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AAO Foundation Final Report Form (a/o 6/30/2018)

Type of Award: **Orthodontic Faculty Development Fellowship Award**

Name(s) of Principal Investigator(s): **Dr. Sudha Gudhimella**

Institution: **University of Louisville School of Dentistry**

Title of Project: **Histological Analyses of Orthodontic Tooth Movement in a Rodent Model Using Skeletal Anchorage and Light Forces**

Period of AAOF Support: **07-01-18 to 06-30-19**

Amount of Funding: **\$20,000**

Summary/Abstract:

Objectives: Current rodent orthodontic tooth movement (OTM) studies use maxillary incisors as an anchor to move the first molar with hyper physiologic forces (25cN to 100cN). This model has several disadvantages, including a drastic reduction in bone volume/total volume (BV/TV). This current study aims to elucidate the BV/TV changes in the inter-radicular bone and osteoclast dynamics during OTM with ~3cN force at five time points using histomorphometric analysis.

Methods: Male Sprague-Dawley rats (n = 45) were divided into five groups (3, 7, 14, 28, or 40 days). A miniscrew and a nickel-titanium coil spring placed a load of 3 cN (n = 6 rats in each group, experimental) or 0 cN (n = 3 rats in each group, sham) on the maxillary first molar in a split-mouth design. After euthanasia, the paraffin sections were stained with hematoxylin and eosin (H/E) and Tartrate-resistant acid phosphatase (TRAP). Osteoclast index and BV/TV in the interradicular region were quantified using TrapHisto software and microscope analysis.

Results: Mean interradicular BV/TV was lowest, 0.65, at day 7 in the experimental animal on the TM side and was significantly lower (p<0.05) than BV/TV means at day 14 and 28 in the same group. The median number of osteoclasts was highest, 6, at day 7 in the experimental

animal on the TM side. The sham animal TM side also had a significant median osteoclast peak of 5. The sham and experimental TM sides were significantly different ($p < 0.00001$) than their respective control groups. Overall, the most osteoclast activity was on the distal root surfaces early in molar protraction.

Conclusion: The reduction in BV/TV is lower than in previously reported rodent models of OTM. Greater reductions in BV/TV are undesirable as they impact the rate of OTM. Osteoclastic resorption is likely dynamic and non-linear at various time points. This novel OTM model will likely become more widely accepted to study OTM in rodents.

Questions:

1. Were the original, specific aims of the proposal realized? **Yes, All the goals stated in the grant proposal's educational, clinical, teaching, and research categories were accomplished.**
 2. **This research project fulfilled the requirements for the Orthodontic resident's master's thesis (Dr. Jacob Britt).**
 3. **As part of their summer research, Chad Robinson and Bradley Sanders, DMD students at MUSC, contributed to this project. Currently, both are pursuing orthodontic residency.**
2. Were the results published? **Not published yet. The results from the plastic sections will be presented qualitatively in the same manuscript. After publication, a copy of the article will be forwarded to AAOF.**
- a. If so, cite reference/s for publication/s including titles, dates, author, or co-authors, journal, issue, and page numbers.
 - b. Was AAOF support acknowledged? **AAOF support will be acknowledged.**
 - c. If not, are there plans to publish? If not, why not? **Yes, we are in the process of submitting this manuscript for publication.**
3. Have the results of this proposal been presented? **Yes.**
- a. If so, list titles, author or co-authors of these presentation/s, year, and locations.
Results were presented at virtual IADR in July 2021.
Bone Adaptation During Orthodontic Tooth Movement in a Rodent Model, Gudhimella Sudha, Britt Jacob, Robinson Chad, Sanders Bradley, Michael Daniels Michael, Huja Sarandeep, J Dent Res (Spec Iss):1221, <https://iadr.abstractarchives.com/search>
 - b. Was AAOF support acknowledged? **Yes, AAOF support was acknowledged.**

4. To what extent have you used, or how do you intend to use, AAOF funding to further your career?

The AAOF has been instrumental in shaping my professional journey. The RAA grant I received during my residency funded my thesis, which earned me both the Harry Sicher Award and the Charley Schultz Award in 2018. As a junior faculty member at the University of Louisville, the two OFDA grants I obtained played a significant role in establishing myself as a researcher and educator. Thanks to this support, I have recently received tenure and a promotion to Associate Professor. I am sincerely grateful to AAOF for their cooperation and flexibility, particularly during the challenging times of the COVID pandemic, as they worked with me to navigate the limitations in the labs and accommodate my NCE's and Rebudget requests. Looking ahead, I am eager to apply for the Biomedical Research Award to further advance my research endeavors.

Accounting for Project: No funds remaining. Funds were used as budgeted.

Respectfully,

Sudha Gudhimella