

Biomedical Research Award

Dr. Jeffrey Nickel, *Oregon Health and Science University*

Synopsis

2019 Robert L. Boyd Biomedical Research Award:
Mechanobehavior and Autonomic Function in Adolescents of
Two Facial Types

Biography: Dr. Nickel was born in Regina, Saskatchewan, Canada. His university degrees are from the University of Manitoba: DMD (1977-1981), MSc (1994-1987), PhD (1987-1992). Prior to his faculty appointment with OHSU, he was a faculty member at the University of Manitoba (1992-1996), University of Nebraska Medical Center (1996-2006), and University of Missouri Kansas City (2006-2018) where he was the DJ Thompson Associate Professor.



Description of the Project: In the United States, approximately \$12.1 billion are spent annually on orthodontic treatments. Management of mandibular growth involves more than 30% of patients. When excluding for non-compliance, failure rates of orthopedic therapies range from 13-34%, resulting in costs of failed treatment exceeding \$700 million dollars annually

There is little known concerning whether mechanobehavior, the combination of muscle-associated loading of the temporomandibular and in vivo contact mechanics, may be a significant factor in the rate and cessation of growth of the mandible. Our overall objective is to address the lack of knowledge concerning why orthopedic therapies to enhance mandibular growth are less successful in dolichofacial children. Our long-term goal is to address the issue of missing foundation data of the differences in mechanobehavior between adolescents in the diagnostic groups of dolichocephalic and brachycephalic facial types.

The project plan involves the recruitment of 36 adolescent children between the ages of 10-14 years. Three Specific Aims that will test for significant group differences in: **(1) TMJ loads for the same biting tasks; (2) Night-time jaw muscle duty factors; (3) Night-time sympathetic and parasympathetic spectral powers.**

To address these specific aims, we have developed protocols for ECG and EMG recording of nocturnal autonomic nervous system and jaw muscle activities, respectively, in subjects' home environments. Funds from the AAOF will be used to purchase recording equipment and provide remuneration to participating subjects.

How orthodontic education will benefit from the award: Currently, there is little information concerning the mechanism by which localized mechanical microenvironments affect stem cell biology in the TMJ. The AAOF award will support the development of a body of knowledge that will be used to make scientifically informed decisions concerning efficacy of orthopedic therapies of patients.

Why the Foundation is important to the project: The funding from the AAOF supports the long-term goal of securing funding from the NIH to study, longitudinally, how mechanobehavior affects TMJ homeostasis.

How Foundation funding has advanced my career: Funding by the AAOF has been a key element enabling increased productivity of our biomechanics lab, and funding from the NIH since 2006.