



Effects of dance on motor functions, cognitive functions, and mental symptoms of Parkinson's disease: A quasi-randomized pilot trial



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Motor functions;
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Rehabilitation

Summary

Objective: To examine the effectiveness of dance on motor functions, cognitive functions, and mental symptoms of Parkinson's disease (PD).

Design: This study employed a quasi-randomised, between-group design.

Setting: Dance, PD exercise, and all assessments were performed in community halls in different regions of Japan.

Participants: Forty-six mild-moderate PD patients participated.

Intervention: Six PD patient associations that agreed to participate in the study were randomly assigned to a dance group, PD exercise group, or non-intervention group. The dance and PD exercise groups performed one 60-min session per week for 12 weeks. Control group patients continued with their normal lives. All groups were assessed before and after the intervention.

Main outcome measures: We used the Timed Up-and-Go Test (TUG) and Berg Balance Scale (BBS) to assess motor function, the Frontal Assessment Battery at bedside (FAB) and Mental Rotation Task (MRT) to assess cognitive function, and the Apathy Scale (AS) and Self-rating Depression Scale (SDS) to assess mental symptoms of PD. The Unified Parkinson's Disease Rating Scale (UPDRS) was used for general assessment of PD.

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Results: When comparing results before and after intervention, the dance group showed a large effect in TUG time (ES=0.65, $p=0.006$), TUG step number (ES=0.66, $p=0.005$), BBS (ES=0.75, $p=0.001$), FAB (ES=0.77, $p=0.001$), MRT response time (ES=0.79, $p<0.001$), AS (ES=0.78, $p<0.001$), SDS (ES=0.66, $p=0.006$) and UPDRS (ES=0.88, $p<0.001$).

Conclusions: Dance was effective in improving motor function, cognitive function, and mental symptoms in PD patients. General symptoms in PD also improved. Dance is an effective method for rehabilitation in PD patients.

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Introduction

Parkinson's disease (PD) has recently come to be understood as a systemic disease presenting not only motor symptoms but also non-motor symptoms such as cognitive and mental symptoms. The impairment of nerve pathways in the basal ganglia due to dopamine deficiency, together with the spread of pathological Lewy bodies, result in a decline in function of many neurotransmitter systems, creating a complex clinical picture. The motor and non-motor symptoms of PD both negatively impact the daily life and quality of life (QOL) of PD patients.^{1,2} In particular, the non-motor symptoms such as cognitive impairment and mental symptoms such as depression and apathy have a major effect on daily life. Cognitive impairment in PD includes impairments of attention, planning and execution, memory and visuospatial cognition. Mental symptoms include impairments of emotion and motivation such as depression and apathy.

The main objective of rehabilitation in PD is usually to recover motor function, but an approach geared toward non-motor symptoms is essential for improving the daily life and QOL of patients. We thought that dance would be an effective form of rehabilitation, since it is an enjoyable and appealing activity that activates the basal ganglia network in PD patients and can therefore be used to work on motor function, cognitive function, and mental symptoms simultaneously.

Dance works on motor function by getting patients to stretch their muscles, perform steps, and maintain balance. It also works on cognitive function by requiring patients to plan and execute imagined movements, follow music and signals, remember repeated actions, and be aware of their own body. Furthermore, as a social activity performed with others, dance also works on the emotions by encouraging the dancers to express their feelings,³ increasing motivation,⁴ and providing enjoyment through greater ease of movement.⁵ Dance can therefore be used to work on motor function, cognitive function, and mental symptoms in PD patients simultaneously. Through this simultaneous action dance also activates the basal ganglia network. We did not directly measure basal ganglia activity during dancing *in this study*, but previous research suggests that dancing could enhance such activity. Using positron emission tomography (PET), Brown and Lawrence⁶ have shown that blood flow to the motor areas and cerebellum increases when dance steps are performed. Calvo-Merino et al.⁷ and Cross et al.⁸ also discuss activation of a motor planning system. Sacco et al.⁹ indicate that tango lessons stimulate activation of the premotor area and supplementary motor area. These studies show that dance activates functions of the basal

ganglia. Many previous studies on dance have described improvements in walking speed, balance, and other aspects of motor function.^{10–15} In addition, many studies have used Unified Parkinson's Disease Rating Scale (UPDRS) for general assessment of PD, but while there have been two studies on dance and cognitive function,^{16,17} neither tested the effect of dance over a fixed period in PD patients.

Several studies have looked at mood, motivation and depression in relation to mental symptoms,^{11,14,18} but there has been insufficient investigation of apathy, which is a major problem in PD patients. If dance is an enjoyable form of rehabilitation that can address motor function, cognitive function, and mental symptoms simultaneously, then its effectiveness should be tested.

The objective of this study was to investigate the extent of the effects of dance on motor function, cognitive function, and mental symptoms, all of which underlie the motor and non-motor symptoms in PD patients. We investigated the motor functions of walking and balance, the cognitive functions of memory, execution, attention and motor imagery, and the mental symptoms of depression and apathy. We also tested whether daily life and overall function in PD were improved. To do this, we compared the outcomes in a dance group, a PD exercise group, and a non-intervention group.

Methods

Participants

The target participants were patients diagnosed with PD who lived at home and received outpatient treatment. They had to be capable of independent walking and able to engage in dance or PD exercise for 1 h. They also had to give written consent to participate in the study for approximately 3 months.

We estimated a sample size of 14 participants per group for a significance level $\alpha=0.05$ and power = 0.8, based on the research by Hackney et al.^{10,15} and Cohen's effect size.¹⁹

We then invited a number of local PD patient associations to participate in the study in order to secure participants who met these conditions. Six patient associations agreed to participate in the study.

Procedure (Fig. 1)

Explanatory meetings were held to secure study participation. At these meetings, we explained that the study

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