Herman Ostrow School of Dentistry of USC

2018 Annual Research Day
Winning Posters

Poster #: 8 **Title:** Programmable Orthodontic Expander for Treating Cleft Lip and Palate Patients
Name: Ana Torres **Faculty Advisor:** Stephen Yen
Background: The NiTi Expander is a novel appliance that has several advantages over the other methods of expansion, such as shape memory, reprogrammability, surgical field non-interference, and cost. Currently there are no controlled studies comparing different kinds of expansion in patients with UCLP. **Purpose:** The aim of this study was to analyze the dentoalveolar effects of the NiTi Expander in patients with complete unilateral cleft lip and palate (UCLP) and compare them to the effects of a conventional Rapid Palatal Expander and Quad-Helix. **Methods:** This clinical trial has a sample of 71 patients with complete UCLP, ages 7-14 years, who were divided in three groups and had expansion with Rapid Palatal Expander (RPE), Quad-Helix (QH) or NiTi Expander prior to the secondary alveolar bone graft surgery. Occlusal changes were measured in digital models that were obtained pre-expansion (T1) and 6 months post-expansion at the time of appliance removal (T2). **Results:** The NiTi Expander and QH were able to produce a differential expansion with more anterior than posterior expansion. The RPE overexpanded the posterior segments. The expansion with NiTi expander was successful in 100% of the subjects. Complications occurred in 10% of the patients and included impingement of the appliance, wire breakage, and wire embedment into palatal tissue if the expander size was too large to begin with. **Conclusion:** Due to the successful expansion results obtained in this study, ability to customize the NiTi expander with reprogramming, lack of interference with the surgical field and its reduced cost, the NiTi Expander could be an alternative to the current methods of expansion for the treatment of patients with UCLP.

Poster #: 21 **Title:** A Novel Biofilm Mediated Osteolytic Infection Model- A Micro-CT Analysis
Name: Jasveen Wadia **Faculty Advisor:** Homayoun Zadeh
Background: Peri-implantitis is a major biologic complication of implant dentistry. One obstacle in studying peri-implantitis is the lack of an appropriate animal model. Bacterial biofilm is the main cause of peri-implantitis. Bacterial biofilm is more resistant to clearance by immune components or antimicrobial agents. **Purpose:** This study was designed to establish a novel animal model to study the peri-implantitis by establishing *Aggregatibacter actinomycetemcomitans* (Aa) biofilm in vitro and transferring it to our in vivo animal model. **Methods:** Modular titanium implants and abutments were used. The abutments were inoculated in vitro with Aa. Sham-inoculated abutments served as control. Sterile titanium implants were inserted into the buccal maxillary alveolar ridge in laboratory rats. The abutments with or without established Aa biofilm were attached to implants and were followed for 8 weeks. In vivo Micro-CT imaging was performed at baseline, 3- and 8-week to examine peri-implant bone volume. The micro-CT images were superimposed in AMIRA software to evaluate the bone loss in a volumetric fashion. **Results:** Utilization of imaging software to quantify peri-implant bone loss was very sensitive and capable to detect minute linear and volumetric peri-implant bone loss and bone to implant surface contact (BISC). We analyzed the images according to bone volume and BISC at baseline, week 3, and week 8. Quantitation of peri-implant bone loss is ongoing and will be reported at USC Research Day 2018. **Conclusions:** Biofilm mediated osteolytic infection model in concert with quantitative volumetric analysis of peri-implant bone loss can provide valuable insights into the pathogenesis of peri-implantitis mediated by specific pathogens.

Poster #: 47 **Title:** Modeling Wdr62-related microcephaly disease in 3D cerebral organoid system
Name: Wei Zhang **Faculty Advisor**: Jianfu Chen
Background: Primary microcephaly is a neurodevelopmental disorder in which brain size is markedly reduced. Mutation in *WDR62* is one of common genetic causes of autosomal recessive primary microcephaly (MCPH) in human. Mouse model studies suggest that Wdr62 depletion mediates the reduction of neural progenitor cells (NPCs), which in turn underlies microcephaly phenotypes. However, mouse mutants have failed to recapitulate the severely reduced brain size seen in human patients.The complexity of the human brain has made it difficult to study many brain disorders in model organisms, highlighting the need for an in vitro model of human brain development. The development of 3D cerebral organoid system offers an opportunity to generate human brain-like organs to investigate mechanisms of human brain development and disorders. **Purpose**: Using 3D cerebral organoid system to recapitulate MCPH disease phenotypes seen in human patients and study the mechanisms of action of WDR62 during human brain development. **Methods**: We used CRISPR-Cas9 technology to generate the *WDR62* mutation human pluripotent stem cell (PSC) lines. Then cerebral organoids were generated in 3D culture system using wild-type and gene-edited PSC lines. **Results**: We found that *WDR62* deletion causes smaller cerebral organoid sizes than wild-type control group, which is similarly found in *Wdr62* null mouse model. WDR62 ablation leads to NPCs population reduced, delayed cell cycle re-entry and premature differentiation of NPCs during cerebral organoid development. **Conclusion**: Our results demonstrated that 3D cerebral organoid system can be used to recapitulate Wdr62-related microcephaly disease in human, suggesting a new strategy to study human developmental diseases in central nerve system.

Poster #: 46 **Title:** Fgfr2 patterns cell fate at the tendon and bone interface
Name: Ryan Roberts **Faculty Advisor**: Amy Merrill
Background: Tendon is joined to bone through a transitional connective tissue known as the enthesis. The enthesis is morphologically graded from tendinous to osseous and arises from bipotent progenitors that co-express Scleraxis (Scx) and Sox9 (Scx+/Sox9+). **Purpose**: While it is known that Scx+/Sox9+ progenitors differentiate into either tenocytes or chondrocytes, the mechanisms that spatially resolves their bipotency has remained unclear. **Methods**: Using mouse genetics, we demonstrate that FGF signaling determines the spatial pattern of Scx+/Sox9+ progenitor cell differentiation in the mammalian lower jaw. **Results**: We show that conditional inactivation of *Fgfr2* in the neural crest-derived Scx+/Sox9+ progenitors of the mandible disturbs their regional differentiation into tenocytes and chondrocytes, induces ectopic bone formation, and disrupts the gradation of the tendon insertion. We find that, upon loss of Fgfr2, altered Scx+/Sox9+ progenitor differentiation is tightly correlated with changes in Notch-Jagged-Delta signaling, including loss of salt-and-pepper expression of Notch2. Correspondingly, conditional deletion of Notch2 and Jagged1 in neural crest cells leads to abnormal development of mandibular entheses. **Conclusion**: These results suggest that Fgfr2 establishes a spatial gradient of cell fate during enthesis morphogenesis by regulating Notch signaling.

Poster #: 57 **Title:** Translational regulation of neural progenitor cells (NPCs) and brain development
Name: Stephanie Herrlinger **Faculty Advisor:** Jianfu Chen
Background: While many transcriptional regulators of neural progenitor cells have been identified, few post-transcriptional regulators have. The RNA-binding protein Lin28 is a heterochronic gene regulator. Lin28 single knockouts exhibit microcephaly. Mammals have two homologs of Lin28, Lin28A & Lin28B. Double knockouts exhibit neural tube defects and embryonic lethality. This study sought to examine the post-transcriptional roles of Lin28 in brain development. **Purpose:** To examine post-transcriptional regulation of neural progenitor cell behaviors in neurodevelopment. **Methods:** In vivo mouse models: Lin28a, Lin28b mutant mice, Rpl24 (Belly Spot and Tail) hypomorphic mice, Lin28a overexpression transgenics. Polysome profile analyses combined with RNA-seq experiments to identify downstream post-transcriptional targets of Lin28 activity in the brain. **Results:** We found that Lin28 modulates protein synthesis rate in vivo, and in doing so maintains the NPC cell fate. It does this in part by promoting ribosome biogenesis and maturation. **Conclusion:** Post-transcriptional regulators of neurodevelopment play important temporal roles to potentiate NPC proliferation. This is important for brain development, as it must grow quickly over a relatively short period of time.

Poster #: 65 **Title:** Neural Crest-Derived Forebrain Pericytes in Development and Disease
Name: Casey Griffin **Faculty Advisor**: Ruchi Bajpai
Background: Defects in or loss of functional forebrain pericytes leads to breakdown of the integrity of the BBB, causing leakage of toxins and pathogens into the brain and compromising the immune-privileged state of the brain. Leakiness of the BBB has recently been found to play a part in numerous neurodegenerative diseases, most notably Alzheimer's disease. Despite their importance in pathophysiology and onset and progression of disease, little has been done to characterize these cells at a global and an individual level, and in the context of disease. **Purpose**: Forebrain pericytes are critical players in the blood-brain barrier (BBB). Despite their importance, little is known about forebrain pericytes and what makes this population of pericytes both able to maintain the BBB and become prone to damage with agining and disease. My project focuses on understanding what defines forebrain pericytes as a unique pericyte population, with emphasis on their developmental source as well as their transcriptome and epigenome architecture, and the changes in these aspects associated with disease. **Methods**: I have developed a system of generating forebrain pericytes from neural crest cells in vitro. I have characterized these cells functionally and transcriptomically, comparing to primary brain pericytes across different species. I have also generated pericytes from AD patient cells and compared these to primary patient pericytes and controls to begin to characterize the pericyte-specific defects in Alzheimer's disease. **Results**: I have identified pericyte defects that are common across different patients and mutations of Alzheimer's Disease, honing in on possible general pathways important to pericyte function at the BBB. I have also shown that the in vitro system I created is able to recapitulate in vivo conditions in both the wild type state and the disease state when compared to both primary human and primary rat samples. **Conclusion**: My in vitro method of generating forebrain pericytes is able to provide insights into the roles pericytes play in development and maintainence of the BBB, as well as the mechanisms of various defects associated with disease. This system can be used to study pericytes of different AD mutations, as well as be applied to other diseases involving pericytes, such as ALS and Parkinson's.

Poster #: 77 **Title:** Trunk control in persons with recurrent low back pain
Name: K. Michael Rowley **Faculty Advisor:** Kornelia Kulig
Background: Recurrent low back pain (rLBP) is an incredibly large problem with up to 80% of adults experiencing at least one painful episode and a third of those suffering recurrence. Motor control changes during symptom remission have been identified in these patients and are thought to contribute to recurrence. **Purpose:** The purpose of this study was to investigate trunk control during a novel Balance-Dexterity Task and the effects of dual-task interference in participants with and without rLBP. **Methods:** Nineteen back-healthy controls and nineteen participants with rLBP were recruited to participate in the IRB-approved study. Participants completed five trials of the Balance-Dexterity Task and five trials with concurrent cognitive dual-task. Trunk control was quantified using kinematic frontal-plane coupling and trunk muscle activation. **Results:** Participants with rLBP exhibited reduced trunk coupling ($p=0.024$) associated with the ratio of deep-to-superficial trunk muscle activity – both for paraspinals ($R=0.608, p=0.007$) and abdominals ($R=0.473, p=0.048$) – where greater deep muscle activation was associated with more coupled trunk motion. Participants with rLBP increased trunk coupling under conditions of dual-task interference, and this increase was modulated by difficulty rating of the cognitive task ($R=-0.497, p=0.036$), recall pain ratings ($R=-0.642, p=0.005$), and lumbar erector spinae activation change ($R=-0.580, p=0.019$). **Conclusion:** Persons with rLBP exhibited more dissociated trunk motion during dynamic balance. Trunk coupling increased in this group under dual-task interference, and those who increased the most rated the cognitive task easier, had lower recall pain ratings, and decreased erector spinae activation. These findings indicate dual-tasking could address dissociated trunk motion in persons with rLBP but will work better for certain patients.

Poster #: 68 **Title:** Piloting of Paired Associative Stimulation to Modulate Resting-state Intracortical Connectivity
Name: Andrew Hooyman **Faculty Advisor:** Carolee Winstein
Background: Resting-state Intracortical connectivity measured by electroencephalography (EEG) can be used as a robust predictor of motor skill learning and stroke recovery. However, a method capable of modulating resting-state intracortical connectivity has not been well established. An innovation in Transcranial Magnetic Stimulation (TMS) research is the combined use of Paired Associative Stimulation (PAS) with electroencephalography (EEG) to modulate and measure changes in resting-state brain activity. **Purpose:** The overall purpose of this experiment is to examine the initial feasibility of using Paired Associative Stimulation (PAS) to increase targeted intracortical connectivity. **Methods:** Individual participants either received 120 pulses of real PAS with a 5 ms delay (PAS+5; N = 3) or sham PAS with a 100 ms delay (PAS+100; N = 2) between the paired pulses. The lead pulse was applied over the orbital frontal cortex and the proceeding pulse was applied to the dorsal lateral prefrontal cortex. To determine the effect of PAS, resting state EEG data was collected pre-PAS, during PAS and post-PAS. **Results:** Visual analysis of Pre/Post-PAS resting-state EEG contrast demonstrated a trend of the PAS+5 condition to increase measures of functional connectivity between the targeted electrodes compared to the PAS+100 condition. Additionally, there was also a longitudinal trend in facilitation of intracortical connectivity while PAS+5 was being applied. **Conclusion:** Preliminary results demonstrate the application of PAS+5 can feasibly modulate specific resting state intracortical connectivity. Future work should focus on recruiting larger samples sizes and utilize more robust study designs to statistically confirm PAS effectiveness at manipulating resting-state intracortical connectivity.

Poster #: 76 **Title:** Learning and generalization of an obstacle negotiation task in VR
Name: Aram Kim **Faculty Advisor:** James Finley
Background: Obstacle negotiation is an essential skill for everyday performance. Recent studies demonstrated that goal-oriented obstacle negotiation can be trained on a treadmill with auditory feedback within a single day. However, it remains to be seen how this training generalizes to over-ground walking and whether the skill is retained after 24 hours. **Purpose:** Here, we present a novel obstacle negotiation task in VR to determine how locomotor skills are retained in VR and generalized to over-ground walking. **Methods:** On Day 1, 19 healthy young participants stepped over virtual obstacles viewed through a head-mounted display while walking on a treadmill. Participants were instructed to minimize the vertical distance between the foot and the obstacles (foot clearance). During training, three types of auditory feedback were provided: 1) pleasant sound for foot clearance within 0-2 cm, 2) error sound whose frequency scaled with foot clearance greater than 2 cm, and 3) failure sound following collisions. Moreover, participants performed over-ground physical obstacle negotiation before (PRE) and after (POST) training with the same instruction as the virtual obstacle negotiation. On Day 2, participants completed one retention block in VR without auditory feedback and over-ground retention trial. **Results:** Foot clearance during training in VR decreased on Day 1. Day 2 foot clearance was also lower than baseline foot clearance on Day 1. Participants also reduced foot clearance from PRE to POST over-ground, and maintained the POST over-ground performance on Day 2. **Conclusion:** Our findings support applicability of VR for locomotor training and transfer for interventions in the clinic.

Poster #: 86 **Title:** Using Exploratory Learning to Encourage Selective Hip-Knee Movement in Infants
Name: Jeongah Kim **Faculty Advisor**: Linda Fetters
Background: In the US, each year more than 100,000 infants are born VPT. They are at higher risk for motor impairments, including cerebral palsy. A primary motor impairment in cerebral palsy is limited selective joint movement. We scaffolded a mobile task to encourage infants to generate more selective hip-knee movement. **Purpose**: To determine: (1) if infants born full-term (FT) and very preterm (VPT) can learn the Scaffolded Mobile Task and (2) if they generate more selective hip-knee joint movement during the task. **Methods**: Nine infants (5 FT, 4 VPT) at 4 months corrected age participated. Infants were supine under a mobile. An Optotrak Motion Capture System was used to quantify hip and knee joint angles. Day 1 consisted of a 2-min baseline "spontaneous kicking" condition followed by an 8-min acquisition condition, during which the musical mobile rotated when the infant lifted either foot vertically over an individually determined threshold. Day 2 and 3 consisted of a 10-min acquisition condition, during which the height of the threshold was systematically increased. **Results**: Four of 5 infants born FT and 2 of 4 infants born VPT learned the task (%mobile active time ratios: 1.70-3.98). Among these infants, 3 infants born FT and 1 infant born VPT exhibited more selective hip-knee joint movement (hip-knee correlation coefficients decreased by 0.11-0.62). **Conclusion**: Infants born FT and VPT can learn the Scaffolded Mobile Task and the task can motivate more selective hip-knee movement. Our data will inform motor capability in early infancy and will provide foundational knowledge for developing therapeutic interventions.

Poster #: 104 **Title:** Motor Ability Correlates with Neural Activity during Imitation in Autism
Name: Christiana Butera **Faculty Advisor**: Lisa Aziz-Zadeh
Background: Motor and imitation skills are significantly impaired in some children with ASD (Williams et al. 2004). Previous neuroimaging work found reduced BOLD signal activity in adolescents with ASD during imitation of hand actions as compared to typically developing (TD) participants (Wadsworth et al, 2017). Mechanisms underlying the imitation deficit are uncertain; there may be a relationship between reduced motor skill and imitation deficits in ASD. **Purpose**: The purpose of this study is to (1) compare performance on the Movement Assessment Battery for Children (MABC-2; Henderson, 2007) between a sample of typically developing (TD) children and children with autism spectrum disorder (ASD) and (2) assess how performance on this motor assessment correlates with neural activity in motor-related brain regions during an imitation task. **Methods**: Data from 9 participants with ASD (age 10.93 ± 1.86), and 15 TD participants (age 11.15± 1.39) were analyzed. In an MRI scanner participants imitated videos of hand actions, and parameter estimates from motor regions (e.g., primary motor cortex) were extracted and correlated with MABC-2. **Results**: MABC-2 scores were significantly lower in ASD compared with TD participants ($p<.001$). In the ASD group only, significant correlations between MABC-2 total standard score and imitation of hand actions were found in the right precentral gyrus ($r=.67$, $p=.04$), and the left postcentral gyrus ($r=.69$, $p=.03$). **Conclusion**: These data suggest that in ASD, MABC-2 scores may be related to activity patterns in premotor and primary motor regions recruited during hand action imitation.

Poster #: 95 **Title:** Evaluating Automated Lesion Segmentation Approaches for Stroke MRI Data
Name: Kaori Ito **Faculty Advisor:** Sook-Lei Liew
Background: Understanding the pathophysiology of stroke is critical to enhancing the efficacy of post-stroke rehabilitation. Manual lesion segmentation remains the gold-standard for lesion annotation for stroke research, but is labor- and time-intensive. A number of automated approaches have been developed in recent years, but have not yet been systematically evaluated on a large, public dataset. To this end, we evaluate the performance of automated lesion segmentation approaches on a large stroke dataset. **Purpose:** To facilitate future use and development of automated lesion segmentation approaches. **Methods:** We evaluated three automated lesion segmentation approaches ("ALI", "lesion_gnb", and "LINDA") using a dataset of 181 chronic stroke MRIs. We compared performance among all automated segmentations with respect to manual tracing of lesions using three different evaluation metrics: Dice Coefficient (DC), Hausdorff's Distance (HD), and Average Symmetric Surface Distance (ASSD). Friedman's Tests were conducted on DC, HD, and ASSD to assess differences in performance on automated segmentation approaches. **Results:** For all evaluation metrics, a significant difference was found among the three automated approaches ($p<0.0001$). Pairwise comparisons (Bonferroni corrected) showed that LINDA performed best on DC and ASSD ($p<0.01$). For HD, LINDA outperformed lesion_gnb ($p<0.0001$), but did not differ from ALI ($p=1$). Performance across methods was worse on small lesions and on brainstem/cerebellar lesions. **Conclusion:** Overall, LINDA performed best on the evaluation metrics. By identifying the optimal approach for lesion segmentation, we hope to enhance stroke rehabilitation research in its discovery of clinically meaningful insights, and facilitate future development of algorithms.

Poster #: 113 **Title:** Functionalized Scaffold and Membrane for Ridge Preservation
Name: Taewan Kim **Faculty Advisor**: Seiko Min
Background: Tissue engineering approaches to bone repair involved with scaffolds, stem cells and exogenous growth factors. An alternative was proposed involving anti-Bone Morphogenetic Protein (BMP)-2 monoclonal antibodies (mAbs) immobilized on a scaffold which captures endogenous BMP to mediate bone formation. **Purpose**: The aim of this study was to investigate the ability of anti-BMP-2 mAb used to functionalize scaffolds to mediate bone regeneration in a canine model. **Methods**: Mandibular right PM4 was extracted on eight beagle dogs and grafted with anti-BMP-2 mAb + anorganic bovine bone mineral with 10% collagen and porcine bilayer native collagen membrane (CM). The ABBM-C and CM were functionalized with either anti-BMP-2 mAb (test group) or isotype matched control mAb. (control group). Animals were euthanized at 12 weeks for radiographic, histologic and histomorphometric analyses. Across group outcomes were compared. **Results**: 3D imaging, using CBCT revealed that, compared with control groups, sites treated with ABBM-C and CM functionalized with anti-BMP-2 mAb exhibited significantly more remaining bone width, near the alveolar crest. Histologic and histomorphometric analyses demonstrated that in anti-BMP-2 mAb treated sites, unlike control sites, de novo bone formation extending significantly beyond the confines of the alveolar bone crest. In anti-BMP-2 mAb treated sites, de novo bone formation was observed under the barrier membrane. **Conclusion**: Functionalization of ABBM-C scaffold and CM appeared to have led to de novo bone formation within healing alveolar bone sockets.

Poster #: 112 **Title:** Effects of Periodontal Disease on Transgenic Rat Model of AD
Name: Simon Youn **Faculty Advisor**: Ruchi Bajpai
Background: A positive correlation has been observed between AD and PD in patients. Recent findings have suggested that compromised blood brain barrier, which makes the brain more susceptible to recurring infections, has been detected in AD patients prior to the onset of dementia. Bacteria that cause periodontitis such as P. gingivalis have been proven to be able to travel to the brain. In a study done in 2017, there was a 1.707-fold increase in the risk of developing AD for subjects who had chronic periodontitis for 10 years (Chen et al., 2017). Our lab has recently described several molecular markers underlying brain microvasculature defects in invitro models of AD. These defects are recapitulated in brain tissue samples from deceased AD patients (Griffin et al, in revision). We hypothesize that similar microvasculature defects may be the underlying cause of chronic periodontal disease in spite of good oral hygiene. Here we determine (i) whether AD rats are more prone to getting PD (ii) if similar microvasculature defects are observed in the brain and around the tooth pulp of AD rats and (iii) the natural variation in molecular markers among patients' tooth pulp with age and disease status. **Purpose**: To test whether recurring periodontal disease (PD) increases the severity of Alzheimer's Disease (AD). **Methods**: 1. Analysis of rodent tooth and brain at different ages from normal and AD model rats. 2. Analysis of mandible and brain pathology in AD and control rats with induced PD. 3. Analysis of patient teeth at different ages and disease status. **Results**: 1. Microvasculature defects in brains of AD rats predicted from our stem cell studies and consistent with microvasculature defects in patient brain samples. 2. Expression of these markers in isolated root pulp and the oral cavity from the same animal models. **Conclusion**: AD rat serves as a powerful model to assess molecular basis of the correlation between PD and AD.

Poster #: 119 **Title:** Multi-bacterial Biofilm and Bone Loss in Peri-implantitis
Name: Nathan Nourian **Faculty Advisor**: Neema Bakhshalian
Background: Peri-implantitis, an infection associated with implants, has a complex etiology and pathogenesis. The lack of proper animal models where the inflammatory response to biofilms can be analyzed is a hindrance to research. Models utilizing biofilm composed of multiple bacteria would enhance the understanding of peri-implantitis. **Purpose**: The aim of this study was to compare the peri-implant bone volume among the 4 different groups (sterile, *Aggregatibacter actinomycetemcomitans* (Aa), *Dialister pneumosintes* (DP), and Aa+DP biofilm inoculated titanium abutments); bone to implant surface contact (BISC) among the 4 treatment groups; bone volume between baseline and post-op within each group and BISC between baseline and post-op within each group. **Methods**: Titanium implants were placed in the natural diastema between the first molar and incisor of the rats. Rats were assigned to 4 groups, with groups A-C involving inoculated titanium abutments, (A: Aa; B: DP; C: Aa+DP) and group D as a control group with sterile biofilm. 2 CT scans, after implant placement and 8 weeks post-op, analysis was completed using Amira, FEI. **Results**: Post-op bone volume was reduced in all test groups presented. The DP group (35.6%±31.7) showed the largest decrease in post-operational bone volume ($P>0.05$). Post BISC was also reduced in the 4 groups studied. The DP (19.5%±23.6%) group presented the lowest post-op BISC ($P>0.05$). **Conclusion**: The results describe the amount of bone loss, volume and surface contact, in rat oral cavity where DP's osteolytic destruction rate was the most rapid. This multi-bacterial model may be utilized for future investigations involving biofilm and host responses during peri-implantitis.

Poster #: 117 **Title:** Bio-remineralization with Quantitative Light-induced Fluorescence (QLF)
Name: Amrita Chakraborty **Faculty Advisor:** Janet Oldak
Background: QLF estimates mineral loss by extrapolating the change in fluorescence of the lesion compared with the fluorescence of the surrounding sound enamel. **Purpose:** To determine the validity of Quantitative Light-induced Fluorescence (QLF) for the detection of White Spot Lesions (WSLs) and quantification of peptide induced enamel remineralization in situ. **Methods:** 10 sound human molars were collected and windows of dimension 5*3mm were created on the buccal surface of each sample. Customized

crowns of thermoplastic bleaching tray material were fabricated with reservoirs against the created windows. The tooth samples were subjected to a 14 day demineralization cycle at pH 4.6, 37°C. The samples were then distributed into two groups (N=5) treated with Control (Artificial saliva only) and Peptide-Chitosan (P-CS) hydrogel over a 30 day remineralization period. Artificial saliva was replenished every 24 hours and gel application made once a week. White light and fluorescence images (Shutter speed: 1/30s; ISO 1600) were obtained from each specimen in 3 stages; healthy enamel, demineralised enamel and remineralized enamel. **Results:** ΔF values were used to determine lesion depth. ΔF of sound enamel was 0 and the ΔF baseline of artificial carious lesions ranged from -7.22 to -9.74. Mineral gain was significantly higher in teeth treated with P-CS (ΔΔF = +1.14±1.76) than in teeth treated Control (ΔΔF = -1.04±2.34); (ΔΔF = ΔFremin- ΔFdemin;$p<0.05$). **Conclusion:** QLF can be proposed as an adjunctive diagnostic tool for assessing the efficacy of P-CS hydrogel inducing enamel remineralization in situ.