Biomedical Research Award

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I am a clinician-scientist who is well trained in both basic and clinical sciences directly linked to mandibular biology and orthodontics. On April 1, 2016, I was promoted to a Research Assistant Professor in the Department of Orthodontics of Texas A&M College of Dentistry, which provided me a new platform for my academic career development. In search for my own independent project in the field of orthodontics, I devote efforts to developing new strategies for the prevention of white spot lesions.

To obtain this goal, I collaborated with an expert in material science (Dr. Chi Ma, one Co-I in this proposal) and developed an innovative post-processing strategy to modify the ordinary O-rings so that they can release fluoride (Ca-F O-rings). We hypothesize that Ca-F O-rings can provide a long-term therapeutic release of fluoride. This hypothesis is based on the following preliminary data: 1) Ca-F was successfully loaded in the periphery portion of the O-ring in the form of nanoparticle; 2) the modified O-ring (Ca-F O-ring) was able to release a therapeutic level of fluoride ion up to 3 weeks; and 3) the modification has limited impacts on mechanical performance and chemical composition of the O-ring. We plan to attain our study goal by optimizing the releasing profile of fluoride through adjusting the parameters of the post-processing strategy. In particular, we will evaluate the effects of four different parameters, including: 1) the amount of loaded Ca-F; 2) the impregnation depth of Ca-F; 3) the releasing profile of Ca-F; and 4) the elastic property of the Ca-F O-rings.

Our study is significant since there is currently no ideal strategy to prevent WSLs during orthodontic treatment. Successful completion of this proposal will establish an efficient method to impregnate Ca-F into ordinary O-rings and make it possibility to adjust the fluoride release kinetics and provide an affordable mean to prevent WSLs for orthodontic patients. This study represents the first step in a series of projects designed to prevent WSLs. Our future direction is to test the effect of Ca-F O-rings on the prevention of WSLs in vitro by using pH cycling, which will provide more comprehensive data to plan its clinical application.

As a junior faculty, I appreciate that the AAOF provides me a great opportunity and platform to continue my research study and broaden my knowledge in different areas. Of note, with the support of my last AAOF/BRA grant entitled Novel roles of chondrocyte-derived bone cells in mechanical strain-induced TMJ remodeling (2017-2018), I was able to generate pilot data with high novelty and successfully obtain a R03 from NIDCR in 2020.