

**AAO Foundation Final Report
(6/30/2019)**

Type of Award: Orthodontic Faculty Development Fellowship Award

Name of Principal Investigator: Tingxi Wu

Institution: Department of Orthodontics, University at Buffalo

Title of Project: Explore Microbiome Associated with Orthodontic Complications

Period of AAOF Support: 6/30/2018-6/30/2019

Amount of Funding: \$20,000

Summary/Abstract:

Orthodontic fixed appliances and clear aligners are both used to achieve corrective orthodontic movement in patients. However, few studies have been conducted on how these therapies affect the complex, delicately balanced ecosystem of the oral microbiome.

Objective: To identify clinical and microbial changes in patients treated with fixed appliances or clear aligners and to characterize the microbial plaque composition at different locations (anterior vs posterior teeth and inside clear aligners).

Methods: We examined patients with fixed appliances (n=17) and clear aligners (n=17) from baseline (directly prior to treatment) through the first six months of orthodontic treatment. Plaque was collected during each visit from anterior teeth, posterior teeth, and from the inner surface of their most recently worn clear aligners. DNA from the plaque samples was extracted via standard procedures and subjected to next generation sequencing of the 16S rRNA encoding gene. Microbial community analysis was performed by applying standard bioinformatical approaches.

Results: Distinct albeit mostly patient-specific shifts in the microbial communities from the baseline were observed in the oral biofilms of both groups upon treatment (Fig. 1). The microbial community present on the teeth of clear aligner group is less diverse than those found on the teeth of fixed appliance group (Fig. 2). The microbial community present inside the clear aligners is unique and notably less diverse than those found on the teeth based on alpha-diversity analysis in clear aligner patients (Fig. 1, 2). However, the overall composition of tooth-associated plaque between the different appliances was very similar based on beta-diversity analysis (Fig. 3). Anterior and Posterior plaque samples collected throughout the study period from patients with fixed appliances or clear aligners over the study time period have shown no significant difference in collection sites (Fig. 3).

Conclusions: Changes in microbial communities were observed in both patient groups treated with orthodontic fixed appliances and clear aligners. Within the small sample size of this study, no significant differences were observed in the tooth-associated biofilm communities present in patients with clear aligners versus fixed appliances, however clear aligners harbor a unique microbial community.

Respond to the following questions:

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

Yes, the aims in the proposal were achieved.

A . Educational Plan: I have participated in diverse research-related seminar and workshop series offered by University at Buffalo which helped me enhancing research and clinical skills. To further enrich my professional development as an orthodontic leader and educator, I have also attended several meetings including Society of Educators as part of the American Association of Orthodontists meeting, International Association for Dental Research meeting.

B . Research Plan: Significant progress has been achieved from proposed research project. The research results have been prepared for two publications. One paper has been accepted to publish at Journal of the California Dental Association. The second paper is under preparation and planned to be submitted to AJODO. The result also presented in 2019 IADR/AADR annual meeting.

C . Teaching Plan: I have taught in multiple didactic courses and resident clinic supervision.

Didactic courses:

ORT 954 Craniofacial Growth and Development (Course Director)

ORT 915 Applications of Research Methodology (Course Director)

ORT 959 Journal Club Seminar (Course Director)

ORT 923 ABO Case Presentations

Clinical supervision:

ORT 940 Post-graduate Orthodontic Clinic Supervision

D. Clinical Plan: I taught and supervised patient care in the post-graduate orthodontic clinic throughout the year and prepared to start faculty practice at University at Buffalo. I attended multiple clinical CE courses offered by school of dental medicine, university at buffalo to have further improved my clinical skills.

2. Were the results published?

We aim to publish two papers from this study. One paper has been accepted to publish at Journal of the California Dental Association. The second paper is under preparation and planned to be submitted to AJODO.

3. Have the results of this proposal been presented?

The results were presented in 2019 IADR/AADR annual meeting. 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 funding provided by OFDFA award has allowed me to develop my research program during my junior faculty period. I have full intention to continue applying AAOF funding to continue my career development as an academic clinician.

Accounting for Project: All of the funding has been used for this research.

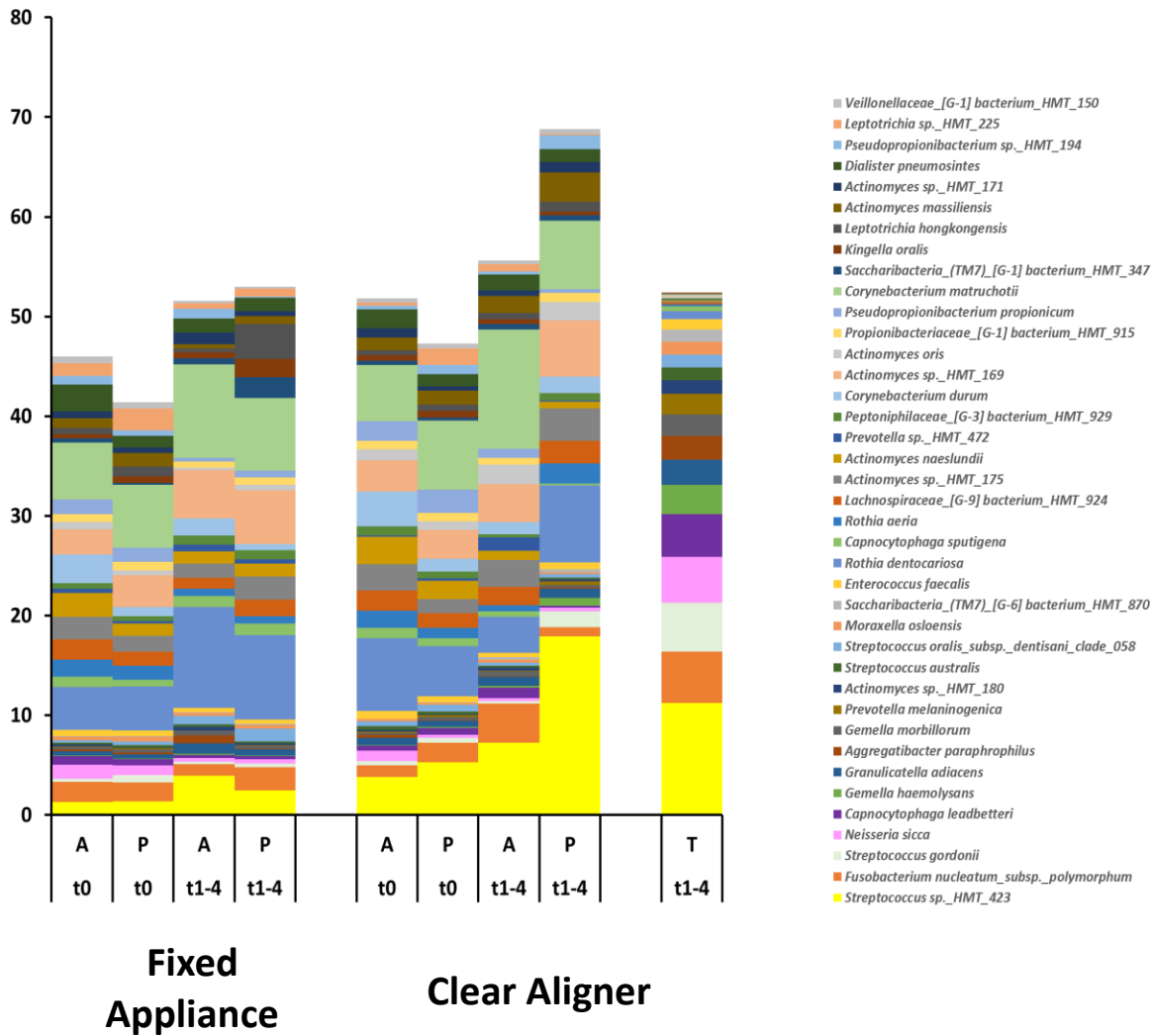


Fig 1. Differential Abundance of Individual Species: Comparison Plaque Collected from Anterior (A) and Posterior (P) Plaque from Patients with Fixed Appliance or Clear Aligner and Clear Aligner Trays (T) Prior to Treatment (t0) and Post Treatment (t1-4)

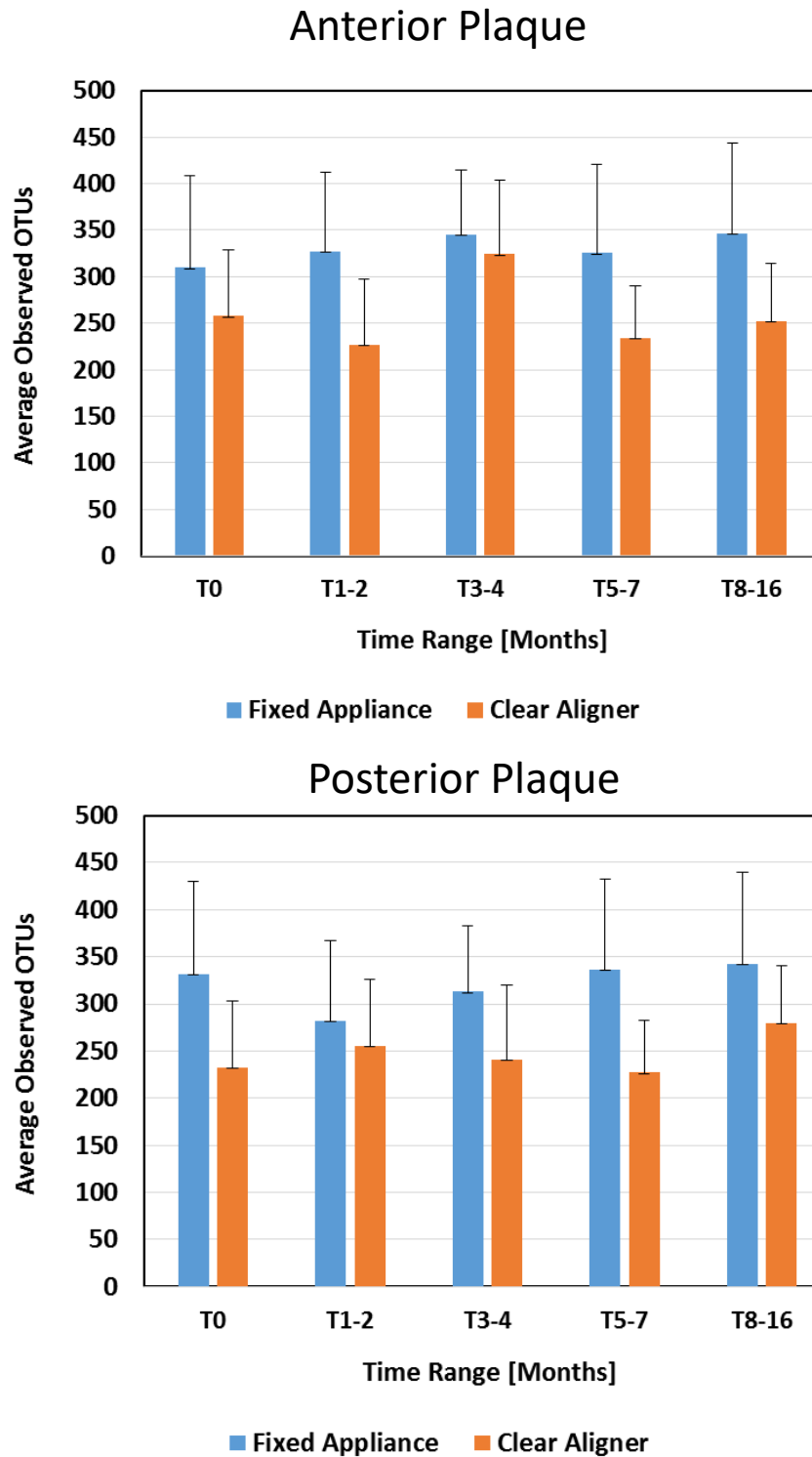
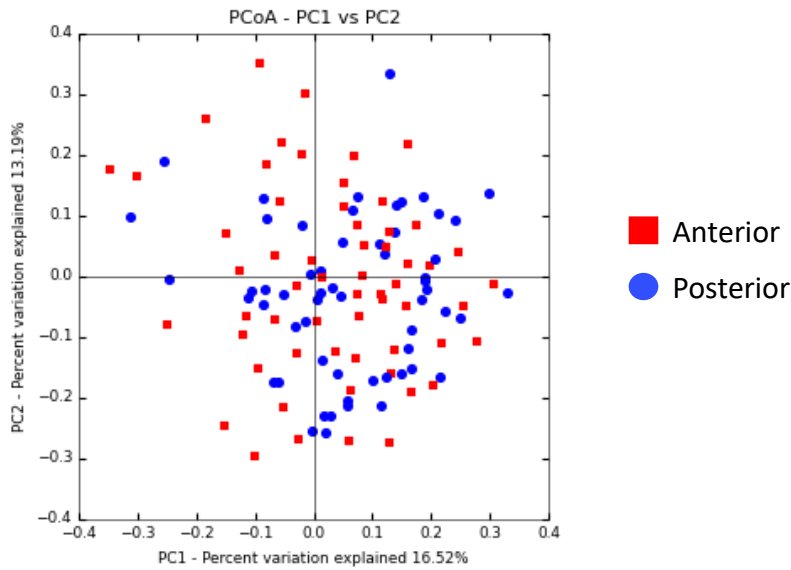


Fig 2. Alpha-Diversity Analysis-Comparison Averages of Anterior and Posterior Plaque Between Fixed Appliance and Clear Aligner

a) Fixed Appliance A vs P



b) Clear Aligner A vs P vs T

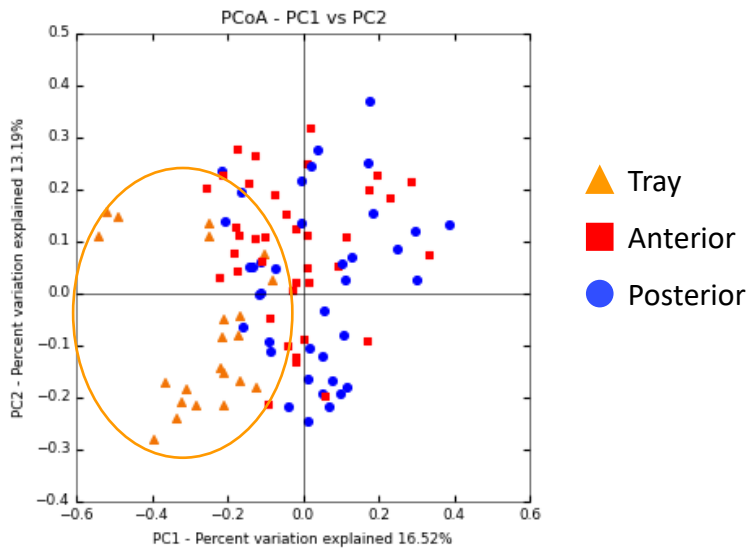


Fig 3. Weighted UniFrac Analysis of a) Anterior (A) and Posterior (P) plaque samples from patients with fixed appliances and b) A, P and T (Tray) plaque samples from patients with clear aligners over the study time period. The T microbiome is distinct from other collection sites.