

Faculty Spotlight: Dr. Plowman -- Department of Communication Sciences & Disorders

Dr. Emily Plowman founded the Neuromotor Speech and Swallowing Restoration (NSSR) laboratory whose mission is to improve and maintain upper aerodigestive tract function in individuals with neurologic disease and the associated processes of speech, breathing and swallowing. Her research program focuses on studying the underlying neural sensorimotor control of these processes as well as factors mediating recovery or preservation of function in neurologic disease. She utilizes a synergistic and translational approach through the use of animal models of oral motor dysfunction and human clinical trials.



Dr. Plowman and colleagues from the University of California-Davis and University of Illinois were the first to test the feasibility and utility of muscle derived stem cells (MdSC) for treatment of the injured or paralyzed tongue. The tongue is a critical organ for the functions of speech and swallowing and can be damaged following head and neck cancer, stroke, or neurodegenerative disease. Current rehabilitation options for the damaged tongue are sub-optimal, as they typically fail to restore dynamic range of motion and strength, and also place high demands on patients who are already in a compromised state. In recent research published in the *Laryngoscope*, Plowman et al. (2014) provide the first ever documentation that MdSCs injections into the tongue are feasible and lead to increases in tongue muscle fiber diameter and a concomitant increase in tongue strength in an animal model of dysphagia. This work changes the landscape of restoration techniques previously thought possible for the damaged tongue and has the potential to improve the lives of those afflicted with speech and swallowing disorders.

Her work on upper esophageal sphincter (UES) dysfunction has led to new conceptualizations of the UES. Dr. Plowman and colleagues determined that current treatment techniques are subject to a high rate of failure and recurrence. To discover why these techniques are so problematic, they completed geometric morphometric shape analysis of the UES in a large animal model and determined that the geometry of the UES is not round as was previously thought. Instead, the UES approximates a kidney-shape, which may play a role in the failure and recurrence rate of current treatment techniques that are focused on dilating a presumably round closed sphincter. Using this new information, Dr. Plowman and colleagues evaluated the use of two controlled radial expansion balloon dilators to treat UES dysfunction and determined it to be feasible, safe, and a more effective intervention. This work has led to the development, production, and use of new dilators to treat individuals with dysphagia.

Dr. Plowman's labs are generating innovative neurophysiological studies. In her NSSR laboratories, Dr. Plowman's work is focused on oral motor impairments in individuals with neurodegenerative disorders with an emphasis on Parkinson's disease (PD) and amyotrophic lateral sclerosis (ALS). PD is a chronic, progressive and currently non-curable neurodegenerative disease, which affects approximately 1.5 million Americans. Current pharmacologic and surgical treatment techniques that alleviate limb motor symptoms of PD fail to confer similar improvements in bulbar functions, such as speech and swallowing. Aspiration pneumonia, which occurs with swallowing impairments, is the leading cause of death in this patient population. Dr. Plowman was awarded an R03 grant from the National Institute of Deafness and other Communication Diseases (NIDCD) to determine the underlying neural mechanisms mediating bulbar dysfunction in PD and has discovered that unlike

limb motor symptoms, dopamine does not play a primary role in oral motor control for functions of speech and swallowing but rather plays a secondary, or perhaps, tertiary role. This finding may explain why dopaminergic therapy does not work as effectively for patients with oral motor control impairments as it does for limb motor control impairments. In her basic science laboratory at USF she is currently exploring the impact of novel pharmacologic and behavioral interventions for bulbar brain circuitry and function in an animal model of PD with funding from the NIDCD.

In her human clinical laboratory at USF, Dr. Plowman is one of the first researchers in the world to explore the utility of active intervention and exercise on respiratory, cough and swallowing dysfunction in individuals with ALS. Awarded the American Board of Swallowing and Swallowing Disorders Research Award in 2013 for this work, her research has resulted in the receipt of an R21 grant from the Eunice Shriver National Institute of Child Health Development (NICHD) to examine the effects of expiratory muscle strength training (EMST) on bulbar function in ALS. This constitutes the largest randomized clinical trial evaluating exercise in this patient population to date and results will guide future treatments for this devastating and currently non-curable disease. Synergistic efforts to study the role of exercise on bulbar function in ALS are being performed in Plowman's basic science NCSR laboratory where she has an active study examining the impact of oral motor exercise in a transgenic ALS mouse model on function, survival and underlying motor neuron integrity. This work is funded by the USF Center for Research and Innovation.

For more information on Dr. Plowman and her research, contact her at plowman@usf.edu, visit her lab at <http://www.nssrlab.org/>, or see more of Dr. Plowman's articles on her [website](#).

READ ONLINE: Plowman, E. K., et al. (2013). Differential sensitivity of cranial and limb motor function to nigrostriatal dopamine depletion. *Behavioural Brain Research*, 237, 157-163.