

AAO Foundation Award Final Report

Principal Investigator	Rodrigo F. Viecilli, DDS, PhD
Co-Investigator	
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Award Type	Faculty Development Fellowship
Project Title	Effect of initial stress and time on orthodontic external root resorption
Project Year	2011/12
Institution	New York University College of Dentistry
Summary/Abstract (250 word maximum)	<p>Introduction: Optimum stresses to minimize necrosis and OERR during Orthodontics are still unknown. Here, our main objective was to test the effect of time and stress in OERR. Methods: 42 inbred rats (Fischer CDF) were divided into groups of 0, 3, 15, 21 and 30 days of 10cN of force application. Finite element (FE) models of the first maxillary molars were constructed from μCT scans to calculate PDL stresses. A section of the middle-buccal root was selected and divided into 3 initial mean 3rd principal stress regions (high= -19.3kPa, medium= -9.92kPa, low= -7.75KPa) for OERR analysis. These maximum stresses are approximately produced in human canine bracket forces of ~80, 40 and 30cN respectively, according to our human FE model. μCT scans were used for 3D OERR measurements before specimen histology and TRAP IHC. Linear mixed models were used to identify the effects of stress, time, number of on OERR. We also examined the effect of stress and time on the number of osteoclasts in each root zone.</p> <p>Results: The effects of time, stress and their interaction were statistically significant ($p < 0.01$) to increase OERR in the regions of medium and high stress, confirming that treatment time and higher stresses lead to more OERR, and that time exacerbates the medium and high stress effect on OERR. OERR was not significantly different between control and treated animals over time in the region of low stress. Significant OERR occurred in the region of medium and high stress after 21 and 30 days when compared to control and 3 day groups. A significant increase in cell count resulted in more OERR only in high stress zones. At the end of 30 days, resorption increased by 5 and 3-fold when compared to low stress at the high and medium stress regions respectively. Direct bone resorption occurred in this region.</p> <p>Conclusion: Our analysis, limited to this inbred strain, suggests that the ideal 3rd principal stress range to promote direct bone resorption</p>

	and minimum OERR for a 30 day tooth movement is between -9.92 and -7.75KPa. These translate to maximum forces of 30-40cN applied at the bracket level (tipping) or 90-120cN at the center of resistance (translation) to a maxillary canine.
Were the original, specific aims of the proposal realized?	Yes
Were the results published? If not, are there plans to publish? If not, why not?	Manuscript is in preparation and should be published within this new academic year. It was a very long project that was finished in May, and we first prioritized meeting presentations before preparing the manuscript.
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?	Yes. The results have been presented at the NYUCD 2012 Research Day and won an award for best presentation by an International Fellow. The poster has also been presented at the 2012 IADR convention, where it was selected as a top 10 finalist for the Sarnat Award.
To what extent have you used, or how do you intend to use, AAOF funding to further your career?	The AAOF funding is fundamental to allow for startup projects that can serve as preliminary data for NIH grant applications. It is also critical to aid in resolving the loan-related financial strain of individuals that decide to pursue an academic career. This funding opportunity is extremely important to assist Junior Faculty to pursue their route to become independent researchers. If given the opportunity, I intend to continue to use AAOF funding to continue to produce orthodontics-related translational research.