The Effect of Training with the Porterfield Device on Core Trunk Muscle Strength in Healthy Adults: A Pilot Study

Background and Purpose

Core trunk muscle strength has been reported to play an important role in spinal stability[1,2] and in the successful performance of sports related as well as everyday activities.[3] Panjabi (1992) first described a model for spine stability such that the muscles surrounding the spine provide the support and stiffness at the intervertebral level to sustain forces commonly encountered in life.[4] Trunk muscle weakness such as the transversus abdominis have been linked with functional deficits in persons with low back pain[5-8] where strength and endurance is often diminished.[3] Functionally, the core is regarded as a kinetic link between the upper and lower extremities that allows for the effective transfer of force and angular momenta during various activities.[9] It has also been noted that muscular and functional decrements are associated with a reduced quality of life.[10] Monfort-Panego et al. (2009) reported that voluntary co-contraction of the abdominal muscles (abdominal bracing) is effective in increasing trunk stability and this maneuver is often recommended and/or included in rehabilitation and/or fitness programs.[11-12] The Bent Knee Lowering Test (BKLT) has been used in conjunction with abdominal hallowing in order to objectively measure core strength.[13-20]

Therefore, the aim of this pilot study was to understand the effects of a trunk strengthening program that involves the voluntary co-contraction of the abdominal muscles using a novel training device. We hypothesize that utilization of the Porterfield Device will result in improved core trunk muscle strength as determined by the Bent Knee Lowering Test.

Procedures

A convenience sample of 7 subjects was recruited for this pilot study (Avg. Age = 23 years old, 5 Male, 2 Female). Core strength was assessed utilizing the Bent Knee Lowering Test (BKLT). Participants were positioned supine with the knees and hips flexed to 90 degrees, as measured by a goniometer. A pressure biofeedback cuff (i.e. the stabilizer pressure biofeedback unit, Chattanooga Group, Chattanooga, TN), was inflated to 40 mm Hg, and the center of the device was placed under the lumbar segment spine. Participants then performed an abdominal hollowing maneuver while maintaining consistent 40 mm Hg pressure. To perform abdominal hollowing portion of the test, participants were positioned supine with knees bent to 45 degrees (Figure 1b). Participants were instructed to draw the lower abdomen towards the spine, so as to hollow the abdomen. If performed correctly, the pressure stayed at 40 mm Hg. Once participants were able to perform the abdominal hollowing maneuver, they were then instructed in the bent knee-lowering portion of the test. In the bent knee lowering portion of the test, participants lowered their legs toward the table until the investigator noted a visual change on the pressure cuff monitor indicating a change in pelvic position. The hip angle (in degrees) was measured at this point. The average of the three test trials was used for data analyses. A single examiner gave all participants verbal and visual instruction on the BKLT prior to testing.

Subjects then participated in a 4-week training program utilizing the Porterfield Device, a novel training tool that utilizes spring resistance, abdominal hallowing, and kinetic chain movements designed to engage the trunk core musculature. Subjects performed the exercises 4-5 times a week for 20 minutes. The BKLT was conducted by the same examiner upon program completion.

Results

There was a statistically significant difference in the scores for Pre-Test BKLT (M=77.7 degrees, SD=5.1) and Post-Test BKLT (M= 73.2 degrees, SD=7.3) conditions; $t(5)=2.015$, $p = .015$ suggesting that core muscle strength was improved following a 4 week strengthening program

that involves the voluntary co-contraction of the abdominal muscles and a novel training device.

Discussion

Core musculature strength has been identified as a key requirement in stabilizing the trunk prior to the limb movements.[16] Functionally, this relationship is deemed important for the effective transfer of force between the limbs and trunk during functional and athletic activity.[9] In persons with low back pain, weakness and decreased endurance in core musculature is common.[5-8] As a result, many programs have been introduced that aim to improve trunk stability.[9]

This pilot study demonstrated that participation in a core strengthening program utilizing the Porterfield Device resulted in a statistically significant improvement in performance on the Bent Knee Lowering Test. The BKLT has been identified as an objective measure of core trunk strength. Further research must be conducted to aid in determining the efficacy of this training program in core strength. A randomized control trial with greater power should be conducted.

Conclusion

Core trunk strength as determined by the BKLT was shown to improve after a 4 week core strengthening program utilizing the Porterfield device. Increase in core strength may be beneficial in improving functional ability, low back health, and overall quality of life.

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