congenital malformations in humans. Similarly, loss of Tgfbr2 in neural crest cells leads to cleft palate and other developmental defects in mice. However, it is still unknown how TGF-b signaling is involved in regulating palatal development. Purpose: We investigated the TGF-b signaling mechanism during palatogenesis. Methods: We performed microarray analyses to identify TGF-b downstream target genes during palatogenesis using Tgfbr2 mutant mice. Based on the gene expression profile analyses, we performed both in vivo and in vitro experiments to test our hypothesis that a TbRII-independent TGF-b signaling mechanism is responsible for causing cleft palate in Tgfbr2 mutant mice. Results: We found that loss of Tgfbr2 in neural crest cells results in elevated TGF-b2 expression in mice. The elevated TGF-b2 activated an alternative TGF-b signaling pathway that was responsible for the cranial neural crest (CNC) cell proliferation defect in Tgfbr2 mutant mice. Modulation of this alternative TGF-b signaling pathway rescued the CNC cell proliferation defect and resulted in normal palatal fusion. Furthermore, modulation of this alternative TGF-b signaling also resulted in partial rescue of other craniofacial defects in Tgfbr2 mutant mice, suggesting that this alternative TGF-b signaling is a widely used mechanism and deserves further investigation. Conclusion: Modulation of TGF-b signaling may thus be beneficial for the prevention and diagnosis of congenital birth defects.

Poster #: 52
Title: Cleft Palate in Ctgf-null Mice: A Model to Study the Intrinsic and Extrinsic Factors Influencing Palatal Shelf Elevation
Name: Carolina Parada
Faculty Advisor: Yang Chai

Background: CTGF is a matricellular protein that interacts with growth factors and integrins to regulate vital biological activities, including proliferation and ECM synthesis. In mice, Ctgf deficiency leads to skeletal dysmorphology and cleft palate, which is due to failure of the palatal shelves to elevate. Theories concerning shelf elevation can be broadly divided into two groups: (1) the shelves elevate as a result of extrinsic activity from other craniofacial structures and (2) elevation requires an active role by the shelves themselves. The cause of failure of shelf elevation in Ctgf-null mice is still unknown. Purpose: Our study is designed to elucidate the cause of cleft palate in Ctgf-null mice. Methods: Our analyses of Ctgf-null-mice included morphogeometric studies as well as in vivo and in vitro approaches. Results: In order to determine the cause of cleft palate in Ctgf-null mice, we analyzed intrinsic and extrinsic factors previously reported to be associated with palatal shelf elevation processes. In our evaluation of intrinsic influences, apoptosis and proliferation levels in Ctgf mutants were comparable to those of controls prior to and after elevation. However the expression of several ECM proteins, including collagens, was changed. Analysis of the expression domains of ECM proteins suggests an alteration in the oro-nasal patterning of Ctgf-null palates. Next we evaluated extrinsic factors using in vitro and in vivo assays and we ruled out that malposition of the tongue due to mandibular hypoplasia in Ctgf mice was mechanically interrupting elevation. Morphogeomeotric analyses indicated there are significant shape differences between Ctgf mice and controls distributed all over the skull but that the most severely affected regions are the palate and the anterior cranial base. Ctgf- null-mice have a short anterior cranial base and a significantly higher degree of cranial base flexion relative to control mice. A multivariate regression analysis of shape on cranial base angle suggests that palate and cranial base are not independent and that there is a relationship between the changes occurring in the palate and the cranial base caused by altered expression of Ctgf. Conclusion: Our findings suggest that the cause of cleft palate in Ctgf-null mice is a combination of intrinsic and extrinsic defects, including altered ECM synthesis within the palatal shelves and defective straightening of the cranial base during development.

Poster #: 53 Title: Biomechanical Demands and Effectiveness of Yoga Variations in Older Adults
Name: Sean Yu
Faculty Advisor: George Salem

Background: A 2008 study indicates that 15.8 million U.S. adults practice Yoga. Nearly 20% Of the Yoga practitioners surveyed are over 55 years old. The acceptance and popularity of Yoga in seniors may be due to its relatively smooth movements and its purported associated improvements in strength, flexibility and balance. Conventional wisdom suggests, however, that the traditional poses

used in older-adult programs should be modified to increase senior participation and prevent injury. The Tree (Vrksasana) pose is traditionally incorporated and modified into these programs. Common modifications of the pose include the use of a wall for balance (TreeW) and placement of the contralateral foot on the floor (TreeWF). Nevertheless, there is little biomechanical evidence demonstrating the benefits and insights of these Yoga variations. Purpose: To understand the biomechanical demands of the Tree pose and its variations by examining the lower extremity joint moments engendered during their performance by elderly participants. Methods: 10 healthy older adults (2M & 8F, 71.5 ± 5.0 yr.) participated in this study. After 16 weeks of Yoga sessions, the participants were instrumented for biomechanical analysis and performed the Yoga routine under an experienced yoga instructor's instructions. Joint moment of force (JMOF) of the dominant knee and hip in the frontal plane, and the support moment were chosen to identify Yoga's demands and effectiveness. Repeated measures ANOVA and Tukey HSD post hoc tests were used to examine the differences across variations of the Tree pose. Results: Support moment for the traditional Tree was significantly larger than both of its variations. An increasing physical demand was found from the double-support to single-support position (TreeWF to TreeW) and from wall-supported to unsupported pose. Both hip and knee abductor moments did not differ between the two single-support Tree poses; however, both single-support poses produced greater hip and knee abductor moments than the double-support pose (TreeWF). Conclusion: Traditional perspectives related to the modification of yoga poses may not lead to more effective positions for older practitioners. This study demonstrated that using a wall for support during performance of the Tree does not reduce knee or hip frontal plane moments. With regard to lower extremity and balance strengthening, it is observed that both single-support Tree poses are likely to be equally effective at targeting the hip abductors. Thus, instructors need not insist on a free-standing Tree pose for this training purpose and older adults with balance limitations can be encouraged to use a wall for support.

Poster #: 54
Title: Amelogenin-Containing Chitosan Hydrogel for Biomimetic Enamel Remineralization
Name: Qichao Ruan
Faculty Advisor: Janet Oldak

Background: Enamel reconstruction is a significant topic of study in materials science and in dentistry as a novel approach for prevention and treatment of caries. During amelogenesis, the initial formation of organized enamel crystals occurs in an amelogenin-rich gel-like matrix. Purpose: Amelogenin-containing chitosan hydrogel was investigated as a matrix for enamel remineralization. Our objectives were (1) to investigate the interaction between chitosan and amelogenin, and (2) to optimize conditions for preparation and mineralization of chitosan hydrogel in the presence of amelogenin. Methods: Chitosan-amelogenin interactions were investigated by Circular Dichroism (CD) and Fluorescence spectroscopy. Recombinant amelogenins (rP172) and HPO42- were mixed with chitosan, and Ca2+ ions were introduced by diffusion to initiate mineralization. For re-mineralization experiments the complex hydrogel was applied onto the etched human enamel surface prior to mineralization in artificial saliva. The morphologies of mineralized chitosan-based matrix were observed by scanning electron microscopy. 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 3 days in artificial saliva, random bundles of needle-like crystals were observed inside the rP172-containing chitosan hydrogel. When etched enamel surface was covered by amelogenin-containing hydogel, the typical radial pattern of prisms was preserved following mineralization reaction suggesting that the oriented growth of crystals on the enamel surface was templated by the amelogenin-chitosan matrix and the pre-existed substructure. Conclusion: These preliminary data support the notion that amelogenin-containing chitosan hydrogel is a promising and easy-to-handle biomaterial for enamel repair.

Graduate Pre-Doctoral Candidate

Poster #: 55
Title: Aggregatibacter actinomycetemcomitans Evolves in vivo in Patients with Periodontal Disease
Name: Ruoxing Sun
Faculty Advisor: Casey Chen

Background: Periodontal pathogen Aggregatibacter actinomycetemcomitans (Aa) exhibits remarkable variations in genomic content among strains. Such variations may be due to evolutionary adaptation of the species to the human host. Purpose: To determine whether Aa strains may evolve in vivo in patients with periodontal disease. Methods: Four pairs of Aa strains isolated from four individuals over a period of 0-10 years were examined for gene gains and losses. These strains were subjected to genome sequencing, comparative genomic hybridization with an Aa pan-genome microarray. Detected genomic differences were verified by PCR/sequencing. Transcriptome analysis was also performed for 3 pairs of the Aa strains grown in an identical laboratory condition. Results: Two pairs of Aa strains demonstrated genomic variation within the paired strains. For strains 2302 (first strain)/AAS4a (isolated after 3 years) the former strain gained a gene (encoding a bacteriophage Mu GP27-like protein). For strains serotype b S23A/nontypeable I23C (isolated at the same time) the former strain has 10 genes that were not detected in the latter strain. Seven of the 10 strain-specific genes resided on two loci of 1,736 bp and 2,816 bp. The inability to express the serotype specific antigen in strain I23C was likely due to a 353-bp reversion within the serotype gene cluster. The transcriptomes of Aa strains were identical for 2 pairs of Aa, but showed 8 genes with ≥2-fold difference in expression levels for S23A/I23C. Conclusion: Aa genomes are stable over time but may evolve due to gains and losses of genes in vivo.

Poster #: 56
Title: Bone Regeneration by AMOR: The Role of Scaffolds Functionalized with Anti-BMP-2 Antibody
Name: Sahar Ansari
Faculty Advisor: Homa Zadeh

Background: Bone regeneration often requires harvesting of autologous bone from various donor sites.BMP has provided an attractive therapeutic alternative to autologous bone grafting by administration of rhBMP-2. Purpose: The purpose of the current study was to examine the efficacy of immobilized anti-BMP-2 antibodies on 3 different biomaterials in promoting Antibody Mediated Osseous Regeneration (AMOR). Methods: Three scaffolds used included Ti microbeads, alginate hydrogel (Alg) and absorbable collagen sponge (ACS). Anti-BMP-2 mAb (25 ug/ml), isotype control Ab (negative control; 25 ug/ml) as well as recombinant human BMP-2 (rhBMP-2, 1.5mg/ml; positive control) were adsorbed on each of the scaffolds by incubation at room temperature for 1 hour. The treated biomaterials were surgically implanted into 5mm rat calvarial defects. After 8 weeks, the animals were sacrificed and calvarial specimens were harvested. Micro-CT analysis of dissected calvarial specimens was followed by histologic and histomorphometric analysis to evaluate bone formation. 5 µm thick sections were stained with hematoxylin and eosin and Masson Trichrome. Nikon camera was used to image the stained slides and the histomorphometric analyses were performed using NIH ImageJ software. Immunohistochemistry was used to examine the distribution of BMP-2 and

osteocalcin proteins in situ. One-way and two-way analysis of variance (ANOVA), followed by Tukey`s test at significant level of α = 0.05, was used for statistical analysis of data. Results: The micro-CT and histomorphometric analysis showed significant bone regeneration within calvarial defects implanted with anti–BMP2 mAb immobilized on each of the scaffolds, but not those with isotype control Ab ($p<0.05$). Ti microbeads showed the highest degree of bone regeneration, followed by alginate hydrogels and ACS. The degree of bone regeneration achieved with immobilized anti–BMP2 mAb was comparable to the positive control (rhBMP-2). Conclusion: This study confirms the ability of anti-BMP2 mAb to efficiently promote bone formation when immobilized on protein (ACS), hydrogel (Alg) as well as metal (Ti) scaffolds.

Poster #: 57
Title: Marginal Fit of All-ceramic Crowns using Conventional and Digital Impressions
Name: Ana Luisa Oliveira
Faculty Advisor: Jin-Ho Phark

Background: The use of CAD/CAM technology for fabrication of indirect restorations is increasing. However, the accuracy, especially in terms of marginal fit has been questioned for such systems. Purpose: To compare the marginal fit of pressed all-ceramic crowns made on dies obtained from conventional vinyl polysiloxane (VPS) and digital impression system. Methods: An all-ceramic full-coverage crown preparation with shoulder margins and 90° finishing line, mounted in a typodont was used as master preparation for conventional and digital impressions. Ten conventional VPS impressions were made by double-mix technique (Extrude WASH, Extrude EXTRA, Kerr), poured-up with die stone (Hard Rock, Whip Mix), sectioned and trimmed. To obtain digital impressions the master preparation was scanned 10 times using iTero (Cadent). A milled polyurethane model (iTero Model, Cadent) was obtained from each scan. Results: Marginal gap width in µm: - VPS(Mean=58.62±47.87; Mesial=59.52±48.81; Distal=51.05±33.62;Facial=51.80±38.94; Lingual=69.15±63.60). - iTero (Mean=60.85±53.58; Mesial=60.45±42.03; Distal=69.40±53.08; Facial=67.95±72.28; Lingual=54.55±44.48). No statistically significant differences were found between conventional and digital impressions. Conclusion: Marginal fit of pressed all-ceramic crowns obtained from conventional VPS and digital impressions are comparable.

Poster #: 58
Title: A Narrative Analysis of Fathering Occupations
Name: Aaron Bonsall
Faculty Advisor: Mary Lawlor

Background: Though mothering occupations have been an important subject within occupational science, fathering occupations have received little attention. From a multidisciplinary perspective, researchers have increasingly called for an examination of quality of time fathers spend with their children. I propose the use of fathering occupations in order to examine what fathers and their children with disabilities are doing together. Purpose: The aim of my research was to use fathering occupations in order to examine what fathers and their children with disabilities are doing together. Methods: In order to identify fathering occupations I examined narratives of participation in occupations within memoirs written by fathers of children with special needs. Books ranged form the 2000 to 2011 and were written by fathers themselves. There were 17 books identified on Amazon.com available for the Amazon Kindle, a popular electronic reader with over one million titles available. Descriptions of occupations were collected and classified into themes. Themes that emerged were described and analyzed. Results: The six themes that emerged in the literature are co-created occupations, meaningfulness of the ordinary, the importance of communication, distribution of responsibilities, adaptations, and extending the fathering role. Conclusion: This examination of the experience of raising a child with disabilities written by the fathers demonstrated that occupations could be a valuable way to examine the participation between fathers and children with disabilities. This study of fathering occupations proved to be a valuable means to examine the quality of time that fathers spend with their children from a fathering perspective.

Poster #: 59
Title: Acceptance of Randomized Assignment in Adolescent Cleft Palate Trial
Name: Elizabeth Jane McIlvaine
Faculty Advisor: Stephen Yen

Background: Dr. Yen developed a new, non-surgical technique for correcting underbite. The NIH requested a design for a randomized clinical trial but there were possible factors that would make randomization difficult. Purpose: To assess the feasibility of randomizing treatment (surgical vs. non-surgical) correction of a Cl III malocclusion(underbite) resulting from earlier surgical correction of cleft lip and palate. Methods: Surveys about willingness to accept randomized treatment during adolescence(13-17) were mailed to the parents of cleft lip and palate patients under the care of CHLA between 2005 and 2010 as identified by billing records. Inclusion criteria were cleft lip and palate, a Cl III malocclusion and absence of medical and cognitive contraindications to treatment. Out of 287 surveys 82 were completed and returned. Results: Forty-seven percent of subjects held a strong treatment preference (95% CI: 35% - 58%) while thirty percent were willing to accept randomization (CI: 20% - 41%). Seventy-eight percent would drop out of a randomized trial if dissatisfied with assigned treatment (CI: 67% - 86%). The three most commonly cited reasons for being unwilling to accept random treatment assignment were 1)the desire for doctors to have input on treatment, 2) the desire for parents to have input on treatment, and 3) the desire to correct the underbite as early as possible. Conclusion: There is sufficient evidence that parents and patients would be unwilling to accept a randomly assigned treatment and would not remain in an assigned group if treatment did not meet expectations. Possible contributing factors include the dissimilarities between the two treatments, the comparatively late age of the treatments, and the formation of strong treatment opinions by patients and their parents over the course of the child's medical care. A randomized clinical trial may not be feasible for Cl III treatment in adolescent patients and a prospective cohort design may need to be considered.

Poster #: 60
Title: Investigating the Regulatory Role of HU Protein PG0121 in Porphyromonas gingivalis Capsule Expression
Name: Natalia Tjokro
Faculty Advisor: Steven Goodman

Background: K-antigen capsule is one of the key virulence factors of the oral pathogen Porphyromonas gingivalis. This cell surface structure is encoded by a series of genes transcribed as a large polycistronic message. Previously, a 77-bp inverted repeat region was identified upstream of the start codon of PG0106, the first gene in the synthesis cluster, that was predicted to form a large stem-loop structure. Two genes that flank the synthesis cluster (PG0104 and PG0121) were also found to be co-transcribed with the capsule synthesis operon, and they are both predicted to encode DNA binding proteins because of their high similarity to other known DNA binding proteins. The transcript levels of the capsule synthesis genes in PG0121 deletion mutants are significantly lower than the parent strain, indicating that PG0121 plays a role in regulating expression of the K-antigen capsule synthesis genes. Previous studies have also indicated that PG0121 encodes a non-specific DNA binding protein; thus given the function and sequence similarity, PG0121 likely encodes the HU-β orthologue in P. gingivalis. Purpose: We set out to determine the affinity of HU protein PG0121

to the potential structures formed by the 77-bp inverted region; to further investigate whether or not this region plays a role in the regulation of the K-antigen capsule synthesis. Methods: A series of Electromobility Shift Assay (EMSA) was performed to test the affinity of HU protein PG0121 to the inverted repeat region. Results: We find that the protein encoded by PG0121 interacts with the 77-bp inverted repeat region upstream of the K-antigen capsule synthesis gene cluster non-specifically. Conclusion: The data indicates that the inverted repeat stem loop region may serve as the substrate for HU-beta because this protein prefers the 77-bp inverted repeat heteroduplex DNA over the cruciform DNA substrate. Therefore, the 77-bp inverted repeat homoduplex needs to be tested for its affinity to PG0121 to determine if the mismatches play a role in any enhanced affinity to the DNA.

Poster #: 61
Title: Fibrillin-1 Regulates Lineage Differentiation of BMMSCs through IL-4/mTOR signaling
Name: Chider Chen
Faculty Advisor: Songtao Shi

Background: Fibrillin-1 (Fbn1) plays a crucial role in several osteogenic deficient human diseases such as Marfan syndrome and Systemic Sclerosis (SS). However, the detail mechanism of Fbn1 in bone metabolism is unknown. Purpose: In this study, we try to figure out the detail mechanism of Fbn1-induced osteoporosis in SS mouse model and discover the novel therapeutic manner for the disease. Preclinical pilot study will also be performed in this project. 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 Rapamycin drug therapy to treat Fbn1+/- SS mouse model. Results: We show that Fbn1+/- mice exhibit a low turnover osteoporosis phenotype as indicated by reduction of both bone resorption and formation. BMMSCs from Fbn1+/- mice exhibit decreased osteogenesis alone with increased adipogenesis, which are regulated by IL-4/IL-4Rα pathway through PI3K/Akt/mTOR signaling. IL-4/IL-4Rα pathway in Fbn1+/- BMMSCs is activated by TGFb/Sp1/IL-4R signaling and maintained by IL-4/IL-4R/Stat6 autocrine loop. Furthermore, we show that knockdown IL-4Rα by siRNA or block mTOR by Rapamycin can rescue Fbn1 deficient BMMSC function. To confirm the role of mTOR signaling in SS-associated osteoporosis, we reveal that Rapamycin treatment rescues osteoporotic phenotype in Fbn1+/- SS mice. Conclusion: In the present study, we reveal that Fbn1 control BMMSC osteogenic/adipogenic lineage differentiation via IL4Rα/PI3K/Akt/mTOR signaling. Blockage of mTOR cascade by Rapamycin, an anti-cancer and immune suppression drug, ameliorates osteoporotic phenotype in Fbn1+/- SSc mice.

Poster #: 62
Title: Gingiva Mesenchymal Stem Cell from Different Origin Shows Different Characteristics.
Name: Xiangtian Xu
Faculty Advisor: Songtao Shi, Yang Chai

Background: Organ and tissue development in the craniofacial region derives from different origin, cranial neural crest cells is one of important sources 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 a low inflammation and quick wound healing profiles compared with the other soft tissue. Purpose: We found mesenchymal stem cells in gingiva (GMSC) come both from the neural crest and mesodermal origin, which may have biological significance in maintaining the tissue homeostasis. Methods: We isolate the gingiva mesenchymal stem cell from the Wnt1-Cre; R26R mouse model, using LacZ staining to mark and 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 and in vivo. An induced mouse colitis model was used to test the in vivo immunomodulation capability. Results: Cranial neural crest derived GMSC shows impaired potential of osteogenesis and adipogenesis capacity, but it enhanced neural differentiation ability in vitro. They also display a better immunomodulation and anti-inflammation function compared with the non-neural crest derived GMSC. Conclusion: The composition of the cells from different origin may function as a synergy leading to the distinct character of the gingiva tissue.

Occupational Science and Occupational Therapy Student

Poster #: 63
Title: Reconciling Discrepancies in Incidence Data on Medically Serious Pressure Ulcers
Name: Claire Li
Faculty Advisor: Florence Clark

Background: The USC Pressure Ulcer Prevention Study 2 (PUPS 2) is investigating the cost-effectiveness of a Lifestyle Redesign® intervention in preventing medically serious pressure ulcers (MSPU) in people with a spinal cord injury. Assessment of the hypothesized primary outcome requires precise determination of ulcer incidence. A previous pilot study revealed there were large discrepancies across four data sources for ascertaining incidence of MSPU for the participants in the PUPS 2 Study. Purpose: This study's purpose is to develop a valid method for detecting incidence of MSPU in PUPS 2 participants. Methods: In this study, we are developing a valid approach for reconciling differences in incidence data across six data sources including skin assessments conducted by registered nurses, phone interviews with participants, and four categories of medical records. Incidence data from the six sources on PUPS 2 participants are being entered into a database. Two independent registered nurses next rate the severity of each ulcer by reviewing its description across the data sources. Results: The reconciliation procedures are still being developed. At this point, it appears that the data set possesses discrepancies similar to those found in the pilot study. Conclusion: Between-data-source discrepancies seem to be related to variability in staging standards and missing and/or incomplete medical records. Researchers needing to obtain valid counts of pressure ulcers from multiple sources should anticipate the need to reconcile discrepancies.

Poster #: 64
Title: Structural Neuroanatomy Correlates with Functional Motor-related Networks in Stroke Patients
Name: Sook-Lei Liew
Faculty Advisor: Lis Aziz-Zadeh

Background: Stroke is the leading cause of disability in adults, often resulting in lasting motor impairments that hinder one's ability to engage in meaningful activities. Recent rehabilitation efforts have focused on ways to activate damaged motor regions through action observation, by engaging the putative human mirror neuron system (MNS), a neural network comprised of premotor and parietal motor-related regions that are active both during the execution of an action and the observation of the same or similar actions. Purpose: Here we examined how individual differences in the underlying structural anatomy of the post-stroke brain may influence functional activity in these motor-related brain regions, and how these measures may correlate with behavioral motor outcomes. Methods: We scanned 12 participants with chronic stroke resulting in moderate-to-severe upper limb hemiparesis and obtained high-resolution structural MRIs, diffusion-weighted imaging, functional MRI while participants observed grasp actions, and behavioral scores from standardized motor assessments. Results: Relationships between this battery of measures demonstrate several promising findings: 1) functional plasticity of the MNS when observing actions performed by the counterpart to the paretic limb correlate with structural measures of lesion volume

and ventricular volume, and 2) structural plasticity of motor-related white matter tracts can be examined with functional activation patterns. Conclusion: These findings suggest specific measures of functional and structural plasticity that hold promise as biomarkers for improved motor recovery. Such information provides a foundation for developing individualized treatments that harness each patient's specific profile of structural and functional plasticity post-stroke for maximal rehabilitation benefits.

Poster #: 65
Title: Mirror Neuron System Dysfunction in Developmental Coordination Disorder
Name: Julie Werner
Faculty Advisor: Lisa Aziz-Zadeh

Background: Little is known about the neural etiology of developmental coordination disorder (DCD). DCD is characterized by impairments in motor learning and may overlap with a related condition, developmental dyspraxia, characterized by impairments in imitation. The literature suggests that individuals with DCD may have specific impairments in visuomotor transformation and motor imagery. These impairments implicate the human mirror neuron system, a brain network involved in imitation, motor learning, and motor imagery as a potential site of dysfunction in DCD. Purpose: We sought to determine if differences exist in human mirror neuron system regions between individuals with DCD and typically developing individuals during imitation and motor planning. Methods: 10 participants aged 18-26 (4 DCD, 6 controls) performed imitation, action execution, and action observation of meaningless gestures while undergoing functional MRI. Data was analyzed during motor planning preceding imitation and during imitation. Results: Whole-brain fMRI data reveals functional neural activity differences in regions of the human mirror neuron system, namely the IFG, ventral premotor area, and IPL, during imitation and motor planning in individuals with DCD as compared to typically developing peers. Conclusion: Dysfunction in the human mirror neuron system may be responsible for the motor learning and imitation impairments in DCD. Furthermore, these results suggest a potential explanation for related impairments in DCD, such as motor imagery impairments.

Poster #: 66
Title: Coding Children's Behavior during Oral Care: A Reliability and Validity Study
Name: Leah I. Stein
Faculty Advisor: Sharon A. Cermak

Background: Oral health is integral to both physical and psychological well-being, yet is particularly challenging for certain populations such as children with developmental disabilities (DD), including 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 dental fear and anxiety (DFA), as well as over-responsivity to sensory stimuli, which are well-documented in children with DD/ASD. Within the literature self-, parent-, and dentist-report measures of anxiety and behavior are frequently utilized to examine DFA and uncooperative behaviors. Although observational measures exist to assess the anxiety and distress of children during painful procedures such as bone marrow aspirations, no measure with clear operational definitions objectively examines the challenging behaviors displayed by children during routine dental care. Purpose: To modify and adapt existing measures to create a rating scale, the Child's Dental Behavior Rating Scale (CDBRS), to evaluate challenging behaviors during dental treatment. We developed the CDBRS, created operational definitions for all variables, and examined its psychometric properties including inter-rater reliability and validity. Methods: Dental cleanings were video-recorded in 22 participants aged 6-11 years (n=14 DD/ASD; n=8 typical). Utilizing these recordings and existing behavior observation measures in an iterative process, the CDBRS was developed. Reliability and validity analyses were conducted. Results: Inter-rater reliability was high for CDBRS ratings of each of the individual videos (K's=.73-.98; all p's=.00) as well as the combined reliability (K=.90; p=.00). Validity analyses are currently being performed. Conclusion: This rating scale will benefit future research analyzing children's behavior in the dental setting.

Poster #: 67
Title: Sensory Integration Patterns in Autism Spectrum Disorder
Name: Susanne Smith Roley
Faculty Advisor: Sharon Cermak

Background: Sensory differences in individuals with autism are commonly reported, yet, to date, there are no reports using standardized measures of sensory functions. The Sensory Integration and Praxis Tests (SIPT) are standardized measures with well documented sensory processing and integration patterns; however there are no reports of the use of these measures with individuals diagnosed with an autism spectrum disorder (ASD). While anecdotal evidence exists for the link between sensory-related deficits and performance difficulties in ASD, this has not been studied specifically in relation to the relevance for the provision of occupational therapy and children with ASD. Purpose: This descriptive study is a retrospective analysis of occupational therapy evaluation results in a sample of children with ASD. Patterns of sensory integration and praxis in this sample will be compared to those published on typical and learning disabled samples. As part of this study, referring problems will be studied to determine whether there are links between types of sensory integration and praxis deficits present in ASD and reported performance difficulties. Implications for the relationship between sensory integration and praxis patterns and performance deficits will be made along with recommendations for occupational therapy practice with children with ASD. Methods: Information will be recorded in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. The data will be analyzed descriptively to identify patterns of sensory integration dysfunction in samples of children with ASD compared to children without ASD. The data on referring problems and performance deficits in children with ASD will be coded and analyzed relative to the emerging patterns of sensory integration and praxis. Results: The results of the study will be prepared for dissemination to report on patterns of Sensory Integration and Praxis in children with ASD, relevance of these difficulties to referring problems for occupational therapy, and the implications for the impact of sensory integration and praxis deficits on performance in the daily lives of families who have children with ASD. Conclusion: The study will inform occupational therapy practitioners and consumers of occupational therapy about the nature of sensory processing and integration difficulties, standardized assessments available for children with ASD, and possible interventions that address sensory-related and performance deficits.

Biokinesiology and Physical Therapy Student

Poster #: 68
Title: Validity and Accuracy of a Slip Resistance Measurement Protocol
Name: Mark G Blanchette
Faculty Advisor: Christopher M Powers

Background: Slips occur when an individual's utilized friction (uCOF) exceeds the available friction provided by the shoe-floor interface. Currently, the method accepted in the footwear industry as the gold standard to assess available friction (SATRA STM 603) has not been evaluated in the peer-reviewed literature. Purpose: To assess validity and accuracy of the SATRA STM 603 whole shoe tester using standard ISO EN13287 in predicting slip potential. Methods: During a walking trial, 34 subjects were exposed to a potentially slippery condition (distilled water applied to porcelain tile). Ground reaction forces were recorded and used

to calculate uCOF (ratio of resultant shear to vertical force). Available friction of the wet porcelain was assessed with the SATRA STM 603. Logistic regression was used to determine the relationship between slip probability and the difference between available and uCOF. Validity was determined by model significance (Wald test $p<0.05$). Slip prediction accuracy was determined as the percentage of no-slip and slip outcomes that corresponded to the associated positive or negative difference between available and uCOF. Results: Twenty-two subjects slipped and 12 did not slip. The difference between available and peak uCOF was a significant predictor of slip outcome for the EN13287 protocol ($p = 0.034$). The model accurately classified 0% of slip events (0/0) and 35.3% of no-slip events (12/34). Conclusion: Our results indicate that using the SATRA STM 603 with the EN 13287 protocol is a valid method to predict slip potential. However, the poor accuracy with which this protocol predicts slip potential suggests an alternative protocol should be explored.

Poster #: 69
Title: Patella Water Content and Bone Marrow Lesions in Patellofemoral Pain
Name: Kai-Yu Ho
Faculty Advisor: Christopher M. Powers

Background: It has been shown that individuals with patellofemoral pain (PFP) exhibit greater patellofemoral joint (PFJ) stress during functional activities. Higher stress is thought to result in increased bone marrow water content, and MR-detected bone marrow lesions (BMLs). The presence of BMLs may result from the accumulation of extracellular fluid within bone marrow and has been suggested as a source of pain. Purpose: The purpose of this study was to compare patella water content and BMLs between individuals with and without PFP using an iterative decomposition of water and fat with echo asymmetry and least squares estimation(IDEAL) MRI protocol. Methods: Nine females with PFP and 8 gender, age, weight, and height-matched pain-free controls participated. A spoiled-gradient-echo IDEAL protocol was utilized. The reconstructed fat-fraction images were used for water content calculation and identification of BMLs. An independent t test was used to compare patella water content between PFP and control subjects. Chi-square test was used to compare the proportion of exhibiting BMLs between PFP and control subjects. Results: Individuals with PFP demonstrated significantly higher patella water content when compared with pain-free controls (14.1±3.4% vs. 9.4±2.6%; $p=0.006$). Local BMLs were observed in 44.4% (4/9) of PFP subjects and 12.5% (1/8) of control subjects ($p=0.149$). All local BMLs were found at the lateral facet of patella. Conclusion: We propose that the increase in patella water content found in the patellofemoral group may be responsible for PFP. The higher patella water content may be indicative of venous engorgement and elevated extracellular fluid due to chronic overloading.

Poster #: 70
Title: Effects of Hip Abductor Fatigue on Ankle Biomechanics during a Dynamic Task
Name: Szu-Ping Lee
Faculty Advisor: Christopher Powers

Background: Previous studies have shown that diminished hip abductor performance is associated with increased risk of ankle injury and postural instability. However, the effects of hip abductor dysfunction on ankle pathomechanics and neuromuscular activation have never been investigated. Purpose: To investigate the effects of hip abductor fatigue on ankle biomechanics and neuromuscular activation during a unipedal drop landing task. Methods: Thirty healthy females participated. Ankle biomechanics and neuromuscular activation of the ankle muscles were assessed before and after a hip abductor fatiguing exercise protocol. Peak ankle inversion/eversion angles, moments, and EMG amplitude from medial gastrocnemius (MGAS), peroneous longus (PL), soleus (SOL) and tibialis anterior (TA) were sampled during the deceleration phase of landing. Paired t-tests were used to detect the effects of fatigue. Results: Significant increases in peak eversion angle (8.6 ± 2.9° vs. 9.5 ± 3.4°, $p = 0.01$) and decrease in peak ankle inversion angle (3.4 ± 5.2° vs. 2.6 ± 5.2°, $p < 0.01$) were observed. For ankle moments, significant increase of inverter moment was observed (0.61 ± 0.39 vs. 0.63 ± 0.41 Nm/kg, $p = 0.03$). Analyses of the EMG amplitudes revealed significant increases in PL and SOL activation (0.75 ± 0.18 vs. 0.86 ± 0.21, $p < 0.01$; 0.94 ± 0.36 vs. 1.06 ± 0.47, $p = 0.04$, respectively) after hip abductor fatigue. Conclusion: Our findings suggested that hip abductor fatigue can lead to altered ankle joint biomechanics and increased neuromuscular activation of the lower leg. These changes indicated a compensatory ankle balance strategy in the presence of proximal instability.

Poster #: 71
Title: Lower Extremity Dexterity is Associated with Agility in Soccer Athletes
Name: Mark Lyle
Faculty Advisor: Christopher Powers

Background: Agility is important for sport performance and potentially injury risk, but intrinsic factors that influence agility performance remain unknown. The capability to dynamically interact with the ground (i.e. dexterity) could be an attribute that influences agility performance. Recently, we developed a method to quantify this sensorimotor ability we call the lower extremity dexterity test (LED-test). Purpose: To examine whether dexterity (as opposed to strength and power) is associated with agility in high-school soccer athletes. Methods: Lower extremity dexterity, strength, power, and agility were assessed in 14 male and 14 female high-school soccer athletes. The LED-test was used to evaluate the capability of the lower limb to dynamically interact with the ground. Single limb agility was evaluated using a hopping sequence that focused on change of direction ability. Pearson correlation coefficients were used to evaluate the association between agility and measures of dexterity, strength and power in males and females separately. For variables with significant correlations across sex, linear regression was used to evaluate their association with agility after controlling for sex. Results: Dexterity was the only variable significantly correlated with agility (females: $r= -0.65$; males: $r= -0.73$), and explained 49% of the variance in agility after controlling for sex. Conclusion: This study provides evidence that the LED-test quantifies an important construct required for sudden deceleration and change of direction maneuvers in male and female soccer athletes. Given that most sports injuries occur during rapid transition maneuvers, lower extremity dexterity may also influence injury risk.

Poster #: 72
Title: Changes in Hip Biomechanics Following Surgical Intervention for Femoracetabular Impingement
Name: Jennifer Peterson
Faculty Advisor: Christopher Powers

Background: Femoroacetabular impingement (FAI) is a cause of hip and groin pain. Also, FAI is thought to affect hip kinematics and kinetics. Although arthroscopic surgery to correct bony deformity and repair damaged tissue is common, little is known of the effects of surgery on pelvis/hip biomechanics. Purpose: To compare sagittal plane pelvis and hip kinematics and hip kinetics during a step down task before and after arthroscopic surgery in individuals with FAI. Methods: Four individuals with FAI (3 female, 1 male) have participated thus far in this on-going study. Kinematic and kinetic data during a step down task were collected using Qualysis Motion Capture (250Hz) and AMTI force plates (1500Hz) prior to and 3.5-14.5 months post arthroscopic osteochondroplasty/labral repair. Sagittal pelvis and hip kinematics, and hip kinetics were compared within subjects before and after surgery using paired t-tests ($\alpha=0.05$). Results: Following surgery, individuals with FAI subjectively reported decreased pain and increased sports participation (11.3% vs. 81.3%, $p=0.014$).

In addition subjects exhibited increased total sagittal pelvis motion (4.7° vs. 7.4°, p=0.047), peak hip flexion (41.7° vs. 46.5°, p=0.019), and peak hip extensor moment (0.15Nm/kg vs. 0.68Nm/kg, p=0.039). Average sagittal hip moment changed from a flexor moment (0.006Nm/kg) to an extensor moment (0.37Nm/kg) (p=0.023). Conclusion: Following arthroscopy and rehabilitation individuals with FAI reported increased sports participation secondary to decreased hip pain. In addition, subjects also demonstrated increased sagittal pelvis motion and hip flexion, resulting in increased utilization of the hip extensors (i.e increase in the hip extensor moment).

Poster #: 73
Title: Muscle Performance and Landing Biomechanics Following a Hip-focused Training Program
Name: Kristen Stearns
Faculty Advisor: Christopher M. Powers

Background: Deficits in hip muscle performance have been proposed as an underlying cause of abnormal lower extremity biomechanics thought to place females at higher risk for ACL injury. Purpose: To determine if an intervention program aimed at improving hip muscle performance can influence lower extremity biomechanics during a drop-jump task. Methods: Eighteen recreationally active females participated in biomechanical and muscle performance testing before and after a 4 week training program (3 times/week, 30 min/session). The program consisted of hip-focused plyometric and balance perturbation exercises. Maximal rate of torque development (RTD) for the hip abductors (HA) and hip extensors (HE) was assessed during a rapid isometric contraction. Peak hip and knee flexion angle, peak knee abduction angle, and peak knee adductor moment were calculated over the early deceleration phase of a drop-jump task. Pre- vs. post-training differences were evaluated using paired-samples t-tests ($p \leq 0.05$). Results: Post-training, there was a significant increase in HA RTD (757.9 ± 164.4 vs. 863.5 ± 220.2 Nm/ms; p=0.002) and HE RTD (1253.3 ± 440.4 vs. 1368.6 ± 436.7 Nm/ms; p=0.0002). Post-training, there was a significant increase in peak knee ($p \leq 0.001$) and hip flexion angles (p=0.04); and a significant decrease in peak knee abduction angle ($p \leq 0.02$) and knee adductor moment ($p \leq 0.003$). Conclusion: Changes in lower extremity biomechanics can be achieved by increasing hip muscle RFD. We propose that injury prevention training programs targeting hip muscle RFD may be important in mitigating biomechanical risk factors associated with ACL injury in female athletes.

Poster #: 74 Title: Trunk Posture is Associated with Patellofemoral Joint Stress during Running
Name: Hsiang-Ling Teng
Faculty Advisor: Christopher Powers

Background: Patellofemoral pain (PFP) is one of the most common injuries among runners. A commonly accepted cause of PFP is elevated patellofemoral joint (PFJ) stress. Recent literature suggests that trunk flexion angle can influence the knee extensor moment and therefore, may be related to PFJ stress. Purpose: To examine the association between an individual's self-selected sagittal plane trunk posture and PFJ stress during over-ground running. Methods: Eight healthy adults participated in this study. Trunk and knee kinematics (10 camera Qualysis motion capture system; 250 Hz) and knee kinetics (AMTI forceplates; 1500 Hz) were obtained while subjects ran with their self-selected trunk posture at 3.4m/s. PFJ stress was estimated using a previously described biomechanical model. Results: Significant correlations were found between an individual's self-selected trunk flexion angle and peak PFJ stress (r=-0.50) and PFJ reaction force (r=-0.57). This association was driven by the significant correlation between trunk flexion angle and knee extensor moment (r=-0.73). Conclusion: This is the first study to demonstrate the association between sagittal plane trunk posture and PFJ stress. Our data suggest that a more flexed trunk posture is related to a lower PFJ stress during running. Individuals who run with a more extended trunk posture may pre-disposed to higher patellofemoral joint stress and therefore the development of PFP.

Poster #: 75
Title: Adaptation of Contact Dynamics Following an Eight-week Transition from Shod to Barefoot Running
Name: Rami Hashish
Faculty Advisor: George Salem

Background: Epidemiological studies suggest that 70 percent of the United States' eleven million adult shod (SH) runners will sustain a yearly overuse injury – predominantly in the lower extremity. An increasing number of distance runners are transitioning to barefoot (BF) on the premise that the associated forefoot initial contact (IC) reduces the loading rate (LR), and thus 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: Kinematics and three-dimensional kinetics were collected on two habitually SH distance runners performing over-ground SH running at their self-selected speed and BF running at a matched speed. These runners were measured again following an eight-week transition to BF running consisting of a weekly incremental increase in BF running percentage. Loading rate was quantified as the peak derivative between initial loading (200 N) and the impact transient. Leg stiffness was modeled according to McMahon and Cheng (1990). 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 degrees; ES 2.52), a reduction in LR (-65.6 BW/s; ES 4.05), yet an increase in leg stiffness (1.0 kN/m; ES 2.18). Following the transition period, there was a reduction in plantar flexion at IC (2.2 degrees; ES 1.027), as well as a reduction in both LR (-57.4 BW/s; ES 1.08) and leg stiffness (-4.4 kN/m; 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. This may be associated with an increase potential for bony injury and be indicative of an impaired, or un-practiced, movement strategy. 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. These findings will inform the design of expanded, controlled prospective studies, which are needed to determine a transition protocol from SH to BF running.

Poster #: 76
Title: Adaptations in Plantar-flexor Performance Following a Transition to Barefoot Running
Name: Sachithra Samarawickrame
Faculty Advisor: George Salem

Background: Recent anecdotal reports substantiate a claim first proposed by Robin and Hanna (1987) that habitual barefoot runners have reduced lower-extremity injury rates compared to their shod counterparts. In order to examine the long-term adaptive changes in lower limb muscle performance, a pilot study was conducted to demonstrate the changes in ankle plantar-flexor peak torque (PT) and peak rate of torque development (RTD) in two habitually shod recreational runners who progressively transitioned into barefoot running over an 8-week period. Purpose: To compare the post-exertion decline of ankle plantar-flexor PT and RTD between two running conditions - a novel barefoot condition and a post-transition barefoot condition. Methods: Two habitually shod runners (26-year-old female and 34-year-old male) were tested for PT and RTD at 10° plantar-flexion on a dynamometer, before and after a bout of running (defined as

20% of their typical daily running distance). Dynamometry was repeated after an 8-week transition period. Results: In the novel barefoot condition, PT declined 38-45% (24N.m, 39N.m) for the female and male subject respectively. Post–transition, the PT declined only by 22-26% (17N.m, 25N.m) after exertion. The plantar-flexors demonstrated an overall improvement of 32.5% (Cohen's D Effect Size (ES): 2.12) in resistance to the exertion related decline in PT. In the novel barefoot condition, RTD declined 30-43% (42N.m/s, 59N.m/s). Post–transition, the RTD declined only by 20-29% (24N.m/s, 34N.m/s). The overall improvement of the resistance to the post-exertion decline of RTD was 42.8% (ES: 4.34). Conclusion: There is evidence of adaptive improvements in the performance parameters of the plantar-flexors following a transition to barefoot running. This exploratory study will inform the design of expanded prospective studies on the transition from shod to barefoot running, ultimately leading to the formulation of recommendations on the benefits/risks of transitioning to barefoot running.

Poster #: 77
Title: Holistic Lifespan Health Outcomes Among Intercollegiate Student-Athletes: The TLC Study
Name: Shawn Sorenson
Faculty Advisor: George J. Salem

Background: Despite prominent public attention, lifespan health data for elite athletes remains sparse. Purpose: This investigation provides descriptive epidemiology on holistic lifetime health among Division I intercollegiate student-athletes. Methods: 496 university students and alumni, including varsity student-athletes (SA) and non-athletes (NA), completed anonymous questionnaires documenting lifetime physical, mental and emotional health, health-related quality-of-life (HRQL), and exercise behaviors & attitudes. Age-stratified, cross-sectional analyses were used to evaluate relative risk (unadjusted odds ratios with 95% confidence intervals) for professional treatment of joint, cardiopulmonary, and psychosocial health concerns, in SA compared to NA. Results: Older alumni SA (ages 43+) had 14x the risk of treatment for joint concerns, compared to age-matched NA; odds ratio = 14.0 (1.6 - 126). Current and younger alumni SA had similar risk vs. NA. Collapsed across groups, older alumni were 7x as likely as current students to be treated for cardiopulmonary concerns, but risk was similar for SA and NA. Treatment for psychosocial concerns was similar, irrespective of age and athletic participation. Conclusion: These data suggest that intercollegiate athletic participation increases risk for treatment of joint concerns later in life. Despite high levels of exercise as young adults, SA demonstrated no protective cardiopulmonary health effects, and no differences in psychosocial health. This may offer valuable guidance for interventions seeking to optimize lifespan outcomes in this population. Additional studies are necessary to evaluate exercise and HRQL outcomes, and generalize these results to larger and more diverse populations.

Poster #: 78
Title: Lower Extremity Movement Strategies in Individuals with Achilles Tendinosis
Name: Yu-Jen Chang
Faculty Advisor: Kornelia Kulig

Background: The tendinotic Achilles tendon exhibits lower stiffness. This alteration in tissue material property may impact physical performance. Purpose: The aim of this study is to investigate the L/E movement strategies employed by individuals with and without Achilles tendinosis during novel unipedal ballistic activity. Methods: 12 male subjects (5 with Achilles tendinosis) participated. Lower extremity kinematics and kinetics were obtained during single-legged hopping at 2.2Hz. Sagittal plane NJM and NJP were obtained. Support moment and sum of powers were calculated. The eccentric phase was defined by all 3 joints exhibiting a negative NJP and the concentric phase was defined by positive NJP. Results: Support moment and sum of power during 2 phases were not different. The tendinotic ankle contributed less and the hip contributed more to the support moment during both phases. The same analysis of NJP showed similar contribution shifts. Tendinotic subjects used less ankle angular displacement, and exhibited lower angular velocity, NJM and NJP. Conclusion: The energy storage-release mechanism at the calf might be altered in the presence of a more compliant Achilles tendon. Lower joint powers in tendinotic subjects suggest that the musculotendinous unit is less capable of contributing to power output at a higher rate. Furthermore, because joint power is the product of joint moment and angular velocity; in this cohort both lower joint movement and lower angular velocity contributed to a lower joint power. The tendinotic ankle joint moved slower with a smaller angular displacement. This might be attributed to either the subjects' inability to move rapidly or that the pathology altered the motor control strategy limiting the angular displacement. Further studies will address (1) validation of these findings by increasing the sample size; and (2) examination of the muscle activation pattern in order to better understand the motor control strategy in the presence of Achilles tendinosis.

Poster #: 79
Title: Modeling the Demands of a Dance Jump
Name: Danielle N. Jarvis
Faculty Advisor: Kornelia Kulig

Background: Many athletic activities require jumping maneuvers, and strategies for maximizing height in a vertical jump have been studied extensively. However, dancers perform jumps in many different directions. A saut de chat jump requires propulsion forward and upward to allow the dancer to extend both legs while in the air. Purpose: The purpose of this study was to use modeling to look at the feasible force output of the takeoff leg during postures used in vertical jumping and saut de chat takeoff. Methods: A three-link model of the lower limb with seven muscles was used. Takeoff postures were derived from kinematic data. A coordinate system was established such that hip flexion, knee extension, and ankle dorsiflexion were positive torques. Feasible force sets were determined by finding the convex hull of all the possible outputs resulting from different activation patterns of each muscle. Results: The posture used by athletes for a maximal vertical jump has a larger feasible force set than the posture used by dancers for a saut de chat. Conclusion: For force production, the posture used for vertical jumps (more flexion at all 3 joints) looks more appropriate than the posture that is used by dancers in a saut de chat. While using more flexion may be beneficial for producing more force, the aesthetic demands of dance require the movement to look graceful and effortless; this posture may take away from that appearance. However, it is possible that using slightly more flexion may allow for more successful jump performance.

Poster #: 80
Title: The Effects of Intramuscular EMG Electrode Iinsertion on Locomotor Kinematics
Name: Jo Armour Smith
Faculty Advisor: Kornelia Kulig

Background: Intramuscular electromyography is a commonly used methodology in low back pain (LBP) research. To date it has not been established if the potential discomfort and anxiety associated with insertion of intramuscular EMG electrodes affects locomotor kinematics in persons with a history of LBP. Purpose: The purpose of this study was to compare the kinematics of an anticipated walking turn in persons with a history of low back pain pre- and post-insertion of intramuscular EMG electrodes. Methods: Locomotor kinematics of 3 subjects with a history of recurrent LBP were recorded during walking turns before and after insertion of intramuscular EMG electrodes into the paraspinal musculature. The walking turns were performed both at self-selected and controlled speed (1.5m/s).

Anticipated and actual pain during and after electrode insertion was quantified using a 0-10 visual analogue scale. Results: Average (SD) anticipated pain during insertion was 3.20 (1.40). Actual pain during insertion was 5.40 (4.50) but decreased to 0.07 (0.06) immediately afterwards. There was a small decrease in self-selected speed after electrode insertion (0.056 (0.04) m/s) but peak amplitude of trunk motion was not systematically affected. Mean relative motion variability decreased in 2 subjects after insertion (pre 13.46 (5.37)°; post 9.29 (1.21)°) and all subjects had decreased relative motion variability during double-stance phase of the turn. Conclusion: Insertion of EMG electrodes was associated with subtle changes in locomotor speed and relative motion variability in persons with recurrent LBP. Future research will compare these effects with those in healthy subjects.

Poster #: 81
Title: Postural Strategies for Running Termination: Comparison Between Child and Adult
Name: Guilherme Cesar
Faculty Advisor: Susan Sigward

Background: Adult-like locomotor patterns are typically achieved by 5-7 years; however, evidence suggests that postural strategies for advanced locomotion continue to develop into late childhood and adolescence. We hypothesized that children will utilize different postural strategies to terminate running gait compared to adults. Purpose: To compare kinematics and spatiotemporal parameters between a child and an adult during termination of running gait. Methods: Two male subjects (7 and 20 years) ran 10 meters as fast as possible and stopped in a pre-determined area. Distance required to decelerate, approach velocity, number of steps, step length, center of mass (COM) height, and trunk position were calculated during the deceleration phase; defined as the time between initial decrease in forward velocity and termination. Data from 3 trials were averaged. Results: Deceleration initiated 2.54±0.37m and 1.77±0.08m prior to termination from an approach velocity of 4.01m/s and 5.00m/s for the child and adult, respectively. Child used 3.3 steps, the length of 1.61±0.4% of leg length (ll) compared to 5 steps, 0.32±0.1% ll for the adult. Child maintained higher COM position and greater trunk flexion throughout deceleration compared to the adult. Conclusion: Postural strategies differed between child and adult. The child performed the task with fewer, longer steps over a longer deceleration distance. He exhibited a higher COM and greater trunk flexion than the adult. Further work is needed to determine if these differences are representative of differences between young children and adults and if they reflect a maturation of postural strategies for advance locomotor tasks.

Poster #: 82
Title: Relationship between Body Position and Change of Velocity
Name: Kate Havens
Faculty Advisor: SIgward

Background: Reduction in forward velocity is accomplished by positioning the body's center of mass (COM) posterior to the center of pressure (COP). This COM position-velocity relationship has been shown for gait termination, when velocity is reduced to zero. However, turning requires deceleration without complete termination of forward velocity. It is not known if this COM position-velocity relationship exists when the change in velocity requirement is different. Purpose: To investigate the relationship between COM position relative to the COP and the change body velocity during sprinting and a cutting task at two angles. Methods: 4 healthy females participated. 2-dimensional COM and COP position was quantified during running, 45 degree and 90 degree sidestep cutting as fast as possible. COM-COP distance was normalized to body height. Ground reaction force impulse (GRI), which is proportional to change of velocity, was identified during deceleration, defined as the time during which the ground reaction force is directed posterior. Pearson's correlations were used to determine the association between COM position relative to COP and GRI across tasks ($P \leq 0.05$). Results: GRI was greatest for the 90 degree cut and smallest for the straight run. A positive linear relationship ($r=0.852$, $p<0.001$) was found between the COM-COP distance at initial contact and the GRI during deceleration. Greater posterior distance was associated with greater GRI. Conclusion: Greater directional changes require greater deceleration in the original direction of progression and thus greater changes in anterior velocity, indicated by greater GRI. This is accomplished by a systematically more posterior positioning of the COM to COP.

Poster #: 83
Title: Comparison of Task Demands: Drop Land and Side-Step Cut
Name: Kristamarie Pratt
Faculty Advisor: Susan Sigward

Background: Excessive frontal plane knee loading during deceleration of landing and cutting tasks is thought to contribute to noncontact anterior cruciate ligament (ACL) injuries. As these high risk tasks vary with respect to stance limb (double versus single) and direction of deceleration (vertical versus horizontal), the mechanism of knee loading may differ as well. Appreciating these differences is an important for the development of ACL injury prevention programs. Purpose: To compare hip and knee kinematics and kinetics between a landing task and cutting task. Methods: Ten healthy, female athletes performed drop land (LAND) and side-step cutting (SCUT) tasks. Hip and knee average angles, peak moments and average power were calculated in all three planes for both tasks during deceleration; time between force plate contact and maximum knee flexion. Separate 2 X 3 repeated measures ANOVAs were performed for each variable. Results: Significant task x plane interactions were found. Hip and knee flexion angles and hip sagittal plane power were greater during LAND than SCUT. Hip frontal plane power and internal rotation angles were less during LAND. Surprisingly, no significant differences found in peak moments between tasks. Conclusion: Contributions from the sagittal plane were greater during LAND and from the transverse and frontal planes during SCUT. Despite the differences, frontal plane risk factors for ACL injury appear to be similar between tasks. These deceleration strategies may result in different mechanisms of knee frontal plane loading. Further work is needed to understand the contributions to frontal plane loading during high risk tasks.

Poster #: 84
Title: Do Progestins Enhance Estrogen's effect on Skeletal Muscle Mass Regulators?
Name: Lindsey Anderson
Faculty Advisor: E. Todd Schroeder

Background: Little is known regarding the effects of estrogen on regulators of skeletal muscle mass. Studies have been conducted using estrogen alone and/or estrogen + progestin; however, estrogenicity differs between progestins, and lack of control for hormone composition is routinely listed as a study limitation. Purpose: This study hypothesized that myogenic and proteolytic gene expression would be greater after exposure to estrogen (E2) + norethindrone (NORE; an estrogenic progestin) than after exposure to E2 alone. Methods: Experiments were performed in MCF-7 (E2-responsive breast cancer cell line) before human skeletal muscle myotubes. Dose-response curves were established for E2-responsive (cyclin D1; cd1) and NORE-responsive (integrin alpha-6; itga6) genes after E2 [10-4, 10-6, 10-8] M and NORE [10-4, 10-6, 10-9] M exposure, respectively, for 24 and 48 hours (including ERα and PR-A receptor expression). Fold changes were obtained by qPCR using the 2^-ΔΔCT method normalized to the average of gapdh and 18s. The most effective dose for each curve was used as the combined treatment. Independent-samples t-tests detected within and between differences (significance $P \leq 0.05$). Results: (Study underway) E2 [10-4] increased cd1 1.81 ± 0.08 (mean ± SD) fold ($P<0.001$) after

48 hours (N=4). Fold changes for itga6 after 48 hours of exposure to NORE are: 2.57 [10-4], 1.87 [10-6], and 1.44 [10-9] (N=1). Conclusion: The effective dose of E2 is [10-4] for 48 hours and may be the same for NORE. After comparison to the combined treatment, and repeating in myotubes, physiological relevance of results will be explored by analyzing protein expression in human skeletal myotubes and in vivo.

Poster #: 85
Title: Progestin Regulation of Androgen Receptor Activity in Prostate Cancer Cells
Name: Tanya Gupta
Faculty Advisor: E. Todd Schroeder

Background: Testosterone-induced activation of the androgen receptor (AR) has been shown to increase expression of AR and AR target genes. Norethisterone (NET) and levonorgestrel (LNG), testosterone-derived synthetic progestins, also demonstrate high binding affinity to the AR. However, the effects of NET and LNG on AR expression and activity are unknown. Purpose: To assess the effects of NET and LNG on mRNA expression of the AR and AR receptor target genes in human prostate cancer cells. Methods: LNCaP cells were administered a 2 ml volume of a 10-12, 10-10, 10-8, 10-6, or 10-4 M solution of either NET or LNG. RNA was purified using the Promega SV Total RNA Isolation System. TaqMan Reverse Transcription Reagents were used to reverse transcribe the isolated RNA in duplicate. Analyses of AR, PSA (AR target gene), and 18S (housekeeping gene) expression via qPCR were conducted using SYBR Green Supermix in triplicate reactions. Data were analyzed using the 2-ΔΔCT method to obtain the relative fold changes in gene expression between samples, which were compared using the Student's t-test for unpaired samples at a significance level of $p<0.05$. Results: AR expression was significantly lowered by 10-8 M ($p=0.004$) and 10-4 M ($p=0.04$) doses of LNG and by 10-8, 10-6, and 10-4 M doses of NET ($p=0.006$, $p=0.02$, and $p=0.004$ respectively). PSA expression was significantly decreased by 10-12, 10-8, and 10-4 M doses of LNG ($p=0.001$, $p=0.03$, and $p=0.003$ respectively). Conclusion: LNG and NET appear to affect AR gene transcription, while only LNG alters mRNA expression of PSA.

Poster #: 86
Title: Anabolic Steroid Withdrawal Syndrome: Implications for Developing a Cessation Program
Name: Alan Gurler
Faculty Advisor: E. Todd Schroeder

Background: Anabolic steroids induce hypogonadism through negative feedback mechanisms acting on the hypothalamic-pituitary-gonadal-axis. The human body's resilience to these drugs and ability to restore "normal" function are based largely on dose, duration, and individual variation. The stigma created by scandals in professional athletics and exaggerated by the media has shifted attention from rehabilitation to criminalization, leaving restoration of the body's hormonal equilibrium overlooked. Purpose: There is currently no established treatment program for anabolic steroid users; therefore, defining and developing a cessation program would be important for the health and safety of those individuals choosing to participate in anabolic steroid use. Methods: It will be important to better understand the effects of exogenous anabolic steroid administration on the hypothalamic-pituitary-gonadal axis and potential interventions aimed to attenuate and reverse these effects. Clinical research with these primary aims must be done before information can become readily available to physicians challenged with treating these individuals. Results: Based on case studies in the literature, it is expected that there would be a significant decrease in the time required to return to normal function with pharmacological intervention. Conclusion: Research needs to be conducted to discover proper intervention methods to help people transition from being a "user" to a "non-user". In addition, findings from these research investigations can be applied to patients and subjects using clinical administration of testosterone, since there are currently no treatments or FDA-approved drugs to address this ignored problem.

Poster #: 87
Title: Effects of Periodized Resistance Training with and without Creatine/Protein Supplementation in Healthy Older Men
Name: Matthew Villanueva
Faculty Advisor: E. Todd Schroeder

Background: Investigations examining the effects of non-linearly periodized resistance training programs designed to promote concurrent increases in lean mass, muscular strength, and functional performance in older men are limited. Purpose: To examine the effects of a 12-week resistance training program with and without creatine and protein supplementation on changes in lean mass, muscular strength, and physical function in older men. Methods: 22 men (68.1±6.1 years) were randomized to one of three groups: control (C; n=8); resistance training only (RT; n=7); and resistance training combined with supplementation (RTS; n=7). A progressive, total-body resistance training program was performed 3 days/week for 12 weeks, with supervision. Creatine supplementation (RTS): prior to training, participants consumed 0.3 grams/kilogram body weight/day (pill form) for 5 days; after, participants consumed 0.07 grams/kilogram body weight/day until completion of the 12-week program. The RTS group also consumed a ready-to-drink liquid whey protein supplement containing 35 grams of protein, immediately post-training and on non-training days. Exercise testing occurred pre- (Week 0) and post- (Week 12) training intervention to determine changes in body composition (dual-energy x-ray absorptiometry), 1-RM machine chest press and leg press strength, and dynamic power (Margaria power stair climb). Results: ANOVA revealed no significant differences in baseline characteristics among the three treatment groups ($p>0.05$). The RT and RTS groups experienced significantly greater increases in 1-RM chest press strength (+54±15 lbs. and +43±18 lbs., respectively) and 1-RM leg press strength (+378±102 lbs. and +436±241 lbs., respectively), compared to the C group ($p<0.0001$). Changes in fat mass, lean mass, and dynamic power were not significantly different among the three treatment groups ($p>0.05$); however, an independent sample t-test revealed near significant differences in dynamic power between the RT and RTS groups (+58±309 watts vs. +371±361 watts; $p=0.06$). Conclusion: Creatine and protein supplementation, combined with 12 weeks of periodized resistance training, provides no additional enhancements in body composition or muscular strength in older men, but does augment dynamic power performance.

Poster #: 88
Title: TACL: Testosterone Administration and ACL Reconstruction Clinical Outcomes
Name: Brian Wu
Faculty Advisor: E. Todd Schroeder

Background: The anterior cruciate ligament is one of four major ligaments in the knee and provides stability during physical activity. A tear in the ligament is characterized by joint instability that leads to decreased activity, knee dysfunction, and reduced quality of life. Purpose: To determine if 8 weeks of testosterone, first administered 2 weeks prior to surgery, can improve muscle mass, strength, and physical function following ACL reconstruction with standard-of-care rehabilitation in men compared to men who receive placebo and standard-of-care rehabilitation. Methods: Men, 21-50 years of age, scheduled for ACL reconstructive surgery will be randomized to one of two groups. Group 1 (n=7) will receive testosterone administration, one weekly 200 mg dose intramuscularly of testosterone enanthate in sesame oil, for 8 continuous weeks beginning 2 weeks prior to surgery and standard-of-care rehabilitation following surgery. Group 2 (n=7) will follow the same dosing and rehabilitation schedule but receive a sesame oil placebo instead of testosterone. Results: Primary outcomes include relative changes in

lean mass and will be measured using Dual Energy X-ray Absorptiometry. The other primary outcome will be the changes in the clinical outcome questionnaire, Knee Injury and Osteoarthritis Outcome Score, between the two groups. Secondary outcomes include changes in muscle strength, range of motion, and knee stability. Conclusion: For the primary outcome variables, repeated-measures ANOVA will be used to statistically compare mean differences in lean mass between groups, muscle strength, and the KOOS scores between groups. Other end points will be analyzed with the T-Test (TAS score).

Poster #: 89
Title: Does Practice Schedule Alter the Effect of Incidental Context Learning?
Name: Ya-Yun Lee
Faculty Advisor: Beth E. Fisher

Background: Contextual information is known to influence motor learning. Global context, also called incidental context, is defined as elements that are associated with a particular task but not an essential requirement for task completion (i.e., the color of a sequence). Local context, on the other hand, refers to the order or essential components of multiple tasks, such as practice schedule of multiple sequences (i.e., random versus blocked practice). Purpose: The purpose of this study was to determine whether different practice schedules affect incidental context learning. Methods: Twenty healthy participants were recruited into a random or blocked practice group. All participants were required to practice three finger sequences either in a random or blocked order. Each sequence is associated with specific contexts (color and location). One day following practice, the participants were tested under two conditions: SAME and SWITCH conditions. In the SAME condition, the sequence and its associated contexts remained the same as during practice; while the context for each sequence was changed in the SWITCH condition. Total time (TT) was the primary outcome measure and was calculated as the time from stimulus onset to completion of the key presses. Results: Repeated measures ANOVA analyses showed that both groups significantly decreased TT throughout the practice, but there was no group differences in TT performance at the end of practice ($p = 0.251$). At retention, both groups showed a significant increase in TT when tested under the SWITCH compared to the SAME condition ($p=0.032$). However, there was no significant difference between the two practice schedule groups ($p=0.742$). Conclusion: The results suggested that practice schedule does not affect incidental context motor learning.

Poster #: 90
Title: Dynamics of Dexterous Manipulation Reveal Developmental Improvements through Adolescence
Name: Sudarshan Dayanidhi
Faculty Advisor: Francisco J. Valero-Cuevas

Background: Dynamic control of fingertip force magnitude and direction is the paramount requirement for manipulation of small, deformable and fragile objects. Even though it is well known that neuroanatomical developments go on well into late adolescence, we have few behavioral correlates in manipulation to demonstrate their functional benefits. The prevailing thought in developmental and clinical rehabilitation is that there are no changes in dexterous manipulation in children beyond the age of eight. Purpose: This study focuses on clearly establishing the relationship between the known timelines of neuroanatomical development and this novel means to grade behavioral improvements in dexterous manipulation. Methods: One hundred and thirty children (4-16 yrs), participated in this study. Two compression load cells were used across a slender spring, which required less than 3 N of force for complete compression. However with compression the instability of the spring increased. The subjects were asked to compress the spring to the point beyond which they felt the device would slip out of their hand and maintain it there for at least 2 seconds.Three to five trials were collected for each subject. Results: During development there is a steady increase in the mean force children are able to achieve with the dexterity device. Importantly, musculoskeletal growth and strength are poorly correlated with these functional improvements.Time series analyses reveal that in the state space the dynamics of control show significant improvement thoughout childhood and adolescence, with marked changes in the younger years. Conclusion: We now show that a novel extension of our prior work establishes a clear—and previously missing—link between known neuroanatomical development and dexterous manipulation well after the age of eight, an age beyond which hand function is assumed to saturate.

Poster #: 91
Title: Optimization of Arm Position and Muscle Selection for Botulinum Toxin
Name: Nahyeon Ko
Faculty Advisor: Francisco Valero-Cuevas

Background: Children with spastic cerebral palsy experience difficulties in activities of daily living because of hypertonia and limited range of motion (ROM). Casting, splinting and botulinum toxin (BT) injection can reduce spasticity in spite of muscle weakness from BT. Given that spasticity is a movement disorder, producing optimal force at the end-point of the limb is crucial. Purpose: Our purpose was 1) to find the optimal arm posture for maximum capacity to generate force at the end-point during immobilization and 2) to develop a BT model for feasible force sets (FFS) which comprises all possible forces that muscles can generate at the end-point. Methods: Using a 6 degrees-of-freedom, model of the mapping from 9 muscle coordinations to the 2-dimensional limb endpoint force, we applied linear programming to determine the maximal force for a total of 12 arm postures and found the FFS for each by computing the convex hull of all possible muscle coordination patterns. Results: The maximum optimized muscle force was generated at 60° of shoulder flexion, 60° of elbow flexion, and 15° of wrist extension. Monte Carlo analysis showed that the model was robust. We found a dramatic decrease in FFS when simulating application of BT in multiple muscles. Conclusion: This suggest that the maximum reaching force is generated in the middle range of the elbow joint. For clinical application, instead of administering BT in multiple muscles, it could be used as a series of BT injections in single muscles combined with strengthening exercise.

Poster #: 92
Title: Infant Learning of Contingent Leg Action: Influence on Leg Coordination
Name: Barbara Sargent, PT, MS, PCS
Faculty Advisor: Linda Fetters

Background: Preterm infants are at increased risk for spastic diplegic cerebral palsy, which is characterized by decreased selective leg movement. Purpose: The purpose of this study was to determine if 3-month old full-term and preterm infants can: (1) learn the contingency between leg movement and mobile activation, and (2) demonstrate a greater degree of selective leg movement when these movements are reinforced with mobile activation. Methods: Each infant participated in 2 sessions of mobile reinforcement on consecutive days. During each session, the infant was positioned supine under an overhead infant mobile. The first session consisted of a 2-minute baseline non-reinforcement condition in which the infant mobile did not activate in response to the infant's leg movements and a 6-minute reinforcement condition in which the infant mobile rotated and played music when the infant moved either foot across a virtual threshold. The second session consisted of a 2-minute non-reinforcement condition, 6-min reinforcement condition, and 2-minute non-reinforcement condition. Results: Infants increased the frequency

of mobile activation to meet performance criteria during the first session and learning criteria during the second session. In addition, infants demonstrated a greater degree of selective leg movement during the mobile reinforcement condition than during the baseline non-reinforcement condition. Conclusion: These results indicate that infants demonstrate a greater degree of selective leg movement when these movements are reinforced with mobile activation. The results provide support for the development of a therapeutic intervention to reinforce selective leg movements of infants at increased risk for cerebral palsy.

Poster #: 93
Title: Design of ART (Arm Reach Training) System for Post-stroke Patients
Name: Hyeshin Park
Faculty Advisor: Nicolas Schweighofer

Background: Current rehabilitation systems for upper extremities are impractical for rehabilitation training at home due to their complex interface and high cost. Purpose: Our goal is to design ART system, Arm Reach Training in post-stroke patients. ART is a low cost, effective, and automatic device designed to help rehabilitate upper extremities. ART engages patients intensively, actively, and adaptively to improve reaching ability. Methods: ART is comprised of a magnetic position sensor, an overhead projected display, and a computer. The computer captures position signals, displays a visual target, and stores position data. ART is implemented on Linux OS. Results: ART produces 35 circular targets at different locations and participants are asked to reach to a target with the index finger of their paretic hand as accurately and quickly as possible within 10 seconds. ART provides a pre-test session (day 1, 2, and 3), a reach training session (day 2 and 3), and a retention test session (day 2, 3, 4 and 5). Each training session is comprised of 10 blocks (100 trials for each block), alternating with a 2.5-minute rest period. Depending on their movement time, ART provides five different types of visual and auditory feedback in real-time. Conclusion: In conclusion, ART could provide an effective training for post-stroke patients. The next step of this study is to assess whether or not ART improves reach. In addition, two more sensors will be attached to the elbow and shoulder joint in order to measure both voluntary joint range of motion and inter-joint coordination.

Poster #: 94
Title: Contributions of L-DOPA to Locomotor-Related Limb Movement During Embryogenesis
Name: Bonnie Chen
Faculty Advisor: Nina Bradley

Background: Born into the hospital environment, the premature neonate is often placed in an extended posture that grants minimal mobility. If it is the nervous system that drives fetal posture and movement, then the prenatal environment may be altered to optimize motor development. Purpose: We sought to determine if L-DOPA administration can increase the frequency and intensity of repetitive limb movements (RLM's) Since fetal movement can indicate the state of neural integrity, knowledge about the mechanism that drives fetal movement may inspire new therapeutic approaches in treating neurologically challenged infants. Methods: L-DOPA was applied to the membranes of 20 day old chick embryos (E20). Using a within-subject design, changes in spontaneous muscle activity were observed following two administrations of 0.1 mL L-DOPA dissolved in saline (150 mg/kg), dripped on the capillaries of the chorionic membrane in ovo. Software programs were used for collection and analysis of muscle activity. Results: Spontaneous muscle activity increased after L-DOPA administration. Data for 3 embryos thus far analyzed indicated the greatest changes were observed in the ankle flexor activity (dramatic increases in RLM burst counts and average integrated amplitude). The number of RLMs increased after L-DOPA and background spontaneous activity increased. Conclusion: Data will continue to be analyzed for the remaining 20 animals. As L-DOPA significantly impacts the frequency and amplitude of repetitive limb movements, we may proceed by testing whether this L-DOPA-driven increase in muscle activity will lead to faster motor learning and motor maturity postnatally.

Poster #: 95
Title: Effect of Light during Embryogenesis on Locomotor Navigation in Hatchlings
Name: Jay H. Porterfield
Faculty Advisor: Nina Bradley

Background: The presence or absence of bright continuous light modifies incubation length and locomotor development in chicks. At hatching, chicks rapidly adapt to new gravitational challenges, so in this study we asked if light conditions during incubation alter locomotor navigation, one indicator of vestibular function. Purpose: Our goal was to determine if variability in path trajectory during forward locomotion differed with light exposure conditions during embryogenesis. We predicted that veering angles would be greatest in hatchlings reared in continuous darkness, because this group was slower to develop and findings from a previous study indicated that they exhibited the greatest step width during locomotion, an indication of less-optimal postural control. Methods: We performed new analyses of existing, published kinematic data from a study of locomotor performance in chicks incubated under 3 light conditions: constant light (24L), cycled light 12 hr on/12 hr off (12L), and constant dark (24D). Hatchlings (N=30, 10 per condition) were trained to walk along a Plexiglas® surface prior to 2 video recording sessions within 24 hours after hatching. A MATLAB® function was developed to calculate foot placement angles for consecutive steps from digitized 2D coordinates for 8 walk trials. Calculations were verified by protractor measurements. Results: As predicted, preliminary analyses suggest that veering angles were greatest in hatchlings reared in continuous darkness when compared to hatchlings from 12L or 24L conditions. Conclusion: Preliminary results suggest that light during embryogenesis accelerates vestibular development for locomotion at hatching.

Poster #: 96
Title: Development of Symmetric Alternating Steps in the Chick Embryo
Name: Anil Sindhurakar
Faculty Advisor: Nina Bradley

Background: Bipedal gait is the primary mode of locomotion in human beings. It is characterized by symmetrical alternating steps of the left and the right legs. In this study, we examine interlimb stepping in chick embryos as a model for locomotor development in humans. Purpose: Our purpose was to determine when symmetric alternating steps emerge and what role the environment might play in their development. In our previous study, embryogenesis was shortened or lengthened by exposing embryos to continuous bright light or continuous darkness. Thus, we predicted that embryos incubated in bright light will initiate alternating steps earlier during embryogenesis than embryos incubated in darkness. Methods: Fertile eggs were incubated in 1 of 3 light conditions throughout embryogenesis (20-22 days): 24 hours daily, 4000-7000 lux; 12 hours daily, 650 – 3000 lux; 24 hours daily darkness, < 1 lux. Electromyography was recorded on embryonic (E) day 19 from the ankle muscles of both legs. Concurrent ankle displacements were tracked in video recordings. Results: As predicted, symmetric alternating steps of the legs were more frequently observed in embryos incubated in bright light compared with embryos incubated in darkness. Conclusion: These results indicate that alternating steps for locomotion emerge during late embryonic development. Further, environmental factors such as light can significantly impact when bipedal stepping

emerges during embryogenesis.

Poster #: 97
Title: Strychnine Alters Ankle Muscle Activity Patterns in Chick Embryos
Name: Soo Yeon Sun
Faculty Advisor: Nina Bradley

Background: Chick embryos begin moving their limbs spontaneously on embryonic day (E) 3.5. By E9, leg movements are characterized by alternating flexion and extension at the hip, knee, and ankle, similar to leg movements during locomotion. Therefore, it is argued that limb movement during embryonic development is the beginning of the continuum for locomotor development. Nonetheless, the mechanisms underlying the continuum in locomotor development remain to be more fully understood. Purpose: The aim of this study is to explore the pharmacological system underlying the repetitive alternation of ankle flexor and extensor muscles at E20 in chick embryos. It is hypothesized that glycine mediates flexor-extensor alternation. Thus we predict that administration of strychnine, a glycine receptor antagonist, in chick embryos will convert alternate flexor-extensor bursting of ankle muscles to synchronous flexor-extensor bursting. Glycine has not been found to act on interlimb control of stepping in other animals. Thus we hypothesize that strychnine administration will not impact alternation of homologous left and right ankle muscles. Methods: Chicken eggs were incubated under standard conditions and instrumented for EMG recordings at E20. Ankle muscle EMG was recorded before and after strychnine application. Burst analyses quantified the effects of strychnine. Results: The main findings of this study were that flexor-extensor alternation and left-right alternation of homologous ankle muscles were disrupted by strychnine application. Conclusion: However, it remains to be determined if the underlying circuitries are selectively mediated by glycine in late stage chick embryos.

UNDERGRADUATE DDS STUDENT BASIC SCIENCES

Poster #: 98
Title: Gingiva-derived Mesenchymal Stem Cells Suppress Th9-driven Asthma
Name: Julian Soro
Faculty Advisor: Anh Le

Background: Asthma is a very common, chronic inflammatory disorder of the respiratory system. Current therapies use non-specific immune response inhibitors and anti-inflammatory agents, and although they effectively diminish some asthma symptoms, they produce a minimal effect in the reversal of airway remodeling. Targeting T-helper type 9 (Th9) cells, an important mediator in asthma pathogenesis, offers some hope in the development of new therapies. Mesenchymal stem cells have anti-inflammatory and immunomodulatory properties and are effective in treating inflammatory and autoimmune diseases, such as rhinitis and asthma in mice. However, the underlying mechanism of MSC-mediated suppression of allergic airway response remains unknown. Purpose: Our study further investigates the pathophysiological processes of asthma and explores possible targets for future asthma therapies by studying the interaction between gingiva-derived MSCs (GMSCs) and Th9 cells in an OVA-induced asthma murine model. Methods: OVA-induced asthma was generated in mice by sensitization with 20 µg ovalbumin (OVA) emulsified in 1mg aluminum hydroxide, via intraperitoneal injection, on days 0 and 14, followed by intranasal challenges with aerosol 5% OVA in PBS for 30 min daily on days 21-23. GMSC therapy groups were injected with 2x106 cells in 200 µl PBS one hour following the first challenge. Control groups received only PBS. Two days following the last OVA challenge, airway resistance were evaluated and broncho-alveolar lavage (BAL) fluid, blood, and lung tissues were collected for further analysis. Results: Our findings suggest that GMSC can ameliorate symptoms associated with airway hyper-responsiveness in asthma via down-regulation of Th2 cytokine levels and suppression of Th9 cells function in mice. Conclusion: (included in Results section)

Poster #: 99
Title: Will the NBDE Part-I Pass/Fail Grading Format Affect Student Preparation?
Name: Hamid Barkhordar, Pooyan Nasibi
Faculty Advisor: Dennis Tartakow

Background: Starting January 1st, 2012 the American Dental Association will report candidate performance on National Board of Dental Examiners (NBDE) Part I Examination as Pass/Fail. The change to Pass/Fail grading could potentially affect how dental students prepare for the Part-I exam. Purpose: The aim of this study was to assess how the new Pass/Fail scoring format of the NBDE Part I exam will influence Ostrow School of Dentistry of USC student motivation with regard to preparation for the exam. Methods: A multiple-choice, eleven-item web-based survey was administered through the Ostrow School of Dentistry student listserv to Students of the Junior and Senior classes. The Questionnaire addressed the following: a) start date of studying, b) hours of average study, c) amount of monetary investment, and d) the number times participants went through or planned on going through the Dental Decks. Results: The survey results showed that student motivation is expected to decline with Pass/Fail scoring. Participants reported beginning their studies at later times in their dental student careers in addition to lower average study hours and monetary investment for resources with the Pass/Fail grading system. Conclusion: Scoring creates a competitive nature that Pass/Fail grading systems were designed to eliminate. Is it possible with the new grading format that student preparation may decline to a point where there is a lowered pass rate for NBDE Part-I?

Poster #: 100
Title: Virulence of Aggregatibacter actinomycetemcomitans Strains in Biofilm Mediated Osteolytic Model.
Name: Andrew Young
Faculty Advisor: Homa Zadeh

Background: Biofilm-induced inflammatory osteolytic oral infections such as periodontitis and peri-implantitis have complex etiology and pathogenesis. Aggregatibacter actinomycetemcomitans (A.a.) biofilm is considered one of the most virulent bacteria in the periodontal polymicrobial. The mechanism by which this bacterial virulence is attributable is unclear. Purpose: The aim of this study was to study genomic manipulation influence in growth and virulence of 6 specific strains of Aggregatibacter actinomycetemcomitans (A.a.) in biofilm mediated ostelytic animal model. Methods: Implant surfaces microtextured by grit-blasting and acid-etching were inoculated in vitro with 6 strains A. actinomycetemcomitans: D7S, HK1651R, D7SΔkat, D7SΔ285R, D7SΔcdtΔltx and NJ8700, establishing a biofilm for 1-3 days, verified by morphological analysis by SEM and viability by CLSM. Implants with and without established biofilm were transmucosally inserted into rat hard palate or alveolar ridge up to 6 weeks. Peri-implant tissues of animals were evaluated clinically and bone levels were by Micro-CT scan 2 and 4 weeks stage after implant placement. Results: A. actinomycetemcomitans biofilm was successfully established on titanium implants in vitro with viable bacterial cells, detected by SEM. Biofilm pattern showed by CSLM showed that the biofilm formed a consistent thickness not statistically significant among the 6 strains: D7S (66µm), HK1651R (68µm), D7SΔkat (80µm), D7SΔ285R (65µm), D7SΔcdtΔltx (88µm) and NJ8700 (67µm). An inflammatory response characterized by clinical inflammation, bleeding, ulceration, hyperplasia, and necrosis was observed around biofilm-inoculated implants after 2 and 4 weeks. D7S fimbriated wildtype appeared to be the strain exhibiting the greatest clinical inflammation. Micro-CT analysis demonstrated in 4 weeks lower bone volume around biofilm-inoculated (29.6% ± 7.6%) compared with non-inoculated implants (50.5% ± 9.6%). Conclusion: These

results describe for the first time the study of genomic island association with virulence in vitro and in vivo. This model may have potential utility for investigation of bot bacterial virulence and their effects on host responses to biofilm pathogens and anti-biofilm treatment modalities.

Poster #: 101
Title: Efficacy of Anti-BMP Antibody in Bone Engineering
Name: Anthony Nguyen
Faculty Advisor: Homa Zadeh

Background: Bone regeneration often requires harvesting of autologous bone with potential morbidity and cost. Recombinant human bone morphogenetic protein (rhBMP-2) has surfaced in becoming a novel substance for bioengineering bone. Purpose: The purpose of this study was to characterize the efficacy of tethered anti-BMP-2 3G7 monoclonal antibody and begin to comprehend its biological and molecular mechanisms. Methods: In vivo efficacy analyses was performed by immobilizing anti-BMP-2 mAb, isotype control Ab (25 ug/ml), and rhBMP-2 (1.5 ug/ml) in each of the scaffolds by adsorption and treating the 5mm critical size defects of rats with the matrices. After 6 weeks, bone formation was evaluated by Micro-CT scan and histology. To investigate protein availability of both BMP-2,-4,-7 and abs in early stages (1,7 days) after surgical implantation, confocal analysis was utilized. To characterize Ab binding affinity by which the 3G7 binds to BMP-2, BMP-4 and BMP-7 in vitro, ELISA was developed. Results: Bone regeneration revealed by micro-CT and histological analysis after 6 weeks, demonstrated that bone healing was significantly increased to isotype control ($p<0.001$) when defects were treated with 3G7 anti-BMP-2 antibody and rhBMP-2. In vitro cross reactivity of 3G7 antibody was positive for rhBMP-2,-4-7. Confocal analyses of in situ expression BMPs showed increase detection of endogenous BMP-2,-4,-7 after 1 to 7 days. Kinetics Abs and BMPs interaction showed high dissociation constant(kD=11nM) and moderate affinity for BMP-4 and BMP-7(3.6uM). Conclusion: This data provides the first molecular elucidation of the interaction of AMOR 3G7 antibody and BMP-2,-4,-7. Anti-BP-2 3G7 antibody efficacy increased bone formation and formed a complex with BMPs in vivo, suggesting a novel role of monoclonal antibodies in bioengineering.

Poster #: 102
Title: The Transcription Factor NFIc Regulates Expression of FGF5 and CSF in Odontoblast-like Cells Maintained in vitro
Name: Megan Laughlin
Faculty Advisor: Margarita Zeichner-David

Background: The transcription factor NFI-C has been shown to be essential for root development. Knockout mice for Nfic do not form roots and these mice end up losing their teeth. Histological studies have shown morphological abnormalities in the dental papilla mesenchyme (DPM)-derived odontoblast cells in these mice, as well as the formation of a sparse and irregular dentin layer. Using an established DPM cell-line lacking Nfic (silenced using small hairpin RNA (shRNA) we can determine changes in gene expression in these cells as compared to control cells expressing Nfic. This cell line can be used to determine down-stream genes affected by Nfic during dentinogenesis. Purpose: Compare gene expression in DPM cells maintained in vitro where Nfi-C has been silenced with shRNA and DPM cells where Nfic is expressed normally and confirm some of these changes at the protein level. Methods: Immortalized DPM cells were stably transfected with Nfic-shRNA. The presence of Nfic in these cells was reduced by 94%. Cells were grown in culture; RNA or proteins were extracted and mRNA was converted to cDNA for DNA microarray analysis between the treated and control cells. RT² Profiler™ PCR Arrays for Growth factors (SuperArrays, Bioscience Corp) were used. Proteins were used for immunostaining. Results: Our data shows that there were statistically significant changes in more than 35 different growth factors when DPM cells depleted of Nfic were compared to the control DPM cells grown under the same conditions. The most significant change was a 100 fold increase in fibroblast growth factor 5 (fgf5) in DPM cells lacking Nfic. There was also considerable reduction (17 fold) in the amount of Colony stimulation factor 1 (Csf1) in these cells. Analysis at the protein level using western blot immunostaining confirmed these results. Conclusion: These results suggest that one mechanism that Nfic uses to regulate root formation is by controlling expression of FGF5. Overexpression of this growth factor has been associated with tumor formation.

Poster #: 103
Title: ShcA Modulation of Smad2 Phosphorylation is Independent of Smad7 Levels
Name: Ben Schaefer
Faculty Advisor: Matt Lee

Background: TGF-β is an important regulator of development and wound healing. Its activity is mediated by complexes of type I and type II receptors on the surfaces of targeted cells. Upon TGF-β binding, the type 1 TGF-β receptor phosphorylates substrates that initiate intracellular signaling processes. The best described substrates are Smad2 and Smad3 proteins that, upon phosphorylation, complex with Smad4 to regulate gene transcription. This process is antagonized by Smad7. TGF-β receptors also directly phosphorylate ShcA proteins, which initiate an intracellular signaling pathway that culminates in ERK/MAP kinase activation. Purpose: Recent work indicates that ShcA overexpression reduces the efficiency of Smad2 phosphorylation. The mechanism by which ShcA regulates Smad2 phosphorylation is unclear. Our experiments are designed to differentiate between direct inhibition of Smad2 phosphorylation by ShcA and indirect inhibition in which the ShcA regulates Smad7 levels. Smad2 phosphorylation is subsequently regulated by the Smad7. Methods: TGF-β -induced Smad2 phosphorylation was assessed by western blot in Mv1Lu mink lung epithelial cells in the presence or absence of p52Shc overexpression, and in the presence or absence of Smad7 silencing. p52Shc was over expressed by adenoviral vector. siRNA was used to silence Smad7 expression. Results: We found TGF-β -induced Smad2 phosphorylation was reduced by over expression of p52Shc independent to the silencing of Smad7. Additionally, a decrease in Smad2 phosphorylation occurs when Smad7 is silenced even when p52Shc is not over expressed. Conclusion: These findings indicate that the inhibitory effects that ShcA has on Smad2 are not dependent on ShcA regulation of Smad7 expression.

Poster #: 104
Title: A Collaborative Approach to Advance Student Research at USC
Name: Heather Stephens, Bridger Jensen and Weston Carpiaux
Faculty Advisor: Parish Sedghizadeh, Yang Chai

Background: Research is the foundation upon which any scientific field is built. Research allows for new ideas to be developed, tested and analyzed thereby advancing the field of study. Introducing students to research is important not only to encourage their future participation in scholarship, but also to ensure that as future dental practitioners they will be able to objectively evaluate research, therapeutics and products they are presented with while in practice. Purpose: The continued advancement of oral health and science relies upon the cultivation of students' interest in research. The Student Research Group (SRG) at the Ostrow School of Dentistry of USC is working to increase student involvement in research and develop future academic leaders. Methods: Through student surveys, this study aims to quantitatively evaluate students' involvement in research, students' interest in participating in research and to identify specific barriers students feel challenge their ability to participate in research. Results: Students reported that the biggest challenge facing USC dental school students interested in research was time. Time was the category

choice with the most responses in every class in both years surveyed. Conclusion: The data shows that over half of the DDS and ASPID students in the dental pre-doctoral program at USC are interested in participating in research activities, but that only about 10% do participate. Further studies are necessary to determine the sustainability and effectiveness of SRG efforts. I is our hope that a core group of motivated students, with the support of research faculty can increase the quantity and quality of student dental research at USC.

Poster #: 105
Title: Effects of Force on Gene Transcription in Periodontal Ligament Cells
Name: Ninette Hacopian
Faculty Advisor: Seyed Nasser Ostad

Background: Orthodontic tooth movement is a mechanotransduction event involving a complex feedback mechanism. Numerous transcriptional factors are involved in the differentiation, proliferation and function of different cell types, which eventually lead to mechanically induced remodeling. Tissue reaction may vary depending upon the type and duration of the applied forces. Purpose: The purpose of the present study was to analyze the effects of centrifugal force on the transcription of collagen type-1 (Col-1), matrix metalloproteinase-1 (MMP-1), and tissue inhibitor of metalloproteinase-1 (TIMP-1) genes in human periodontal ligament (PDL) fibroblasts. Methods: Human fibroblasts obtained from the PDL were subjected to centrifugal forces, continuously for 30, 60, 90 min, and interruptedly three times 30 min and six times 15 min with 5 min intervals. The mRNAs encoding for Col-1, MMP-1, and TIMP-1 were quantified using semi-quantitative RT-PCR. Results of gene expression were presented as the ratio to β-actin. The normalized mRNA levels for each gene in mechanically stimulated cells were compared with those of control cells by one way ANOVA and Tukey post test. Results: The mRNA levels of Col-1 and MMP-1 were increased while continuous forces were applied for 30 min and 60 min respectively. The interrupted type of forces had almost no effect on Col-1, MMP-1 and TIMP-1 genes. Conclusion: These results indicate that continuous forces may have greater effect in inducing gene expression during the remodeling process of PDL than interrupted forces with short rest periods.

Poster #: 106
Title: Human Cytomegalovirus Causes Salivary Gland Mucoepidermoid Carcinoma
Name: Michelle Zin
Faculty Advisor: Tina Jaskoll

Background: Human cytomegalovirus (hCMV) infection is one of the most common, affecting 50-95% of adults. Similar to other herpes viruses, hCMV exhibits lifelong and latent infection after primary exposure, with latent hCMV residing in salivary gland ductal epithelia. Active hCMV infection is known to be associated with various malignancies including brain, breast, lung, colon and prostate. Purpose: The aim of our study was to investigate the relationship between hCMV and salivary gland mucoepidermoid carcinoma (MEC). Methods: Human specimens of salivary gland MEC ranging from 7 years (2004-2011) from the Oral Pathology Laboratory at Ohio State University and serial sections were obtained from formalin-fixed, paraffin embedded tissues. Histological analysis and immunohistochemical assays for active hCMV proteins and components of the COX/AREG/EGFR/ERK signaling pathway were performed. Results: Our results strongly indicate a causal relationship between hCMV and salivary gland MEC. We found the characteristic cytomegalic cells, viral inclusion bodies, and protein markers for active hCMV infection in 97% of MECs. There is a positive correlation between the expression of viral IE1 and pp65 proteins and cancer severity. hCMV infection of MEC cells is correlated and colocalized with the upregulation and activation of the COX/AREG/EGFR/ERK signaling pathway. Conclusion: Our results confirm that hCMV is a cause of salivary gland MEC and can be classified as an "oncovirus." In addition, our data indicates that hCMV-induced MEC tumorigenesis is mediated through the oncogenic COX/AREG/EGFR/ERK signaling pathway.

Poster #: 107
Title: Three-Dimensional Imaging Modalities for Craniofacial Analysis in Mouse Embryos
Name: Diana Jee, Hyun Lyu
Faculty Advisor: Yang Chai

Background: Cleft lip with or without cleft palate is one of the most common congenital birth defects. Treatment requires complex surgical treatment and long-term therapies. The etiology is multifactorial with many genes in mouse and human known to cause early failure of palate development some of which also affect other craniofacial structures ultimately influencing morphology, size and volume. Purpose: Although recent studies using various mutant animal models have advanced our knowledge of the regulatory mechanism of palatogenesis, most studies rely on traditional two-dimensional histology to analyze defects in mutant mice. This study aims to characterize wildtype and mutant mice palates and tongues using three-dimensional magnetic resonance micro-imaging (micro-MRI) and x-ray computed tomography (micro-CT) scans with the final goal to generate a resource of volumetric data for palate and tongue anatomy. In the process, we will be able to compare the benefits and limitations of each imaging modality and its use in craniofacial development. Methods: Imaging modalities are actively being developed and optimized to visualize hard and soft tissue anatomy in wildtype and conditional knockout mutant mouse embryos. Specifically, four genotypes (WT, Tgfbr2(fl/fl);Wnt1-Cre, Tgfbr2(fl/fl);Wnt1-Cre;Tgfbr2(+/-), and Tgfbr2(fl/fl);Wnt1-Cre; Alk5(fl/+)) were selected for a comparison study. Three-dimensional micro-MRI and micro-CT data were acquired from multiple embryos at each genotype and staged at E18.5 days of gestation. Individual voxel labeling methods were used to detail the qualitative topography of the anatomy and extract the volume of the palate and tongue for quantitative analysis. Results: Using micro-MRI and CT scans, we were able to characterize the defects in palatal shelf and tongue of mutant mice in comparison to wildtype mice. Our preliminary results demonstrate that both micro-CT and micro-MRI modalities are powerful tools for characterizing and analyzing phenotypes in a variety of genetically engineered mice. The higher image resolution and soft tissue contrast seen in the micro-CT images provides an excellent platform for anatomical labeling of muscle and bone whereas the micro-MRI has better volumetric consistency with less surface distortion and thus better surface rendering. Conclusion: With the current sample processing protocols for head imaging it is clear that there are qualitative and quantitative differences in the anatomy between the four genotypes and that CT scans provide higher soft tissue resolution and thus a greater accuracy in the qualitative and quantitative comparisons.

Poster #: 108
Title: Validation of Intra-observer Reproducibility of Mice Intrinsic Tongue Volume via Micro-CT
Name: Hamid Barkhordar, Pooyan Nasibi
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 datasets, intra-observer variance must be quantified and assessed. Purpose: The aim of this study was to assess the intra-observer reproducibility of mice intrinsic tongue volume measurements using images from 10mm micro-CT scans, and to validate the utility of this method to define and measure craniofacial morphogenesis. Methods: Data from a single dental student was used for this analysis. Participant received individualized training in craniofacial

anatomy and landmarks of mice intrinsic tongue muscles. Anterior and posterior boundaries were identified as the tip of the tongue and the hyoid bone, respectively. Five mice at the same embryonic stage (P0) were imaged at 10mm resolution using micro-CT scans and manually segmented to generate 3D reconstructions of the intrinsic tongue. The three volumetric measurements for each sample were generated and analyzed for variance and relative deviation from the mean (RDM) to test intra-observer reproducibility. Results: Statistical analysis of the volumetric data obtained from manually segmenting mice intrinsic tongue muscles showed an average variance of 12.13%. The average RDM of the samples was 3.4%. Conclusion: Our preliminary data shows that the differences in volume of the same sample from one trial to the next are insignificant. Although future studies are necessary to further fine-tune this protocol, intra-observer reproducibility is possible.

UNDERGRADUATE DDS STUDENT CLINICAL SCIENCES

Poster #: 109
Title: Adolescent Dentistry Needs Assessment: A Survey of California Pediatric Dentists
Name: Trishia Contreras, Christine Tran
Faculty Advisor: Andrea Pinnick

Background: The period of adolescence is defined as youths between 10 to 19 years of age according to the Center for Disease Control. It is a critical transitional period in life where there is a growing array of behavior related health problems, such as substance abuse, pregnancy, eating disorders, and depression. It is important that dental health care providers be educated on the unique oral health care needs and social and behavioral issues that impact dental care of the adolescent. Purpose: To conduct a needs assessment survey to determine the scope of practice and confidence in the management of adolescent patients by pediatric dentists in the State of California. Methods: A 4-part, 28 item questionnaire was developed and mailed via postal mail to 513 active members of the California Society of Pediatric Dentists addressing areas of demographics, training, patient/practice characteristics, and adolescent dentistry. An introductory email was sent, and follow-up surveys delivered. Data was statistically analyzed using descriptive statistics, measures of central tendency. Results: 303 surveys were completed and returned (59.1% response). One hundred percent of the respondents provide treatment for adolescent patients. 94.6% were not familiar with HEADSS, 83.4% were unfamiliar with positive youth development, and 62.9% did not feel confident in recognizing and seeking help for adolescent patients experiencing psychosocial difficulties. Conclusion: Using the adolescent dentistry needs assessment, this study identified a large need for additional educational programs for the pediatric dentist and dental auxiliary in the management of the adolescent patient. Ensuring pediatric dentists are capable of counseling patients on the above issues can influence positive youth development and may improve dental and overall health.

Poster #: 110
Title: Assessment of Dentin Demineralization Using PS-OCT after Fluoride/Laser Irradiation Exposures
Name: Saman K. Manesh
Faculty Advisor: Daniel Fried

Background: Previous studies have demonstrated that polarization-sensitive optical coherence tomography (PS-OCT) can be used to image natural and artificial caries in dentin. Purpose: The purpose of this study was to measure nondestructively the severity of artificial caries lesions in dentin and determine the efficacy of intervention with anticaries agents including fluoride and lasers. Although several studies have assessed the utility of PS-OCT to image caries lesions in enamel and to quantify the lesion severity, only a few studies have focused on lesions in dentin. Methods: In this study, images of artificial dentin lesions on extracted human teeth were acquired with PS-OCT. Before exposure to an artificial demineralizing solution, three incisions were made on the sample surfaces using either Er:YAG, Nd:YAG (λ = 355 nm), or TEA CO_2 lasers and selected areas were treated with topical fluoride to create six unique treatment areas for each of the three laser conditions investigated. The integrated reflectivity and depth of demineralization were calculated for each of the six areas on each sample using the PS-OCT images. Polarized light microscopy (PLM) and transverse microradiography (TMR) were used to measure lesion severity on histological thin sections for comparison. Results: PS-OCT successfully measured the inhibition of demineralization by topical fluoride. Laser irradiation was not particularly effective in increasing or decreasing the rate of dentin demineralization. PLM and TMR corroborated those results. Conclusion: This study demonstrates that PS-OCT can be used to measure demineralization on dentin surfaces and determine the degree of inhibition of demineralization by anticaries agents.

Poster #: 111
Title: V2 Nerve Block: Anatomical Considerations Using CT Scans
Name: George Jaber
Faculty Advisor: Fariborz Farnad

Background: V2 block through Greater Palatinal Foramen (GPF) is not a popular injection. One of the main reasons is the difficulty for the practitioners to localize the foramen. This study aims to analyze over 100 patients' CBCTs to localize position, angulation, and length of the canal containing the second division of the Trigeminal Nerve V2. Purpose: While this particular study is ongoing, the data shows certain interesting information previously not well described. The goal of this study is to determine the position of the Greater Palatine Foramen (GPF) as well as the length and angulation of the Greater Palatine Canal (GPC). Methods: Utilizing CT scans of patients, we analyzed the location of the GPF and GPC with CBCT images taken with Kodak 9300 machine. This allowed for the precise measurement of GPF relative to the midline and molar teeth, also the length, antero-posterior and medio-lateral angulation of the GP canal. Results: So far, it is clear that there is significant variation in the location, size of foramen, and also the angulation and length of the canal. Interestingly, the canals showed a variance in angulation in all three planes and even multiple curves within one plane. This makes an injection of local anesthetic with the intention of V2 block difficult, if not impossible, as the needle may need to travel up to 30mm. Curves in the canal can happen as early as 10mm from the orifice of the GPF, which makes the V2 block injection not feasible. Conclusion: This project is still under way and the interpretation is pending. The proximity of the GPF to the posterior edge of the hard palate, variation of size of the foramen, curvatures of the canal are some of the reasons that can cause failure in blocking V2 nerve through greater palatinal foramen. By categorizing the patients in different groups based on their age or anatomy, the practitioner may have better expectations how to localize the foramen and proceed with the V2 block.

Poster #: 112
Title: Occlusion of Amelogenin into Calcite Promoted by Amphiphilicity
Name: Mitchell Thompson
Faculty Advisor: Janet Oldak

Background: The morphology of many biominerals is altered via occlusion of organic biomolecules. Occlusion does not occur within the hydroxyapatite nanocrystals of tooth enamel despite the presence of a high concentration of amphiphilic proteins. Purpose: By understanding how amelogenin and its cleavage products affect calcite crystal growth, we can explore how enamel avoids biomolecule occlusion and give insight into the function of proteinases in enamel. Methods: Crystallization of calcite was

achieved by diffusion of CO2 into solutions of CaCl2 containing variable amounts of recombinant amelogenin proteins (rP172, rP147 or C-terminus) for 0 – 3 days. The crystals were grown onto glass cover slips and studied using optical microscopy and SEM. Results: Only the full-length rP172 had an effect on the morphology of calcite. The C-terminus could affect the crystals' orientation on the glass, while the truncated rP147 had no effect on morphology or orientation. Increasing rP172 concentration resulted in more pits, steps and kinks on the surface, whereas decreasing rP172 concentration prevented morphological changes, although many of crystals were grown in the same orientation. Stopping the growth of rP172-calcite at an early stage (<180 minutes) revealed smaller crystals with identical surface morphology, implying occlusion may have occurred. Conclusion: The morphology of calcite is altered via binding of amelogenin to the <104> faces during calcite growth. Full-length amelogenin binds for long enough to alter morphology and become occluded because of the attractive interaction of the C-terminus with the calcite surface and its relatively low solubility. We hypothesize that selective removal of the C-terminus of amelogenin during enamel development prevents occlusion of amelogenin which would compromise the stability of the hydroxyapatite nanocrystals.

Poster #: 113
Title: Probing the Effect of Fluoridation on Tooth Erosion
Name: Monica Abdelshahid
Faculty Advisor: Mark Stauffer

Background: Determination of the effects of different concentrations of acids and bases on the wearing of fluoridated and non-fluoridated sound teeth, and measurement of the calcium concentration that diffused from the teeth into the solutions using flame atomic absorption spectroscopy. Purpose: The purpose of this study was to demonstrate that fluoridated solutions protect the teeth from decay caused by acidic and basic beverages that people consume daily and to monitor this tendency toward decay by determination of calcium concentrations that diffuse from the teeth into these solutions. Methods: Two groups of sound teeth were tested. Group A teeth were soaked in a fluoride-containing solution before immersion in the acidic and basic solutions; group B teeth were not subjected to prior fluoridation. Tooth erosion was determined by mass measurements before and after immersion in the acidic and basic media. To determine the concentrations of calcium leached from the fluoridated and non-fluoridated teeth by acidic and basic solutions, flame atomic absorption spectrometry (FAAS) was employed. However, since not all beverages used were amenable to aspiration into the air-acetylene flame used, the use of microwave digestion with concentrated nitric acid was employed for such solutions. Results: Solutions tested in this research were coke, vinegar, lemon juice, herbal tea, soymilk, 10% citric acid, and 10% sodium carbonate. The results for vinegar and the 10% citric acid supported our hypothesis where the non-fluoridated tooth soaked in each of the solutions showed more mass loss than the fluoridated tooth. As for the teeth soaked in soymilk, an increase in mass was shown with the fluoridated tooth showing more increase. As for the fluoridated tooth immersed in the 10% sodium carbonate, a small decrease in mass was attributed to the fluoridation protection, but the non-fluoridated tooth experienced a mass increase with shiny crystals observed on the surface. The results obtained for the teeth immersed in coke, lemon juice, and herbal tea also showed a decrease in mass from fluoridated and non-fluoridated teeth. As for the FAAS, the concentrations of calcium leached from the selected teeth suggested that fluoridation protected the teeth from erosion. This was shown in all tested solutions except sodium carbonate. Conclusion: Fluoridated solutions protect the teeth from decay caused by the beverages that people consume every day. The greatest difference between the fluoridated and non-fluoridated teeth immersed in a specific solution was found with the 10% citric acid solution. The R-square value from the FAAS shows the probability of the corrected absorbance being linear with the calcium concentration. More calcium diffused from the non-fluoridated tooth to the solution than from the fluoridated tooth to its corresponding solution. This shows that the deposition of fluoride on the surface makes it harder for the calcium to diffuse out.

Poster #: 114
Title: Dentists Knowledge of Genetic Diseases with Dental and Craniofacial Manifestations
Name: David McAninch
Faculty Advisor: Pragna Patel

Background: This study was inspired by a family with multiple cases of supernumerary teeth. These patients were seen by dentists and all went undiagnosed. As experts of the dental and craniofacial region, dentists must be able to recognize syndromes affecting these regions of the human anatomy for proper treatment. Purpose: The purpose of this study is to gauge the current knowledge and understanding that dentists have of genetic diseases with dental and craniofacial manifestations. Our hypothesis is that dentists' current level of knowledge of genetic diseases is inadequate due to either poor education and/or lack of clinical experience. Methods: A survey will be issued to dentists of all specialties and varying years in practice. The survey will attempt to assess the respondents' education in genetic diseases, knowledge of genetic diseases, clinical exposure to genetic diseases, and their interest in learning more about genetic diseases. Results: Pending Conclusion: TBD

Poster #: 115
Title: Immune Biomarkers of BRONJ in High-Risk Cancer Patients
Name: Peter Lee, Andrew Kiss
Faculty Advisor: Anh Le

Background: Bisphosphonate related osteonecrosis of the jaws (BRONJ) is an adverse effect of bisphosphonate therapy, with the highest incidence reported in oncologic patients receiving intravenous bisphosphonates (BP). Our group previously established that Zolendronate, a potent intravenous BP, caused BRONJ-like disease in mice by suppressing the adaptive regulatory T cell (Tregs) and activating the inflammatory T helper producing interleukin 17 cells (Th17), thereby decreasing the ratio of Treg/Th17. C-telopeptide (CTX), an indicator of bone turnover, is currently used by some clinicians to predict treatment response in BRONJ patients. Here, we determined whether the altered immune homeostasis elicited by bisphosphonate therapy, specifically a suppressed Treg/Th17 renders cancer patients susceptible to BRONJ. Purpose: To identify novel immune biomarkers/predictors of BRONJ in the high-risk cancer patients. Methods: We conducted a cross-sectional study using a well-defined group of cancer patients with a history of chemotherapy and bisphosphonate treatment. The case-controlled study evaluated patients who presented with osteonecrosis of the jaws (ONJ). Age and ethnically matched patients without ONJ were compared to the affected patients. Patients were screened from the Norris Cancer Center, the Ostrow School of Dentistry, and the LAC+USC medical center. Treg and Th17 cells were determined using flow cytometric analysis. Bone serum marker, C-telopeptide, was measured using ELISA. Results: Data demonstrated that BRONJ patients showed a significantly higher level of Th17 cells than control patients ($n=30$, $p<0.05$) and the suppressed ratio of Treg/Th17 cells appears to correlate with the presence of active BRONJ lesion in these affected patients. In addition, the Treg/Th17 ratio also correlates with BRONJ disease severity following the established diagnosis guidelines by the American Association of Oral and Maxillofacial Surgeons. The differential immune cells profile between control and high-risk BRONJ groups were more significant than the currently used serum C-telopeptide assay. Conclusion: The Treg/Th17 ratio appears to correlate with BRONJ disease severity and potentially

serves as an immune biomarker for prediction of BRONJ in cancer patients on IV bisphosphonate and chemotherapy.

Poster #: 116
Title: Management of BRONJ: the USC Experience
Name: Andrew Kiss, Peter Lee
Faculty Advisor: Anh Le

Background: Bisphosphonate related osteonecrosis of the jaw (BRONJ) is a morbid bone disease associated with bisphosphonate therapy. The Current treatment protocol has adapted guidelines established by the American Association of Oral and Maxillofacial Surgeons (AAOMS) based on diagnostic stages. Management of BRONJ remains a clinical challenge with unpredictable outcomes. Purpose: The purpose of this retrospective study is to determine the treatment response of BRONJ in the patient cohort group evaluated at both Oral Medicine and Oral Surgery clinics from 2007-2011. Methods: Medical records of patients with clinical BRONJ who presented to the Oral Medicine and Oral Surgery clinics at the Ostrow School of Dentistry of USC from 2007-2011 were retrieved from the Axium database and reviewed (approval from USC Institutional Review Board - IRB). Diagnostic staging of BRONJ and stage-dependent treatment will be implemented according to the AAOMS guidelines. Demographic data and treatment response at follow-up will be obtained and analyzed. Patients that presented with stage I and II BRONJ lesions were independently analyzed following initial treatment at one, two, three, and four month follow-up visits. Treatment outcomes were evaluated as Regression versus No change/ Progression. Regression is defined as lesions with 25% or more clinical reduction compared to the initial area; clinical regression has to be confirmed with radiographic findings. No change or Progressions are determined as no new lesions or no change in initial area or lesions with any increase from initial area. Results: The combined stage I and II at one-month follow-up visits showed no differences in treatment response between patient ethnicity (African American, Asian, Caucasian, Hispanic) and gender. At one-month, two-month, and three-month follow-up visits, more stage II patients (13 out of 21, 62%; 11 out of 14, 79%; 6 out of 11, 55%, respectively) showed regression of the initial lesions or decrease in disease severity compared to stage I patients (7 out of 23, 30%; 6 out of 16, 38%; and 5 out of 14, 36%, respectively). Conversely, at the four-month follow-up visits, more stage I patients (9 out of 14, 64%) showed regression of the initial lesions than stage II patients (4 out of 11, 36%). Conclusion: Our data suggests that access to care based on gender and ethnicity has no effect on treatment response in both stage I and II BRONJ patients. The favorable response in stage II BRONJ lesions at one-month follow-up suggests that antibiotic therapy and removal of exposed necrotic bone is effective in the control of infection at the early phase.

Poster #: 117
Title: In-Vitro Comparison of Rotary and K-files in Root Canal Preparation of Primary Molars
Name: Amirali Mirenayat
Faculty Advisor: Shahrzad Javadinejad

Background: The roles of applying rotary instruments in reducing preparation time and proper root canal preparation have been approved in permanent teeth. Purpose: The aim of this study was to compare the rotary instruments (Hero642) and K-files in root canal preparation of primary molars. Time and canal transportation were compared. Methods: In this experimental, in vitro study, 30 human extracted primary molars with 8 mm length were selected and divided into two equal groups. After preparing the access cavity, group 1 was prepared by Kfiles and group 2 by Hero642 systems. Before canal preparation, with # 15 K-file, and after canal preparation, with master apical file, canal curvature was evaluated by Weine technique using Radiovisiography. Apical transportation was calculated. Time taken for preparation was recorded by chronometer. The results were analyzed with T-test and Mann-Whitney. $P<0.05$ was considered as the level of significance. Results: The average canal transportation angle was 3.42 for Hero642 group and 7.33 for K-file group ($p<0.04$). The mean instrumentation time was 4.28 for Hero642 group and 8.76 minutes for K-file group ($p<0.001$). There was a significant difference between two groups. Conclusion: Based on the findings of this study, it is suggested to apply Hero642 rotary instrument for primary molar canal preparation due to less preparation time and less canal transposition.

OTHER

Poster #: 118
Title: Attitude towards Rapid HIV Testing in a Dental School Clinic
Name: Jiho Rhee
Faculty Advisor: Reyes Enciso

Background: 1.2 million adults and adolescents are estimated to be living with HIV infection in the United States with 20% unaware of their infection. Detection provides an opportunity for transmission reduction and lifesaving treatment strategies. Purpose: This study examined patients' willingness to take a routine, rapid oral HIV test if offered as a part of a visit to a dental school clinic. Methods: For fifteen days in 2011, an anonymous survey (in English or Spanish) containing demographic and willingness to be tested questions was offered to all patients awaiting treatment at the Ostrow School of Dentistry of USC. Results: 383 participants (40% Hispanic, 27% Caucasian, 19% African-American, and 5% Asian) completed the questionnaire with 59% indicating that they had been previously tested for HIV (as compared to the California mean of 41.5%). If offered, 76% of the respondents indicated a willingness to take the rapid HIV test. The fear of being treated differently (33%) was the primary reason for declining testing. Conclusion: Patients attending a dental school clinic were highly likely to participate in a free HIV rapid test when given the opportunity. Developing assurances to manage fears of potential bias that would inhibit testing participation would be important to encourage additional participation. A dental clinic provides an non-traditional site for patients to be HIV tested and it may also be the only healthcare encounter for individuals who are healthy and the impoverished.

Poster #: 119
Title: An Intranucleolar Role for FGFR2 in Bent Bone Dysplasia
Name: Brian Idoni
Faculty Advisor: Amy E. Merrill

Background: Fibroblast Growth Factor Receptor 2 (FGFR2) is a crucial regulator of bone formation during development. Both gain and loss of function studies in mice have shown that Fgfr2 maintains a balance between the proliferation and differentiation of skeletal progenitors. Purpose: How FGFR2 activity couples proliferation and differentiation remains unclear. Methods: Our analysis of the pathophysiology of a new lethal skeletal disorder caused by FGFR2 mutations reveals a novel activity of FGFR2: immunofluorescent and biochemical assays suggests that the receptor acts in the nucleolus to regulate ribosomal biogenesis, a process essential for cell proliferation. Results: We have identified novel de novo FGFR2 mutations in a sporadically occurring perinatal lethal skeletal dysplasia characterized by poor mineralization of the calvarium, craniosynostosis, dysmorphic facial features, prenatal teeth, and bent long bones. Histological examination of the long bones revealed the growth plate contained smaller hypertrophic chondrocytes and a thickened hypercellular periosteum. Four affected individuals had heterozygous mutations introducing a polar amino acid into the hydrophobic transmembrane domain of FGFR2. Patient-derived chondrocytes and cell-based assays determined that these mutations reduced plasma membrane levels of FGFR2 and selectively enriched nucleolar levels of the

receptor. That enhanced intranucleolar FGFR2 altered ribosomal biogenesis was supported by a 5-fold elevation of 45S precursor ribosomal RNA (rRNA) expression in diseased growth plate. Conclusion: This clinical and molecular characterization of a new skeletal dysplasia suggests that intranucleolar FGFR2 activity regulate ribosomal biogenesis. Future studies will establish how nucleolar FGFR2 regulates rRNA transcription and influences proliferation versus differentiation in skeletal progenitor cells.

Poster #: 120
Title: Reliability of Foramen-based Landmarks for Use with CBCT images of the skull
Name: Xin Jin
Faculty Advisor: Stephen Yen

Background: Standard landmarks in Cephalometric Radiographs are difficult to reproduce in 3 dimensional renderings of the face and skull, making conebeam CT technology less user-friendly to the orthodontic clinician. Purpose: The purpose of this study is to test the reproducibility of substitute landmarks that are based on Foramina of the face and skull. Methods: Using Dolphin 3D imaging software of cone beam CT images from six different patients,three classes of six orthodontic residents were asked to reproduce superior and exterior point on the following foramina: mental f., infraorbital f. porion f. , lower incisve f. upper incisive f. anterior foramen magnum. A training booklet and demonstration were used to define the position of the landmarks. The position of the landmark as defined by the resident was compared by linear distance to the landmark defined by Dr. Jianlu Shi, an orthodontic chairman, who defined the target position. The linear differences between resident landmarks and Dr. Shi's landmarks were recorded, averaged and tested using Student-tests. Results: The pilot study showed variation in the resident landmark positions; however, most residents were within 1 mm of the target position. There were no significant differences recorded between the resident position and the target position. We conclude that the foramina represent reproducible three-dimensional landmarks that can be used for measurement of facial dimensions and bony length. Conclusion: We plan to repeat the experiment in two other orthodontic departments in order to develop a multi-center trial of the landmark reproducibility.

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