

Biomedical Research Award

Dr. Rishma Shah, *University of North Carolina*

Biography

Dr. Rishma Shah is Assistant Professor at the University of North Carolina, Adams School of Dentistry and a member of the UNC Craniofacial Center team. She completed her BDS with honors (DDS equivalent) at the United Medical and Dental Schools of Guy's and St. Thomas' Hospitals, London. Dr. Shah received her MS in Orthodontics with distinction and her PhD in Biomaterials and Tissue Engineering from the University of London, England. She has also completed Fellowships in Dental Surgery and in Orthodontics at the Royal College of Surgeons. She is experienced in the management of complex craniofacial and interdisciplinary cases. Her research complements her clinical interests and is focused on the role of the craniofacial muscles in dentofacial deformity and muscle tissue engineering applications.



Project Synopsis

'The Application of Low-Intensity Pulsed Ultrasound (LIPUS) in Dentofacial Deformity'

In the United States, it is estimated that 5% of the population (16.5 million) present with moderate-severe dentofacial deformities that require surgical intervention of the hard and, occasionally, the soft tissues to restore dentofacial balance and function. The estimated cost of combined orthodontic treatment and orthognathic surgery ranges from \$20,000-\$40,000 per case. Possible complications of surgery include nerve damage, infection, relapse, and poor aesthetic and functional outcomes; the associated financial burden amounts to millions of dollars. There is a need to develop therapies for the prevention of dentofacial deformity and, in the case of corrective procedures, improve outcomes in all cases. Our long-term goal is to develop innovative therapies for dentofacial deformities.

The evidence suggests a role of the masticatory muscles in dentofacial deformity. There is an urgent need to better understand this role in order to identify potential preventative interventions. In addition, understanding factors that promote muscle adaptation and regeneration are of relevance to stability and faster recovery following surgical correction.

Low-intensity pulsed ultrasound (LIPUS) has been demonstrated as a non-invasive physical stimulus for numerous therapeutic applications. An extensive literature search has revealed the absence of studies on the effects of LIPUS on the *craniofacial* skeletal musculature. We propose to study the role of LIPUS in skeletal muscle regeneration and adaptation *in vitro*, and understand its potential as a therapeutic agent in dentofacial deformity. Our hypothesis is that successful and faster skeletal muscle regeneration and adaptation is dependent on the application of LIPUS. The following specific aims will answer our hypothesis: Aim 1 - Modification of our current tissue

bioreactors and optimization of LIPUS parameters; Aim 2 - Investigation into the in vitro effects of LIPUS on skeletal muscle regeneration and adaptation.

How Orthodontic Education Will Benefit from the Award

Orthodontists have in-depth knowledge of growth and development of the dentofacial complex. Studies have demonstrated the role of the muscles of mastication in dentofacial deformity. Our proposal to investigate the effects of LIPUS on craniofacial skeletal muscle is timely, novel and innovative. There is the potential to generate *new knowledge* on the effects of LIPUS on the soft tissues of the dentofacial region, and how this may be utilized in the development of future therapies for our patients.

Why the Foundation is Important to the Project

The Foundation is an important advocate of the project and its long-term implications for the orthodontic patient. The funding provided by the Foundation is essential for the generation of preliminary data to support future funding applications. Furthermore, the new knowledge learned from this project has the potential to support novel, less invasive and cost-effective therapies to manage dentofacial deformity.

How Foundation Funding Has Helped Advance My Career

I am grateful to the Foundation for the award of this funding. The generation of preliminary data from this project funded by the Foundation will support a future R21 funding application to the NIH/NIDCR. As a tenure-track Assistant Professor, the award of research funding from institutions, such as the NIH/NIDCR, is important for advancing my career as a clinician-scientist-educator in the field of orthodontics.