

AAO Foundation Final Report Form

Type of Awards: Biomedical Research Award

Names of Principal Investigator(s): Phimon Atsawasuwan

Institutions: University of Illinois at Chicago

Title of Project: Roles of Secretary microRNA-21 and -29 during tooth movement

Period of AAOF support: 07/01/2017-09/30/2020

Amount of Funding: 30,000

Summary/Abstract:

Secretary microRNAs (miRNAs) have been used increasingly as biomarkers for many pathological conditions. They are reported as being freely circulated or encapsulated in microvesicles such as exosomes. This study was performed to elucidate the presence of secretary miRNA-21 and -29 in human gingival crevicular fluid (GCF), and the expression profiles of *miRNA-21 and -29* during orthodontic tooth movement. IN addition, the association of expression of miRNA-21 and -29 with the distance of tooth movement was evaluated. Healthy eleven orthodontic patients who need first premolar extraction were enrolled in the study. Secretary miRNA in GCF was collected using a Periotron® and analyzed using a real-time PCR while the distance of tooth movement was analyzed using intraoral scans with Geomagic® program. The canine retraction with calibrated 150g retraction spring ligated to miniscrews was performed. The expression profile of secretary *microRNA-21 and -29* family in GCF was analyzed during the course of canine retraction for 7 weeks. The results demonstrated the presence of microRNA-21 and -29 in the GCF. The expression profiles of microRNA-21 and -29 family were shown in Figure 1 and no significant difference was found. However, the expression profile

microRNA-21 was gradually decreased compared to the baseline while the ones of microRNA-29 family was increased after activation then gradually decreased back to baseline level. We also demonstrated significant tooth movement between time-points of the study at the rate of 0.2 mm per week (Figure 2). The association between microRNA-21 expression and microRNA-29b with distance of tooth movement was found at week 2 post retraction (t2) (Figure 3).

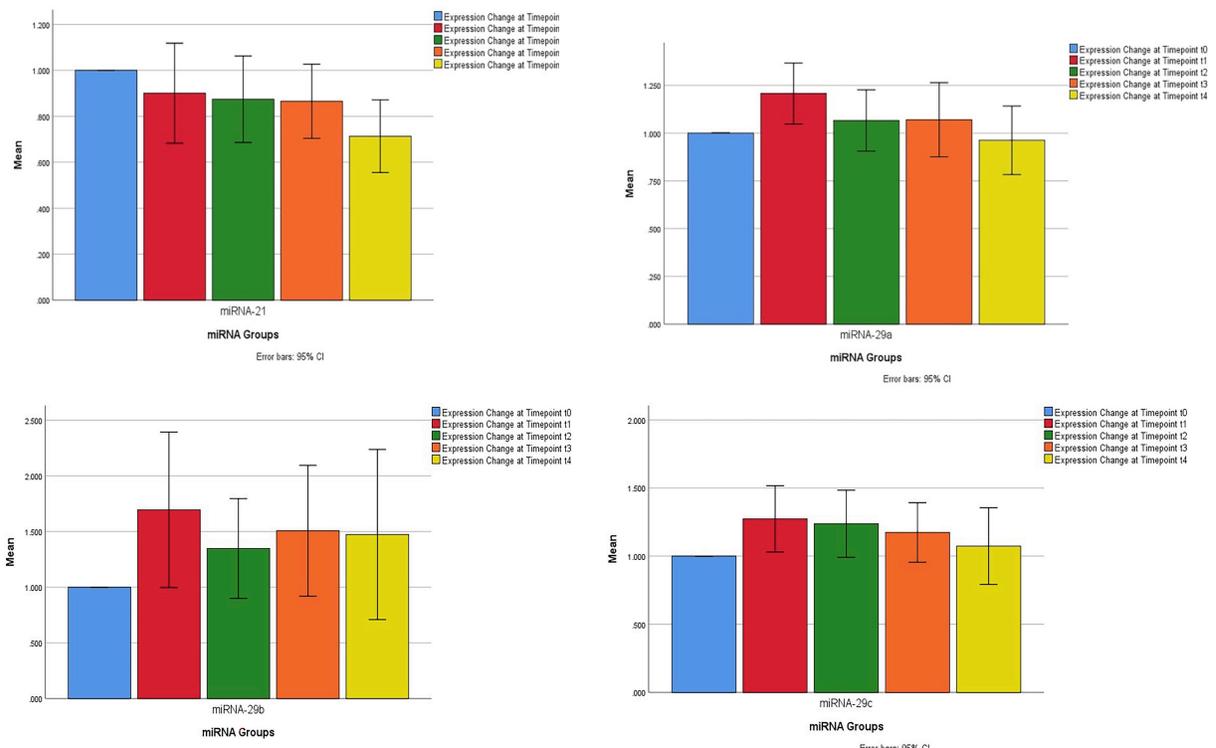


Figure 1. Expression profiles of microRNA-21 and 29 family during 7-week of study

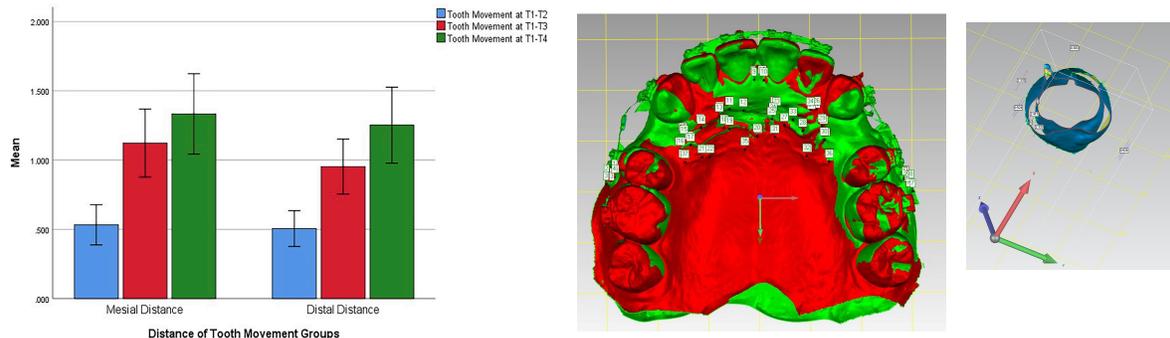


Figure 2. The distance of tooth movement at mesial and distal contact points of canines and its superimposition

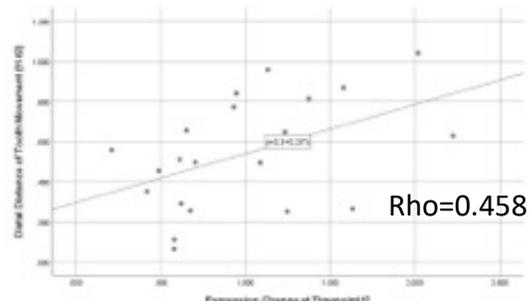
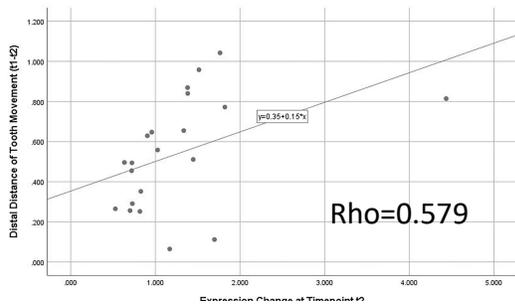


Figure 3. The association of microRNA-21 (left) and microRNA-29 with distance of tooth movement at t2 (2wk after retraction).

The conclusion showed that secretory miRNA-21 and -29 family were present in GCF and its expression level correlated with the distance of tooth movement at early timepoint after canine retraction over 7-week period.

Response to the following questions:

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

Yes. We speculate that secretory miRNA-21 and -29 play important roles and exhibit certain association with tooth movement. We found that these microRNAs play significant roles in osteoclast function and differentiation according to previous studies and literatures.

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 have acknowledged AAOF for the support in the previous manuscript and all presentation and will acknowledge AAOF in the future manuscript and presentation.

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

The manuscripts will be submitted for the publication in a couple months after we organize the narration and literature review.

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. The secretory microRNA-21 and -29 projects was presented as below.

1. Atsawasuwan P. et al. Extracellular microRNAs in gingival crevicular fluid during tooth movement. Moyers presymposium (47th International Conference on Craniofacial Research), University of Michigan, Ann Arbor, Michigan, USA, March 2020.

2. Chmil C., Shirazi S., Chen Z., Seagraves A., Altun S., Elnagar M., Caplin J., Gilrado Ledesma AF., Viana G., Zhou X., Nares S., Atsawasuwan P. Secretory miRNA-21, -29 and -155 in GCF during tooth movement. University of Illinois at Chicago, College of Dentistry, Clinic and Research Day, ABSTRACT #552, 2020.

We also utilized the funds from AAOF to pursue additional projects for the resident MSc theses and presented on the 2020 Clinic & Research day at UIC as below.

3. Altun S., Shirazi S., Chen Z., Seagraves A., Chmil C., Elnagar M., Caplin J., Gilrado Ledesma LF1, Viana G., Zhou, X., Nares S., Atsawasuwan P. Characterization of microRNA-101, -124, -143, -145, -223 in GCF during orthodontic tooth movement. University of Illinois at Chicago, College of Dentistry, Clinic and Research Day, ABSTRACT #554, 2020. **(Submitted for 2021 AAO resident research award competition)**

4. Altun S., Shirazi S., Chen Z., Seagraves A., Chmil C., Elnagar M., Caplin J., Gilrado Ledesma LF1, Viana G., Zhou, X., Nares S., Atsawasuwan P. Characterization of microRNA-101, -124, -143, -145, -223 in GCF during orthodontic tooth movement. University of Illinois at Chicago, College of Dentistry, Clinic and Research Day, ABSTRACT #554, 2020. **(Won 2020 Clinical/Clinical Translational Sciences Best Resident Award)**

5. Altun S., Shirazi S., Chen Z., Seagraves A., Chmil C., Elnagar M., Caplin J., Gilrado Ledesma LF1, Viana G., Zhou, X., Nares S., Atsawasuwan P. Characterization of microRNA-101, -124, -143, -145, -223 in GCF during orthodontic tooth movement. Annual session of American Association of Orthodontist 2020, Atlanta ,Georgia **(nominated for Charley Schultz resident scholar award competition)** (cancelled).

6. Seagraves A., Shirazi S., Chen Z., Chmil C., Altun S., Elnagar M., Caplin J., Gilrado Ledesma AF., Viana G., Zhou X., Nares S., Atsawasuwan P. Circulatory

MicroRNA-27,-146, AND-214 in GCF during Tooth Movement. University of Illinois at Chicago, College of Dentistry, Clinic and Research Day, ABSTRACT #553, 2020.

b. Was AAOF support acknowledged?

Yes. AAOF support was acknowledged in all presentations.

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. We also established the method to measure the tooth movement with intraoral scans and were able to superimposed each time-point to eliminate the error from impression methods. 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 projects 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