EFFECT OF A UNILATERAL BALANCE TRAINING PROGRAM ON BILATERAL BALANCE: A CROSS-EDUCATION EFFECT

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INTRODUCTION

The purpose of this pilot study was to examine the neuromuscular phenomenon of cross-education, and its relationship to the act of balancing. Otherwise known as cross-activation or cross-transfer effect, cross-education is an adaptation to a unilateral training intervention from which gains are seen to both the trained and untrained side (Zhou 2000). This is due to neural adaptations whose mechanism and location of action have been hypothesized to be situated in supraspinal regions of the nervous systems (Ruddy et al. 2013).

Cross-education has been investigated with a resistance training intervention where strength increases have been observed in both the trained and untrained sides. Literature reviews have found a baseline gain of 7.8-9.8% for the untrained side (Munn et al 2004) and a 35-60% strength increase of the total increase seen with the trained side (Zhou 2000). There is very limited and inconclusive literature on the relationship between balance and cross-education (Oliveira et al 2013).

In light of the fundamental differences between balance and strength, we aimed to investigate a unilateral balance intervention to observe the adaptations to balance of the trained and untrained sides. If such a relationship can be shown in the amputee population it would become possible to attenuate the learning period and decrease the high fall risk associated with receiving a new prosthesis.

METHOD

Subjects: Able bodied individuals who were free of any lower extremity and vestibular disorders in the past 6 months, have not had lower extremity surgery and were not participating in regular exercise training programs were recruited for this study

Apparatus: NeuroCom EquiTest Balance System

Procedures: Subjects completed a Sensory Organization Test (SOT) using Computerized Dynamic Posturography (CDP) pre and post intervention. Intervention consisted of a three week progressive unilateral (dominant side) balance training program.

Data Analysis: SOT composite scores were analyzed using percent change for pre/post test in bilateral and single leg stance (Trained and untrained) as well as percent change for sensory components (Visual, Vestibular, and Somatosensory) for bilateral and single leg stance (SLS).

RESULTS

Four subjects (1 Female, 3 Male) aged 23-26 years, right-side-dominant, participated in this pilot study.

The mean percent changes for bilateral stance, SLS right and SLS left were respectively 7.3 (SD=1.2), 1 (SD=4.4), 5.2 (SD=9.3) (Figure 1).

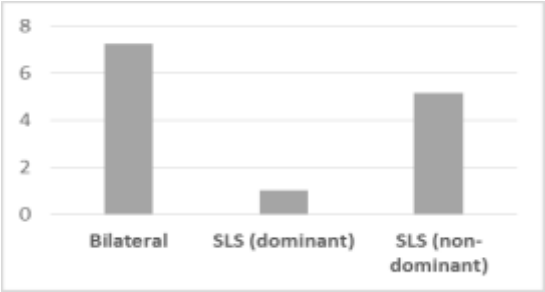

Figure 1: Mean percentage change in outcome variables after 3 week unilateral training protocol.

DISCUSSION

Preliminary results give some indication that the unilateral balance training program did produce balance improvements in bilateral stance. The results for SLS left and right are overall inconclusive due to the variance of effects across the sample. Additional data collection as part of the ongoing study is expected to clarify the observed trend that there are improvements with all three sensory inputs for bilateral stance but inconsistent effects in SLS for right (trained) and left (untrained) side showing improvement only in some subjects.

CONCLUSION

Preliminary data suggests that the intervention was competent in eliciting balance improvements based on the improvements of all subjects in bilateral stance. However due to the variance in SLS results not conclusion can be made on the effect of cross-education on balance. Further work is required to establish the relationship of cross-education and balance in people with lower limb loss.

CLINICAL APPLICATIONS

Applicability of our findings on post-amputation balance training depends on additional evidence on the effect of cross-education on balance.

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