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A pilot study to evaluate multi-dimensional effects of dance for people with Parkinson's disease

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ABSTRACT

Parkinson's disease (PD) is a progressive neurodegenerative disease associated with deficits in motor, cognitive, and emotion/quality of life (QOL) domains, yet most pharmacologic and behavioral interventions focus only on motor function. Our goal was to perform a pilot study of Dance for Parkinson's—a community-based program that is growing in popularity—in order to compare effect sizes across multiple outcomes and to inform selection of primary and secondary outcomes for a larger trial. Study participants were people with PD who self-enrolled in either Dance for Parkinson's classes (intervention group, N = 8) or PD support groups (control group, N = 7). Assessments of motor function (Timed-Up-and-Go, Gait Speed, Standing Balance Test), cognitive function (Test of Everyday Attention, Verbal Fluency, Alternate Uses, Digit Span Forward and Backward), and emotion/QOL (Geriatric Depression Scale, Falls Efficacy Scale-International, Parkinson's Disease Questionnaire-39 (total score and Activities of Daily Living subscale)) were performed in both groups at baseline and follow-up. Standardized effect sizes were calculated within each group and between groups for all 12 measures. Effect sizes were positive (suggesting improvement) for all 12 measures within the intervention group and 7 of 12 measures within the control group. The largest between-group differences were observed for the Test of Everyday Attention (a measure of cognitive switching), gait speed and falls efficacy. Our findings suggest that dance has potential to improve multiple outcomes in people with PD. Future trials should consider co-primary outcomes given potential benefits in motor, cognitive and emotion/QOL domains.

1. Introduction

Parkinson's disease (PD) is a progressive neurodegenerative disease. Cardinal motor symptoms of PD—including resting tremor, bradykinesia, rigidity and gait dysfunction—can be debilitating [1]. However, approximately 25–40% of people newly diagnosed with PD experience cognitive and emotional impairments, which can be as debilitating as motor symptoms [2]. Pharmacological and surgical interventions are partially effective in reducing PD motor symptoms, however cognitive and emotional impairments are difficult to address with current treatments [3]. Thus there is a need to test alternative interventions that can simultaneously address motor, cognitive and emotional symptoms associated with PD, thereby improving daily functioning and quality of life.

A wide range of exercise interventions including aerobic exercise, resistance training, and stretching have been shown to improve some aspects of physical functioning such as balance and gait speed in people with PD [4–6]. There is growing evidence that exercise can also potentially improve non-motor symptoms, including cognitive and emotional deficits, in PD [7]. However, despite growing evidence of the multi-dimensional benefits of exercise, most people with PD are not regularly active and the factors that contribute to exercise behaviors in PD remain poorly understood [8]. Until recently, identifying barriers to exercise in people with PD has received little attention [9,10]. It is important to understand what influences physical activity engagement so that programs can be designed to increase participation and maintain interest in the PD community.

Dance is rapidly gaining mainstream popularity in people with PD because it is enjoyable in nature and may offer multi-dimensional

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benefits [11,12]. Clinical trials have shown that dance improves motor symptoms, particularly problems with balance and mobility [13], as well as overall physical fitness [14]. Dance also may improve cognitive functioning—including executive functioning, working memory, action planning and attention—because it requires the ability to connect one movement to the next and execute complex motor plans [15]. Some studies have shown that dance participants report improved mood after having shared the dance experience with others [16,17] and that they feel more accepted and understood [11], which could improve emotional well-being and quality of life. Yet few studies have simultaneously examined the effects of dance on motor symptoms, cognitive function and emotional well-being in a single study.

Our long-term goal is to perform a full-scale randomized, controlled trial of dance in people with PD. Given the potential multi-domain benefits of dance, the primary goal of the current study was to perform a pilot trial to inform selection of primary and secondary outcomes for this larger trial [18]. We included a non-randomized, no-contact control group to provide additional information about expected changes in these measures without intervention.

2. Materials and methods

2.1. Recruitment

Participants for the intervention group were recruited by distributing recruitment flyers to a pre-existing Dance for Parkinson's program. Those who expressed interest in our study contacted our study team and were then provided more detailed information about our study. Participants for the no-contact control group were recruited by contacting community-led PD support groups that provide talks from health professionals on topics such as nutrition, physical therapy services, and legal matters for individuals with PD. Recruitment flyers were distributed and those who expressed interest in our study contacted our study team and were provided more information about our study.

2.2. Inclusion and exclusion criteria

Inclusion criteria were: self-reported diagnosis of PD, age 55–80 years and no previous dance experience. Exclusion criteria were: history of stroke, significant head trauma, prior neurosurgery, significant vision impairment, atypical PD (i.e. age of onset < 55), and global cognitive impairment (Mini-Mental State Exam score < 25). The study was performed with the approval of the University of California, Davis, Committee for Human Research (#217359–2), and all participants provided written informed consent.

2.3. Testing procedures

All participants were evaluated at two time points: time point 1 (T1) and time point 2 (T2). For the dance intervention group, assessments were completed at T1 prior to beginning dance classes and after completing 10 dance classes at T2. Six participants completed 10 consecutive dance classes, while two participants completed 10 dance classes in non-consecutive weeks due to other obligations (e.g., travel, caring for sick family members). Median time between T1 and T2 for the dance intervention group was 4.5 months. For the no-contact control group, assessments were completed at T1 and T2 but they did not receive the dance intervention. Time between T1 and T2 was matched to the dance intervention group. Median time between T1 and T2 for the no-contact control group was 4 months.

2.4. The dance intervention

Dance classes were led by 2 instructors trained in Dance for PD® methodology and consisted of 10–20 participants (not all of whom were study participants). The duration of each class was 1.25 h once per week following the 3-part format of the Dance for PD® program [11]. Part I: classes began with a 20 minute seated warm-up session. Participants were instructed to focus on connecting their breath to their movements. Instructors first demonstrated the movements, then participants practiced small movements on their own, isolating different parts of the body (i.e. moved feet first, then moved arms, practiced head movements). Part II: participants transitioned to a standing position behind the chairs, held chairs for support during a 20 minute standing warm-up, and practiced weight shifting and balance poses. Although the entire dance class could be completed in the seated position if so desired, participants in our study were able to complete all standing exercise positions. Again, instructors first demonstrated the movements and participants then repeated the movements once on the left-side of the body and once on the right-side of the body. Part III: participants moved to the center of the dance floor and completed a series of choreographed dance movements (dance forms included ballet, jazz, Broadway style dance), improvisational movement such as mirroring, or movement across the floor for 20 min. Movements were performed at least twice, with and without music. A list of sample music pieces is provided in Supplementary material. Every class concluded in a circle dance in which participants stood facing one another, held hands and passed a "pulse" (e.g., hand squeeze) to the next person in the circle. This allowed the participants to acknowledge one another and to acknowledge the shared experience in the class.

2.5. No-contact control group

Participants in the no-contact control group were instructed to engage in usual activities during the study period. They were offered to enroll in Dance for Parkinson's classes after study completion. During the duration of the study, participants in the dance intervention group did not interact with participants in the control group.

2.6. Outcome measures

We selected outcome measures in three domains: motor function, cognitive function and emotion/quality of life. Tests were administered in a university research laboratory setting by a trained assessor who was blind to group assignment at T1 and T2. Participants were assigned a subject identification code and group assignment information was stored in a separate locked file cabinet from the testing material so that the assessor remained blind to group assignment. In addition, participants were instructed not to discuss the dance intervention during evaluation sessions to ensure that the assessor remained blind to group assignment. Evaluation sessions averaged 2 h in duration, and in order to avoid fatigue, frequent breaks were provided to keep participants alert and motivated during testing. Each participant completed the testing while "ON" medication at T1 to establish the degree of impairment in aspects of motor and cognitive performance known to be affected by PD. To reduce practice effects at T2, alternate forms of tests were used when possible. For example, we used two versions of the Alternate Uses test: one version included common objects such as a shoe, button, key, wooden pencil, automobile tire, eyeglasses; a second version included objects such as a chair, watch, safety pin, bed sheet, milk carton, nail. If a participant was given one version at T1, they were given the alternate version at T2. Two versions of the Test of Everyday Attention and Letter Fluency were also available. Therefore, one version of each test was administered at T1 while the second version was administered at T2. Testing at T2 was completed in the same university research laboratory setting at the same time of day as T1 testing while participants were "ON" medication.

2.6.1. Motor domain

Three measures of motor function were used. The Timed-Up-and-Go (TUG) test was used to measure mobility. Participants started from a