

Balance Recovery Training for Fall Prevention in Retirement Communities

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STUDY PROTOCOL

Objective

The objective of this study was to compare the efficacy of RBT versus Tai Chi performed at, and among residents of, older adult senior housing. This RBT is a form of task-specific, perturbation-based balance training involving trip-like perturbations on a modified treadmill (1, 2). Based on evidence of fall risk reduction among older adults (3) and wide implementation, Tai Chi was chosen as an active control training exercise. Outcome measures included reactive balance tests involving trip-like perturbations on the modified treadmill, and standard clinical tests of balance and mobility. We tested two hypotheses, both of which were motivated by the principle of training specificity. We hypothesized that participants randomized to RBT would show better performance on reactive balance tests compared to participants randomized to Tai Chi. We also hypothesized that participants randomized to Tai Chi would show better performance on clinical tests of balance and mobility compared to participants randomized to RBT.

Design

A two-group pretest-posttest design was used. Participants were allocated to RBT or Tai Chi using a computer-based algorithm to minimize differences in key confounders including age (70-79 or 80 and over), gender (male or female), and baseline reactive balance rating (RBR) score (0-12). The pretest was conducted approximately one week prior to starting the assigned intervention. Repeated posttests were conducted one week, one month, three months, and six months after completing the intervention. In addition, real-world falls were tracked for the six months after completing the intervention.

Methods

Pretests and posttests were identical and included a battery of balance tests. The battery of balance tests included six standard clinical tests of balance and mobility, and a reactive balance test. All tests were performed by an investigator who was blinded to participants' group assignment.

Clinical tests: Six fall-risk relevant tests of balance, mobility, and balance confidence were included along with their standard scoring: timed-up-and-go test (TUG) (4), unipedal stance time (5), maximum step length (6), Berg Balance Scale (7), Performance-Oriented Mobility Assessment (POMA) (8), and Activities-specific Balance Confidence Scale (ABC) (9).

Reactive balance test: Participants stood on a stationary modified treadmill (Freemotion 800, Freemotion Fitness, Logan, UT), and reactive balance was assessed in response to a sudden treadmill belt posterior acceleration (~ 40 msec). A slender, rectangular foam block (4×4 cm cross section) was positioned approximately 3-7 cm in front of the toes to elicit a step over an obstacle, similar to that needed after a trip. Participants wore a fall protection harness, supported by an overhead gantry, to prevent knee or hand contact with the treadmill in the event of an unsuccessful attempt to recover balance. Participants were instructed to, upon treadmill movement, step over the obstacle, prevent a fall into the harness, and re-establish stable walking. Two perturbations were performed at each of three speeds (0.8 mph, 1.6 mph, and 2.4 mph) to provide three levels of difficulty (along with two trials at 0.8 mph in the reverse belt direction to reduce anticipation, but these were not included in characterizing reactive balance).

Interventions: Both RBT and Tai Chi interventions involved twelve 30-minute sessions, scheduled three times per week for four weeks. Participants were required to complete at least nine sessions (75% of the total 12) to be considered to be adherent to the protocol; mean RBT and Tai Chi

attendance was 91% and 94%, respectively. Each RBT session involved one participant at a time, and up to 40 treadmill perturbations with rest breaks every 10 perturbations. Perturbations were similar to those during reactive balance tests, with speed and direction (backward or forward belt movement) pseudorandomized to minimize anticipation, and speeds individualized to each participant's capabilities. Each Tai Chi session was led by an instructor with experience in leading community-based Tai Chi for older adults, used 12 unique sequences from the Yang Short Form, and was conducted in groups of a mean size of 5.3 participants. All testing and intervention sessions were performed on-site at the senior housing facilities.

Falls assessment: The number of all-cause falls and trip-induced falls outside of testing and training were recorded over the six months after the intervention (from week 5 to week 28). Such falls were quantified through telephone calls made every two weeks to each participant. A fall was defined as unintentionally coming to rest on the ground or lower level, not caused by loss of consciousness or overwhelming hazard (10).

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