Strength training, endurance training, and skill training represent three different types of exercise. A recent review article (Adkins, Boychuk, Remple, & Kleim, 2006) suggests that differential neuroplastic effects occur depending on the type of exercise that is engaged in. This paper gives a specific review of the neural and myogenic adaptations that occur with exercise providing evidence from both animal and human studies, which should be useful to the development of future research studies on rehabilitation programs in speech pathology. This article is divided into three main sections. The first provides an introduction to the different exercise paradigms used in rehabilitation science, followed by a brief discussion of animal model use in the study of neural and myogenic adaptations associated with skeletal muscles. Arguments in favor of and against the use of animal models and interpretation relative to corticospinal muscle adaptation in the study of speech and swallow rehabilitation are presented. The second section discusses the evidence available for neural adaptations at various levels of the neuraxis including the cortex, motor command, and motor unit. Various human and animal studies demonstrating the neural adaptations with training, lesions/pathology, and environmental changes affecting various skeletal muscles are included to illustrate the diverse nature of the adaptive changes observed. An overview of the studies examining adaptations occurring within the skeletal muscles (both corticobulbar and corticospinal) using the various models of increased and decreased muscle use follows. The third section on myogenic adaptations provides information on a variety of transdisciplinary studies investigating corticospinal muscles and discusses their applicability to musculature involved in speech, swallow, and cough.


Aspiration pneumonia is the leading cause of death in Parkinson's disease (PD) patients. In clinical practice, the videofluoroscopic examination (VFE) is the most common method for evaluation of swallowing disorders. One of the variables manipulated during the VFE is consistency of the bolus. The results of this examination greatly influence the recommendations made by speech-language pathologists regarding swallow therapy and/or intervention. The primary aim of this study was to investigate the effects of bolus consistency on penetration-aspiration (P-A) score and timing of swallow of persons with PD. The videoradiographic images of ten participants with PD swallowing six thin and six pudding-thick boluses were analyzed. Swallow timing and P-A were measured. (i.e., oral transit time, pharyngeal transit time, number of tongue pumps, and P-A score). The results demonstrated various significant
differences and relationships among the dependent variables. Implications for further research and clinical practice are discussed.


The use of expiratory muscle strength trainers improves parameters related to pulmonary function, speech, and cough in both healthy and patient populations. Recently, it has been speculated that expiratory strength training may alter the force generation of muscles used during the swallow process. Specifically, the use of the trainer may result in increased activation of the submental muscle complex. Support for this hypothesis was tested by examining the timing and amplitude of submental muscle activity obtained using surface EMG. These muscles are known to be important for normal swallow function. Twenty participants (10 males, 10 females; mean age = 29 years) were recruited to participate in a one-session study. Participants were asked to perform two swallows (saliva swallow and water swallow) and develop an expiratory pressure set at 25% and 75% of their maximum expiratory pressure (MEP) using an expiratory muscle strength trainer. These tasks allowed comparison of muscle activity during both the swallow and expiratory tasks completed with the trainer. Results indicated that the patterns of activation in the submental muscle group while training on the expiratory device had longer duration of activation with higher amplitude of EMG activity when compared with the swallowing condition. These findings indicate that expiratory muscle strength training (EMST) increases motor unit recruitment of the submental muscle complex. Discussion centers on the potential benefit of EMST as a treatment modality for dysphagia characterized by decreased amplitude of hyoid movement during swallowing.


Professional voice users comprise 25% to 35% of the U.S. working population. Their voice problems may interfere with job performance and impact costs for both employers and employees. The purpose of this study was to examine treatment outcomes of two specific rehabilitation programs for a group of professional voice users. Eighteen professional voice users participated in this study; half had complaints of throat pain or vocal fatigue (Dysphonia Group), and half were found to have benign vocal fold lesions (Lesion Group). One group received 5 weeks of expiratory muscle strength training followed by six sessions of traditional voice therapy. Treatment order was reversed for the second group. The study was designed as a repeated measures study with independent variables of treatment order, laryngeal diagnosis (lesion vs non-lesion), gender, and time. Dependent variables included maximum expiratory pressure (MEP), Voice Handicap Index (VHI) score, Vocal Rating Scale (VRS) score, Voice Effort Scale score, phonetogram measures, subglottal pressures, and acoustic and perceptual measures. Results showed significant improvements in MEP, VHI scores, and VRS scores, subglottal pressure for loud intensity, phonetogram area, and dynamic range.
No significant difference was found between laryngeal diagnosis groups. A significant difference was not observed for treatment order. It was concluded that the combined treatment was responsible for the improvements observed. The results indicate that a combined modality treatment may be successful in the remediation of vocal problems for professional voice users.


Purpose: This study investigated the effect of expiratory muscle strength training (EMST) on voice production, dysarthria, and voice-related quality-of-life issues in persons with multiple sclerosis (PwMS). It was hypothesized that PwMS would have improved voice production and reduced voice-related quality-of-life issues following EMST. Participants and Methods: Seventeen participants with MS and 14 healthy (H) controls completed 8 weeks of EMST, followed by 4 weeks of no training. Analyzed outcomes as a function of EMST were maximal expiratory pressure (MEP), sustained vowel prolongation (SVP), words per minute (WPM) measured from connected speech, and quality-of-life indices related to the presence of the dysarthria and dysphonia. Results: PwMS had lower MEPs, shorter SVP, and less WPM than the controls prior to training. Following EMST, both groups had significant improvement in MEPs that stayed above baseline after training halted. EMST did not improve voice production or voice-related quality of life for PwMS. Conclusion: Respiratory muscle weakness is present in PwMS having mild- to moderate-level disability. EMST improved expiratory muscle strength but did not statistically change objective and subjective components of voice/speech production in PwMS.