



2025 Research Aid Award Dr. Arshia Ashjaei, University of Pittsburgh

1) a short biography

Dr. Arshia Ashjaei is currently an orthodontic resident and graduate student at the University of Pittsburgh School of Dental Medicine. He earned his DDS from the University of the Pacific and completed a General Practice Residency at the San Francisco VA, followed by an Advanced Clinical Simulation Fellowship at the Pittsburgh VA. Dr. Ashjaei is deeply committed to education and mentorship, demonstrated by his co-founding of the Dugoni Pre-Dental Bootcamp, a hands-on program designed to prepare pre-dental students for the rigors of dental school.

Currently pursuing a Master of Dental Science degree alongside his orthodontic residency, Dr. Ashjaei's thesis research focuses on the biological mechanisms behind the hyper-eruption of unopposed teeth. His work investigates the potential role of the epithelial rests of Malassez (ERMs) in this process, with the goal of developing clinical strategies to prevent overeruption and preserve natural dentition.

In addition to his academic pursuits, Dr. Ashjaei has developed and facilitated simulation-based training for both dental and medical education and co-authored a peer-reviewed study on airway hemorrhage management. His long-term goals include advancing orthodontic science, improving patient care, and mentoring future dental professionals through teaching and research.

2) a brief description of the project

This project aims to uncover the biological mechanisms underlying the overeruption of unopposed teeth, a condition that limits interarch space, often necessitating invasive interventions such as tooth intrusion, leading to longer treatment times, increased cost, and a higher risk of root resorption. Notably tooth intrusion is one of the more difficult tooth movements because there is a limit on the amount of safe intrusion (1-2mm) before the likely side effect of moderate/severe root resorption. Despite its clinical significance, little is known about the molecular and cellular drivers of this phenomenon.

The central focus of this study is the epithelial rests of Malassez (ERMs), epithelial cell remnants found in the periodontal ligament (PDL) space. While ERMs have been historically dismissed as inert remnants of the Hertwig's epithelial root sheath (the cells that develop the root), our preliminary data suggest that they may play active roles in maintaining periodontal homeostasis, regulating ankylosis, contributing to regeneration, and influencing post-eruptive tooth movement. Notably, both the number of ERMs and the amount of overeruption appear to decline with age, suggesting a possible causal relationship.

To test this hypothesis, the study will use genetically engineered mouse models and novel 3D imaging techniques to achieve two primary aims:

1. Aim 1: Determine whether there is a direct correlation between ERM quantity and the degree of overeruption across different age groups in mice. Using KRT14Cre;Ai9(RCL-tdT) mice, the study will extract upper molars to induce overeruption in the opposing lower molars and visualize ERMs using high-resolution tissue-clearing and fluorescence imaging. The project will quantify overeruption and ERM density in 6- (e.g., teenager), 12- (e.g., adult), and 24- (e.g., middle age) week-old mice.
2. Aim 2: Confirm a definitive role for ERMs in overeruption by genetically disrupting their integrity. This will be achieved by conditionally inactivating *Perp*, a desmosome-associated gene specifically expressed in ERMs. Desmosomes are distinct cell-cell attachment complexes that attach the ERM cells in clusters. Using a tamoxifen-inducible KRT14CreERT;*Perp* flox mouse model, the extent of overeruption will then be measured to assess the impact of targeted ERM disruption.

Preliminary results already demonstrate that older mice show significantly less overeruption, aligning with reported declines in ERM populations with age. This project builds upon those findings by testing whether ERMs actively mediate this process and whether their disruption can reduce overeruption independently of age.

By elucidating the cellular and molecular basis of overeruption, this research could pave the way for novel, biologically based interventions that prevent or limit unwanted tooth movement, particularly in partially edentulous patients, including geriatric and veteran populations where tooth loss is common and traditional orthodontic options may be limited.

In addition to its clinical relevance, the project contributes to the broader understanding of tooth eruption, periodontal biology, and epithelial-mesenchymal interactions. It also introduces advanced genetic and imaging tools into the orthodontic research space, promoting cross-disciplinary training and innovation. Ultimately, this work will not only enhance clinical outcomes but also elevate the scientific foundation of orthodontics and support the integration of basic science into resident education and academic development.

3) a statement of how orthodontic education will benefit from your award

This project investigates the biological mechanisms underlying the overeruption of unopposed teeth, with a particular focus on the role of epithelial rests of Malassez (ERMs). By leveraging advanced 3D imaging techniques and genetically modified mouse models, the study aims to clarify the functional roles of ERMs in post-eruptive tooth movement and PDL homeostasis—areas of significant clinical implications that remain poorly understood. Support from the AAOF Award will directly enhance orthodontic education by bridging the gap between basic science and clinical application. The findings of this research will inform evidence-based strategies to prevent or manage overeruption, a common barrier to restorative and orthodontic treatment. Furthermore, the project will serve as a model for integrating translational research into residency training, exposing future orthodontists to cutting-edge methodologies and encouraging scientific inquiry as a core component of their clinical development. By advancing our understanding of fundamental tooth biology and contributing novel insights to orthodontic literature, this project aligns with the AAOF's mission to promote excellence in education and scholarship. It will also help cultivate the applicant's academic career in orthodontics, reinforcing a long-term commitment to teaching, mentorship, and innovation in the field.

4) why the Foundation is important to your project

The AAOF Foundation plays an indispensable role in enabling projects like mine to move from pilot stages to fully powered investigations. Its mission, to advance the orthodontic specialty by supporting exceptional education and research that leads to excellence in patient care, is directly reflected in its track record of funding critical orthodontic studies. With the Foundation's award, my project was able to secure the resources necessary to generate a robust sample of dental models required for meaningful statistical analysis needed to validate our pilot findings. This investment not only facilitates robust data collection and meaningful analyses but also exemplifies AAOF's commitment to cultivating a rigorous scientific approach among emerging researchers. I am profoundly grateful that AAOF support has made this work possible and provides an extraordinary opportunity to impact our profession, shaping both evidence-based clinical practice and the future of orthodontic education.

5) how Foundation funding is expected to or has benefited your career

The support from the AAOF Foundation has already had, and will continue to have, a transformative impact on my career. By enabling me to design and execute a rigorous, statistically powered study, the Foundation has provided invaluable training in research planning, grant writing, and project management, skills essential for pursuing future academic and clinical research opportunities. This experience has not only increased my confidence in pursuing scholarly activity but also confirmed my passion for teaching residents and trainees. The opportunity to contribute original findings to orthodontic science, bolstered by AAOF's commitment to empowering junior faculty and researchers, reinforces my long-term career goal of becoming an educator-researcher who fosters evidence-based clinical practice in the next generation.