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Physical rehabilitation for Parkinson's disease: assessment and treatment preferences of physical therapists

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Muhammad Kashif[1], Rabbia Mustafa[1], Salma Bunyad[2], Noreen Aslam[1], Feryal Arshad[2], Bilal Umar[1]

[1] Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Lahore Campus, Lahore Pakistan

[2] Pakistan Society of the Rehabilitation of the Disabled (PSRD), Lahore, Pakistan

Abstract

Introduction. Patients with Parkinson's disease are often prescribed physical therapy. Physiotherapists often assist Parkinson's disease patients with assessment and treatment, but little is known about the assessment tools and interventions they use. Additionally, physical therapists do not consistently integrate standard outcome measures and treatment procedures into their practices. Consequently, this study was carried out to determine physical therapists' preferences for assessment and treatment of Parkinson's disease.

Methods. Five hundred questionnaires were distributed to physiotherapists working in clinical settings. Overall, 446 physiotherapists responded to the survey and returned the questionnaires. Questionnaires with incomplete information were excluded from the survey. In total, 418 physiotherapists participated in the study, of whom 324 saw PD patients in their clinical practice.

Results. Overall, 446 physiotherapists responded to the survey and returned the questionnaires. Questionnaires with incomplete information were excluded from the survey. In total, 418 physiotherapists participated in the study, of whom 324 saw PD patients in their clinical practice. Study participants included 43.8% male PTs and 56.2% female PTs with an average age of 30.02 ± 5.38 years. The Berg balance scale for balance assessment was preferred by 220 (67.9%), the Mini Mental State Examination for cognitive assessment was preferred by 317 (97.8%), and the Unified Parkinson's Disease Rating Scale was preferred by 168 (51.85%) PTs. Neurological PTs employed PNF (proprioceptive neuromuscular facilitation) to decrease stiffness, and exercise and task-focused training for functional training. Virtual Reality and Motor Imagery were also known by 56.6% and 62.4% of PTs, respectively, although only 4.8% and 1.85% used them.

Conclusions. Study results revealed that most physiotherapists follow routine assessment and treatment protocols and do not implement innovative technology in the physical rehabilitation of patients with Parkinson's disease.

Key words: Parkinson's disease, assessment, physical therapists, physical rehabilitation, physiotherapy treatment, outcome measures

Introduction

Parkinson's disease (PD) is a complex condition characterised by a variety of motor and non-motor problems, for which medical intervention alone is not enough. PD is more prevalent at 65 years of age and above [1] and is a cause of emotional stress in the form of anxiety and stress as well as economic losses, leading to financial stress on caregivers [2, 3]. PD has a variety of disabling symptoms that cause a huge economic burden on the patients and society and threaten each patient's quality of life [4, 5]. The prevalence of PD is influenced by many factors, such as age, race, sex, and geographic location [6–10]. In the past 26 years, this problem has doubled in size worldwide [11], increasing from 2.5 million persons afflicted with the disease in 1990 to 6.1 million people reported to be afflicted with PD in 2016 [12, 13]. It is expected that this trend will continue over the next 30 years, in which case up to 12 million people will be affected by PD in 2050 [11]. This alarming surge in the worldwide PD population adds urgency to all research concerning new and effective treatment strategies [14].

Pakistan is a developing country where PD is already surging and the number of patients with neurological pathologies is expected to increase in the coming years due to the increasing life expectancy, urbanisation of the population, and better diagnostic facilities in this region [15]. However, the people in Pakistan remain relatively unaware of the growing problem of PD due to common misdiagnoses targeting age-related neurodegenerative disorders. Approx. 63% of those living with Parkinson's disease in Pakistan are men. It has also been reported that about 219 out of every 100,000 individuals suffer from PD, as 450,000 people currently suffer from this disease out of the 182 million in Pakistan [16, 17].

Many allied health professionals can be involved in the management of PD, for which physiotherapy is the most applied and scientifically supported management approach. Moreover, rehabilitation therapies are increasingly supported as an adjuvant approach for pharmacological and neurosurgical treatment and provide plentiful options. In particular, many different physical therapy interventions are used in PD rehabilitation for the symptoms resistant to pharmacology, including progressive resistance exercises, stretching exercises, balance and coordination exercises, cueing, and treadmill training [18–21].

Modern approaches to the rehabilitation of PD have also emerged, including virtual reality (VR) [22], exer-gaming [23], motor imagery (MI) [24], action observation (AO) [25], robot-assisted physiotherapy [26], and non-conventional therapies such as dance and martial arts [18, 21]. MI is the mental implementation of an action in the absence of any explicit move-

Correspondence address: Muhammad Kashif, Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University, Gullberg-III, Lahore 4200, Pakistan, e-mail: kashif.shaffi@gmail.com; https://orcid.org/0000-0002-8487-9256

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ment or muscle activation. It is found to be effective for improving motor skills and is extensively used in sports as well as in many neurological disorders in which motor recognition and execution are affected [24, 27, 28]. VR is a rehabilitation computer technology that integrates related information into an imaginary environment [29–31]. Moreover, a protocol for physiotherapy combined with VR and MI has been reported for the rehabilitation of PD [32]. Though physiotherapists (PTs) strive to achieve the best outcomes during the rehabilitation of PD, the multifactorial nature of the disease and the complexity of the symptoms demand efficiently designed assessment and treatment protocols. Thus, the present study was designed to provide an overview of current preferences for assessment tools and treatment methods or protocols to improve outcomes in the rehabilitation of PD.

Subjects and methods

From June 2020 to September 2020, a survey was carried out among PTs working in clinics and hospitals in Faisalabad, Lahore, and Islamabad. PTs working as academics, students and interns were excluded due to a lack of direct contact and exposure to the patients. Ethical approval was given by the Institutional Review Board of the University Institute of Physical Therapy, Riphah International University and the written consent of each participant was obtained prior to data collection.

The study used a self-administrated questionnaire consisting of four sections. Section-I comprised demographic information, section-II included assessment methods, section-III incorporated treatment protocols for PD, while section-IV included questions on the PTs' knowledge of VR and MI. The questions pertaining to assessment methods [33, 34] and treatment methods were based on previous studies and clinical guidelines [19, 35, 36]. The questions on the knowledge assessed specifically knowledge about the use of innovative technologies. The questionnaire was given to almost 500 PTs registered with the Pakistan Physical Therapy Association (PPTA). Out of the 500 PTs, we received 446 responses. Therefore, the response rate for this study was 89.2%. After receiving the responses, the data was reviewed and incomplete responses were excluded. As a result, 418 questionnaires were included and entered into SPSS version 24 for analysis. To uncover associations between numbers of patients seen by PTs with their specialty while assessing patients with PD, the chi-square test was used. Moreover, the chi-square test was also used to determine the associations within different specialties. The participant selection process is explained in Figure 1.

Ethical approval

The research related to human use complied with all the relevant national regulations, institutional policies, was in accordance the tenets of the Declaration of Helsinki, and was approved by the Institutional Review Board of the Department of Physical Therapy, Riphah International University (approval No.: RCRAHS/ERB/329).

Informed consent

Informed consent has been obtained from all individuals included in this study.

Results

The study participants consisted of 43.8% male PTs and 56.2% female PTs, with an average age of 30.02 ± 5.38 years. All participants were registered with the Pakistan Physical Therapy Association (PPTA) (Table 1).

Overall, 324 PTs treated patients with PD. Among a total of 149 neuro PTs, 46 were seeing less than five patients per month and 103 were seeing more than five patients per month. Out of 140 orthopaedic PTs, 113 saw five or fewer patients in a month, while 27 saw more than five patients, and out of 35 geriatric PTs, 26 saw more than five patients in a month (Table 2).

According to our study, 88.3% of neuro PTs who saw more than five PD patients in a month used the Hoehn and Yahr scale to determine the stage and severity of PD. There were 54.4% of neuro PTs that utilised BBS for balance evaluation for patients with PD. On the other hand, the 19 PTs specialised in orthopaedic physiotherapy primarily used Functional Independence Measure (FIM) as a tool for functional assessment. For the gait assessment, the Meter walk test was employed by the 130 (87.2%) of neuro PTs, which was statistically significant ($p < 0.046$). 73 (48.99%) of the neuro PTs, 80 (57.1%) of the orthopaedic PTs and 15 (42.9%) of the geriatric PTs were using UPDRS as a disease-specific assessment tool, which was significant ($p < 0.001$) (Table 3).

Our study elaborates the treatment options used by PTs specialised in different fields of physical therapy for the management of patients with PD. For treating balance impairments, the majority of the neurologic PTs (38.8%) were using combination therapies, while verbal, tactile/proprioceptive

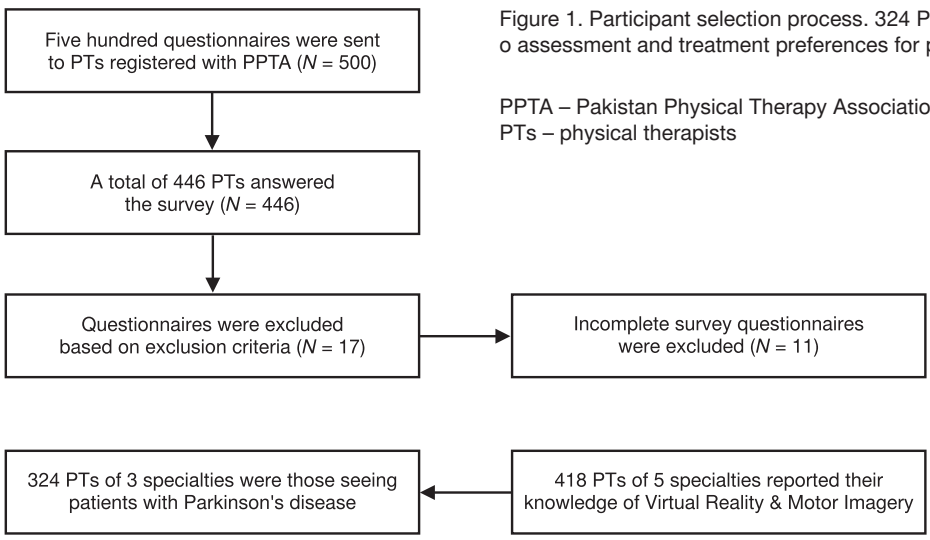

Figure 1. Participant selection process. 324 PTs were surveyed with regard t o assessment and treatment preferences for patients with Parkinson's disease

PPTA – Pakistan Physical Therapy Association
PTs – physical therapists

Table 1. Demographic information of physical therapists participating in the study (*N* = 418)

Variables	*n*	%
Sex		
Male	183	43.8
Female	235	56.2
Age (years, mean ± *SD*) 30.02 ± 5.38		
24–27	202	48.3
28–31	86	20.5
> 31	130	31.1
Highest degree		
DPT	105	25.1
MS (PT)	311	74.4
Ph.D. PT	2	0.5
Specialty		
Neurological physical therapy	149	35.6
Orthopaedic manipulative physical therapy	140	33.5
Sports physical therapy	43	10.3
Geriatric physical therapy	35	8.4
Cardiovascular physical therapy	51	12.2
Nature of job		
Public hospital	154	36.8
Private hospital	168	40.2
Clinic	96	23
Region		
Faisalabad	151	36.1
Lahore	162	38.8
Islamabad	105	25.1
Experience		
Less than or equal to 5 years	284	67.9
5–8 year	103	24.6
8–10 years	26	6.2
More than 10 years	5	1.2

DPT – doctor of physical therapy, MS (PT) – master of science in physical therapy, Ph.D. PT – doctor of philosophy in physical therapy

Table 2. Physical therapist's clinical record and interventional strategies for the management of PD (*N* = 324)

Speciality	Number of PD patients seen by PTs (per month)	
Speciality	≤ 5	> 5
Neurological PTs	46	103
Orthopaedic PTs	113	27
Geriatric PTs	9	26
Do you plan short-term & long-term treatment goals?	Frequency	%
Yes	307	94.7
No	17	5.3
Do you work on the psycho-social aspect of your patient?		
Yes	292	90.1
No	32	9.9
Do you work on the environmental situation of your patient?		
Yes	317	97.8
No	7	2.2
Do you work on patient motivation?		
Yes	304	93.8
No	20	6.2
Do you recommend a fall risk diary to your patient to record fall events?		
Yes	284	87.6
No	40	12.4
Do you focus on the speech of your patient?		
Yes	304	93.8
No	20	6.2

PD – Parkinson's disease, PTs – physical therapists

cues were used by 48.1% and 38.5% of orthopaedic and geriatric PTs, respectively. To reduce rigidity of patients with PD, the neurological PTs treating more than five PD patients per month were using PNF (proprioceptive neuromuscular facilitation) techniques mainly (58.3%) while the same tendency was found among the geriatric PTs, as 30.8% of the therapists for opted this technique. On the other hand, 48.1% of the orthopaedic PTs preferred gentle sow rocking movements to reduce rigidity. Gait impairments were treated by 45.6% and 34.6% of neurological PTs and geriatric PTs using combination therapies, but orthopaedic PTs were mostly (40.7%) found to be using motor learning strategies. Virtual reality and mirror therapy techniques were not found to be preferred by the therapists as the main option by the neurological, orthopaedic or geriatric PTs (Table 4).

When analysing the PTs' knowledge of virtual reality (VR) and motor imagery (MI) with reference to their use in the rehabilitation of PD patients, 135 of the 149 neurologic PTs were acquainted with VR and 133 were familiar with MI. Thirty and twenty of the 35 geriatric PTs had knowledge of MI and VR, respectively (Figure 2).

Discussion

The goals of physical rehabilitation for people with neurological disorders are to make the clinical manifestation manageable, to avoid secondary complications, to restore an appropriate level of physical functioning, and to make advancements in re-participation into the public [36]. Similarly, the roles of physical therapy are to maximise functionality and diminish secondary complications from exercise rehabilitation as part of the education and to support the individuals suffering from PD. The purpose of this study was to determine the assessment and treatment preferences of Pakistani PTs in the management of PD.

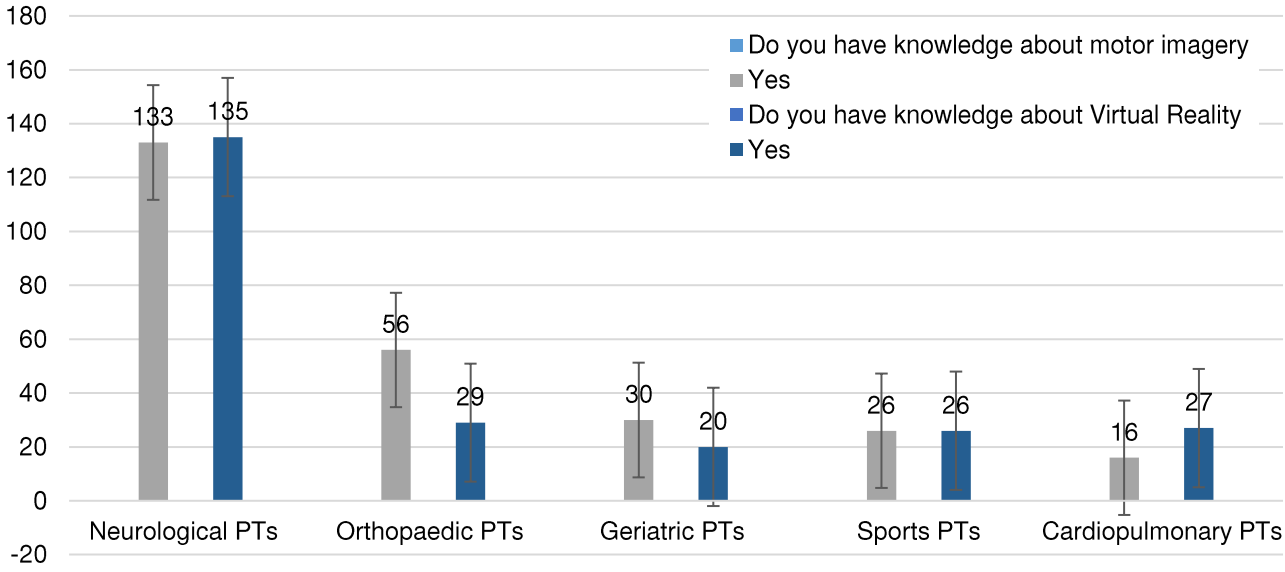

Figure 2. Physical therapists' knowledge of motor imagery and virtual reality. 418 physical therapists interviewed reported knowledge of virtual reality and motor imagery for the rehabilitation of Parkinson's disease

In the present study, the Berg balance scale (BBS) was the most preferred assessment tool for balance in patients with PD by the PTs treating more than five patients per month with $p < 0.001$. The existing literature supports this finding. Downs et al. [37] conducted research to study the BBS and reported that this tool was widely accepted and commonly used because it required less equipment and a shorter duration than other options. In addition, in 2022, Kashif et al. [38] demonstrated that the Urdu version of the BBS is a reliable and valid tool with excellent psychometric properties for assessing balance in patients with Parkinson's disease. The BBS has a high relative reliability with an inter-rater reliability of approximately 0.97 (95% CI 0.96–0.98) and an intra-rater reliability of 0.98 (95% CI 0.97–0.99) and is generally recognised and frequently used, requiring less equipment and a short period of time [39, 40]. However, other balance rating tools were recommended when patients were able to walk independently. One study reported that the validity of BBS had high inter-class coefficients (ICC) of 0.86–0.99 (ICCs = 0.86–0.99) and consequently considered it a valid and reliable tool for balance assessment [41, 42].

In the current study, the Barthel index (BI) was preferred by 37.6% of neurological PTs for assessing independence in performing ADLs by patients with PD. BI is considered the most convenient measure of competency in basic ADL performance by persons affected by neurological and musculoskeletal disorders [43]. The self-reported version of the BI has been validated and is considered reliable for use among this patient population [44]. While FIM was the preferred scale over other assessment tools such as BI, the five-time sit to stand test (FTSTST) and Schwab and England activities of daily living scale (SE-ADL) were used by the majority of the orthopaedic (123/140) and geriatric (8/35) PTs in the present study. FIM is also valid and reliable for patients with motor and cognitive dependence as in PD [45]. It should be borne in mind that the FIM scale requires formal training, while there is no such requirement for using the BI [46], which may explain why the BI is preferred by the Pakistani Neurological PTs.

In our study, the most preferred treatment for managing balance impairment by the PTs (neurological, orthopaedic and geriatric) who were seeing more than five PD patients per month was verbal, tactile, and proprioceptive cues with $p < 0.001$. The existing literature supports our findings, as somatosensory cues are very effective in postural control, engaging patients during rehabilitation, and improving basal ganglia signal production [47]. In addition, external cues are known to produce compensatory strategies and automatic reactions and to prevent falls [48]. Despite these facts, looking at the neurological PTs separately, they were mainly found to choose a combination of techniques with involving mirror therapy and the Nintendo Wii balance board for this purpose (37.6% of the total). This might be due to their broader knowledge and exposure to neurological conditions and their management. According to the existing literature, mirror visual feedback (MVF) or mirror therapy induce significant, positive impacts on the recovery of patients with PD. Previous studies also reported that mirror therapy was particularly beneficial for improving bradykinesia and motor performance. Bonassi et al. [49] conducted research to determine the efficacy of mirror visual feedback (MVF) for PD patients and produced results that support the findings of the present study, where 32.9% of the neurological, 41.4% of the orthopaedic and 31.4% of the geriatric PTs tend to use mirror therapy as a second treatment option to improve balance issues among patients with PD.

Among the treatment options for dealing with balance impairments in PD is the Nintendo Wii balance board, which is rarely used in Pakistan, possibly due to a lack of awareness regarding its therapeutic potential. Consequently, only 6% of the PTs considered the Nintendo Wii balance board a useful treatment option for balance improvement. However, the existing literature has reported significant benefits from using the Nintendo Wii balance board, including improved balance by playing challenging games and the continuous visual feedback provided by the balance board [50–53]. According to one study, the balance board is a valid tool for assessing postural instability (ICCs = 0.92–0.98) [54].

In the present study, the majority of the PTs involved in the assessment and management of more than five PD patients in a month preferred the Hoehn and Yahr classification of disability scale (H&Y) scale for staging and determining severity among patients with PD with $p = 0.001$. Several previous studies agreed with our study and reported that the H&Y scale is the most widely and commonly used scale among the grading scales for PD [55, 56].

Table 3. Association of number of patients seen by physical therapists with their speciality while assessing patients with PD (*N* = 324)

Question statements	Neurologic PTs (*n* = 149)				Orthopaedic PTs (*n* = 140)				Geriatric PTs (*n* = 35)				Total *p*-value
	number of patients		total	*p*-value	number of patients		total	*p*-value	number of patients		total	*p*-value	
	≤ 5	> 5			≤ 5	> 5			≤ 5	> 5			
	n (%)	*n* (%)	*n* (%)		*n* (%)	*n* (%)	*n* (%)		*n* (%)	*n* (%)	*n* (%)		
Scales used for staging and severity of patients with PD													
H&Y scale	36 (78.3)	91 (88.3)	127 (85.2)	0.109	72 (63.7)	22 (81.5)	94 (67.1)	77	7 (77.8)	18 (69.2)	25 (71.4)	0.625	< 0.001
Others	10 (21.7)	12 (11.7)	22 (14.8)		41 (36.3)	5 (18.5)	46 (32.9)		2 (22.2)	8 (30.8)	10 (28.6)		
Scales used for balance assessment of patients with PD by physiotherapist													
BBS	29 (63.0)	56 (54.4)	85 (57.0)	0.869	103 (91.2)	25 (92.6)	128 (91.4)	0.81	2 (22.2)	5 (19.2)	7 (20.0)	0.992	< 0.001
TUGT	2 (4.3)	4 (3.9)	6 (4.0)		0	0	0		1 (11.1)	3 (11.5)	4 (11.4)		
DGI	3 (6.5)	7 (6.8)	10 (6.7)		0	0	0		2 (22.2)	5 (19.2)	7 (20.0)		
ABCS	2 (4.3)	7 (6.8)	9 (6.0)		0	0	0		2 (22.2)	5 (19.2)	7 (20.0)		
Combination	10 (21.7)	29 (28.2)	39 (26.2)		10 (8.8)	2 (7.4)	12 (8.6)		2 (22.2)	8 (30.8)	10 (28.6)		
Scale used for functional assessment of patients with PD													
FIM	8 (17.4)	20 (19.4)	28 (18.8)	0.682	104 (92.0)	19 (70.4)	123 (87.9)	0.002	3 (33.3)	5 (19.2)	8 (22.9)	0.077	< 0.001
Barthel index	15 (32.6)	41 (39.8)	56 (37.6)		0	0	0		2 (22.2)	3 (11.5)	5 (14.3)		
FTSTST	2 (4.3)	7 (6.8)	9 (6.0)		1 (.9)	3 (11.1)	4 (2.9)		2 (22.2)	2 (7.7)	4 (11.4)		
Schwab and England ADLs Scale	1 (2.2)	3 (2.9)	4 (2.7)						2 (22.2)	2 (7.7)	4 (11.4)		
Combination	20 (43.5)	32 (31.1)	52 (34.9)		8 (7.1)	5 (18.5)	13 (9.3)			14 (53.8)	14 (40.0)		
Scales used for gait assessment of patients with PD													
Meter walk test	40 (87.0)	90 (87.4)	130 (87.2)	0.943	104 (92.0)	23(85.2)	127 (90.7)	0.271	7 (77.8)	19 (73.1)	26 (74.3)	0.781	<.046
Walkie-Talkie test	6 (13.0)	13 (12.6)	19 (12.8)		9 (08.0)	4 (14.8)	13 (9.30)		2 (22.2)	7 (26.9)	9 (25.7)		
Scales used for cognition assessment of patients with PD													
MMSE	44 (95.7)	99 (96.1)	143 (96.0)	0.894	113 (100.0)	27 (100.0)	140 (100.0)		9 (100)	25 (96.2)	34 (97.1)	0.551	0.06
MoCA	2 (4.3)	4 (3.9)	6 (4.0)		0	0	0			1 (3.8)	1 (2.9)		
Scales used for disease-specific measures													
UPDRS	26 (56.5)	47 (45.6)	73 (48.99)	0.561	67 (59.3)	13 (48.1)	80 (57.1)	0.293	5 (55.6)	10 (38.5)	15 (42.9)	0.238	< 0.001
PDQ-39	9 (19.6)	23 (22.3)	32 (21.48)		46 (40.7)	14 (51.9)	60 (42.9)		4 (44.4)	7 (26.9)	11 (31.4)		
PDQ-39SI	3 (6.5)	13 (12.6)	16 (10.74)		0	0	0		0	2 (7.7)	2 (5.7)		
Combination	8 (17.4)	20 (19.4)	28 (18.79)		0	0	0		0	7 (26.9)	7 (20.0)		
Non-motor symptoms of PD patient assessed													
Yes	36 (78.3)	80 (77.7)	116 (77.9)	0.936	78 (69.0)	18 (66.7)	96 (68.6)	0.812	6 (66.7)	19 (73.1)	25 (71.4)	0.714	0.199
No	10 (21.7)	23 (22.3)	33 (22.1)		35 (31.0	9 (33.3)	44 (31.4)		3 (33.3)	7 (26.9)	10 (28.6)		

PD – Parkinson's disease, PTs – physical therapists, DPT – doctor of physical therapy, MS-PT – master of science in physical therapy, FIM – Functional Independence Measure, FTSTST – Five Time Sit To Stand Test, ADLs – Activities of Daily Living, UPDRS – Unified Parkinson's Disease Rating Scale, PDQ-39 – Parkinson's Disease Questionnaire, BBS – Berg balance scale, TUGT – Time Up and Go Test, DGI – Dynamic Gait Index, ABCS – Activities specific Balance Confidence Scale, H&Y – Hoehn and Yahr scale, MoCA – Montreal Cognitive Assessment Scale, MMSE – Mini-Mental State Examination

Table 4. Association of number of patients seen by physical therapists with their speciality while treating the patients with PD (*N* = 324)

Question statements	Neurologic PTs (*n* = 149)				Orthopaedic PTs (*n* = 140)				Geriatric PTs (*n* = 35)				Total *p*-value
	number of patients		total	*p*-value	number of patients		total	*p*-value	number of patients		total	*p*-value	
	≤ 5	> 5			≤ 5	> 5			≤ 5	> 5			
	n (%)	*n* (%)	*n* (%)		*n* (%)	*n* (%)	*n* (%)		*n* (%)	*n* (%)	*n* (%)		
Treatment options for balance improvement in PD													
Verbal, tactile/ proprioceptive cues	11 (23.9)	24 (23.3)	35 (23.5)	0.13	49 (43.4)	13 (48.1)	62 (44.3)	0.52	4 (44.4)	10 (38.5)	14 (40.0)	0.89	< 0.001
Mirror therapy	19 (41.3)	30 (29.1)	49 (32.9)		46 (40.7)	12 (44.4)	58 (41.4)		3 (33.3)	8 (30.8)	11 (31.4)		
Nintendo Wii balance board	0	9 (8.7)	9 (6.0)		0	0	0		0	0	0		
Combination	16 (34.8)	40 (38.8)	56 (37.6)		18 (15.9)	2 (7.4)	20 (14.3)		2 (22.2)	8 (30.8)	10 (28.6)		
Treatment options to reduce rigidity in PD													
Gentle, slow rocking movements	0	0	0	0.12	57 (50.4)	13 (48.1)	70 (50.0)	0.21	3 (33.3)	8 (30.8)	11 (31.4)	0.96	< 0.001
Rotation of trunk and extremities	0	0	0		18 (15.9)	8 (29.6)	26 (18.6)		0	0	0		
PNF	33 (71.7)	60 (58.3)	93 (62.4)						3 (33.3)	8 (30.8)	13 (37.1)		
Combination	13 (28.3)	43 (41.7)	56 (37.6)		38 (33.6)	6 (22.2)	44 (31.4)		3 (33.3)	10 (38.5)	11 (31.4)		
Treatment options for PD patient gait training													
Motor learning strategies	19 (41.3)	37 (35.9)	56 (37.6)	0.78	52 (46.0)	11 (40.7)	63 (45.0)	0.53	3 (33.3)	8 (30.8)	11 (31.4)	0.82	0.02
Treadmill training	3 (6.5)	9 (8.7)	12 (8.1)		9 (8.0)	4 (14.8)	13 (9.3)		0	2 (7.7)	2 (5.7)		
Strengthening and flexibility exercises	6 (13.0)	10 (9.7)	16 (10.7)		22 (19.5)	7 (25.9)	29 (20.7)		2 (22.2)	7 (26.9)	9 (25.7)		
Combination	18 (39.1)	47 (45.6)	65 (43.6)		30 (26.5)	5 (18.5)	35 (25.0)		4 (44.4)	9 (34.6)	13 (37.1)		
Exercise training in PD rehabilitation													
Stretching	3 (6.5)	5 (4.9)	8 (5.4)	0.95	5 (4.4)		5 (3.6)	610	2 (22.2	2 (7.7)	4 (11.4)	0.68	< 0.001
ROMs	11 (23.9)	21 (20.4)	32 (21.5)		50 (44.2)	14 (51.9)	64 (45.7)		3 (33.3)	9 (34.6)	12 (34.3)		
Assistive exercises	2 (4.3)	6 (5.8)	8 (5.4)		0	0	0			1 (3.8)	1 (2.9)		
Assistive and resistive exercise	9 (19.6)	24 (23.3)	33 (22.1)		18 (15.9)	3(11.1)	21 (15.0)		2 (22.2)	4 (15.4)	6 (17.1)		
Combination	21 (45.7)	47 (45.6)	68 (45.6)		40 (35.4)	10 (37.0)	50 (35.7)		2 (22.2)	10 (38.5)	12 (34.3)		
Treatment options for PD patient functional training													
Mirror therapy	17 (37.0)	42 (40.8)	59 (39.6)	0.48	16 (14.2)		16 (11.4)	0.04	6 (66.7)	15 (57.7)	21 (60.0)	0.57	< 0.001
Task-oriented training	26 (56.5)	49 (47.6)	75 (50.3)		97 (85.8)	27 (100)	124 (88.6)		3 (33.3)	8 (30.8)	11 (31.4)		
Others	3 (6.5)	12 (11.7)	15 (10.1)		0	0	0			3 (11.5)	3 (8.6)		
Do you prefer relaxation techniques for patients with PD?													
Yes	46 (100)	103 (100)	149 (100.0)	N/A	110 (97.3)	20 (74.1)	130 (92.9)	< 0.001	9 (100)	26 (100)	35 (100)	N/A	< 0.001
No	0	0	0		3 (2.7)	7 (25.9)	10 (7.1)		0	0	0		
Have you used a Virtual Reality Technique as a treatment for PD?													
Yes	0 (00)	15 (14.6)	15 (10.06)	0.07	0	0	0	N/A	0	0	0	N/A	< 0.001
No	46 (100)	88 (85.4)	134 (89.93)		113 (100)	27 (100)	138 (98.6)		9 (100)	26 (100)	35 (100)		
Have you used a Motor Imaginary Technique as a treatment for PD?													
Yes	0	7(6.8)	7(4.7)	0.07	0	0	0	N/A	0	0	0	N/A	< 0.001
No	46 (100.0)	96 (93.2)	142 (95.3)		113 (100)	27 (100)	140 (100)		9 (100)	26 (100)	36 (100)		

PD – Parkinson's disease, PTs – physical therapists, N/A – not applicable

Among the participating PTs, the majority thought that motor learning strategies were helpful during gait training and thus employed these in their plan of care ($p < 0.016$). The findings of the current study are also supported by the work of Plotnik et al., as motor learning strategies such as rhythmic auditory stimulation (RAS) are effective in reducing freezing of gait (FOG) [57]. Another study conducted by Schlick et al. in 2016 [58] reported that a combination of visual cues and treadmill training had more beneficial effects for improving gait speed, stride length, and functional gait performance than treadmill training alone. Furthermore, recent trials reported that combing MI and VR with routine PT will improve motor control, balance and ADLs in patients with PD [59, 60].

In contrast to the findings in our study, the existing literature has reported that Montreal Cognitive Assessment (MoCA) is a more useful assessment tool than mini-mental state examination (MMSE) in terms of its sensitivity in evaluating cognitive impairment. In the present study, 97.8% of the PTs preferred MMSE for assessing cognitive impairment [61]. The reasons might be that MMSE takes only about 7–8 minutes while MoCA takes 10–12 minutes to administer, whichthis is an important factor for its use in in-patient settings while MoCA is difficult to use in patients with moderate-to-severe impairments. Some research reports MMSE as useful in detecting cognitive deterioration in patients with PD [62] while other recommends the use of MoCA [63, 64, 65] but these studies were conducted with small sample sizes, therefore no conclusions can be drawn until more studies are conducted with stronger methodological bases [66]. Another study suggests that MoCA may be more sensitive for detecting early cognitive changes in PD, but that MMSE may be a better option for tracking cognitive decline [66]. According to another study, MMSE and MoCA are equal in measuring the rate of cognitive changes over time in Lewy Body Disease [67].

In the present study, the majority of PTs (51.8%) preferred using the original version of the Unified Parkinson's Disease Rating Scale to assess the overall health of PD patients ($p < 0.001$). This finding agrees with the existing literature, which showed a preference for the UPDRS. Nevertheless, excellent internal consistency was found in many studies on UPDRS [68, 69]. Considering the rater consistency of the tool, it has been labelled as having adequate inter-rater reliability and intra-rater reliability for section-II [70] and section-III [71, 72]. The studies also reported low-to-medium intra-rater reliability for the original version of the scale. Moreover, UPDRS has also been proven to respond to the changes observed in the patients in clinical settings, whether the patient is treated or not [72, 73].

To maximise independence and prevent secondary complications, a combination of drug therapy and rehabilitation approaches were used. Exercise training such as treadmill training, stretching, strengthening exercises, balance training and cueing influences neurotransmission and thus functional circuitry. Exercise training has a central role in promoting motor learning in patients with motor control deficits. According to a recent meta-analysis, the effects of exercise training were short-lasting but clinically significant. Recent innovations, including motor imagery, virtual reality, robotic therapy and action observation, have shown tremendous benefits in previous research. The rehabilitation approach should be goal-specific and parameters should be determined according to each individual [21].

In the present study, physical therapists recommended aerobic exercise for patients with Parkinson's disease. These exercises can improve mood and motor performance and reduce fatigue in mild-to-moderate Parkinson's disease. Aerobics includes treadmill training, bicycle, walking, yoga, swimming, etc. Aerobics is a useful adjuvant therapy with other rehabilitation approaches [74].

The current study reports that physical therapists recommend assistive devices such as canes, walkers, etc., but there is controversy in evidence from the literature review about the use of assistive devices. Some studies suggest assistive devices might increase the freezing episodes of Parkinson's gait. Other studies suggest that canes, walkers, etc. improve movement ability and balance and prevent falls. These devices increase the support base, thus enhancing the sense of safety and confidence. A handheld ACT device, power wheelchair, or scooter can be recommended in patients with tremors, balance impairment, poor posture and endurance [75–77].

Cardiovascular complications are considered the most common cause of death in Parkinson's disease. Due to posture abnormality, chest expansion is restricted and patients experience respiratory dysfunction [78]. Several benefits of aquatic therapy were reported in the literature from immersion in warm water among patients of PD [79, 80]. A study conducted in 2020 reported an increase in mean diastolic pressure, heart rate and double product in Parkinson's disease patients with cardiovascular complications after sessions of aquatic therapy [81]. This stands in contrast to the present study, in which no physical therapist used aquatic therapy as a choice of treatment for PD.

The focus of rehabilitation has shifted from a biological to a bio-psychosocial model. Rehabilitation is now aimed at improving functional activities and community participation, which are two major concerns for patients with neurological deficits [36]. Exercises that are patient-specific should incorporate functional activities of the affected limb(s). Physical therapy is a time-consuming treatment option, while the major issue during rehabilitation is the patient's lack of motivation and lack of engagement in the exercise plans. VR is a recent innovative technology that has significant benefits for PD patients and can help them achieve their best recovery outcomes and with minimal risk of injury. Thus, it seems likely that augmented simulation (VR) will allow PTs to overcome many rehabilitation challenges in the coming years [82]. According to the current study, 135 of the 149 Neuro PTs knew about VR and 133 knew about MI, whereas only 4.8% of Pakistani PTs used VR and 1.85% used MI, respectively. However, studies on VR have shown good effects in early patient recovery, especially enhanced postural control and decreased fall risk. Patients get somatosensory input while exercising in demanding virtual surroundings. Patients' dynamic balance, walking speed, and quality of life also improved using the Wii Fit VR system. According to Liao et al. [83], the Wii Fit was superior to standard treatment. MI has lately been discovered as a viable therapy in PD rehabilitation. This unusual rehabilitation method increases motor learning via imagination, says one study. MI enhances the patient's functional abilities and motor performance [84].

Conclusions

Our study revealed that neurological PTs employ the H&Y Scale to evaluate the disease stage and severity, BI to assess function, the meter walk test to assess gait, the MMSE to assess cognition, and the UPDRS to assess disease-specific measures. PTs use mirror therapy, exercise, motor learning, and task-oriented training to improve balance. Neurological PTs employed PNF to decrease stiffness and exercise and task-focused training for functional training. Moreover,

most PTs do not use innovative technologies for the rehabilitation of PD patients.

Recommendations

The current literature focuses on the beneficial effects of using innovative technologies in the rehabilitation of PD with results obtained in a short time period and sustained for a longer duration. Therefore, the combined use of new, innovative techniques with routine physiotherapy in the physical rehabilitation of Parkinson's disease is recommended and may contribute to better outcomes.

Limitations

Data were collected from two main cities, and the study questionnaire included most of the relevant questions relating to the assessment and interventions of Parkinson's disease. In future studies, we may add further questions regarding such areas as external cueing and over-ground gait training regarding gait, which weren't addressed in this study.

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Conflict of interest

The authors state no conflict of interest.

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