AAO Foundation Final Report Form

Type of Award: Biomedical Research Award

Name of Principal Investigator: Phimon Atsawasuwan

Title of Project: The effect of microRNA-29 on orthodontic tooth movement

Period of AAOF Support: 07-01-15 to 06-30-17

Amount of Funding: $30,000

Summary/Abstract of Completed Project Results (250 word maximum)

Orthodontic tooth movement occurs when a mechanical load is applied to a tooth through an appliance. Osteoclasts play important role during this process. MicroRNAs (miRNAs) are short non-coding RNAs that are emerging as important regulators of post-transcriptional gene expression in osteoblastogenesis and osteoclastogenesis. Several miRNAs play a crucial role in osteoclastogenesis and osteoclast differentiation. In this study, we focus on the miR-29 family, which expresses in different patterns corresponding to different orientations of forces in human periodontal ligament cells. Reports show that miR-29 family plays important roles in osteoblasts/clasts differentiation and functions. In this study, we utilized miR-29 sponge transgenic mice (miR-29 underexpressor) to gain insights into possible mechanisms of how miR-29 family affects tooth movement via osteoclast function. Methods: A 5-cN expansion spring was installed to create tooth movement on a mandibular first molar of the mice for 2 weeks. The distance of tooth movement was evaluated using Faxitron® radiograph and microcomputed tomogram. Immunohistochemistry were performed to investigate the activity/numbers of osteoclasts. miRNA realtime PCR was performed to

evaluate the level of miR-29 family. Results: Less tooth movement was evident in the miR-29 sponge mice (164±42 μm) was detected compared to the control wildtypes (211±33 μm) ($P<0.05$). The expression of miR-29 family in the miR-29 sponge mice were 0.2-0.6 folds lower than the ones in the control mice. In addition, the numbers of osteoclasts in the miR-29 sponge mice were significantly less than the ones in the control mice (Figure 1 and 2). Conclusion: Underexpression of miRNA-29 hinders tooth movement via modulation of osteoclast numbers.

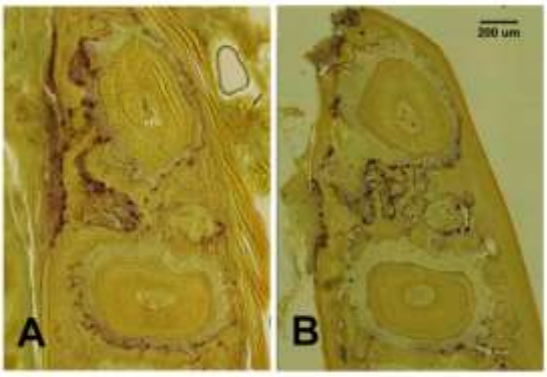

Figure 1. TRAP staining positive osteoclasts (purple color) (A, control wildtype, B, miR-29 sponge mice)

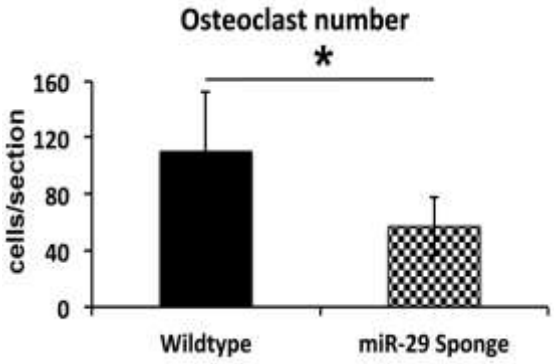

Figure 2. Osteoclast numbers in each group. * $P<0.05$

Response to the following questions:

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

   Yes. We speculate that miR-29 plays an important role in osteoclast differentiation and function. We found that tooth movement in miR-29 sponge transgenic mice was hindered compared to the one in control wildtype due to the less numbers of osteoclasts in the miR-29 sponge mice.

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.

No. However, the manuscript of the study has been prepared will be ready to be submitted to American Journal of Orthodontics and Dentofacial Orthopedics.

b. Was AAOF support acknowledged?

Yes. We acknowledged AAOF for the support in the manuscript.

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

The manuscripts will be submitted for the publication in a couple months.

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.

   1. Lu A., Ouibaidin M., Zhou X., Atsawasuwan P. Abnormal Tooth Movement in Transgenic miRNA-29 sponge mice. Annual Session of American Association of Orthodontists meeting, San Diego, California, USA, ABSTRACT#1694, 2017.
   2. Lu A., Viana G., Zhou X., Nares S., Atsawasuwan P. Abnormal tooth Movement in Transgenic miRNA-29 sponge mice. University of Illinois at Chicago Clinic & Research day, IL, USA ABSTRACT#147, 2017.

   b. Was AAOF support acknowledged?

      Yes. AAOF support was acknowledge

   c. If not, are there plans to do so? If not, why not?

      N/A

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

   With the generous funding of this AAOF Biomedical Research Award for this project, we had an opportunity to investigate the effect of miRNA-29 on orthodontic tooth movement and relapse. This exciting project provided a preliminary result that confirms the role of miR-29 in osteoclasts and it will enhance a translational approach to improve orthodontic care. We have presented our results at several scientific meetings and promoted the recognition of AAOF support for orthodontic research. AAOF funding is a key component to promote my academic career and gives me an opportunity to

pursue my research interest in orthodontic tooth movement. The Biomedical Research Award from AAOF was also used to support a resident research project at UIC. Moreover, the funding from AAOF allows me to obtain preliminary results for development of my research proposal and establishment of my research direction toward independent investigator status.

Accounting for Project; i.e., any leftover funds, etc. No.

Please return to AAOF via email attachment to aaofevp@aaortho.org