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ORIGINAL ARTICLE

Effect of Tai Chi on Physical Function, Fall Rates and Quality of Life Among Older Stroke Survivors

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Abstract

Objective: To examine the effect of a 12-week Tai Chi (TC) intervention on physical function and quality of life.

Design: Single-blind, randomized controlled trial.

Setting: General community.

Participants: Community-dwelling survivors of stroke (N=145; 47% women; mean age, 70y; time poststroke: 3y; ischemic stroke: 66%; hemiparesis: 73%) who were aged ≥50 years and were ≥3 months poststroke.

Interventions: Yang style 24-posture short-form TC (n=53), strength and range of movement exercises (SS) (n=44), or usual care (UC) (n=48) for 12 weeks. The TC and SS groups attended a 1-hour class 3 times per week, whereas the UC group had weekly phone calls.

Main Outcome Measures: Physical function: Short Physical Performance Battery, fall rates, and 2-minute step test; quality of life: Medical Outcomes Study 36-Item Short-Form Health Survey, Center for Epidemiologic Studies Depression Scale, and Pittsburgh Sleep Quality Index.

Results: During the intervention, TC participants had two thirds fewer falls (5 falls) than the SS (14 falls) and UC (15 falls) groups ($\chi^2=5.6$, $P=.06$). There was a significant group by time interaction for the 2-minute step test ($F_{2,142}=4.69$, $P<.01$). Post hoc tests indicated that the TC ($t_{53}=2.45$, $P=.02$) and SS ($t_{44}=4.63$, $P<.01$) groups had significantly better aerobic endurance over time, though not in the UC group ($t_{48}=1.58$, $P=.12$). Intervention adherence rates were 85%.

Conclusions: TC and SS led to improved aerobic endurance, and both are suitable community-based programs that may aid in stroke recovery and community reintegration. Our data suggest that a 12-week TC intervention was more effective in reducing fall rates than SS or UC interventions. Future studies examining the effectiveness of TC as a fall prevention strategy for community-dwelling survivors of stroke are recommended.

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Survivors of stroke often report poor physical function leading to significantly decreased quality of life.[1-4] After impairment as a result of stroke, gait and balance are essential components of physical function; they lead to a significantly increased risk of falling, nearly 7 times more than healthy adults of a similar age.[5-7] Regular physical activity has been shown to improve physical function, reduce fall rates, and improve quality of life.[8,9] Effective interventions for improving physical function and quality of life among survivors of stroke are critically needed.[10-12]

A growing body of evidence suggests that Tai Chi (TC) exercise leads to improved physical function, fewer falls, and better quality of life in healthy older adults.[13-16] The safety of TC has been established among adults with chronic diseases (eg, heart failure, fibromyalgia, Parkinson's disease),[17-19] including survivors of stroke.[20-23] However, the effectiveness of TC in improving physical function in survivors of stroke has not been adequately studied,[20,21] and there are no studies that have examined its effect on fall rates or quality of life. The objective of this study was to examine the effect of a 12-week TC exercise intervention on physical function, fall rates, and quality of life among a group of community-dwelling older stroke survivors compared with strength and range of movement (SS) exercise and usual care (UC).

An audio podcast accompanies this article.
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Methods

Design

This was a single-blind, 3-group randomized controlled trial conducted between January 2009 and December 2012.

Sample and setting

Community-dwelling survivors of stroke (aged ≥50y) who were at least 3 months poststroke and living in the greater Tucson, Arizona, area from all sex and racial/ethnic groups were eligible. Study approval was obtained from the Institutional Review Boards at the University of Arizona, HealthSouth, and Carondelet Health Network in Tucson. The investigation was conducting according to the principles delineated by the Declaration of Helsinki, which included ascertainment of the written informed consent of all subjects.

Recruitment, screening, and randomization

Details of the recruitment plan have been previously reported.[24] Briefly, potential participants were recruited from multiple sources, including radio and newspaper advertisements, flyers and brochures placed at outpatient rehabilitation centers, community centers, and physician offices. Participants were screened for safety and eligibility prior to study enrollment using standardized tests to assess functional disability (modified Rankin Scale),[25] overall physical function (Short Physical Performance Battery [SPPB]),[26] and cognitive impairment (Mini-Mental State Examination).[27] Ineligible survivors of stroke included those who had no disability (eg, no poststroke sequela), a severe disability (eg, bedridden and requiring constant nursing care), or a serious medical condition (eg, active cancer treatment) that would interfere with study participation. Participants were recruited over a 3-year period (January 2009−January 2012) in cohorts of 12 to 15 survivors of stroke. Participants were randomly assigned to TC, SilverSneakers (SS), or UC groups using simple randomization with allocation concealment.[22,28]

Interventions

Tai Chi

Participants assigned to the TC group attended a 1-hour class 3 times a week for 12 weeks. Over the 12 weeks, they gradually learned the Yang style 24-posture short-form developed by Fei,[29] which was taught at an outpatient rehabilitation center by a long-term TC practitioner with over 30 years of teaching experience. Participants were asked to replicate motions, postures, and speed of the instructor. Each class approximately consisted of a 10-minute warm-up period, 40 minutes of TC exercise, and a 10-minute cool-down period. Chairs were positioned in close proximity to the participants to allow for brief rest periods, and participants were allowed to use walkers and canes as needed throughout the class. Participants were monitored for safety by the instructor and study staff.

List of abbreviations:

CES-D	Center for Epidemiologic Studies Depression Scale
PSQI	Pittsburgh Sleep Quality Index
SF-36	Medical Outcomes Study 36-Item Short-Form Health Survey
SPPB	Short Physical Performance Battery
SS	SilverSneakers strength and range of movement exercises
TC	Tai Chi
UC	usual care

SilverSneakers

Participants assigned to the SS group attended a 1-hour class 3 times a week for 12 weeks. SilverSneakers is a national fitness program for older adults that offers different types of group-based exercise classes (eg, aerobics, strength and range of movement, water aerobics, yoga).[30] Muscular strength and range of movement classes were taught by a certified instructor at local community fitness centers. Each class approximately consisted of a 10-minute warm-up period, 40-minutes of SS exercise, and a 10-minute cool-down period. Some exercises were performed from a seated position. Chairs were positioned in close proximity to the participants to allow for brief rest periods, and participants were allowed to use walkers and canes as needed throughout the class. Participants were monitored for safety by the instructor and study staff.

Usual care

The UC group received written materials and resources for participating in community-based physical activity suitable for older adults, which they could contact on their own. In addition, they received a weekly phone call to inquire of their health status to provide individual attention.

Main outcome measures

Physical function

The SPPB is a brief performance battery specifically developed for older adults, including those with chronic diseases or disabilities, to assess balance, gait speed, and lower body strength.[26] Timed balance tests (up to 10s) with increasing levels of difficulty include a side-by-side stand, a semitandem stand, and a tandem stand. The gait speed test measures the time required to walk 4m at a normative pace. Lower body strength is assessed by a chair stand test and measures the time to perform 5 rises from a chair to an upright position as fast as possible without use of the arms. Each performance test is assigned a categorical score ranging from 0 to 4 (0: inability to complete test, 4: highest level of performance). A summary performance score (0−12) is calculated by adding the 3 performance tests. The SPPB takes approximately 5 to 10 minutes to complete. Concurrent, predictive, and known-groups validity, interrater (intraclass correlation coefficient>.90) and 2-week test-retest (intraclass correlation coefficient=.72) reliabilities, and sensitivity to change have been reported.[26,31-33] In our study, 3-month test-retest reliability was very good (Pearson r=.79−.88, P<.01). Small and substantial meaningful changes in SPPB scores among older adults are represented by a 0.5 or 1 difference, respectively.[31]

Participant-reported fall rates were used as another measure of physical function, specifically balance control. Beginning in August 2010, we interviewed participants weekly during the 12-week intervention on the number of falls and near-fall events they experienced. Falls were defined as events in which subjects end up on the floor or ground when they did not expect to. Near falls were