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REVIEW

Dancing and Parkinson's disease: updates on this creative approach to therapy

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Joanne Shanahan[1]
Meg E Morris[2]
Orfhlaith Ní Bhriain[3]
Daniele Volpe[4]
Amanda M Clifford[1]

[1]Department of Clinical Therapies, Faculty of Education and Health Sciences, University of Limerick, Co. Limerick, Ireland; [2]Department of Physiotherapy, School of Allied Health, La Trobe University, Bundoora, Australia; [3]Irish World Academy of Music and Dance, Department of Arts Humanities and Social Sciences, University of Limerick, Co. Limerick, Ireland; [4]Department of Neurorehabilitation, Casa di Cura Villa Margherita, Vicenza, Italy

Introduction: Parkinson's disease (PD) is associated with slowness of movement and balance disturbance. Anxiety and social isolation are common and quality of life (QoL) can be compromised. Dancing enables people with PD to participate in an enjoyable form of exercise within a group. This review provides an updated synthesis of the literature comparing dance to other interventions in people with PD.

Methods: Six databases were electronically searched. Relevant articles were identified using inclusion criteria. Data on participants, the dance intervention, and outcomes were extracted from suitable articles.

Results: Methodological limitations were evident in 13 included articles. The evidence reviewed suggests that dancing is enjoyable and can improve balance, motor function, and QoL. Further research is needed to determine the effect of dancing on cognition and depression in this population. Longer term dance interventions may be needed to achieve more meaningful benefits in mobility.

Conclusion: Dancing can be a feasible and beneficial physical activity and improve the wellness of individuals with PD.

Keywords: Parkinson's disease, dance, physical activity

Introduction

Parkinson's disease (PD) is common, affecting at least 7 million people worldwide.[1] With disease progression, people can experience movement difficulties[2] and problems participating in social[3] and family life[4] and physical activities.[5] Movement disorders associated with PD together with insufficient exercise can compromise balance and gait, contributing to further inactivity,[6] falls,[7] isolation, and loss of independence.[8] Although the benefits of exercise are well-recognized for people with PD,[9,10] sedentary lifestyles remain common and can be debilitating.[11]

Therapeutic dancing has become popular for people with Parkinson's.[12,13] It is purported to offer an enjoyable and social setting for physical activity in addition to boosting exercise motivation,[14,15] social interaction, and emotional well-being. Previous reviews have shown that some forms of dance can improve balance,[16] motor function,[17] and quality of life (QoL)[12] in people with mild to moderately severe PD. More recently, a resurgence of new studies has been published and offers new insight into the benefits of dance for people with PD. There is a need to provide an updated synthesis of the multidimensional benefits of dance for people with PD compared to other interventions or a control. This may enable evidence based practice and help

Correspondence: Joanne Shanahan
Department of Clinical Therapies, Faculty of Education and Health Sciences, University of Limerick, Co. Limerick, Ireland
Email joanne.s@outlook.com

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clinicians and/or dance therapists to justify their treatment decisions and offer the most beneficial therapies to patients.

The aim of this systematic review is to provide an updated 1) synthesis and critique of the literature on dance for people with PD and 2) review of the physical and non-motor benefits of dance for people with PD compared to other interventions and/or control groups.

Methods

The methods of this review conform with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[18]

Inclusion criteria

Peer-reviewed published articles were included if they evaluated the benefit of a dance program for people with PD. There was no restriction on the stage of PD, described using the Hoehn and Yahr or modified Hoehn and Yahr scale. Studies must have been written in English, included more than one participant, and reported at least one of the outcomes of interest using a quantitative approach. Only study designs involving two or more arms were eligible for inclusion. Review articles and qualitative studies were not included in this review.

Literature search

EBSCO was used to electronically search Academic Search Complete, AMED, MEDLINE, and CINAHL Plus, in 2017. ScienceDirect and Pubmed Central were also searched. Databases were searched by title/abstract. The search terms used were "Parkinson OR Parkinson's" AND "dance OR dancing OR dancers". One reviewer (JS) screened the retrieved articles by title/abstract and those unrelated were excluded. The remaining full-text articles were read and two reviewers determined their suitability for inclusion (JS and AMC). Any discrepancies between the reviewers were resolved through discussion. An overview of the search process is shown in Figure 1.

Data extraction

The following data were extracted from eligible articles:

- Characteristics of participants (number of participants, age, stage of disease).
- Characteristics of the intervention (dosage, therapy offered, attendance, satisfaction, adverse events, dropouts).
- Outcomes of interest.
- Results: the results of both intragroup (the difference between pre- and post-assessment results within each study group) and intergroup comparisons (the difference between the study groups after the intervention) were extracted. In line with the aim of this review, data on both types of comparisons were included in order to 1) identify the aspects of health improved by dance participation and 2) ascertain if dancing may be equally or more beneficial than other therapies or a control.
- Methodological features.

Outcomes of interest

The lives of people with PD are often negatively affected by physical and non-motor symptoms associated with the condition. Therefore, the outcomes of interest and measurement tools listed in Table 1 were chosen for this review.

Only data from one measurement tool were extracted per outcome. If an outcome was assessed using two or more tools, data from the measurement tool of interest (Table 1) were prioritized. Outcomes of interest assessed using tools not mentioned in Table 1 were considered for review. If an outcome was assessed with two or more tools not detailed in Table 1, data regarding the first tool listed in the study were extracted.

Quality assessment

The design of each study was defined using the Cochrane Handbook of Systematic Reviews of Interventions.[28] The quality of randomized controlled trials (RCTs), quasi-RCTs, stratified RCTs, and non-RCTs was appraised using the PEDro scale.[29,30] This scale has been used in previous systematic reviews.[9,12] The quality of controlled before and after studies and case-controlled studies was critiqued using a checklist developed by Lötzke et al.[13] This tool provides a list of criteria for evaluating the quality of various study designs and has been used in previous reviews of dance interventions for people with PD.[13]

Data synthesis

The information extracted from the included articles was synthesized qualitatively. Due to the high level of clinical heterogeneity in the studies, quantitative analysis was not recommended.

Results

The search strategy retrieved 305 articles and 13 were eligible for inclusion (Figure 1). The included articles consisted of one quasi-RCT,[31] one case-controlled study,[32] one controlled

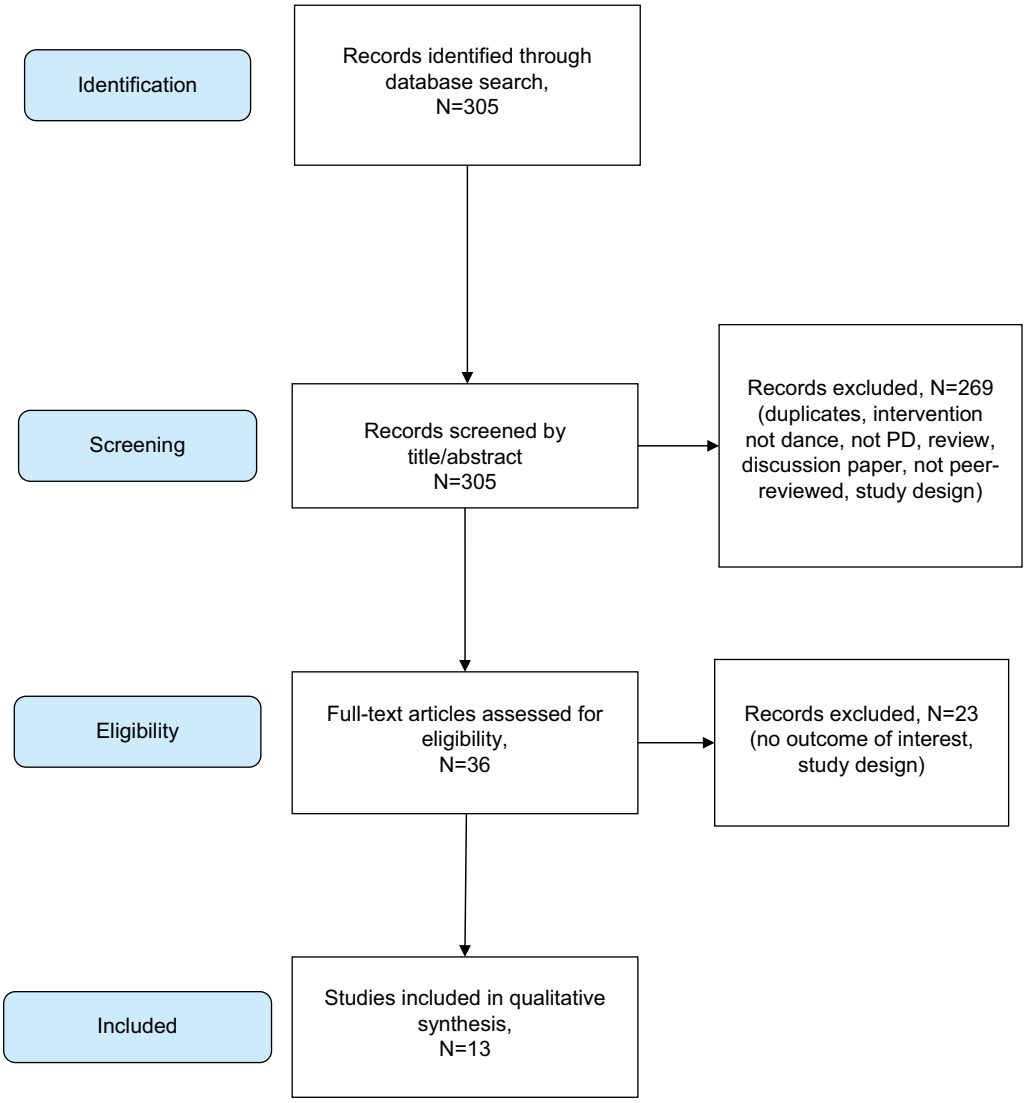

Figure 1 Search strategy based on PRISMA flow diagram.
Abbreviations: PD, Parkinson's disease; PRISMA, preferred reporting items for systematic reviews and meta-analyses.

Table 1 Outcomes and measurement tools of interest

Outcome of interest	Measurement tool of interest
Physical outcomes	
Balance	• Berg balance scale[19] • Mini-BESTest[20]
Motor function	• UPDRS-3[21] • MDS-UPDRS-3[22]
Mobility	• TUG[23]
Non-motor outcomes	
Depressive symptoms	• Beck Depression Inventory[24]
Cognitive function	• MoCA[25]
Quality of life	• PDQ-39[26]
Fatigue	• Parkinson's fatigue scale[27]

Abbreviations: MDS, Movement Disorders Society; mini-BESTest, mini balance evaluation systems test; MoCA, Montreal cognitive assessment; PDQ-39, Parkinson's disease questionnaire 39; TUG, timed up and go test; UPDRS-3, unified Parkinson's disease rating scale motor section.

before and after study,[33] two non-RCTs,[34,35] one stratified RCT,[36] and seven RCTs.[37–43]

Table 2 displays the characteristics of the included studies. The collective sample size across the studies was 533 participants and the average age of participants ranged from 57.90 to 72.6 years.[35,40] There were 138 dropouts across all studies. Some of the reasons for dropping out of dance classes included fatigue,[39] changes in health status,[39,41–43] fractures,[31] knee pain,[37,38] leg injury outside of class,[32] family reasons,[32,38,42] desire not to continue,[39,41] and travel or schedule difficulties.[38,39,41,42] Two studies did not state the reasons for dropout and the number of dropouts per group.[34,35] Over 50% of studies failed to state if they monitored for adverse events.

Table 2 Characteristics of included studies

Study (study design)	Intervention strategy	Dropouts (N)	Stage of disease (H and Y ranges)	Adverse events monitoring	Adherence	Intervention satisfaction
de Natale et al[34] (NRCT)	Tango: N=9, 66 years Traditional therapy: N=7, 70 years	N=2 (unclear which group)	Range = ND Tango =2.5 Traditional rehabilitation =2.6 (mean)	None	N/A	N/A
Duncan and Earhart[41] (RCT)	Tango: N=32, 69.3 years Control (no intervention): N=30, 69 years	Tango group =16 Control group =11	1–4	N/A	Tango: 78% Control: No intervention offered	N/A
Hashimoto et al[31] (quasi-RCT)	Dance (fusion of dance genres): N=19, 67.9 years Exercise: N=21, 62.7 years Control (no intervention): N=19, 69.7 years	Dance =4 Exercise =4 Control =3	2–4	N/A	N/A	N/A
Hackney and Earhart[39] (RCT)	Partnered tango: N=19, 69.6 years Non-partnered tango: N=20, 69.6 years	Partnered tango =7 Non-partnered tango =5	1–3	N/A	N/A	Partner group: greater enjoyment and desire to continue
Hackney and Earhart[37] (RCT)	Tango: N=19, 68.2 years Waltz/foxtrot: N=19, 66.8 years Tai chi: N=17, 64.9 years Control (no intervention): N=20, 66.5 years	Tango =5 Waltz/foxtrot =2 Tai chi =4 Control =3	1–3	N/A	N/A	N/A
Hackney and Earhart[38] (RCT)	Tango: N=19, 68.2 years Waltz/foxtrot: N=19, 66.8 years Control (no intervention): N=20, 66.5 years	Tango =5 Waltz/foxtrot =2 Control =3	1–3	N/A	80% attended 100% of dance sessions	No difference between enjoyment and desire to continue in tango and waltz/foxtrot
Hackney et al[40] (RCT)	Tango: N=9, 72.6 years Exercise: N=10, 69.6 years	None	2–3 (modified)	N/A	100% all participants	Tango: N=4 attended additional sessions Exercise: N=0 attended additional classes
Lukšys and Griškevičius[35] (NRCT)	Lindy hope dance: N=14, 65.43 years Control (no therapy): N=10, 57.9 years	N=1 (unclear which group)	Range: ND Lindy hop dance: 2 Control: 2.1 (mean)	N/A	N/A	N/A
McNeely et al[32] (case-controlled study)	Dance for PD: N=11 Tango: N=8, 67.66 years	Dance for PD =3 Tango (matched participants)	1–3 (modified)	N/A	7.46 participants per class (average)	N/A

(*Continued*)

Table 2 (*Continued*)

Study (study design)	Intervention strategy	Dropouts (N)	Stage of disease (H and Y ranges)	Adverse events monitoring	Adherence	Intervention satisfaction
Rios-Romenets et al[43] (RCT)	Tango: N=18, 63.2 years Control (self-directed exercise): N=15, 64.3 years	Tango =7 Control =2	1–3	Tango: falls, mild fatigue, muscle cramps Control: Falls (Not clear if falls occurred in class)	Tango: N=6 missed >50% Control: ND	Tango *more satisfied Tango *more enjoyable Desire to continue (61% tango, % control)
Shanahan et al[42] (RCT)	Irish set dance: N=45, 69 years Control (usual care): N=45, 69 years	Irish set dance =25 Control =24	1–2.5 (modified)	None	Irish set dance: 93.5%	Irish set dance: expressed enjoyment and desire to continue
Ventura et al[33] (controlled before and after study)	Dance for PD group: N=8, 71.8 years Control (no intervention): N=7, 70.4 years	None	1–2 (modified)	None	N/A	N/A
Volpe et al[36] (stratified RCT)	Irish set dance: N=12, 61.6 years Physiotherapy: N=12, 65 years	None	1–2.5 (modified scale)	Irish set dance: falls Physiotherapy: falls (Only one fall during dance class)	Irish set dance: 90.9% Physiotherapy: 87.8%	N/A

Note: *Significant difference between the groups.
Abbreviations: H and Y, Hoehn and Yahr; N, number of participants per group; N/A, not applicable; ND, not described in the original article; NRCT, non-randomized controlled trial; PD, Parkinson disease; RCT, randomized controlled trial; years, mean age per group.

The benefit of seven dance genres was investigated. Two studies compared dance with traditional therapy approaches,[34,36] one compared dance to usual medical care,[42] another compared dance to Tai Chi,[37] three studies compared different forms of dance,[32,38,39] three other studies compared dance to exercise,[31,40,43] and six studies compared dance with no intervention. Participants in the traditional therapy and exercise interventions performed exercises to improve strength, flexibility, range of motion, mobility, balance, and motor coordination. Cueing was also used in two studies as part of the intervention.[34,36] The dance interventions were well-described in 10 studies.[35,40,41] Seven studies stated that a warm-up was performed at the start of class[31–34,36,39,42] and nine studies used dance instructors with previous experience.[31,33,36–40,42,43] Two studies included a home dance program as part of the dance intervention.[36,42]

The volume of dance activity in each study and the results of intragroup (the difference between pre- and post-assessment results within each study group) and intergroup comparisons (the difference between the study groups after the intervention) are summarized in Tables 3 and 4. Where possible, the results of intragroup comparisons were presented quantitatively. If the required raw data were not provided in the original article, the results were described qualitatively.

The results of the quality appraisal for RCT and non-RCTs are presented in Table 5. No study fulfilled the criteria for blind therapists and subjects. Five studies scored 7/10 indicating good methodological quality. One study scored 2/10 indicating major methodological flaws. The case-controlled trial and controlled before and after study fulfilled the majority of criteria in the checklist as shown in Table 6.

Discussion

The results of this review inform clinicians and dance therapists about the potential benefits of dancing compared to other therapies and will help therapists to treat and advice patients considering dancing as an exercise hobby.

Promoting well-being and physical activity are key priorities for clinicians treating individuals with PD.[44] Nevertheless, physical inactivity remains common[11,45] and may negatively impact mood, balance, and gait.[6] The evidence in this review indicates that dancing is enjoyable and can motive regular participation. The group setting[46] of dance along with the various styles[47] and music[48] may create positive emotional responses and encourage weekly participation. Whether or not people with PD will continue dancing over prolonged periods of time requires further research.

Table 3 Intervention design and results of intragroup comparisons

Study	Volume of dance therapy	Groups	Balance	Mobility	Motor function	Depression	Cognition	QoL	Fatigue
de Natale et al[34]	20 h in 10 w	Tango Traditional rehabilitation	+2.13 +2 BBS	+2.69* +0.2 TUG	+0.25 +2.33 UPDRS-3	N/A	+1.38 +0.67 FAB	N/A	N/A
Duncan and Earhart[41]	2 h/w ×12 months	Tango Control	Improved* Deteriorated Mini-BESTest	N/A	+12.8* +3 MDS-UPDRS-3	N/A	N/A	N/A	N/A
Hashimoto et al[31]	12 h in 12 w	Fusion dance Exercise Control	+4* +0.2 0 BBS	+1.9* +1.1* +0.9* TUG	N/A	+6.6* +2.5 +3.3 SDS	+3.1* +1* +1.1 FAB	N/A	N/A
Hackney and Earhart[39]	20 h in 10 w	Partnered tango Non-partnered tango	+3.2* +2.6* BBS	+0.4 −0.1 TUG	N/A	N/A	N/A	N/A	N/A
Hackney and Earhart[37]	20 h within 13 w	Tango Waltz/foxtrot Tai chi Control	N/A	N/A	N/A	N/A	N/A	Improved* tango only PDQ-39	N/A
Hackney and Earhart[38]	20 h within 13 w	Tango Ballroom Control	+3.9* +4* −1.2 BBS	+2.1 +0.1 −2 TUG	+1.6 +2.6 −5* UPDRS-3	N/A	N/A	N/A	N/A
Hackney et al[40]	20 h within 13 w	Tango Exercise	+3.8* +1.7 BBS	+0.9 −0.1 TUG	+8* +7.6* UPDRS-3	N/A	N/A	N/A	N/A
Lukšys and Griškevičius[35]	22 h in 2 months	Lindy hop dance Control	N/A	N/A	+5.15 −12.44 UPDRS-3	N/A	N/A	N/A	N/A
McNeely et al[32]	24 h in 12 w	Dance for PD Tango	+0.5* +1.25* Mini-BESTest	−0.51 +0.97 TUG	+1.62 +9.38 MDS-UPDRS-3	N/A	N/A	−4.58 +27.5 PDQ-39	N/A
Rios-Romenets et al[43]	24 h in 12 w	Tango Self-directed exercise control	+0.7 −2.6 Mini-BESTest	+1.3* −0.1 TUG	+1.6 +1.2 MDS-UPDRS-3	+0.2 +0.4 BDI	+0.4 −0.6 MoCA	+0.4 +1.3 PDQ-39	+3.5 −2.6 Krupp FSS
Shanahan et al[42]	25 h in 10 w (15 h class plus 10 h HEP)	Irish set dance Control	No change in either group Mini-BESTest	N/A	Minimal improvement Deteriorated UPDRS-3	N/A	N/A	Dance improved more than control PDQ-39	N/A

(*Continued*)

Table 3 (*Continued*)

Study	Volume of dance therapy	Groups	Balance	Mobility	Motor function	Depression	Cognition	QoL	Fatigue
Ventura et al[33]	12.5 h in 10 w to 4.5 months	Dance for PD	+6.7	+0.5	N/A	+2.1	+1.0	+8.1	N/A
		Control	+3.9	+1.7		+0.5	0	−4	
			Standing balance test	TUG		GDS	Test of everyday attention	PDQ-39	
Volpe et al[36]	1.5 h/w ×6 months plus HEP ×1 h/w	Irish set dance	+10	Improved*	+7.16*	N/A	N/A	+8.44	N/A
		Physiotherapy	+4.84	Improved*	+2.92*			+4.97	
			BBS	TUG	UPDRS-3			PDQ-39	

Notes: *Significant difference between pre- and post-assessment within the same group. +: Improved performance between pre- and post-assessment. −: Deteriorated performance between pre- and post-assessment.
Abbreviations: BBS, Berg balance scale; BDI, Beck depression inventory; FAB, frontal assessment battery; GDS, geriatric depression scale; HEP, home exercise program; Krupp FSS, Krupp fatigue severity scale; MDS, Movement Disorders Society; MoCA, Montreal cognitive assessment; N/A, not applicable to the study; PDQ-39, Parkinson's disease questionnaire-39; SDS, self-rating depression scale; TUG, timed up and go test; UPDRS-3, unified Parkinson's disease rating scale motor section.

Table 4 Results of intergroup comparisons

Study	Significant results only
de Natale et al[34]	Tango *better mobility than other group(s)
Duncan and Earhart[41]	Tango *better motor function than other group(s)
	Tango *better balance than other group(s)
Hashimoto et al[31]	Tango *better balance than other group(s)
	Tango *better cognitive function than other group(s)
Hackney and Earhart[39]	None
Hackney and Earhart[37]	Tango *better QoL than other group(s)
Hackney and Earhart[38]	ND
Hackney et al[40]	None
Lukšys and Griškevičius[35]	ND
McNeely et al[32]	Tango *better mobility than other group(s)
	Tango *better motor function than other group(s)
Rios-Romenets et al[43]	Tango *better balance than other group(s)
	Tango *better mobility than other group(s)
Shanahan et al[42]	None
Ventura et al[33]	ND
Volpe et al[36]	Set dance *better motor function than other group(s)
	Set dance *better mobility than other group(s)

Note: *Significant difference between the groups after the intervention.
Abbreviations: ND, not described; QoL, Quality of life.

Physical benefits

The results of this review suggest that dancing can improve balance and motor function. With respect to balance, all studies except one[42] reported improvements following the intervention. In the majority of studies, gains >2.84 points were evident on the Berg balance scale. Previous research suggests that this magnitude of improvement could be functionally significant for people with PD[49] and make the completion of everyday tasks easier. Clinically meaningful changes seem more difficult to achieve on the mini-BESTest, particularly in the short term. This suggests that some dance programs may not effectively target all the aspects of postural control assessed in the mini-BESTest.[20] Future studies should carefully plan the content of the intervention and ensure that the material safely challenges all aspects of balance control.

The dosage of dance may influence balance performance. The longest duration interventions noted the largest improvements in balance.[36,41] This is consistent with the American College of Sports Medicine exercise recommendations which advise long-term exercise participation to optimize health benefits.[50] An insufficient dosage of dance, due to low compliance with the home program, may explain the lack of balance improvement found by Shanahan et al.[42] From the

Table 5 Methodological quality of included randomized and non-randomized trials

	De Natale et al[34]	Duncan and Earhart[41]	Hashimoto et al[31]	Hackney and Earhart[39]	Hackney and Earhart[37]	Hackney and Earhart[38]	Hackney et al[40]	Lukšys and Griškevičius[35]	Rios-Romenets et al[43]	Shanahan et al[42]	Volpe et al[36]
Eligibility criteria	√	√	√	√	√	√	√	×	√	√	√
Random allocation	×	√	√	√	√	√	√	×	√	√	×
Allocation concealment	×	×	√	×	×	×	×	×	×	√	√
Baseline comparability	√	√	×	√	×	√	√	×	×	√	√
Blind subjects	×	×	×	×	×	×	×	×	×	×	×
Blind therapists	×	×	×	×	×	×	×	×	×	×	×
Blind assessors	√	√	×	√	×	√	√	×	×	√	√
Adequate follow-up	√	√	√	√	√	√	√	√	√	√	√
Intention-to-treat	×	√	×	√	×	×	√	×	√	×	√
Between group comparisons	√	√	√	√	√	×	√	×	√	√	√
Point measures and measures of variability	√	√	√	√	√	√	√	√	√	√	√
Total PEDro score	5	7	5	7	4	5	7	2	5	7	7

Notes: √ = "Yes", × = "No". Total PEDro score can range from 0 to 10 and higher scores indicate better quality.
Abbreviation: PEDro score, physiotherapy evidence database score.

evidence reviewed, it is obvious that ~20 hours of dancing within 10–13 weeks may be needed to improve balance.

There is preliminary evidence to suggest that dance can improve motor function. Dance participants achieved gains that surpassed the minimal clinically important difference for the unified PD rating scale motor section[51] and Movement Disorders Society unified PD rating scale motor section[52] in six studies (Table 3). Compared to nondance interventions, dancers achieved better motor performance following the intervention and the difference between groups was statistically significant in two studies.[36,41] There is insufficient evidence to indicate that some dance forms are more effective than others for improving motor function; however, further research is warranted. This would identify dance genres that preferentially target certain symptoms and help individualize the referral process to classes.

Although evidence suggests that dance can improve mobility, the results reported in studies demonstrated lower than the minimal detectable change for the timed up and go test for people with PD.[19] Previous research on physiotherapy interventions in this population reported similar results.[53] In the current review, the duration of the interventions may explain the lack of substantial improvement in mobility. Many of the included studies involved short durations and the progressive nature of PD could make it harder to achieve mobility gains within this time frame. At present, there is a paucity of evidence examining the long-term benefit of dance on mobility in people with PD and future studies are needed. Notably, the dance interventions were sufficient to maintain mobility and this was significantly better than comparison therapies in some studies.[34,36,43] This could be very meaningful for patients function.[54] Qualitative research studies are warranted to ascertain the perceived benefits of dancing and determine if dancing positively impacts the everyday lives of people with PD.

Non-motor benefits

At present, there is insufficient evidence to suggest that dance can improve cognitive performance and depression in people with PD. Only one study reported significant cognitive and mood improvements following dance participation.[31] The improvements noted in other studies that assessed these outcomes were small and may be clinically insufficient. Notably, no study in this review reported negative mood or cognitive effects of dancing. In individuals without PD, research has found that participation in partnered dance styles is associated with perceived cognitive, social, and emotional health benefits.[55] The combination of motor skill learning,

Table 6 Methodological quality of controlled before and after and case-controlled studies

Criteria		Ventura et al[33]	McNeely et al[32]
Publication specific aspects	Objective/aim of the study reported	Y	Y
	Description of the study design	Y	Y
	Hypothesis reported	N	Y
Adequate description of the subject assembly process, characteristics of participants	Description of determination of the study participants/number of participants justified	Y	N
	Method of patient selection described	Y	N
	Description of inclusion criteria	Y	Y
	Description of exclusion criteria	N	N
	Eligible but not enrolled subjects and reason for exclusion	N	N
	Number of participants enrolled in study	Y	Y
	If controlled design is reported, how the participants were assigned to the groups	Y	Y
	If RCT, randomization method explained	N/A	N/A
Baseline data for each group	Baseline data reported	Y	Y
	Age reported	Y	Y
	Proportion of female/male reported	Y	Y
	Equality of comparison group in the case of controlled studies discussed	N	Y
Adequate description of subject follow-up	Dropout rates reported	N/A	Y
	Explanation for dropouts	N/A	Y
Adequate description of treatment	Description of treatment	Y	Y
	Intervention period reported	Y	Y
	Number of sessions	Y	Y
	Duration of sessions	Y	Y
	Group/individual intervention	Y	Y
Description of statistical methods		Y	Y
Discussion of limitations		Y	Y

Abbreviations: Y, yes; N, no; N/A, not applicable.

exercise, socialization, and music is hypothesized to improve mood and cognition[14] and further research is recommended in people with PD.

Fatigue affects over 50% of people with PD and is perceived to be one of the most deliberating symptoms of this condition.[56] Music accompaniment in dance may help combat fatigue by activating brain areas such as the amygdala and cingulate cortex and stimulating dopamine.[48] Only one included study examined the impact of dance on fatigue.[43] While the results of this study were positive, more research is warranted to determine if dancing can help people with PD manage this deliberating symptom.

In comparison with nondance groups, QoL improved more in dance participants. Although one study reported contrary results, the clinical meaningfulness of this finding is unclear.[43] Further research will help ascertain the optimum styles of dance to improve QoL.

No relationship between the dosage of dance and the magnitude of improvement in QoL was evident from the literature reviewed. It is possible that other factors such as the environment created at the dance classes may have a greater influence. Previous research indicates that people with PD are most comfortable when dance classes foster a relaxed social and learning environment and are led by a patient teacher who has the skills necessary to adapt dances for each individual.[57,58] Importantly, these factors may influence the joy experienced at dance classes and subsequently effect QoL. A sense of satisfaction and perceived benefit in QoL may be important to enhance continual participation,[59] create positive attitudes toward exercise, and improve well-being. The social context of dance may be particularly pertinent to build social networks, friendships, and social connectedness;[3] however, this needs to be assessed in future studies. In conclusion, it is important that studies consider the effect of environmental factors on health and participation outcomes and implement strategies to overcome any challenges encountered.

Limitations

The limitations of this review must be considered when interpreting the results. Many of the included studies were small. This limits the clinical transferability of the results. Four studies were non-randomized and therefore have an increased risk of bias.[32–35] The majority of RCTs and non-randomized studies have an increased risk of selection bias.[34,35,37–41,43] Comparability between the groups at baseline was also lacking in four studies.[31,35,37,43] Reporting and monitoring of

adverse events were insufficient in the literature (Table 3). This presents a challenge when clinicians need to establish the suitability of dance interventions for people with PD. Future research should consider these limitations and design study protocols that limit their occurrence.

There were a number of dropouts in the included studies. Collectively, the dropout rate was nearly 26%. This is higher than that reported in some other interventions[60] and makes it difficult for clinicians to determine the feasibility of dance therapy. The reason for the higher dropout rate reported in this review is unclear. However, many of the reasons for dropping out are modifiable and need to be considered in future studies. Additionally, many people have experiences of dance[47] and it is plausible that the dancing organized as part of research afforded different experiences and discouraged participation. Dance is not just an exercise. It is a form of artistic expression that captures social and emotional experiences.[58] Collaboration between people with PD and arts and health therapists may help identify the desired elements of dance classes and improve the retention rates in studies.

Conclusion

Dancing can be a valuable and enjoyable activity for people with PD. Dance may benefit balance, motor function, and QoL compared to some other forms of therapy. Further research is needed to examine if dancing can improve mobility and non-motor symptoms in people with PD.

Disclosure

This manuscript entitled "Dancing and Parkinson's disease: updates on this creative approach to therapy" has not been published previously and is not under consideration by another journal. The authors report no conflicts of interest in this work.

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