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The Impact of Electrical Stimulation and Exercise on Independent Static Standing Balance

Jennifer Briant, SPT1; Elizabeth Goldstein, SPT1; Denise Gyselinck, SPT1; Faculty Mentor: Sara Shapiro, PT, MPH

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INTRODUCTION

Impairments in balance can lead to accidental falls which places individuals at risk for injury and decreases quality of life. Each year in the United States one-third of older adults experience a fall. Balance is typically treated with therapeutic exercise to address neuromuscular components. Incorporating electrical stimulation in conjunction with a balance-focused exercise program will address the somatosensory and sensorimotor aspects of balance.

Transcutaneous Electrical Nerve Stimulation (TENS) is the use of low level electrical current to transmit sensory and proprioceptive information through the skin. It is primarily used in rehabilitation settings as conventional TENS by applying the gate theory for pain modulation. Previous studies have shown the effectiveness of TENS on balance by enhancing motor control. TENS provides a consistent level of sensory stimulation and would be simple to incorporate into everyday life to improve balance.

Neuromuscular Electrical Stimulation (NMES) is a modality which uses a therapeutic dose of electrical stimulation to produce a visible muscle contraction as well as sensory input. Using NMES to decrease muscular fatigue and increase strength and endurance of the lower extremities may lead to improved control and increased independent standing balance, thus decreasing fall risk.

There appears to be a link between electrotherapeutic modalities and the improvement of independent static standing balance. However, limited studies have examined the effects of TENS or NMES and compared them to the effects of exercise.

PURPOSE

To examine the effects of electrical stimulation on independent standing balance during single leg stance (SLS) using either NMES with exercise, TENS with exercise or exercise alone.

SUBJECTS

Fourteen participants between the ages 18 and 44 (4 males and 10 females) were recruited through a convenience sample on the University of Puget Sound’s campus.

METHODS

This study was a randomized control trial. Subjects participated in this study five times per week for a total of six weeks. Participants were randomly assigned into each group: NMES with home exercise program (HEP), TENS with HEP and HEP-only. The experimental groups performed 60 minutes of electrical stimulation and all groups received the same HEP. Exercises can be found in Figure 1. Timed SLS balance assessments were performed on the dominant limb of each participant prior to intervention and at six weeks. Parameters of each electrical stimulation unit can be found in Table 1 and electrode placement can be found in Figure 2.

CONCLUSIONS

For the parameters used in this study electrical stimulation in conjunction with a 6 week balance-focused exercise protocol may not have an effect on independent static standing balance. There was no significant difference between the use of NMES, TENS or exercise alone. It does however confirm that visual input is a significant contributor to independent static standing balance.

LIMITATIONS

NMES units have the capacity to recruit motor nerve fibers, however this study’s pulse duration set on each NMES unit was not long enough to truly stimulate a muscle strengthening response.

Accommodation effects were not accounted for and consistent intensity was not received. Voluntary muscle activation was not required of subjects. Participants were asked to wear the electrodes and have the NMES units on while they were carrying about normal activities of daily living...

Additional limitations include, a small sample size of 14 attributing to a low statistical power, short duration of intervention, and researchers not present during the intervention to verify daily participation.

RELEVANCE

This study suggests that applying electrical stimulation with Table 1 protocols may not have an effect on independent static standing balance. Further research should be done that incorporates other protocols and parameters to further investigate the effects of applying a therapeutic modality on independent standing balance.

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