Orthodontic Faculty Development Fellowship Award

Dr. Xu Qian, *Tufts University*

Biography

I am an assistant professor in the Department of Orthodontics at Tufts University School of Dental Medicine. I achieved Board Certification and am a Diplomate of American Board of Orthodontics. I earned my dental degree and completed my orthodontic residency with a MS at West China School of Dental Medicine, Sichuan University. Then I completed a PhD in Oral Health Sciences at the School of Dentistry, University of Michigan. I completed my second residency with a specialty certificate in Orthodontics at School of Dentistry, University of California, Los Angeles. At Tufts, I teach residents/dental students, supervise the residents in orthodontic clinic, and treat orthodontic patients. My research interests include tissue engineering of pluripotent stem cells and craniofacial structures, CBCT and 3D imaging in orthodontics, and treatment of craniofacial deformity.

Project Synopsis

Because of my background in tissue engineering and orthodontics, and the clinical experience I am currently receiving while serving on the Cleft Lip / Craniofacial Anomalies Team, I am interested in applying tissue engineering strategies to achieve craniofacial regeneration. Patients with congenital missing teeth or other tooth loss conditions compose a main group of our orthodontic patients who need multidisciplinary treatment. Either with the conventional dental implants or the promising whole tooth regeneration, lacking of the surrounding periodontal tissues has always been a challenge. Recent studies indicate that mechanical forces can be used to stimulate periodontal ligament cell differentiation and contribute to tissue regeneration. However, these published mechanical stimulations were 2D stretching forces applied to *in vitro* cultured periodontal ligament cells and therefore did not fully reflect the 3D forces encountered by natural periodontal ligament tissue surrounding teeth. Therefore, I intend to promote periodontal tissue regeneration of bioengineered tooth bud and/or titanium dental implants through the 3D mechanical strategies that mimic the physiological stimulus of chewing with a device that has been fabricated to provide cyclic mechanical loading of defined force to *in vitro* cultured 3D cell-encapsulated cell constructs. It is expected that the cyclic 3D mechanical loading will promote periodontal tissue formation and differentiation of bioengineered 3D tooth bud constructs and/or titanium implants by facilitating PDL cell alignment, stimulating the production of the PDL specific biomarkers, and up-regulating osteogenesis. Tissue compatibility of the bioengineered constructs will be confirmed in rat subcutaneous sites.

Importance of the AAOF Foundation

The funds will be used to purchase research equipment/supplies and support the faculty training/educational cost. My prior experiences and the enjoyment I received from a variety of scholarly activities have become a strong motivator for me to further pursue my career development in academic dentistry. With the support of this prestigious fellowship, I will prepare myself to become a well-balanced scholar, educator and clinician.