Original Article

Effect of Task Specific Training on Activities of Daily Living and Functional Balance Among Parkinson's Disease Patients: A Pilot Study

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Abstract

Background: In Parkinson's disease (PD) patients fear of falling, independence in day-to-day activities, and functional balance are interconnected. These impairments can significantly limit functionality and lead to disability, increasing the risk of falling by 46%. Falls can result in severe injuries and reduced quality of life.

Purpose: The main purpose of this study was to examine the effects of task-specific training on the functional balance and Activities of Daily Living (ADL) in individuals diagnosed with PD.

Materials and Method: 10 patients of the both genders who had idiopathic PD ranged from Stage I to III on the Hoehn & Yahr (H&Y) scale. Participants received task specific training for three days a week on alternate days for 8 weeks. The Unified Parkinson's Disease Rating Scale (UPDRS) parts II, Berg Balance Scale (BBS), and Activities-specific Balance Confidence (ABC) Scale were used as outcome measures. The data was tabulated and analysed using sigma plot software.

Results: The results showed significant improvement in functional balance on BBS from 45.60±2.36 to 50.40±1.95, ADL on UPDRS part II from 22.50±1.95 to 16.70±1.63, balance confident on ABC scale from 68.12±2.20 to 78.24±2.61 at the end of 8 weeks, with a p-value of < 0.01.

Conclusion: The study concludes that the task specific training significantly improves functional balance, independence in ADL and reduces fear of fall among PD patients.

Key Words: Fall, Quality of life, Balance, Parkinson disease, Mobility.

Introduction

Parkinson's disease (PD) leads to significant consequences such as compromised balance and reduced mobility. The ability to carry out daily activities independently, known as functional independence, is closely linked to maintaining balance and mobility. These aspects play a vital role in performing Activities of Daily Living (ADL). Motor disturbances associated with PD can contribute to the gradual decline of balance and mobility, exacerbating the challenges faced by individuals with the condition[1]. These impairments frequently lead

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to significant functional limitations and disabilities, which makes the person more likely to fall. A four-month fall rate of forty-six percent indicates that stumbling is not only frequent in people with PD, but it also carries the risk of significant damage. Grey and Hildebrand discovered that forty percent of falls resulted in injuries. When the fall was caused by propulsion, fifty-six percent of cases had injuries. In addition, 10 years following evaluation, those with PD had a 20-fold increased risk of fractures to their hips compared. Falls-related injuries can eventually result in hospitalisation, wheelchair confinement, and/or a crippling dread of future falls, all of which may negatively impact Quality-of-Life (QoL)[2]. ADL depends on a person's motor, cognitive abilities and perception skills and serves as an important barometer of their functional ability. When patients struggle with doing ADLs, they depend on people or mechanical devices, which puts them at risk and decreases their QoL. Additionally, this circumstance increases the pressure on the carers, who are already under considerable stress from caring for the person. The caregiver's physical and mental health may be affected, and there may be a reduction in the amount of care given to the patient as a result of this load[3]. ADL performance deteriorates with the progression of PD, monitoring disease development, improving care, and reducing the burden of the condition are all aided by assessing ADL limits[4]. At present, Parkinson's disease lacks a definitive cure. Existing treatments focus on easing motor symptoms, but full motor function restoration remains elusive. Approaches include medications like levodopa to boost dopamine levels and deep brain stimulation, though some symptoms may not respond to drug-based interventions[5]. Patients worry that their movement problems, such as shaking hands, instability in their posture, and gait disruption, would cause them to lose control over their everyday lives. Unusual symptoms may cause a sense of social isolation[6]. Dopamine treatment for PD appears to increase gait-related mobility but not reactionary postural reflexes, thereby raising the risk of falls, rehabilitation and physical activity might help to lessen this[7].

Task-specific training is a form of therapy that focuses on practicing functional tasks relevant to the individual's daily activities and specific challenges they face due to their condition. By targeting these tasks in a structured and repetitive manner can improve motor skills and functional abilities related to balance and ADL.

Aim

The aim of the study was to investigate the effect of task-specific training on functional balance and ADL among PD patients.

Materials and method

This is a pilot study carried out in a private medical hospital in Chennai during the period between June 2022 and September 2022. 30 patients who had PD were screened, and the convenience sampling technique was used to include 10 PD patients according to the inclusion and exclusion criteria.

Inclusion criteria

- Idiopathic PD patients,
- PD patients aged between 60-75 years,
- PD Patients who were in stage 1, 2 and 3 of Hoehn and Yahr stage.

Exclusion criteria

- PD patients with psychological disorders,
- PD patients with cognitive impairments,
- PD patients with dementia,
- PD patients who are in irregular medication.

Outcome measures

1. The Berg Balance Scale (BBS) is a popular clinical evaluation instrument for evaluating a patient's stability and balance while doing different functional tasks. It is especially made to measure balance and the danger of falling in elderly people and people with mobility issues. The scale consists of 14 various activities that evaluate both static and dynamic balance, from standing and sitting balance to walking and turning tasks. Depending on the degree of independence and stability displayed, assign a score between 0 and 4. Higher scores indicate greater balance and a lower chance of falling. The total score runs from 0 to 56[8].
2. The Unified Parkinson's Disease Rating

Scale (UPDRS) Part II is particularly concerned with the ADL of people with PD. It evaluates numerous motor components of daily functioning activities and offers an understanding of how the illness affects a patient's capacity to carry out such chores. Range of total scores: 0-52 A higher score means that you depend more on other people to do daily tasks[9].

3. The Activity-Specific Balance Confidence (ABC) scale measures a person's confidence in their ability to keep their balance while engaging in particular activities. Participants are asked to assess their degree of confidence in performing each task on a scale from 0% to 100%. This method is frequently used with elderly people or those who have balance problems[10].

Procedure

The selected participants were clearly explained about the research procedure and informed consent was obtained. BBS, UPDRS Part II and ABC were assessed as Pre-test values before proceeding to the training. The task-specific training program was carefully crafted to meet the specific needs and capabilities of the patient and was given to the patient for 8 weeks, with the primary objective of improving their balance and functional abilities. The program comprises ten distinct workstations, each tailored to target different aspects of balance and functional performance. To ensure the patient's readiness and prevent injuries, the program starts with a thorough 10-minute warm-up session. The warm-up includes a range of dynamic exercises, such as marching in place, neck circles, arm swings, shoulder circles, trunk rotation, active stretching of hip flexors, hamstring and calf. The program's design emphasizes progressive difficulty and complexity, allowing the patient to gradually challenge themselves as they progress. As the patient gains confidence and mastery at each workstation, the level of difficulty is increased to promote continuous improvement. Throughout the activities at each workstation, the patient is encouraged to hold an object, which adds an extra element of challenge. By integrating object-holding into the exercises, the patient's stability and proprioception are further developed, enhancing their overall balance and functional performance. At each workstation, the patient completes a set of tasks specifically tailored to target different aspects of balance and functional ability. After completing all the tasks at a workstation, the patient is given a one-minute interval for rest and recovery before moving on to the next workstation (Table 1). Post-test values are recorded as the same as pre intervention values at the end of 8th week and the values are tabulated and analysed.

Table 1: Task specific training

Workstations	Progression
1. Rising from chair to standing	1. Different chair heights 2. Rubbery surface
2. Chair-to-6-meter walk	1. Different chair heights 2. Rubbery surface
3. Negotiating three-meter obstacles	1. Obstacles with different heights 2. Rubbery surface
4. Step-up exercises	Different stepper heights
5. Six-meter object retrieval while walking	Rubbery surface
6. Figure of eight gait pattern walking	Rubbery surface
7. Ascending and descending stairs with rail support	1. Progression of step heights from 15 cm to 20 cm 2. Rubbery surface.
8. Touching several points marked in a semicircle	1. Rubbery surface. 2. During the task, the patient has to hold the objects in their hand.
9. Standing and reaching for an object placed in front of them	1. Placing feet wider, together and in tandem position. 2. On a stable and rubbery surface.
10. Balancing on a foam platform	During the task the patient has to hold the objects in the hand.

Data Analysis

The demographic data of the participants were analysed using descriptive statistics, including measures such as the mean and standard deviation which has been represented in Table 2. Pre-test values and Post-test values of BBS, UPDRS Part II and ABC are analysed by Wilcoxon signed rank using sigma plot software.

Results

The results showed significant improvement in functional balance on BBS from the mean value of 45.60±2.36 to 50.40±1.95, ADL on UPDRS part II from the mean value of 22.50±1.95 to 16.70±1.63 and balance confident on ABC scale from the mean value of 68.12±2.20 to 78.24±2.61 at the end of 8 weeks training, with a *p*-value of < 0.01 (Table 3).

Table 2: Demographic characteristics of the participants

Age (Mean±SD)	65.8 ± 3.42
Hoehn and Yahr stage	
Stage 1	2
Stage 2	6
Stage 3	2
Disease duration (Mean±SD)	3.8± 1.16

Table 3: Comparison of Pre-test values and Post-test values

Outcome	**Pre-test (Mean±SD)**	**Post-test (Mean±SD)**	**p-value**
BBS	45.60±2.36	50.40±1.95	< 0.01
UPDRS PART II	22.50±1.95	16.70±1.63	< 0.01
ABC	68.12±2.20	78.24±2.61	< 0.01

Discussion

This research evaluated the task-specific training on functional balance and ADL in PD patients. The program's structure ensures that the patient engages in a wide variety of activities, targeting various muscle groups and movement patterns. This comprehensive approach helps to address any potential imbalances and enables the patient to progress holistically in their balance and functional capabilities. This personalized approach ensures that the patient is consistently challenged while maintaining a safe and effective training environment. In a pilot study in order to improve gait performance among PD patients, a series of dual task training programs was developed and Four weeks of one-on-one training sessions were dedicated to walking while carrying out various cognitive activities. The outcomes showed that following the four-week training program speed of walking and gait variation during DT greatly improved, which also states that a Task-specific DT gait training program for PD patients is feasible to implement. Even in tasks that were not particularly addressed, the training program had a favourable impact on DT gait performance[11]. One of the most important things in rehabilitation is the surrounding environment which plays a key role in the outcome of the patients. According to the previous study participants walked every day for a week in the Swedish highlands for two years in a row. Low-intensity exertion, a lack of time constraints, and minimal group contact were the defining characteristics of the walking exercise. The results of the study emphasize how interdependent the environment, body, and mind are. This relationship becomes more important when a person has a disease like PD, which affects their capacity to regulate their bodily motions, voluntary mobility, and energy levels[12,13]. Steno Rinalduzzi et al. stated Multiple sensory inputs must be integrated in order to produce the proper neuromuscular reactions, which in turn trigger motor modifications for posture control. In the sensory regulation of balance, the proprioceptive, vestibular, and ocular systems all play important roles[14]. Cognitive impairment is also an important symptom in PD. Recent research stated complex everyday tasks might be challenging for PD patients with minor cognitive impairment. Functional activities can be used to mix cognitive and physical training to improve cognitive functioning, results also showed significant improvement[15,16]. Motivated people may experience hurdles related to their particular diseases that prevent them from engaging in regular exercise[17]. Fear of falling, independence in day-to-day activities, and functional balance have a significant association that may be impacted by the medication phase and the severity of the illness, The

cortisol level measurements has been found associated with the fatigue levels in parkinson's disease[18] Lack of physical activity contributes to gradual declines in the performance of ADL. On the other hand, engaging in regular exercise can stimulate dopamine synthesis in the remaining dopaminergic cells, helping to counteract the negative impacts and potentially improve ADL performance[19]. By following this task-specific training program, the patient can expect to see steady improvements in their balance, stability, and overall functional performance, ultimately leading to enhanced mobility and QoL. This study has a couple of limitations, including the exclusion of individuals with cognitive impairment and a relatively short training duration of 8 weeks. For future research, the authors recommend expanding the sample size to improve the study's statistical power. Additionally, they suggest including cognitively impaired PD patients to gain better insights into outcomes for this subgroup. Furthermore, the authors propose conducting a comparative study between task-specific training and game-based training to determine which approach is more effective in rehabilitating PD patients.

Conclusion

This study concludes that task-specific training has a substantial positive impact on PD patients. It significantly enhances functional balance, leading to improved independence in performing daily living activities. Furthermore, the training regimen effectively reduces the patients' fear of falling, addressing a common concern of PD patients. These findings highlight the potential of task-specific training as a valuable intervention to enhance the overall quality of life for PD patients and minimize the risks associated with falls.

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