Neural Correlates of Efficacy of Voice Therapy Identified by Performance-Correlation Analysis

S. Narayana, W. Zhang, D. Vogel, C. Franklin, D.A. Robin, L.O. Ramig, P.T. Fox

The purpose of this study was to identify the neural correlates of Lee Silverman Voice Therapy (LSVT), an effective and an established treatment of speech disorders of Parkinson's disease (PD). Ten subjects with PD and hypophonia were studied before and after LSVT. Cerebral blood flow (CBF) was measured by $H_2{}^{15}O$-PET during reading and rest; and statistical parametric images of z scores were generated contrasting paragraph reading with rest for both pre- and post-LSVT conditions. In addition, changes in neuronal activity following LSVT were correlated with corresponding change in sound pressure level (SPL). SPL of sustained phonation, paragraph reading, and spontaneous conversation increased significantly after LSVT. Post-LSVT treatment activation maps of reading, and correlation maps of SPL indicated a treatment-dependent shift towards right hemisphere in the speech motor and premotor, attention, sensory and auditory integration areas. We interpret these results as a learning induced strategy change. The successful outcome following LSVT is a result of a shift in the speech motor network from sub cortical and left sided motor and premotor areas to right sided cognitive, attention, sensory and auditory regions. This imaging strategy can readily applied to understand mechanisms of action of therapies of other speech disorders.