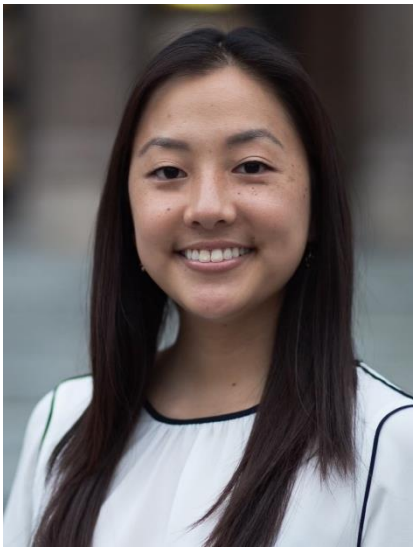
Research Aid Award

Dr. Erin Yoshida, *University of Washington*

Title: Real-time 3D analysis of airborne particles produced during orthodontic composite attachment removal



My name is Erin Yoshida, and I am a second-year orthodontic resident at the University of Washington. I grew up in Hilo, Hawaii and was introduced to the world of orthodontics at a young age in my father's private practice. My interest in the sciences led me to study Chemistry at Pacific University in Forest Grove, Oregon. I then moved further to the east to Kansas City, Missouri, where I attended the University of Missouri-Kansas City School of Dentistry. I completed my dental program and started my orthodontic residency at the University of Washington right as the COVID pandemic entered high gear. The dramatic impact this virus had on our healthcare systems led me to ask the question of how we can reduce the aerosols produced in orthodontic practices to minimize the spread of COVID.

The purpose of my study is to determine existing strategies (different handpieces and evacuation systems) that most effectively minimize the aerosolized particle transmission when removing orthodontic composite attachments. The different types of handpieces that will be tested include conventional (air-driven), electric, and air-free handpieces, while the evacuation systems tested will include high speed (intraoral) evacuation (HSE), and extra-oral suction (EOS). My plan is to use an in-vitro study design to test combinations of each handpiece type and suction scenario (no suction, only HSE, only EOS, and both HSE and EOS). 3-D printed models with bonded composite attachments will be used in each trial. Approximately 25 particle sensing (AeroSpec) units will be placed in a 3-D grid system in and around an orthodontic operatory unit and will collect particle data before, during, and after composite attachment removal. As the operator, I will remove the composite attachments from the 3-D printed models for each combination of handpiece type and suction scenario.

The data collected will then be analyzed to determine the most effective combinations of handpiece type and suction scenario to reduce the number of aerosolized particles disseminated by the attachment removal process. The data will also reveal the areas of the orthodontic operatory where most particles become aerosolized. This will provide us with important information about how far we should seat patients from each other and what boundaries we should maintain around operatories during aerosol-generating procedures.

Enhancing infection control and minimizing the spread of aerosolized particles is especially important in orthodontic residency programs, where there is a significant patient turnover and a larger number of orthodontic providers (residents). Residencies should set an example for other orthodontic practices

by having the gold standard of precautions when performing aerosolizing procedures. The findings from this study will benefit orthodontic education by giving us an idea of what the best practices should be for infection control during these procedures in an educational clinic setting.

While the UW orthodontic alumni association has provided funding for several trials of piloting, the AAOF grant will allow us to realize the full potential of this experiment. The particle sensors are the item for which the majority of the funding will be spent. We will be using AeroSpec portable particle sensor units, which have been developed at the University of Washington's Mechanical Engineering Department and allow us to create a 3D grid to monitor particle generation and dissipation in real-time. We have determined from our preliminary work that about 25 sensors are needed to create a 3D grid of the operatory space, centered around the patient's head.

It is intended that the monies from the AAOF will fund 4 trials, which will be the trials in which we collect the actual data for the experiment. $4000 is earmarked to rent the sensors for 4 trials, with the remainder of the monies utilized for equipment and personnel. Specifically, we have determined that a GoPro camera would be very helpful to capture footage of all trials with time stamps. Using the video allows the procedures to be matched with the particulate counts measured by the AeroSpec units in real-time. There also is funding for the Engineering graduate student, who will continue to provide assistance during all trials.

I am very thankful for the support from the AAOF in funding my research. This funding will allow me to explore the topic of how to reduce dental/orthodontic aerosols, which is something that means very much to me. My father practiced as an orthodontist for over 25 years and passed away just before the COVID-19 pandemic started, from metastatic lung cancer. While the cause of his cancer was unclear, I have realized that it is very important to minimize exposure to particles of dental materials that may be harmful when inhaled.

I believe that this project will be my gateway into the vast world of orthodontic research and this opportunity will hopefully open more doors for me in research and orthodontic education in the future. I was able to talk to members and other award recipients from the AAOF at the award breakfast hosted during the AAO annual meeting in Miami this year, and I was in awe of their dedication and passion for this field. The people I met there have shown me that it is possible to give back to orthodontic research and education, while also working in a private practice or academic setting. The AAOF has helped me realize my dream to one day teach residents like myself and continue to learn from their new ideas and perspectives.