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Appendix 1: Supplemental Data

Methods for Testing Strength, Flexibility, and Balance.

The handgrip strength was measured with 3 consecutive maximal isometric hand squeezes on a grip tool connected to a BTE Work Simulator (Quest) while standing. The force of the isometric squeezes was measured and the average taken. In a similar fashion, the isometric strength knee extensor muscles was measured using the same device but in a seated position. The reasoning behind checking handgrip strength was to determine distant neural effects of training in muscle groups that were not specifically exercised during the intervention. All tests were performed by an experienced physical therapist that was blind to the exercise intervention.

Hip joint flexibility was recorded, using standard goniometric methods. Thoraco-lumbar spine flexibility was measured by the toe touch distance in the seated position with the legs extended.[Kippers, 1987 #58] A senior physical therapist that was blind to the exercise intervention performed both pre and post intervention range of motion testing using the same method each time to ensure reliability.

Balance in single-limb stance was tested by means of timing the subjects while standing on one leg for 3 trials, first with the eyes open and then with the eyes closed. The other leg was flexed at the hip and knee joints with both arms hanging relaxed at the sides. The subjects were instructed to stand as motionless as possible, looking straight ahead at a point on the wall 65 cm away. The time was recorded with a stopwatch from the moment they brought their foot off the ground until they lost balance and had to put their foot back on the ground. Three measurements were made on each leg, with the subjects standing alternately on their right and left leg first with eyes open and then again
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with eyes closed. This method was chosen for its ease of use and reliability.[Birmingham, 2000 #56]

Results for tests of Strength, Flexibility, and Balance.

The baseline measures of strength, flexibility and balance between the two exercise groups were not significantly different. Table 2 shows the mean within person change in grip strength and knee extension strength, flexibility, and single leg stance timed balance with and without eyes open. Only the TCC group showed strength gains (Newton-meters) with training with confidence intervals that did not include 0. Both the TCC and BWG showed similar improvements in most measures of flexibility. In the case of hip flexor range of motion and thoracolumbar flexibility only the TCC group had confidence intervals that did not include 0. On single leg balance time, both groups improved but the TCC group showed a greater change on single leg balance with eyes closed. Analysis of the between group mean change found that only the thoracolumbar flexibility measured with toe touch and the non-dominant single leg standing time with eyes closed was significantly more improved in the TCC group compared to the BWG with P < 0.05.

Discussion of Results on Measures of Strength, Flexibility, and Balance

A range of other fitness outcomes were explored including grip and knee extensor strength, range of motion of lumbar spine and hips, and single leg stance time. When comparing the TCC group versus the BWG, our data shows significant improvement in the measures of the non-dominant knee extensor strength, toe touch flexibility, and non-dominant single leg stance with eyes closed. Overall, grip strength improved 14 – 15%
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and knee extensor strength improved 10% in the dominant leg and 14% in the non-dominant leg in the TCC group. The lack of significance in the between group comparison of extensor strength changes in the dominant leg is likely due to the small sample size. Similar strength increases have been seen in a prior study where elderly woman improved knee extensor strength by 10 – 15% following a 6-month exercise period using a long style of T’ai Chi. [Lan, 2000 #31] The improvement in grip strength following an exercise protocol that did not specifically work on the upper extremities may be secondary to the more powerful distant neural effects of training while learning a new form of exercise such as T’ai Chi rather than with a form of exercise that is automatic such as brisk walking.[Duchateau, 2002 #108;Enoka, 1997 #109] Comparable improvements in the time of single leg balance with eyes closed have also been found in a randomized controlled study of 43 female subjects with osteoarthritis, mean age 63, following a 12 week simplified Sun style of T’ai Chi.[Song, 2003 #87] In this study, the T’ai Chi was also a simplified 10 movement form, although the Sun style is usually quicker and more compact than the Yang style used in our study. Interestingly, in that study with women suffering from osteoarthritis, significant improvements were not seen in knee extensor strength, aerobic power or toe touch flexibility.