Rapid Interventions for Postural Control

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Introduction: Postural control is defined as the ability to maintain the body's alignment and spatial orientation while completing a movement task (Ives, 2014). Measurement of postural control includes measures of balance and postural reaction time, both of which serve an important role across the spectrum of movement, from everyday activities of daily living to athletic performance. Postural reaction time is the time to respond to a postural threats and organize the body into an efficient response to stabilize or balance the body. For example, diving for a low volleyball hit may require a player to rapidly brace for an impact with the floor, or slipping on ice may cause one to instantaneously adjust their posture to avoid falling. In either case, a fast postural reaction time is used to protect against threats or prevent threats altogether. Many studies have been conducted on older populations to improve postural stability and balance, generally with prolonged intervention strategies like exercise (Lee & Lee, 2017; Taing & McKay, 2017). There is minimal data regarding short term, highly specific, interventions to improve postural control. The purpose of this experiment is to determine if a one week training program can lead to short term balance and postural reaction time improvements in young adults. It was hypothesized that the treatment program would produce better balance and faster postural reaction time.

Methods: The current experiment was a pilot study with five subjects conducted with two days of baseline testing and one day of post-intervention testing. Subject participation was part of a class assignment. Pre and post-tests included a limits of stability (LOS) test and unilateral stance test, both using a Balance Master (Neurocom, OR) computerized balance system. The LOS test assesses an individual's ability to displace their center of mass without losing balance, and the unilateral stance test measures one's movement while standing on one foot with eyes either opened or closed.

After the second day of baseline testing, balance improvement treatments were administered. Subjects were divided into two treatment groups. The group 1 (n = 3; Physical) treatment involved the subjects engaging in a task which served as a more challenging version of the actual LOS test. The task involved the subjects standing on foam and catching a ball one-handed that was thrown to make the subject reach. The second group (n = 2; Imagery) practiced mental imagery of the LOS and single leg stance to boost confidence and provide mental rehearsal. Subjects in group 1 engaged in two 30 minute training sessions over the course of one week, and subjects in group 2 participated in one training session 5 minutes before the post test.

Results: Between the two treatment groups, physical training and imagery training produced a reduced reaction time under the LOS test. After analyzing the data by comparing means and using a t-test, the cognitive training had a statistically significant impact on performance on the LOS test. The average reaction time in the pretest for this group was 1.753 seconds while in the post test it dropped to 0.733 seconds. Under the Unilateral Stance test, the physically trained group showed improvement in performance under both conditions (eyes opened and eyes closed) and the cognitive training group showed improvements with the eyes closed. For example, the physical group had 0.733 degrees/second of movement on the right leg before the intervention, and only 0.667 degrees/second of movement post-intervention. However, there was no statistical significance between training and performance in the Unilateral Stance Test.

Discussion: The hypothesis was supported, in part. This study assessed the effectiveness of both a short term physical training regimen and a short-term cognitive training on balance and postural control in young adults. Initially, the impression was that the implementation of these programs would cause an increased performance in the LOS and the unilateral stance tests. After intervention implementation, the study showed that while both interventions yielded positive results on the LOS test, the cognitive training showed to be more effective in comparison with the physical testing. The current study was able to distinguish what interventions provided positive results for our target population in regards to balance performance, and provides positive data from which to plan larger studies.

References:
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