



Published in final edited form as:

Complement Ther Med. 2009 August ; 17(4): 203–207. doi:10.1016/j.ctim.2008.10.005.

Short Duration, Intensive Tango Dancing for Parkinson Disease: An Uncontrolled Pilot Study

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Abstract

Objective—The goal of this pilot study was to determine the effects of short duration, intensive tango lessons on functional mobility in people with Parkinson disease.

Design—This study employed a within-subject, prospective, repeated measures design.

Subjects/Patients—Fourteen people with idiopathic Parkinson disease participated.

Setting—All balance and gait assessments were performed in a laboratory, but dance classes took place in a large, open classroom.

Interventions—Participants completed ten 1.5 hour long Argentine tango dance lessons within two weeks. Their balance, gait and mobility were assessed before and after the training sessions.

Main Outcome Measures—Measures included the Berg Balance Scale, the Unified Parkinson Disease Rating Scale, gait velocity, functional ambulation profile, step length, stance and single support percent of gait, Timed Up and Go, and the six minute walk.

Results—Participants significantly improved on the Berg Balance Scale (effect size (ES) = 0.83, $p = 0.021$), Unified Parkinson Disease Rating Scale Motor Subscale III (ES = -0.64 , $p = 0.029$), and percent of time spent in stance during forward walking (ES = 0.97, $p = 0.015$). Non-significant improvements were noted on the Timed Up and Go (ES = -0.38 , $p = 0.220$) and 6-minute walk (ES = 0.35, $p = 0.170$).

Conclusions—Frequent social dance lessons completed within a short time period appear to be appropriate and effective for these individuals with mild-moderately severe Parkinson disease.

Keywords

rehabilitation; Parkinson disease; gait; balance; dance

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Conflict of Interest Statement

The authors have no personal or financial conflicts of interest associated with this work.

Introduction

Individuals with Parkinson disease (PD) often demonstrate postural instability, gait difficulties, and reduced functional mobility that can lead to decreased quality of life. As pharmacological methods are only partially effective in addressing these problems, there is a clear need for additional, non-pharmacological approaches to address balance and gait difficulties¹. Studies of rehabilitation interventions in PD usually report gains sustained from sessions held 2 to 3 times per week over a 4–12 week period^{2,3,4}. However, higher dosage interventions may be more effective, as evidenced in a meta-analysis of 24 studies of therapeutic training. This study, which included balance/flexibility, aerobic exercise and tai chi programs, reported that only high intensity and dosage programs, defined as those meeting more than 180 minutes per week, had a significant effect on habitual gait speed in the elderly. This finding is particularly meaningful because improved gait speed in community dwelling elderly is predictive of reduced mortality⁵.

While older individuals clearly sustain gains from exercise, it can be difficult to prescribe a sufficient intensity, dosage and duration due in part to participant attrition⁶. As such, exercise dosage effects have been little studied in those with PD, perhaps partly due to the progressive nature of the disease. Those with moderate stage PD asked to engage in higher dosages of traditional balance therapy exercises have shown an attrition rate of over thirty percent⁷. The feasibility and effectiveness of exercise of high intensity using an alternative method such as dance have yet to be determined for individuals with PD.

Evidence now suggests that dance can be used as a therapeutic intervention to effectively target balance and complex gait tasks in healthy elderly^{8,9} and those with medical conditions including PD¹⁰. Dance appears to be an appropriate and pleasurable therapeutic activity for the elderly and physically challenged, in terms of its benefits to physical, mental and emotional states¹¹. Social dance improved quality of life and promoted adherence to an exercise program, while providing cardiovascular benefit to those at risk for cardiovascular failure¹². Participants with PD who participated in free-form movement demonstrated improvements in movement initiation¹³. A frail elderly cohort that participated in Argentine tango lessons demonstrated greater improvements in balance and complex gait tasks than did an age-matched walking group^{8,9}. Recent literature has also shown that participants with PD who participated in twice weekly Argentine tango classes for 10 weeks showed greater improvement in functional mobility than those who participated in a traditional exercise class specially designed for those with PD¹⁰.

The fore-mentioned studies looked at moderate to low dosages of the movement interventions. The purpose of this study was to determine the acceptability and feasibility of a high dosage social dance program for those with mild to moderate PD. Additionally, we aimed to quantify and characterize the effects of an ‘intensive’ dance program, in which participants danced 1.5 hours per day, five days per week for two weeks.

Methods

Participants

An aim of the study was to explore the acceptability and feasibility of an intense dance program for those with PD. To conduct the intervention there were space, time and relevant personnel available to accommodate a class of approximately fifteen individuals with PD. Therefore, 14 people diagnosed with idiopathic PD were recruited and participated in progressive Argentine tango classes. Participants were recruited from the Washington University School of Medicine’s Movement Disorders Center and from the surrounding St. Louis community. PD diagnostic criteria included those used for clinically defined “definite PD”, as previously

outlined by Racette et al.¹⁴ based upon established criteria^{15,16}. Each participant demonstrated clear benefit from PD medications. This study was approved by the Human Research Protection Office of the Washington University School of Medicine (protocol 07-0610). The conduct of this investigation conformed to ethical and humane principles of research. All participants provided written informed consent prior to starting the study.

Data Collection

Assessments of participants were conducted the week prior to initiation of the training sessions and the week following completion of 10 training sessions. All assessments were videotaped for rating by an individual otherwise not involved in the study. Participants were tested on medications at the same time of day for pre and post measures. During each assessment, participants were first evaluated using the Unified Parkinson's Disease Rating Scale Motor Subscale 3 (UPDRS)^{17, 18}. Participants were also evaluated using the Berg Balance Scale (BBS)¹⁹, Timed Up and Go test (TUG)^{20,21} and six minute walk test (6MWT)^{22,24}. Gait was assessed using an instrumented, computerized GAITRite walkway (CIR Systems, Inc., Havertown, PA). Measurement sessions were conducted using a standardized script with specific instructions for each task.

Kinematics

Spatiotemporal features of walking were measured using a 5 meter instrumented, computerized walkway. Participants were asked to perform three trials of forward walking (FW) and three trials of backward walking (BW) on the walkway at their normal pace. Results from the three trials of each condition were averaged. The primary variables of interest were gait velocity, step length, swing percent, stance percent, and functional ambulation profile (FAP). The FAP is a single, numerical representation of gait performance²³ that is valid, reliable, and can discriminate between people with and without PD when walking at preferred speeds²⁴.

Analysis

Data were analyzed using custom-written software and Sigmapstat (Systat, Richmond, VA). Comparisons of pre- to post-test values were made using the method of Mee and Chua (1991), whereby paired t-tests were corrected to account for possible regression to the mean²⁵. Corrections for multiple tests were applied to the group of functional measures (BBS, TUG, and 6MWT) and separately to the gait variables for both FW and BW. Overall significance level for each grouping of variables was set at $p = 0.05$, and the p value for each test was determined using the Bonferroni-Holm method²⁶. No correction was applied to the UPDRS, as it is a measure of overall disease severity and is not specific to balance or walking. All values presented are means \pm standard deviations (SD).

Social Dance Classes

Ten 1.5 hour-long progressive Argentine tango dance sessions were completed in two weeks. All social dance sessions were led by an experienced instructor who is both a professional ballroom dancer and American Council of Exercise certified personal trainer. Every session began with a typical warm up for social dance classes, consisting of breathing, limbering and postural alignment exercises in order to prepare the participants for more complex motor actions. Next, a new step element would be introduced in each class period, and participants worked on the steps with a partner. Following this, the instructor had the participants walk in various rhythms in synchrony with their partner. Finally, the step of the day was revisited and tagged on to steps previously learned in other sessions, so participants could dance a combination of several steps. Both genders danced leading and following roles. Those with PD always danced with a partner without PD, frequently a young volunteer, recruited from the university pre-medical student office. Dancing to commercial recordings, partners rotated

approximately every 10–15 minutes. Although several participants were quite physically challenged, everyone participated in most of each class period. The instructor encouraged all participants, both volunteers and those with PD, to ask questions, provide feedback, and to take breaks as necessary.

Results

Two participants did not complete the study: one withdrew at week 1 citing that he was physically unable to complete the lessons because of long-standing sciatica, and the other withdrew because of a death in the family. Twelve participants completed the study and only their data were analyzed. The sample was 33% female, the mean age was 67.2 ± 9.6 years, mean time with PD, 9.1 ± 4.6 years, and median and interquartile range for Hoehn and Yahr stage, 2.4 (25%:2.0 75%:2.5). There were significant improvements in the UPDRS and BBS, and non-significant improvements in the TUG and 6MWT (Table I). There was a significant decrease in the percentage of the forward gait cycle spent in stance ($p = 0.015$). There were also non-significant improvements in other aspects of forward and backward gait (Table II, Table III).

Discussion

This is the first study to examine the effect of short duration, high intensity tango lessons for those with PD. Twelve people with PD completed an intensive Argentine tango dance course, dancing 1.5 hours per day five days a week for two weeks, for a total of 900 minutes of instruction. With this short two-week intervention, gains were noted in balance, gait and mobility measures and participant attrition rate was only 14% in spite of the high dosage.

We have previously described the effects of a longer duration, lower intensity tango program where participants danced for 1 hour twice a week for 10 weeks¹⁰. The results of the present study are in keeping with the former, despite the fact that the short duration group of the present study received 300 fewer minutes of instruction than the longer duration group of the former study. For the longer duration tango group ($n = 9$), there was a significant 26% improvement in the UPDRS. The short duration group also significantly improved with a 14% change in UPDRS. On the BBS the longer intervention group improved 12.3%, while the present short duration group improved 5.8%. Those in the longer duration tango group showed a trend toward improvement in the TUG test with an 8.4% decrease in time needed to complete the task, while the present short duration group showed a greater improvement, decreasing time needed to complete the task by 15.3%.

Gait

A meta-analysis of therapeutic exercise for older individuals found it necessary to engage in a high dosage program (at least 180 minutes per week) to affect gait speed in an elderly population, whereas no effect was found for low dosage exercise programs²⁷. A 0.1 m/s decrease in speed is considered a substantial meaningful change in older adults with mild to moderate mobility deficits²⁸. Our participants exhibited an improvement of 0.1 m/s for both gait conditions. Although not statistically significant, the improvement in gait speed noted in this study may have functional importance.

Furthermore, a 20 m improvement in the 6MWT is considered a small meaningful change while 50 m is a substantial meaningful change in an older population²⁸. This is the first study to examine 6MWT performance before and after an intensive social dance course. The average increase of 36 m, while again not statistically significant, may be functionally meaningful. This improvement in 6MWT performance may reflect improved balance. Alternatively, the improvement may reflect increased endurance, as a recent study of individuals at risk for heart

failure demonstrated that the waltz was as beneficial as aerobic exercise for cardiovascular health¹². Additionally, the higher dosage of this study exceeds the requisite amount of activity the American College of Sports Medicine recommends to see benefits in endurance: 20 to 60 minutes per session, three to five sessions per week²⁹.

Backward Walking

Falls in the elderly and particularly those with PD often occur while moving or being perturbed in the backward direction³⁰. Tango technique itself involves instruction in, and execution of, safe backward walking with an emphasis on keeping the center of mass over the base of support. The near-significant improvements during backward walking could be a result of habitually walking backward while paying attention to movement patterns during the intervention.

Attrition Rate

Participants in this high intensity tango intervention had an attrition rate of only 14%, while other studies of high intensity traditional balance training showed attrition of more than 30%. Prior work showed that older people were happier dancing than performing aerobic exercise, as evidenced by increases in measures of quality of life and greater likeliness to comply with the exercise regimen¹². In informal interviews, our participants expressed enjoyment of the program, in addition to noting improvements in several aspects of well-being. They also demonstrated compliance with the regimen and indicated interest in continuing, perhaps due to the social and supportive nature of the program, which is inherent to social dance programs.

To conclude, this study demonstrated the feasibility of a high dosage social dance intervention for participants with mild to moderate PD. Given the low attrition rate, it appears the program was acceptable to most participants. Participants were able to complete 1.5 hour tango lessons five days per week for two weeks and demonstrated improvements in gait, balance and functional mobility. This pilot study is limited by a relatively small sample size, and may have been underpowered to detect a difference in outcome, hence the many non-significant differences. The results of a non-randomized controlled design need to be interpreted with caution given the number of possible sources of bias present, e.g., selection bias and confounding factors. However, the results suggest that an intensive social dance intervention may be an effective form of exercise for these individuals with mild to moderately severe PD. Given the pilot nature of this work, we did not have a follow up measure to examine how long benefits were retained after post-testing. In a meta-analysis of physiotherapy, it was demonstrated that impact is generally diminished after cessation of a rehabilitative intervention¹. The data gleaned from this study shall be used to inform a larger study. Conducting follow-up measures to assess retention of benefits would be an important addition to future work.

Acknowledgements

We would like to acknowledge Ruth Clark, Josh Funk, Callie Mosiman, Mike Falvo, Lauren Mehner, Jeff Becket, Kyleen Albert, Patricia Engel, Mathew Lopes, Jeremy Missuk, Sarah Goldenberg, Liz Nylund, Megan Chochol, Poonam Kalidas, Laurie Bonkowski, Madhavi Prabhakar, Rachel Patterson, Ryan Choi, Sophie Galson, and Kim O'Keefe for their assistance with this project. A grant from the American Parkinson Disease Association funded this work. The study sponsors played no role in the study design, collection, analysis and interpretation of data, the writing of the manuscript, the final conclusions drawn or in the decision to submit the manuscript for publication.

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Table 1

Disease Severity and Balance Measures

	Pre-Test Average \pm SD [95% CI]	Post-Test Average \pm SD [95% CI]	Effect Size	P
UPDRS	32.9 \pm 7.3 [28.3–37.5]	28.3 \pm 7.1* [23.8–32.8]	-0.64	0.029
BBS	47.8 \pm 3.2 [45.8–49.8]	50.6 \pm 3.5* [48.4–52.8]	0.83	0.021
TUG (s)	13.1 \pm 5.8 [9.4–16.8]	11.1 \pm 4.8 [8.1–14.1]	-0.38	0.220
6MWT (m)	347.8 \pm 77.2 [186.8–508.8]	383.7 \pm 122.1 [129.1–638.3]	0.35	0.170

Values are means \pm SD.

* significant difference from pre to post

Table II

Forward Gait

	Pre-Test Average \pm SD [95% CI]	Post-Test Average \pm SD [95% CI]	Effect Size	P
Velocity	1.0 \pm 0.2 [0.88–1.11]	1.1 \pm 0.2 [0.95–1.25]	0.500	0.520
FAP	92.5 \pm 8.2 [87.3–97.7]	91.7 \pm 14.6 [82.5–99.9]	0.067	0.430
Step length (m)	0.6 \pm 0.1 [0.53–0.67]	0.6 \pm 0.1 [0.53–0.67]	0.000	0.450
Swing %	34.6 \pm 1.9 [33.4–35.8]	36.8 \pm 3.1 [34.9–38.7]	0.855	0.084
Stance %	65.4 \pm 1.9 [64.2–66.6]	63.6 \pm 1.8* [62.5–64.7]	0.973	0.015

Values are means \pm SD.

* significant difference from pre to post

Table III

Backward Gait

	Pre-Test Average \pm SD [95% CI]	Post-Test Average \pm SD [95% CI]	Effect Size	P
Velocity	0.5 \pm 0.2 [0.38–0.62]	0.6 \pm 0.3 [0.40–0.8]	0.392	0.54
FAP	54.1 \pm 13.8 [42.6–65.6]	61.8 \pm 18.0 [50.3–73.3]	0.480	0.52
Step length (m)	0.3 \pm 0.1 [0.22–0.38]	0.4 \pm 0.2 [0.30–0.50]	0.632	0.40
Swing %	31.7 \pm 3.5 [19.3–44.1]	31.1 \pm 7.1 [26.6–35.6]	0.107	0.440
Stance %	68.5 \pm 3.1 [66.5–70.5]	69.1 \pm 7.6 [64.2–74.0]	0.103	0.820

Values are means \pm SD.