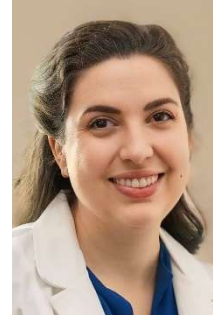


THE HARTWELL FOUNDATION

2024 Nominee Individual Biomedical Research Award

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Applying Precision Medicine to Treat Velopharyngeal Dysfunction

Craniofacial conditions due to anatomic deficits in the roof of the mouth (palate) and throat (velopharynx) disrupt the development of soft tissue and muscles required for speech. Children with velopharyngeal dysfunction (VPD) have a severe speech disorder. Currently, over 600,000 children in the United States have this diagnosis, which requires surgical intervention in early childhood. Unfortunately, current surgical interventions fall short, with failure rates as high as 30-40%, leading to an inability for these children to communicate effectively. This is because current speech assessment methods lack objective, patient-specific information about the anatomy impacted by VPD, and instead rely on perceptual judgments and invasive, highly subjective, endoscopic camera assessments. This leads to a one-size-fits all surgical approach that results in many children undergoing multiple ineffective and costly surgeries, facing prolonged recovery times and uncertain speech outcomes. Notably, with each subsequent attempt at surgery, the likelihood for achieving normal speech decreases. By pioneering early stage, innovative solutions through a combination of pre-clinical investigations and my proposed cutting-edge translational speech imaging assessment paradigm, I am working towards more effective and personalized treatment approaches for these children. In the first phase of my project, I will leverage advanced biomaterials and tissue engineering principles to explore a first-of-its-kind hydrogel application for palatal reconstruction that focuses on tissue integration and regeneration for the speech mechanism. By identifying how this biomaterial behaves in preclinical models, I will develop a protocol for safer and more successful surgical techniques that minimizes the need for multiple subsequent interventions. To foster clinical translation and improve how clinicians decide which surgeries will provide the most benefit to speech, I propose a unique, anatomic MRI-based speech assessment paradigm that personalizes treatment recommendations and surgical interventions. This assessment paradigm integrates imaging technology, 3D computer visualization, and predictive analytics with patient-specific anatomic information about speech muscle morphology, informing clinicians how to predict for any given child's anatomy which surgical intervention will work best to optimize speech outcomes. If I am successful, identifying patient-specific indicators for successful speech and surgical outcomes will transform clinical care for children with craniofacial conditions by moving away from highly subjective judgments to empirical evidence-based decisions, changes that will improve their speech and the ability to communicate effectively.