

AAO Foundation Final Report Form

Type of Award: Research Aid Award

Name of Principal Investigator (S): Sudha Gudhimella, Sarandeep. S. Huja.

Title of Project: Developing a Rodent Model Using Skeletal Anchorage and Light Forces for Orthodontic Tooth Movement (OTM)

Period of AAOF Support: 07-01-16 to 06-30-17

Amount of Funding: \$5,000

Summary/Abstract of Completed Project Results:

Background: Animal models have been extensively used to understand the biological mechanisms of OTM. Most of the current rodent models of OTM used maxillary incisors as anchorage with hyper physiologic forces to move maxillary first molar in mesial direction with a NiTi coil spring. This model has several disadvantages and drastic reduction in Bone Volume/ Total Volume (BV/TV) have been reported in the literature. The purpose of this study was to determine the viability of a skeletal anchorage, the amount of tooth movement and the effect of low force (~3cN) on BV/TV in response to OTM.

Methods: 90 Sprague-Dawley rats were divided in to 4 groups (3, 7, 14, 28 and 40 days). A micro implant was used to protract maxillary first molar with a NiTi coil spring exerting a 3cN load (experimental)/ 0cN (Sham) in a split mouth design. The stability of the micro implants, linear and angular displacement of first molar via micro-CT and BV/TV values of inter-radicular bone were quantified.

Results: The success rate of micro implants and NiTi springs was 100% (n=90) at all time points. Linear and angular tooth movement steadily increased with each time interval with an average linear movement of 0.1mm/week (0.48mm at 40 days). The BV/TV reduction between experimental and contralateral side in 3cN group was significant with $P < 0.05$ at all time points and the reduction was 13%, 23%, 15%, 23% and 16% at 3, 7, 14, 28 and 40 days respectively. Interestingly, the BV/TV reduction in the experimental side of 3CN group was only statistically

significant at ¼ level of maxillary first molar mesial root in 28 days (18%, pvalue-0.004) and at ¼ level (27%, pvalue-0.0071) and ½ level (14%, pvalue-0.0087) in 40 days when compared to the experimental side of 0cN group. The difference in BV/TV values were not statistically significant when the contralateral sides of 3cN and 0cN were compared.

Conclusions: The combination of skeletal anchorage with appropriate force magnitude resulted in a very efficient tooth movement when compared to previous studies. BV/TV reduction is lower than the reported values in the literature which may be due to the usage of very low physiologic force (3cN). A novel rodent OTM model with skeletal anchorage and light forces was developed and validated in this study.

Response to the following questions:

1. Were the original, specific aims of the proposal realized?

Yes, the original specific aims were realized. We found that the BV/TV reduction is lower with physiologic force (~3cN) in response to OTM in a rodent model. We developed and validated a novel OTM model in rodents with skeletal anchorage and light forces.

2. Were the results published?

a. If so, cite reference/s for publication/s including titles, dates, author or coauthors,

Journal, issue and page numbers.

The results have not yet been published. A final manuscript is being composed and will be submitted to AJODO upon completion.

b. Was AAOF support acknowledged?

AAOF support will be acknowledged.

C. If not, are there plans to publish? If not, why not?

The manuscript of our study will be submitted to AJODO in a couple of months.

3. Have the results of this proposal been presented? a.) If so, when and where? And was AAOF support acknowledged.

Yes

Mar 25th, 2017: “Rate of orthodontic tooth movement (OTM) in a rodent model using light forces” International Association for Dental Research (IADR), San Francisco, CA.

March 30th, 2017: “Rate of orthodontic tooth movement (OTM) in a rodent model using light forces” at CCTS Conference and Research Day Lexington, Kentucky. **(1st place in basic sciences category)**

April 22th 2017: “Skeletal Anchorage in a Rat Model of Orthodontic Tooth Movement (OTM)” Charley Schultz resident scholar award competition at American Association of orthodontists (AAO) annual meeting, San Diego, CA. **(3rd place in basic sciences category)**

Aug 2nd 2017: Developing a Rodent Model Using Skeletal Anchorage and Light Forces for Orthodontic Tooth Movement (OTM). Dentsply Sirona Orthodontics Research Award **(1st Place)**

All these presentations acknowledged the support of the AAOF.

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

The funding provided by RAA award supported my MS thesis during my residency. If given the opportunity, I intend to apply for Orthodontic Faculty Development Fellowship award (OFDFA) from the AAOF to pursue my academic research goals.