

AAO Foundation Award Final Report

Principal Investigator	Bo Hou
Co-Investigator	
Secondary Investigators	
Award Type	Orthodontic Faculty Development Fellowship -- Subtelny, Baker, Eastman Teaching Fellowship Award
Project Title	The cellular and molecular responses of mesenchymal stem cells to mechanical stress
Project Year	2011-2012
Institution	Boston University Goldman School of Dental Medicine
Summary/Abstract (250 word maximum)	<p>It is well known that adult patients can benefit from orthodontic treatment in conjunction with other dental therapies. However, many are unable to undergo proper oral rehabilitation due to various dental and medical conditions including severe periodontal disease, osteoporosis and the use of medications, such as bisphosphonates. On the other hand, even when older patients can tolerate extensive orthodontic treatment, it often leads to root resorption and bone loss. Therefore, more efficient and controllable tooth movement is critical for improving orthodontic treatment outcomes. Understanding the cellular and molecular control mechanisms of orthodontic tooth movement will provide insights into designing novel strategies to facilitate orthodontic tooth movement.</p> <p>During the process of orthodontic tooth movement, periodontal ligament (PDL) cells play a critical role in maintaining homeostasis and regeneration in response to orthodontic loading, i.e. mechanical stress. Among the various cell types residing in PDL, mesenchymal progenitor cells are of particular interest as they contribute to the coordinated remodeling of bone, cementum and functional periodontal ligament. However, how these cells sense and respond to mechanical stress remains largely unknown. The goal of this study is to establish a 3D <i>in vitro</i> model of mesenchymal stem cells and investigate the changes of mesenchymal stem cells in response to mechanical stress on cellular and molecular levels.</p>
Were the original, specific aims of the proposal realized?	<p>This project is proceeding. To date, I have successfully established the 3D <i>in vitro</i> system to apply mechanical stress to murine mesenchymal stem cells derived from bone marrow. Preliminary data has shown significant difference in cellular morphology between cells subjected to mechanical stress and without mechanical stress. This finding is the basis for further study on molecular mechanisms responsible for mechanotransduction. I plan to continue this project with characterization of the cells in different mechanical settings at mRNA and protein levels.</p>

<p>Were the results published? If not, are there plans to publish? If not, why not?</p>	<p>I am currently in the process of conducting experiments to analyze cellular responses to mechanical stress using the established 3D <i>in vitro</i> system. I plan to publish these data in orthodontic journal and/or journals in the field of bone biology.</p>
<p>Have the results of this proposal been presented? If so, when and where? If not, are there plans to do so? If not, why not?</p>	<p>Preliminary results of this project will be possibly presented at 2013 IADR/AADR and 2013 AAO meeting.</p>
<p>To what extent have you used, or how do you intend to use, AAOF funding to further your career?</p>	<p>AAOF has been very helpful to my career development. The funding from AAOF has allowed me to collect preliminary data for NIH grant application. With continued support from AAOF this year, I will expand my research and be more competitive in grant application.</p>