



401 N. Lindbergh Blvd.  
St. Louis, MO 63141  
Tel.: 314.993.1700, #546  
Toll Free: 800.424.2841, #546  
Fax: 800.708.1364  
Cell: 314.283.1983  
E-Mail: [rhazel@aaortho.org](mailto:rhazel@aaortho.org)

**AAO Foundation Final Report Form  
(a/o 5/31/2017)**

Please prepare a report that addresses the following:

Type of Award, Biomedical Research Award Award

Name(s) of Principal Investigator(s): Rodrigo F. Vieceilli

Title of Project: Biomechanics of Orthodontic External Root Resorption

Period of AAOF Support (e.g. 07-01-18 to 06-30-19): 07-.01-2014 to 12-31-2017

Amount of Funding: \$25,000

Summary/Abstract of Completed Project Results

This project aimed to evaluate the root resorption response in the first maxillary molars of 5 different inbred strains of rats. A total of 120 rats were divided in 3 groups (control, 10cN force and 20cN force). A custom designed Nickel-Titanium spring was designed to deliver the intended force for 2 weeks. Rats were sacrificed and the maxillary tissues were fixed and stored according to previously published protocols. All tissues were then scanned in a microct at 5 micrometer resolution, and sections in the area of interest of the mesio buccal root were produced to measure the volume of root resorption cavities. No significant differences were found in root resorption between different strains or force groups. Further analysis of the data revealed that there were important anatomical differences that changed the tooth movement type for the same force between different strains. We then proceeded to evaluate, in a derived project, the relationship between root morphology and tooth movement and how the two are mathematically related to better understand how to compare root resorption when teeth move differently. This project was published in the AJODO, and another publication is about to be submitted about the same problem. Due to the lack of significant differences in root resorption due to differences in tooth movement, we temporarily halted further histological analysis of the data. Our plan is to gain further understanding on how we can compensate for the differences in tooth movement between the strains to choose “fair” data normalization to make the areas truly comparable in terms of stress. We are in the process of analyzing the finite element models of the inbred strains to find the best way to do this using our published understanding of the role of 3D root morphology in tooth movement. It is anticipated that the project will generate one more publication, so a total of 3 publications will be derived from this project,

Response to the following questions:

1. Were the original, specific aims of the proposal realized? Yes, partially.
2. Were the results published?
  - a. If so, cite reference/s for publication/s including titles, dates, author or co-authors, journal, issue and page numbers

Savignano, R., Vecilli, RF., Paoli, A., Razionale, A., Barone, S. Nonlinear dependency of tooth movement on force system directions. ***Am J Orthod Dentofac Orthop***. 149(6). 838-46. 2015.

Savignano, R., Vecilli, RF., Paoli, A., Razionale, A., Barone, S. Nonlinear dependency of tooth movement on force system directions. Part 2: Role of Tooth Morphology. Submitted to ***Am J Orthod Dentofac Orthop***.

- b. Was AAOF support acknowledged?  
Yes.
    - c. If not, are there plans to publish? If not, why not?
3. Have the results of this proposal been presented?
  - a. If so, list titles, author or co-authors of these presentation/s, year and locations.  
Yes, presented at the IADR in Los Angeles in 2016.
  - b. Was AAOF support acknowledged?  
Yes.
  - c. If not, are there plans to do so? If not, why not?
4. To what extent have you used, or how do you intend to use, AAOF funding to further your career?

The AAOF has been extremely important to develop my academic career. I successfully completed a Fellowship award to study the biomechanics of root resorption over time in one rat strain. The AAOF supported me further to understand the role of genetic differences in this latest proposal, and the results have already generated two publications, and 3 R03 grant proposals that obtained “Excellent “ scores by NIH. I intend to continue to refine my understanding of the biomechanics of tooth movement and root resorption and am very thankful for the AAOF support.

Accounting for Project; i.e., any leftover funds, etc. All funds were used as intended during the experimental part of the project.