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An Interdisciplinary Functional Exercise Program for Individuals with Parkinson's Disease: A Case Series

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An Interdisciplinary Functional Exercise Program for Individuals with Parkinson’s Disease: A Case Series

Abstract

Background: Traditional exercise programs are beneficial in managing Parkinson’s disease (PD). Little research exists on interdisciplinary, functional exercise programs designed and implemented by licensed therapists.

Method: Our case series presents the development, implementation, and results of an interdisciplinary functional exercise program for individuals with PD and the effects this program had on daily functioning and quality of life. Participants were recruited via flyers, email, and phone communication, and consented to data collection for our objectives. Participants attended two sessions per week for 8 weeks. Sessions addressed fine and gross motor skills, dexterity, cognition, functional strength, gait, balance, and posture. Outcome measures were chosen before the implementation of pre-assessments, including PD-specific evaluations of cognition, mobility, gait, balance, coordination, strength, dexterity, and quality of life.

Results: Seven participants (4 M, 3 F) with PD completed pre-assessment, intervention, and post-assessment. As hypothesized, they demonstrated improvement across multiple outcomes, mostly in mobility metrics.

Discussion: Findings from this case series suggest that an interdisciplinary, functional exercise program integrating occupational and physical therapy can meaningfully improve mobility, reduce bodily discomfort, and positively influence aspects of quality of life for individuals with PD. The program’s emphasis on functional tasks and interdisciplinary collaboration highlights the value of tailoring interventions to both motor and non-motor challenges. These results support further investigation of interdisciplinary exercise approaches as a complementary component of traditional care for this population.

Comments

The authors declare that they have no competing financial, professional, or personal interest that might have influenced the performance or presentation of the work described in this manuscript.

They acknowledge the use of ChatGPT to generate information for background research at the drafting stage of the writing process with the creation of an outline structure for this paper. No content generated by AI technologies has been presented as their work.

Keywords

neurodegenerative, exercise, Parkinson's disease, interdisciplinary

Cover Page Footnote

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Credentials Display

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Parkinson's disease (PD) is a chronic, neurodegenerative condition affecting millions of individuals worldwide. Characterized by both motor and non-motor symptoms, PD impacts not only physical abilities but also cognitive functioning and emotional well-being. Common motor symptoms include bradykinesia, rigidity, tremor, and postural instability. Non-motor symptoms include depression and anxiety, sleep disturbances, and sensory and autonomic disruptions. The rate of progression and clinical presentation of this disease can vary significantly among individuals. While there is currently no cure for PD, various treatment methods, including medication and therapies, exist to help manage symptoms and improve quality of life.

Exercise has been shown to have significant positive benefits for individuals with PD, and regular physical activity can positively impact functional mobility, balance, and overall quality of life (Tsukita et al., 2022). Activities that incorporate fine and gross motor coordination, flexibility, and dual-task training, where cognitive tasks are performed simultaneously with physical activity, can be beneficial for addressing motor and non-motor symptoms. Additional considerations related to exercise and PD are potential neuroprotective effects, improved mental health, enhanced quality of rest and sleep, increased social engagement, fall prevention, and enhanced medication effectiveness (Xu et al., 2019).

PWR!Moves®, a PD-specific exercise program, incorporates evidence-based exercises that target the common motor symptoms of PD and aim to improve functional mobility, balance, strength, and flexibility (Parkinson Wellness Recovery, n.d.). The program is grounded in clinical research and is designed to teach high-intensity efforts, cognitive engagement, attentional focus, and reinforcement for positive behaviors. The focus of the PWR!Moves® program is on the alleviation of PD symptoms and rehabilitation for whole-body movements. Several studies have demonstrated the effectiveness of PWR!Moves® to improve gait, balance, posture, and functional mobility (Hanus, 2018; Imam & Dannenbring, 2020). Using the foundational principles of PWR!Moves® paired with fundamentals of occupational therapy (OT) intervention, we designed a functional exercise program targeting individual skill deficits and overall functional abilities.

Because of the variety and complexity of symptoms associated with PD, access to an interdisciplinary team of professionals who have knowledge about this condition is important. These teams typically include a movement disorder specialist who diagnoses and treats the disease, a physical therapist who addresses mobility and balance, an occupational therapist who addresses challenges in daily function, and a speech language pathologist who addresses voice, speech, and swallowing difficulties.

PD presents significant challenges to individuals in maintaining independence with activities of daily living (ADLs), and OT plays an essential role in addressing these challenges by adapting environments and occupations to promote engagement in meaningful activities, thus enhancing overall quality of life. OT incorporates a holistic approach in the treatment of PD, addressing physical, cognitive, social, emotional, and environmental challenges faced by individuals with PD. Therapeutic interventions may include activities designed to improve functional mobility and balance, coordination, cognition, and fine motor skills related to engagement in meaningful occupations. In addition to addressing motor and cognitive skills related to daily function, occupational therapists also acknowledge the psychosocial impact of PD and provide support to individuals and their families (Wood et al., 2022).

Our program aimed to provide participants with exercise principles from PWR!Moves® incorporated with skilled OT and physical therapy (PT) interventions to address motor, cognitive, and psychosocial outcomes. As stated previously, two case reports have used similar outcome measures and exercise interventions (Hanus, 2018; Imam & Dannenbring, 2020). The case report by Hanus (2018) presents an individual with PD whose goal is to reduce fall risk and improve community mobility. The intervention used was a form of gait training and PWR!Moves®. The participant completed nine therapy sessions and showed improvement in his Berg Balance Scale and improved gait pattern. In the second study by Imam and Dannenbring (2020), an individual with PD completed 16 sessions of LSVT-BIG training followed by eight sessions of PWR!Moves®. In conclusion, the participant demonstrated changes in the Mini-BEST of 12 points, 5xSTS of 3.9 s, TUG Cognitive of 13.11, and TUG Manual of 4.7 s. The participant benefited from this combination of exercise interventions. Both case reports incorporated PWR!Moves® provided by physical and occupational therapists; however, unique to our functional exercise program is the implementation of skilled therapy intervention.

Current Study

A key distinction of our program is its interdisciplinary approach, integrating OT and PT. This combined perspective facilitates a comprehensive assessment of both motor and cognitive domains, potentially providing more nuanced insights into how the synergistic effects of these therapeutic modalities can optimize overall outcomes. In addition, to test the motor, cognitive, and psychosocial domains pre- and postintervention, we gathered 11 outcome measures specific to the PD population that demonstrate the effectiveness of our program. We expect primary positive differences for our functional motor outcome measures and for cognition and psychosocial scores. The a priori hypotheses are that the program will significantly improve functional motor outcomes, cognitive scores, and psychosocial measures, with the largest changes expected in balance and mobility.

Method

Participant Recruitment

This case series includes individuals recruited through local physician practices, outpatient therapy clinics, and community organizations. Individuals had to have a diagnosis of PD, be at least 18 years of age, be able to self-transport, and be able to complete standing or modified standing exercises with minimal physical assistance. Individuals could not have additional neurological conditions other than PD or cardiovascular conditions that would limit safe participation in an exercise program. Ethical approval for this study was obtained through the local University and Medical Center Institutional Review Board.

Study Design

In this study, we employed a case series design with a one-group pretest/posttest AB structure to observe a cohort of individuals with PD undergoing an exercise group intervention inspired by the PWR!Moves® (Parkinson Wellness Recovery, n.d.). Participants were selected based on predefined inclusion criteria and were not randomly assigned. Data were collected at baseline (Phase A) and after the intervention (Phase B) to evaluate changes in key outcomes. While this AB design allows for the identification of trends and potential effects, it does not permit the establishment of causal relationships between the intervention and observed outcomes.

Procedures

Pre-assessments took place during the 2 weeks leading up to the first program session and in the 2 weeks after the last program session. Individuals were instructed to take their medications as scheduled. Two occupational therapists, one physical therapist, three OT students, and three PT students administered the assessments. The students were trained on all assessments and administered these assessments under the supervision of licensed therapists. All researchers had knowledge of the study objectives before the start of the program.

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Intervention

The intervention sessions consisted of 16 sessions conducted over 8 weeks. Five of the participants completed 90% or more of the sessions, while the remaining two participants completed 60% and 70% of the sessions, respectively. The program was held on a university campus using academic classrooms and lab spaces. It began with a 10-min warm-up of PWR!Moves® standing exercises to facilitate stretching, strengthening, and balance, and to reinforce PWR!Moves® principles. The 10-min warm-up was followed by dividing the participants into two groups (three to four per group), with one group of participants starting with PT and the other with OT.

The activities in each PT and OT section focused on delivering therapeutic interventions using specific areas in each discipline's scope of practice. The PT group, led by one physical therapist and PT students, used circuits focused on strength, balance, gait training, flexibility, and functional mobility. Specific interventions included fall prevention, improving step length and arm swing, stretching, implementing strategies to decrease freezing episodes, and improving the ability to complete bed mobility, floor, and seated transfers. The interventions in the exercise circuits that addressed these areas incorporated battle ropes, balance stones in parallel bars, trunk rotation with punching bags, outdoor walking up and downhill, and multi-directional walking and dynamic movements using BlazePods.

The OT group, led by two occupational therapists and OT students, incorporated interventions pertaining to functional strength (balance and posture) and fine motor skills (dexterity and cognition). The format of the intervention categories in the OT section included alternating weeks of activities targeting functional strength (balance and posture) and fine motor (dexterity and cognition). Intervention activities in these categories included standing dynamic reach using playing cards on a vertical surface, kneeling on or prone over a Bosu ball while reaching for and stacking cones, carrying, transporting, and placing beads into medicine containers, memory tasks with colored bells and pattern recognition, and a trail-making activity using large movements on a vertical whiteboard. Each activity's design and connection to ADLs or IADLs were explained to participants before the start of the activity.

The PT and OT sections lasted for 20 min, and then the two groups of participants switched for another 20 min to have equal time in each discipline's section. Once each 20-min section was completed, the two groups of participants joined together at the end for a 10-min cool-down session where PWR!Moves® were facilitated in a seated position at a slower pace to facilitate stretching and deep breathing exercises. The functional exercise program concluded within 1 hr.

Outcome Measures

The pre and postassessment outcome measures in this case series included the Activities-Specific Balance Confidence Scale (ABC scale), the 360-Degree Turn Test (360° test), the 10 Meter Walk Test (10MWT), the Five Times Sit to Stand Test (5XSST), the 3-M Backwards Walk Test (3MBWT), the Freezing of Gait Assessment (FOG-A), the TUG, the Montreal Cognitive Assessment (MoCA), the Nine Hole Peg Test (NHPT), the Handheld Dynamometer (HHD), and the Parkinson's Disease Quality of Life Questionnaire-39 (PDQ-39). Minimal detectable change (MDC) is noted with the following assessments, as these values are useful to therapists in rehabilitation and wellness programs in determining whether a change occurred during or after intervention. Refer to Table 2 for each participant's individual pre- and postassessment outcomes based on MDC scores. Reliability and validity are also listed for each outcome measure to provide information on each outcome measure's use with the PD population. It is also important to note that we chose a bottom-up approach when choosing outcome measures to focus on body functions and structures, performance skills, and client factors (American Occcupational Therapy

Association [AOTA], 2020). Our intervention, discussed later in this paper, focuses on incorporating functional activities into this approach.

Balance

The sensorimotor system includes visual, vestibular, and somatosensory organs integrated in the basal ganglia, which contribute to balance, control, and posture. The integration of multisensory input results in motor adjustments and output. The sensorimotor system, in part or in full, is often dysfunctional in individuals with PD. The result renders postural instability and control as one of the main disabling features of PD, impacting the skills needed to mobilize safely in the home and community environment. Balance was assessed in two different outcome measures in the interdisciplinary functional exercise program and targeted in the program's interventions to address sensorimotor dysfunction. The ABC scale and 360° test were used to specifically assess balance and gait when performing activities and moving dynamically in the environment.

The ABC scale (Powell & Myers, 1995) is a 16-item self-report measure in which participants rate their confidence in balance when performing activities or experiencing episodes of unsteadiness. Items are rated on a scale that ranges from 0 to 100, whereas a score of 0 represents *no confidence* and a score of 100 represents *complete confidence* in balance. An overall score on the ABC scale is calculated by adding item scores and then dividing by the total number of items. The MDC of the ABC scale is 13% established with people with PD (Steffen & Seney, 2008). The ABC scale has excellent test-retest reliability and is a predictor of recurrent falls in the PD population when considering criterion validity (e.g., Dal Bello-Haas et al., 2011).

The 360° test measures dynamic balance by having the participant turn in a complete circle while being timed to complete the circle (Schenkman et al., 1997). The participant is given two trials, and the average of both trials is taken. The MDC timed 360° test times were 1.98 s for the dominant side and 1.48 s for the non-dominant side in people with PD (Soke et al., 2020). The 360° test has acceptable test-retest reliability and adequate convergent validity with the PD population (Schenkman et al., 1997, 2002).

Mobility

Functional mobility is a term used to describe a person's ability to move independently and safely in a variety of environments to participate in ADLs and IADLs in the home and community. Because of the neurodegenerative characteristics of PD impacting motor control, functional mobility is impaired in individuals with this disease process. According to Takakusaki et al. (2003), disorders of the basal ganglia may include dysfunction of the nigrotegmental systems, which is also termed the basal ganglia-brainstem, that leads to dysfunction of abnormal muscle tone and disturbances of gait. The researchers aimed to assess functional mobility using the outcome measures of the 10MWT, 5XSST, 3MBWT, the Functional Gait Assessment, and TUG. The researchers also addressed functional mobility in intervention sessions, aiming to improve the participants' safety in this area of daily function.

The 10MWT assesses gait speed, measuring the time a participant walks at their preferred walking speed over a set distance of 10 m (Steffen & Seney, 2008). Two trials are administered at the participant's comfortable walking speed, followed by two trials at their fast-walking speed, and the three trials are averaged, and two gait speeds are documented in meters per second. The MDC for comfortable and fast gait speeds in people with PD were 0.22 and 0.23 m/s (Lang et al., 2016). The test-retest reliability of the 10MWT for individuals with PD is excellent (Steffen & Seney, 2008).

The 5XSST measures lower extremity functional strength (Duncan et al., 2011). A participant is asked to perform five sit-to-stands with arms folded across their chest, and time is recorded from the first stand to the last. The MDC of the 5XSST is 2.4 (Paul et al., 2012). The 5XSST has excellent test-retest reliability for individuals with PD and excellent interrater/intrarater reliability. There is adequate to excellent criterion validity when compared to other outcome measures, such as the Freezing of Gait Questionnaire, ABC scale, the Nine-Hole Peg Test (NHPT), and more (Duncan et al., 2011; Paul et al., 2012).

The 3MBWT measures participants' ability to walk backward, which is an important part of mobility. Individuals with PD have greater difficulty in walking backward, which impacts their daily life activities (Kocer et al., 2023). The 3MBWT's reliability and validity have not been determined yet in the PD population. However, Kocer et al. (2023) examined its excellent test-retest reliability (ICC = 0.965) and determined the MDC of 2.13 s in people with PD. The 3MBWT was correlated to the Unified Parkinson's Disease Rating Scale and the Berg Balance Scale. No significant relationships were found, indicating predictive criterion validity (Hackney & Earhart, 2009).

The FOG-A is a measure used to assess postural stability during walking while also assessing an individual's ability to perform various motor tasks while walking (Giladi et al., 2001). Each item is scored on an ordinal scale from 0 to 3, with 0 = *severe impairment*, 1 = *moderate impairment*, 2 = *mild impairment*, and 3 = *normal ambulation*. The highest score is 30. The MDC is 4.3 on the Functional Gait Assessment when considering people with PD (Petersen et al., 2017). No reliability or validity information on this outcome measure was found.

The TUG measures mobility, balance, walking, and fall risk in older adults by timing a participant walking from being seated in a chair 3 m at a comfortable pace, turning, and walking back to the chair and sitting down. Time is recorded to obtain a score. The MDC of the TUG is 4.85 s established with people with PD (MDC = 4.85; Dal Bello-Haas et al., 2011). The TUG has adequate to excellent test-retest reliability and excellent interrater reliability. Based on criterion validity, increased TUG time is a predictor for increased risk for falls (e.g., Bennie et al., 2003).

Cognition

Research initiatives have focused on motor symptoms of PD, primarily with little research conducted on non-motor symptoms. Cognitive dysfunction not only occurs in the later stages of PD but also as mild cognitive impairment (MCI) in the earlier stages, which accounts for approximately 40% of individuals with PD (Fang et al., 2020). Cognitive deficits negatively impact individuals with PD as they reduce their daily function, also affecting family members and friends as caregiver support is increased. Cognitive intervention was also a part of the functional exercise group, as evidence has demonstrated that the adoption of exercise at any age could delay or reverse cognitive decline (Northey et al., 2018).

Our functional exercise group used the MoCA in pre- and postassessment as an outcome measure to assess cognition. The MoCA is a 16-item cognitive assessment that measures the domains of visuospatial, executive functions, naming, memory, attention, language, abstraction, and orientation. The total possible score is 30, with 18–25 indicating mild cognitive impairment, 10–17 moderate cognitive impairment, and less than 10 severe cognitive impairment (Nasreddine et al., 2005). The standard error of measurement of the MoCA was 1.5 with an MDC of 4 points among community living middle-aged and older adults. The MoCA has excellent test-retest reliability and excellent interrater reliability. Based on criterion validity, it has excellent correlation with the neuropsychological battery and the Mini-Mental State Examination (Gill et al., 2008).

Fine Motor

Motor symptoms of PD often begin subtly and are mild in the early stages, advancing over time with disease progression. Early motor symptoms of PD include tremors, fine motor impairment, and coordination in the hands and fingers. Fine motor skills of the hands and fingers are important for daily activities, including buttoning a shirt, opening containers, handwriting, and cutting food with utensils. The NHPT and HHD were used as pre- and postassessments to assess the fine motor abilities of the participants.

The NHPT is an outcome measure used to assess finger dexterity (Haaxma et al., 2010). A participant takes pegs from a container, one by one, and places them into holes on the board as quickly as possible. A participant must remove the pegs from the holes, one by one, and replace them in the container. Time is recorded from the moment the participant touches the first peg until the moment the last peg is replaced in the container. In the performance of people with PD, the MDC was 2.6 s for the dominant hand and 1.3 s for the non-dominant hand (Earhart et al., 2011). The NHPT has adequate to excellent test-retest reliability and excellent interrater reliability (e.g., Earhart et al., 2011).

The HHD was a device used to assess the isometric muscular strength of the hand and forearm. The instrument is scored in pounds (0–200), and maximum grip strength is the mean of three trials. Normative data have been collected on men and women over 65 years of age (Jansen et al., 2008). The HHD device for hand strength does not have specific data on reliability and validity for the PD population; however, it has excellent test-retest reliability for community-dwelling older adults (Bohannon & Schaubert, 2005).

Psychosocial

In addition to motor and non-motor symptoms, individuals with PD often experience depression, anxiety, apathy, sleepiness, and mood changes that impact their quality of life. These psychological changes often progress into late stages of PD, requiring individuals to develop coping skills for themselves and caregiver adjustments. Socialization also decreases in the early to late stages of PD, impacting quality of life (Sharma et al., 2023). Impairment in socialization impedes daily activities and alters roles, interfering with employment, relationships with family and friends, and community engagement. The researchers aimed to assess the participants' quality of life using the PDQ-39. The collaborative nature of the exercise program, coupled with engagement from fellow group members, fostered a supportive environment that significantly influenced the psychological well-being of PD participants attending the weekly sessions.

The PDQ-39 (Jenkinson et al., 1997) is a 39-item questionnaire that covers eight dimensions (mobility, activities of daily living, emotional well-being, stigma, social support, cognition, communication, and bodily discomfort). The questionnaire items are measured using an ordinal scoring system where 0 = *never*, 1 = *occasionally*, 2 = *sometimes*, 3 = *often*, 4 = *always*. Lower scores reflect a better quality of life. The MDC of the PDQ-39 is categorized within the domains of the questionnaire as follows: mobility (12.24), ADL (16.72), emotional well-being (14.22), stigma (21.21), social support (24.50), cognition (22.12), communication (21.04), and bodily discomfort (24.48) (Fitzpatrick et al., 2004). MDC = mobility (12.24), ADL (16.72), emotional well-being (14.22), stigma (21.21), social support (24.50), cognition (22.12), communication (21.04), and bodily discomfort (24.48). The PDQ-39 has high test-retest reliability. It has good content validity but lacks addressing transfers, sleep, self-image, and role functioning sufficiently. It has adequate face validity (Bushnell & Martin, 1999).

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Data Analysis

Outcome measures were scored using the standardized assessment tools described above. Scores were recorded for each participant during both the baseline (Phase A) and postintervention phase (Phase B) using Excel sheets. Changes in these scores were analyzed using descriptive statistics, and the MDC was calculated in Excel to determine the smallest change in scores that could be considered beyond measurement error. This analysis helps to interpret whether observed changes are meaningful.

Results

Participants

The demographics of the participants who met the inclusion criteria and were recruited for this study are presented in Table 1.

Table 1

Demographic Characteristics

Participant	Age	Gender	Years since diagnosis	Dopamine replacement medication?	Number of program sessions attended
1	74	F	4.5	Yes	12
2	75	F	3	Yes	16
3	67	M	5	Yes	15
4	69	M	1	Yes	14
5	91	M	< 1	Unknown	16
6	73	M	2	Yes	16
7	57	F	2	Yes	12

The results for each participant pre- and postintervention are summarized in Table 2. On average, participants improved on 13 out of 21 measurements when assessing MDCs (after the 8-week program).

Table 2

List of Outcome Measures for Pre and Postevaluations

	Subj 1		Subj 2		Subj 3		Subj 4		Subj 5		Subj 6		Subj 7	
Outcome measure	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**	**Pre**	**Post**
ABC Scale (%)	93.8	90.2	37.5	50	77.5	75	17.6	50	93.8	96.3	80.6	82.5	54.4	81.9
360° Test (L+R time)	2.4	2.0	4.6	4.0	6.8	6.0	39.4	22.5	2.1	2.1	2.0	2.0	2.8	2.1
10MWT gait speed-P	1.2	1.0	1.0	0.8	1.0	1.2	1.2	1.6	1.6	1.4	1.7	0.9	0.8	1.2
10MWT gait speed-F	2.2	1.2	1.3	1.2	1.6	1.7	1.6	2.8	2.7	1.9	2.1	1.3	1.6	2.2
5XSST	8.9	7.6	11.6	11.5	12.8	10.1	11.2	14.2	5.1	5.0	10.6	9.0	10.9	6.3
3MBWT	4.5	5.1	13.5	7.5	13.5	6.2	22.4	36.8	4.3	3.9	3.9	3.4	5.1	4.2
FOG-A	0	0	0	0	17	5	27	27	0	0	0	0	0	0
TUG	6.5	6.9	11.7	10.2	12.7	7.3	31	25.6	5.3	5.2	6.0	5.6	8.6	7.2
MoCA	27	25	27	29	24	27	23	22	25	28	27	28	20	23
NHPT - D	23.4	23.6	29.1	29.9	29.7	32.5	24.4	28.1	19.5	19.2	19.6	26.2	54.2	36.0
NHPT - ND	24.4	30.1	28.7	30.8	32.9	32.1	23.7	39.1	21.3	26.7	22.2	27.2	44.6	33.0
HHD (lbs) - D	42.3	47.3	50	50	57	67	80	70	85	93	76.7	71	88	80
HHD (lbs) - ND	38.3	35	36.7	45.3	52	60	78.3	69	80	88	71.7	77	78	76
PDQ39-Mobility	12.5	15	35	25	52.5	72.5	55	50	12.5	0	25	12.5	37.5	17.5
PDQ39-ADLS	4.2	4.2	12.5	4.2	20.8	50	54.2	45.8	12.5	16.7	4.2	4.2	8.3	4.2
PDQ39-Emotional	16.7	12.5	58.3	50	50	70.8	16.7	25	0	0	29.2	8.3	29.2	8.3
PDQ39-Stigma	0	0	56.3	43.8	43.8	6.3	25	37.5	31.2	6.3	12.5	0	0	0
PDQ39-Social	0	0	25	16.7	58.3	8.3	0	0	0	0	50	8.3	0	0
PDQ39-Cognition	31.3	18.8	31.3	18.8	56.3	43.8	0	6.3	18.8	6.3	25	25	12.5	18.8
PDQ39-Comm.	0	8.3	25	8.3	41.7	66.7	25	16.7	16.7	16.7	8.3	8.3	8.3	0
PDQ-39-Bod. Disc.	41.7	116.7	58.3	25	25	33.3	33.3	58.3	50	25	66.7	58.3	16.7	0

Note: ABC Scale = Activities-Specific Balance Confidence Scale; 10MWT = 10 Meter Walk Test; 5XSST = Five Times Sit to Stand; 3MBWT = 3-Meter Backward Walking Test; FOG-Q = Freezing of Gait Questionnaire; FOG-A = Freezing of Gait Assessment; TUG = Timed Up and Go; TUGc = Timed Up and Go Cognitive; TUG-DTC = Timed Up and Go Dual-Task Cost; MoCA = Montreal Cognitive Assessment; NHPT - D = Nine-Hole Peg Test - Dominant hand; NHPT - ND = Nine-Hole Peg Test - Non-Dominant hand; HHD - D = Handheld Dynamometry - Dominant hand; HHD - ND = Handheld Dynamometry - Non-dominant hand; PDQ39 = Parkinson's Disease Questionnaire.

Balance and Mobility

The ABC scale data showed improvement in scores postintervention, with some variability across individuals. Participants 4 and 7 had increased ABC Scale scores beyond the MDC, with Participant 2 scoring just below the MDC. For the 360° test data, we found mixed results in the time taken to complete the 360° turn, and overall, little improvement for all participants. Participant 4 had the biggest improvement beyond the MDC, with a faster performance by -16.9 s. Concerning the 10MWT-P, gait speed increased for one participant, while speed (m/s) on the 10MWT-F at postassessment was higher for four out of seven participants. For the 5XSST, we observed an improvement in the time taken to complete the task postintervention for two participants. Similarly, two participants improved their 3MBWT completion time after the intervention, while we saw little improvement in FOG-A scores postintervention. TUG scores improved for two out of seven participants.

Cognition

We did not find a consistent pattern in MoCA scores after the program. Participants 2, 3, 6, and 7 maintained or slightly improved their scores, while Participants 1 and 4 showed slight decreases. None of the changes were above the MDC threshold.

Fine Motor

NHPT-D and NHPT-ND data revealed mixed results regarding both dominant and non-dominant hand tasks, but most of the participants performed worse beyond the MDC (three participants for NHPT-D and five participants for NHPT-ND). Overall, this was the test where we found the least improvement. For HHD-D and HHD-ND, we found improvement in hand strength in the post-test for four out of seven participants, but these results should be viewed with caution since no reliable MDCs were available.

Table 3

Outcome Measures

Outcome measure	Subj. 1	Subj. 2	Subj. 3	Subj. 4	Subj. 5	Subj. 6	Subj. 7
ABC Scale (%)	NC	NC	NC	MDC +	NC	NC	MDC +
360° Test (L+R time)	NC	NC	NC	MDC +	NC	NC	NC
10MWT gait speed - P	NC	NC	NC	NC	NC	MDC +	NC
10MWT gait speed - F	MDC +	NC	MDC +	NC	NC	MDC +	MDC +
5XSST	NC	NC	MDC +	MDC -	NC	NC	MDC +
3MBWT	NC	MDC +	MDC +	MDC -	NC	NC	NC
FOG-A	NC	NC	MDC +	NC	NC	NC	NC
TUG	NC	NC	MDC +	MDC +	NC	NC	NC
MoCA	NC	NC	NC	NC	NC	NC	NC
NHPT - D	NC	NC	MDC -	MDC -	NC	MDC -	MDC +
NHPT - ND	MDC -	MDC -	NC	MDC -	MDC -	MDC -	MDC +
HHD (lbs) - D	NA	NA	NA	NA	NA	NA	NA
HHD (lbs) - ND	NA	NA	NA	NA	NA	NA	NA
PDQ39-Mobility	NC	NC	MDC -	NC	MDC +	MDC +	MDC +
PDQ39-ADLS	NC	NC	MDC -	NC	NC	NC	NC
PDQ39-Emotional	NC	NC	MDC -	NC	NC	MDC +	MDC +
PDQ39-Stigma	NC	NC	MDC +	NC	MDC +	NC	NC
PDQ39-Social	NC	NC	MDC +	NC	NC	MDC +	NC
PDQ39-Cognition	NC	NC	NC	NC	NC	NC	NC
PDQ39-Comm.	NC	NC	MDC -	NC	NC	NC	NC
PDQ-39-Bod.Disc.	MDC +	MDC +	NC	MDC -	MDC +	NC	NC
# of improved tests (out of 21)	2	2	7	3	3	5	7

Note: MDC - = negative change within minimal detectable change (MDC), MDC + = positive MDC, NC = no change, NA = no MDC available. ABC Scale = Activities-Specific Balance Confidence Scale; 10MWT = 10 Meter Walk Test; 5XSST = Five Times Sit to Stand; 3MBWT = 3-Meter Backward Walking Test; FOG-A = Freezing of Gait Assessment; TUG = Timed Up and Go; MoCA = Montreal Cognitive Assessment; NHPT - D = Nine-Hole Peg Test - Dominant hand; NHPT - ND = Nine-Hole Peg Test - Non-Dominant hand; HHD - D = Handheld Dynamometry - Dominant hand; HHD - ND = Handheld Dynamometry - Non-dominant hand; PDQ39 = Parkinson's Disease Questionnaire.

Psychosocial

A pattern of mixed responses was observed among the participants across various aspects regarding the PDQ-39 subscales. Participants 5 and 6 seemed to gain the most concerning their quality of life from the program, when comparing scores before and after the intervention, and in relation to the MDC. Notably, while Participant 2 improved on all subscales, the changes did not surpass the MDC in any subscale besides Bodily Discomfort. In terms of mobility, three participants improved beyond the MDC. No improvement in ADLs was noted, with Participant 1 reporting worsening beyond the MDC. For emotional well-being, we observed positive changes larger than the MDC for two participants. Stigma reduction was found for two participants, with changes as high as 37.5 points for Participant 3. While two individuals reported enhanced social support, five revealed no MDC changes specific to this measure. Improvement in cognition was not observed beyond the MDC. Communication skills specific to this measure did not improve, with Participant 3 showing worsening in passing the MDC threshold. For bodily discomfort, three participants reported improvement. These findings underscore the varied responses to the intervention across different quality-of-life dimensions among individuals with PD. Overall, our interdisciplinary functional exercise program showed promising results in improving several motoric and psychosocial aspects for individuals with PD. Most notably affected were gait speed, mobility, and bodily discomfort.

Discussion

This case-series study summarizes the effects of an 8-week interdisciplinary functional exercise program, including an array of pre- and postmeasures. We chose these reliable and valid outcome measures based on their use with individuals with PD (e.g., Schenkman et al., 1997). MDC was noted for each outcome measure to demonstrate the ability of the measure to detect true change in the PD population (Feeney et al., 2016). With this information, these outcome measures demonstrate good clinical use for rehabilitation professionals. In accordance with previous studies (Imam & Dannenbring, 2020), the participants exhibited considerable improvements across various test parameters, with gait speed, mobility, and bodily discomfort yielding the most progress. These outcomes underscore the efficacy of the exercise program in enhancing gait speed and mobility among individuals with PD, potentially attributable to heightened vascular perfusion, neuronal plasticity, neurogenesis, neuroprotective mechanisms, and benefits to the immune system. Nevertheless, we noted substantial heterogeneity among the participants that could not be exclusively ascribed to variables such as age at testing, gender, session attendance, or years since diagnosis. For instance, Participant 1, diagnosed 4.5 years ago, demonstrated improvement in only two out of 21 measures, whereas Participant 3, diagnosed 5 years ago, demonstrated improvement in seven measures when comparing pre- and postresults. Future studies should factor in important aspects of PD, such as comorbidities and severity of motor and non-motor symptoms. It would also be beneficial to employ neuroimaging approaches to test neural correlates before and after the training program to support the role of exercise in promoting neuroplasticity and other factors. In addition, future studies could explore higher frequency, duration, and intensity of intervention to potentially have more positive clinical effects. To achieve clinical improvements on the Unified Parkinson’s Disease Rating Scale Part III scores, a training period of at least 6 months might be necessary (Mak et al., 2017).

Our PDQ-39 results indicate that the interdisciplinary functional exercise program had varied effects on quality of life among individuals with PD (Tan et al., 2014). While we observed positive trends overall, such as improvements in mobility, emotional well-being, stigma reduction, social support, and bodily discomfort, the extent and significance of these improvements varied among the participants. Some individuals showed notable enhancements in certain areas, while others experienced minimal or mixed progress. These findings highlight the complex and individualized nature of the response to interventions aimed at improving the quality of life in individuals with PD, suggesting the need for personalized approaches in treatment planning and implementation (van der Eijk et al., 2013). In addition, the results emphasize the importance of assessing multiple dimensions of quality of life to capture the holistic impact of interventions for individuals living with PD**.**

There are some limitations to our study. One limitation is the small sample size, and we hope to recruit larger cohorts in future iterations of this intervention program. Our participant sample also lacks diversity, and we are planning to increase our efforts to recruit from a larger set of communities in the future. In terms of PD severity and status, our sample was varied, and this might have contributed to the range of results we found for our intervention. For future studies, it will be vital to recruit larger, diverse samples and to also follow participants over longer periods to gauge the long-term effects of group exercise. In addition, we hope to complete future qualitative research focusing on gathering participant interviews concerning the psychosocial impact that a functional exercise group has on individuals with PD.

Implications for OT Practice

Findings demonstrate the value of OT intervention as well as an interdisciplinary approach when addressing clients with PD. Through this article, occupational therapists can discover assessments that consider the variability of motor and non-motor symptoms of PD during client evaluations to adopt a holistic approach when addressing clients with PD. The provided MDC of each standardized assessment, specific to individuals with PD, demonstrates the smallest amount of change that can be detected by a measure that corresponds to a change in ability (van Der Marck et al., 2013). Using the MDC is a conservative approach, but it ensures the patient outcomes are meaningful and not a result of measurement errors. Occupational therapists may also see greater success when interventions relate to daily function, as was demonstrated through our functional exercise program. Activities relating to occupations of ADLs and IADLs were meaningful to the participants and increased engagement. Lastly, the interdisciplinary approach and weekly meetings of the group provided increased social engagement in a group setting. This shows the importance of group therapy, including those with similar diagnoses, to promote psychosocial wellness in the holistic approach to OT practice. Future studies will focus on obtaining qualitative measures through structured interviews to achieve a holistic view of the program, the lived experience of those with PD, and intervention outcomes.

Conclusion

An interdisciplinary, functional exercise program can be a valuable addition to traditional treatment methods for individuals with PD. This case series revealed improvements in functional mobility and quality of life, highlighting the potential benefits of this type of program. Therapists may consider incorporating functional exercise programs into their plan of care for individuals with PD to address motor and non-motor challenges associated with the disease and to improve overall outcomes.

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QUESTIONNAIRE
J2(26)
An Interdisciplinary Functional Exercise Program for Individuals with Parkinson's Disease: A Case Series

INSTRUCTIONS

- Read through the article and answer the multiple-choice questions provided below.
- **Some questions may have more than one correct answer;** in which case, you must mark **all** the correct answers.

Introduction

Question 1: Parkinson's disease (PD) impacts not only physical abilities but also cognitive functioning and emotional well-being. Common motor symptoms include which of the following? Select **all correct** options.

A. Bradykinesia
B. Rigidity
C. Laxity
D. Postural instability

Question 2: ________________ include depression and anxiety, sleep disturbances, and sensory and autonomic disruptions.

A. Motor symptoms
B. Physical symptoms
C. Non-motor symptoms
D. Neural symptoms

Question 3: Exercise has been shown to have significant positive benefits for individuals with PD, and regular physical activity can positively impact functional mobility, balance, and overall quality of life.

A. TRUE
B. FALSE

Question 4: Because of the variety and complexity of symptoms associated with PD, access to an interdisciplinary team of professionals who have knowledge about this condition is important. These teams typically include which of the following? Select **all three correct** options.

A. Reflexologist
B. Movement disorder specialist
C. Physical therapist (PT)
D. Occupational therapist (OT)

Method: Intervention

Question 5: The intervention sessions consisted of ____ sessions conducted over 8 weeks and the **functional exercise program** concluded within _____________? Both answers must be correct.

A. 9 | 45 min
B. 16 | 20 min
C. 16 | 1 hour
D. 12 | 30 min

Question 6: Physical therapy used circuits focused on strength, balance, gait training, flexibility, and functional mobility. Specific interventions included all of the following, **EXCEPT** …………………………..**?**

A. Fall prevention
B. Improving step length, arm swing and stretching
C. Implementing strategies to decrease freezing episodes
D. Improving the ability to complete bed mobility, floor, and seated transfers
E. Placing beads into medicine containers

Question 7: The ___________ interventions in the exercise circuits incorporated battle ropes, balance stones in parallel bars, trunk rotation with punching bags, outdoor walking up and downhill, and multi-directional walking and dynamic movements using BlazePods.

A. PT
B. OT
C. Physiotherapy

Question 8: The OT group incorporated interventions pertaining to which of the following? Select **BOTH** correct options.

A. Gait training
B. Functional strength (balance and posture)
C. Fine motor skills (dexterity and cognition**)**
D. Flexibility

Question 9: Intervention activities used by OTs included all of the following, **EXCEPT** ……………………….**?**

- **A.** Standing dynamic reach using playing cards on a vertical surface
- **B.** Kneeling on or prone over a Bosu ball while reaching for and stacking cones
- **C.** Carrying, transporting, and placing beads into medicine containers
- **D.** Improving step length, arm swing and stretching
- **E.** Memory tasks with coloured bells and pattern recognition

Method: Balance, mobility and cognition

Question 10: With regard to balance, the sensorimotor system, in part or in full, is often dysfunctional in individuals with PD. The result renders postural instability and control as one of the main disabling features of PD, impacting the skills needed to mobilise safely in the home and community environment.

- **A.** TRUE
- **B.** FALSE

Question 11: The ________ has excellent test-retest reliability and is a predictor of recurrent falls in the PD population when considering criterion validity.

- **A.** TUG
- **B.** MoCA
- **C.** NHPT
- **D.** ABC scale

Question 12: The researchers aimed to assess functional mobility using the outcome measures of which of the following? Select all correct options.

- **A.** 10MWT
- **B.** 5XSST
- **C.** NHPT
- **D.** 3MBWT

Question 13: Cognitive dysfunction not only occurs in the later stages of PD but also as mild cognitive impairment (MCI) in the earlier stages, which accounts for approximately ___________________% of individuals with PD, but evidence has demonstrated that the adoption of exercise at any age could delay or reverse cognitive decline.

- **A.** 20
- **B.** 40
- **C.** 30
- **D.** 50

Discussion and implications

Question 14: In accordance with previous studies, the participants of this study exhibited considerable improvements across various test parameters, with which of the following yielding the most progress? Select **all correct** options.

- **A.** Gait speed
- **B.** Mobility
- **C.** Bodily discomfort
- **D.** Cognition

Question 15: Findings demonstrate the value of OT intervention as well as an interdisciplinary approach when addressing clients with PD, and show the importance of group therapy, including those with similar diagnoses, to promote psychosocial wellness in the holistic approach to OT practice.

- **A.** TRUE
- **B.** FALSE

THE END

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This activity is accredited for **THREE (3) CLINICAL** CEU'S. You have to achieve 70% to pass this activity.

ANSWER SHEET

J2(26)

An Interdisciplinary Functional Exercise Program for Individuals with Parkinson's Disease: A Case Series

***Time spent on activity** **hour** **min**

	A	B	C	D	E		A	B	C	D	E
1						**8**					
2						**9**					
3						**10**					
4						**11**					
5						**12**					
6						**13**					
7						**14**					
						15					

How relevant was the content of this activity to your scope of practice?

Not at all	Somewhat	Mostly	Extremely

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