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Targeted Balance Training in Parkinsonism with Type 2 Diabetes and Hypertension: A Case Study

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Abstract

Parkinsonism is a progressive neurological disorder where postural instability and impaired balance significantly elevate the risk of falls, especially in elderly individuals with comorbidities. The presence of Type 2 Diabetes Mellitus and hypertension further exacerbates fall risk by impairing sensory and cardiovascular responses. Early, structured physiotherapy interventions may mitigate fall risk and improve functional mobility.
A single-subject case study was conducted involving a 75-year-old male diagnosed with idiopathic Parkinsonism (Hoehn and Yahr Stage 2), with controlled diabetes and hypertension. A 6-week physiotherapy program focuses on balance training, lower limb strengthening, and cognitive-motor integration. Sessions were conducted five times per week, lasting 45 minutes each. Outcomes were measured using the Berg Balance Scale (BBS) and Timed Up and Go (TUG) test at baseline and post-intervention. The patient showed significant improvement in both outcome measures. BBS scores increased from 35/56 to 48/56, indicating enhanced static and dynamic balance. TUG time decreased from 22.4 to 13.8 seconds, reflecting improved functional mobility and reduced fall risk. The intervention was well tolerated, with no adverse events reported. This case highlights the efficacy of a structured physiotherapy program tailored to the needs of an elderly Parkinsonism patient with multiple comorbidities. The improvements in balance and mobility underscore the importance of early intervention and individualized care. Integration of comorbidity-specific precautions further ensured safety and participation, promoting functional independence and fall prevention.

Keywords

Parkinsonism, Fall prevention, Physiotherapy, Balance training

Introduction

Parkinsonism is a progressive neurological disorder characterized by bradykinesia, rigidity, postural instability, and resting tremors. Among these, balance impairment and postural instability are the leading contributors to falls and reduced quality of life in the elderly population. Patients

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in Hoehn and Yahr Stage 2 may present with bilateral motor involvement and subtle gait disturbances, making early intervention essential to prevent future falls. Comorbid conditions such as Type 2 Diabetes Mellitus and hypertension compound the risk due to peripheral neuropathy, reduced proprioception, and cardiovascular fluctuations, necessitating a multidisciplinary and tailored approach. (Bloem et al., 2001) Falls are a leading cause of injury, hospitalization, and morbidity in older adults with Parkinsonism. Functional impairments such as delayed motor responses, freezing episodes, and poor postural adjustments increase vulnerability to falls during everyday tasks, especially while multitasking or turning. Additionally, diabetes-related sensory deficits and hypertension-related orthostatic challenges can mask or exacerbate Parkinsonian symptoms, requiring vigilant therapeutic oversight. Physiotherapy plays a central role in mitigating these risks by targeting core components of balance, gait coordination, and lower extremity strength. The purpose of this case study is to underscore the importance of early, individualized physiotherapy in reducing fall risk and enhancing safety in daily functional mobility among older adults with multiple comorbidities (Ashburn et al., 2001; Mirelman et al., 2016)

Methodology

A single-subject case study design was used. The study was conducted on a home care setting in south India, Tamil Nadu. The patient was assessed at baseline and after 6 weeks of physiotherapy intervention. The intervention (Table1) comprised supervised physiotherapy sessions, 5 days per week, lasting 45 minutes per session. Exercises targeted static balance, dynamic balance, lower limb strengthening, and dual-task gait activities. Modifications were made according to patient tolerance, blood glucose levels, and blood pressure readings. The exercise protocol was progressively advanced every two weeks based on patient performance and safety.

The physiotherapy intervention utilized simple and accessible materials including a sturdy chair for sit-to-stand exercises, foam balance pads for proprioceptive training, resistance bands for lower limb strengthening, and obstacle markers such as cones and floor tape for gait tasks. A metronome was employed to provide rhythmic auditory cues during walking, and a stopwatch was used to assess functional mobility during outcome testing. Two validated outcome measures (Table 2) were employed to track progress: the Berg Balance Scale (BBS), a 14-item tool used to assess both static and dynamic balance with a maximum score of 56, and the Timed Up and Go (TUG) test, which measures the time taken to rise from a chair, walk 3 meters, turn, return, and sit—indicating functional mobility and fall risk. Prior to initiating the program, written informed consent was obtained from the patient after clearly explaining the nature, goals, and potential risks of the intervention (Allen et al., 2013; Duncan et al., 2011a; Shulman et al., 2002).

Table 1. Exercise Protocol Table: Balance and Strengthening Program

Week	Warm-Up (5–10 min)	Balance Training	Strengthening	Gait & Dual Task	Progression Notes
1–2	Marching in place, Shoulder rolls	Tandem stance, Weight shifting	Sit-to-stand, Heel raises	Straight line walk	Static support, 2 sets
3–4	Arm swings, Ankle pumps	Single-leg stand with chair, Mini squats	Resistance band leg press	Obstacle stepping	Add foam surface, 3 sets
5–6	Slow step marching, Neck ROM	Balance on foam pad, Eyes-closed tandem	Step-ups, Wall push-ups	Dual-task Walk (counting, color-naming)	Reduce support, challenge speed

Table 2. Assessment Tools (Outcome Measures)

Outcome Measure	Description	Baseline Score	Final Score (after 6 weeks)
Berg Balance Scale (BBS)	14-item scale measuring static and dynamic balance. Max score: 56. Higher is better.	35/56	48/56
Timed Up and Go (TUG) Test	Time (in seconds) to stand from a chair, walk 3m, return and sit. Lower is better.	22.4 sec	13.8 sec

The treatment plan (Table 1) was implemented over a duration of six weeks, with five supervised sessions per week, each lasting 45 minutes. The exercise protocol was structured into progressive phases focusing on balance, strength, and gait training. In Weeks 1 and 2, warm-up

activities included marching in place and shoulder rolls, followed by basic balance exercises such as tandem stance and weight shifting. Strengthening focused on functional movements like sit-to-stand and heel raises, while gait training involved straight-line walking with static support, typically performed in two sets. Weeks 3 and 4 introduced more dynamic warm-ups such as arm swings and ankle pumps, progressing to single-leg stance with chair support and mini squats for balance, and resistance band leg presses for strengthening. Gait training included obstacle stepping, and a foam surface was introduced to challenge proprioception, with exercises increased to three sets. In Weeks 5 and 6, the patient performed more complex warm-ups like slow step marching and neck range of motion exercises. Balance was challenged using a foam pad and eyes-closed tandem stance, while strength training advanced to step-ups and wall push-ups. Dual-task walking, such as walking while counting or naming colors, was added to improve cognitive-motor integration. Progressions focused on reducing external support and gradually increasing task complexity and walking speed (Mak & Pang, 2009; Horak et al., 2015)

The intervention guidelines were carefully tailored to address the patient's multiple comorbidities. General precautions included monitoring blood pressure and blood glucose before and after each session, ensuring a well-lit and clutter-free environment, incorporating hydration breaks, and using external cues like verbal prompts and metronomes. Deep breathing exercises were encouraged to reduce rigidity. Specific considerations involved avoiding high-intensity isometric exercises due to hypertension, promoting slow transitions (such as sit-to-stand) to prevent orthostatic hypotension, and ensuring proper foot care and supportive footwear due to the diabetes-related risk of peripheral neuropathy. As a result of the structured program, the patient demonstrated improved dynamic balance, increased walking confidence, significant reduction in fall risk, enhanced postural control during daily activities, and noticeable gains in lower limb strength and reaction time (Van et al., 2016; Canning et al., 2006; Duncan et al., 2012).

Results and Discussion

Parkinsonism in older adults often presents with progressive motor symptoms such as bradykinesia, rigidity, and postural instability, all of which contribute to an increased risk of falls. In this case, the patient, although in Hoehn and Yahr Stage 2, reported near-falls and instability during walking, especially while turning or multitasking, suggesting early balance impairment. These symptoms were compounded by two prevalent comorbidities: Type 2 Diabetes Mellitus and hypertension. Diabetes can cause peripheral neuropathy and reduced proprioceptive input, while hypertension may lead to episodes of orthostatic hypotension. Both factors potentially increase fall risk and complicate rehabilitation outcomes if not carefully managed (Koller et al., 2010; Fasano et al., 2015).

Table 3. Improvement in Outcome Measures Following a Six-Week Structured Physiotherapy Program

Outcome Measure	Baseline	Post-Intervention	Clinical Interpretation
Berg Balance Scale (BBS)	35	48	Substantial improvement; closer to the threshold for independent mobility

Timed Up and Go (TUG) Test	22.4 sec	13.8 sec	Improved functional mobility; reduced fall risk; approaching normative range

The structured physiotherapy program implemented in this case emphasized a multifaceted approach to fall prevention. Exercises targeting static and dynamic balance, lower limb strength, and cognitive-motor dual tasks were progressively introduced across six weeks. The progression was designed to stimulate neuromuscular control, proprioception, and postural strategies. Dual-task walking, such as counting or naming objects while walking, addressed cognitive-motor interference, which is common in Parkinsonism and is associated with freezing episodes and falls. Importantly, careful monitoring of blood pressure and glucose levels, along with environmental safety measures and activity modifications, ensured that comorbid conditions did not hinder participation or safety (Duncan et al., 2011b; Lord et al., 2013).

The significant improvements observed in both outcome measures support the effectiveness of this approach. The Berg Balance Scale (BBS) score improved from 35 to 48, indicating a substantial improvement in both static and dynamic balance performance. Similarly, the Timed Up and Go (TUG) test time reduced from 22.4 to 13.8 seconds, moving closer to the normative range for older adults and suggesting improved mobility and fall risk reduction (Table 3). These changes not only reflect physical improvement but also correlate with increased confidence in mobility, reduced fear of falling, and likely improvements in quality of life. (Powell & Myers, 1995; Berg et al., 1992; Podsiadlo & Richardson, 1991). Tailoring rehabilitation protocols to account for medical comorbidities, using outcome-driven measures, and promoting functional independence should remain central to fall prevention strategies in geriatric neurorehabilitation (Cavanaugh et al., 2012; Keus et al., 2007).

This case study, while demonstrating positive outcomes from a structured physiotherapy program in a patient with Parkinsonism and multiple comorbidities, has several limitations. As a single-subject design, the findings lack generalizability and cannot establish causality. The absence of long-term follow-up limits understanding of sustained benefits and fall recurrence. Additionally, no cognitive assessments were performed despite cognitive-motor integration being a part of the intervention. However, the study's strengths include a comprehensive, individualized approach that accounted for comorbidity-related risks, use of validated outcome measures (BBS and TUG), and high adherence without adverse events. Future studies should consider larger sample sizes, inclusion of cognitive and quality-of-life metrics, and longitudinal monitoring to evaluate the durability of intervention effects and guide evidence-based recommendations for fall prevention in complex geriatric populations.

Conclusion

This case study demonstrates that a carefully designed, individualized physiotherapy protocol integrating balance training, strengthening, and dual-task gait exercises can significantly enhance postural stability and functional mobility in older adults with Parkinsonism, even in the presence of common comorbidities like diabetes and hypertension. The notable improvements in BBS and TUG scores provide strong evidence of reduced fall risk and better neuromotor coordination.

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