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Effect of balance training on gait and Activities of daily life in parkinson's patients

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Abstract
Background: Parkinson's disease (PD) is a progressive neurological disorder that commonly affects balance, gait, and motor function, increasing the risk of falls and impairing quality of life. Rehabilitation strategies such as balance training and resistance training have shown promise, but their comparative effectiveness remains underexplored.
Aims and Objectives: To compare and evaluate the effects of balance training and resistance training to improve gait and activities of daily living in people with Parkinson's disease.
Methodology: Thirty participants with Parkinson's disease were randomly assigned into two groups: Group A received balance training and Group B received resistance training, over a 12 weeks of intervention period. Outcomes were measured using the Unified Parkinson's Disease Rating Scale (UPDRS) for motor function and gait. Pre- and post-test scores were analyzed within and between groups using paired and unpaired t-test.
Result: Both groups showed significant improvements in Unified Parkinson's Disease Rating Scale (UPDRS) scores post-intervention ($p < 0.05$). However, Group A (balance training) demonstrated significantly greater improvements compared to Group B (resistance training). The mean improvement in Unified Parkinson's Disease Rating Scale (UPDRS) was 27.06 in Group A versus 18.80 in Group B.
Conclusion: Balance training was more effective than resistance training in improving gait and functional activities in individuals with Parkinson's disease.

Keywords: Parkinson's disease, Gait, Balance training, Resistive training

Introduction

Parkinson's disease (PD) is increasing globally at remarkable speed and growing impact from global aging, longer life expectancy and an aging population [1].

The 2021 Global Burden of Disease (GBD) report provides additional information about Parkinson's disease in public health. Parkinson's disease is expected to affect 11.77 million individuals worldwide in 2021, with an age-standardized prevalence rate of 138.63 per 100,000 persons [2]. This accounts for a 274% rise of cases compared to 1990 when the worldwide burden was projected at approximately 3.15 million cases [6]. Global burden of new cases (incidence) was calculated to be 1.33 million in 2021 [3].

The burden of PD has also considerably increases in India. According to a national estimate, 771,000 people were affected in 2019 and disease led to more than 45,000 deaths in 2019 [4]. Prevalence rates in Indian community-based studies showed a distribution of between 33 and 192 per 100,000, according to regional variations and age groups studied. These increasing numbers show a dire requirement for enhanced diagnosis, treatment approaches, and rehabilitation services to deal with the rising burden of PD, especially in developing environments such as India [5].

The most prevalent condition that underlies a variety of parkinsonian movement abnormalities is PD. Bradykinesia, muscle rigidity, resting tremor, and postural instability are its main motor signs [6].

The most common and incapacitating motor decline in PD is gait impairment, which leads to decline in movement and capacity for autonomy. Decreased stride length, reduced speed, shuffling steps, increased steps per minute, and reduced arm swing on the afflicted side are typical gait abnormalities in PD [7].

These deficits are mostly recognized to disturbances in basal ganglia circuits, which control the automaticity and rhythmicity of biomechanical patterns. It interrupts internal cueing

systems, causing the patient to use conscious control to initiate and sustain gait, which is less effective and more subject to errors [8].

The effectiveness of multidisciplinary rehabilitation strategies focused on: gait training, balance exercises, cueing strategies and strengthening are very important for gait rehabilitation of PD and reduction in falls [9].

Balance training has been developed to enhance postural stability and gait function in persons with PD. Because of critical contribution of altered balance to increased fall risk and decreased mobility, balance-based rehabilitation programs were developed to facilitate sensory integration, improve posture, and motor coordination [10]. Exercises such as weight shifting, as well as static and dynamic standing tasks, stepping strategies, and challenging sensory conditions, have been shown to significantly improve postural sway and stability limits in PD patients [11].

The most challenging part about PD is how it messes with balance and getting along. As the disorder worsens, individuals may develop shorter steps, slowly move about during walking, and walk on shuffling legs. These alterations not only complicate simple walk-in everyday life but increase dependence. Thus, the study proposed to evaluate the effect of balance training and resistance training on gait in parkinson's individuals.

Methodology

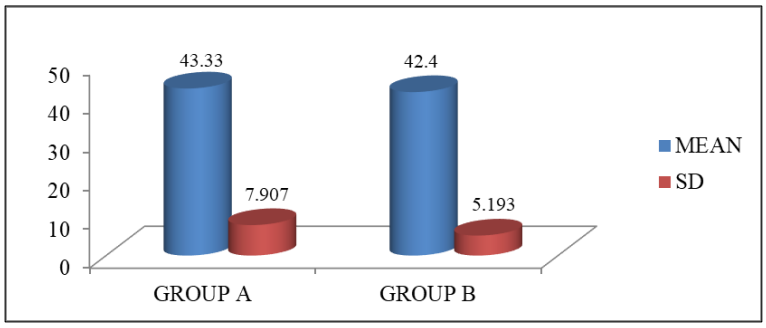
Thirty Parkinson's disease confirmed individuals as per predefined criteria, were recruited and then randomly assigned to gain data and were split into two groups, A and B following eligibility screening and they completed the screening process and handed over written consent to each participant. Balance training was given to group A. Group B was shown to complete resistance training. Each exercise session was under supervision to ensure adequate methods and safety. All participants of each group have adhered to their protocol of 45 minutes in a session for five days a week for overall 12-week period. Before the study, and again after a 12-week intervention period, participants completed a series of standardized assessments that was aimed at measuring ADL and gait performance. ADL and gait outcomes were measured Unified Parkinson's Disease Rating Scale (UPDRS) [12]. Pre-test outcome measures were recorded on beginning of the study and post-test data collected after 12 weeks.

Results

1. Between Groups: UPDRS

Table: 1 Between-Group Comparison of Pre-Test Unified Parkinson's Disease Rating Scale (UPDRS) Scores

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	43.33	15	7.907	2.04	0.93	2.714	0.7915	0.4353
B	42.40	15	5.193	1.34				



Graph: 1 Comparison of Pre-Test UPDRS Scores Between Group A and Group B

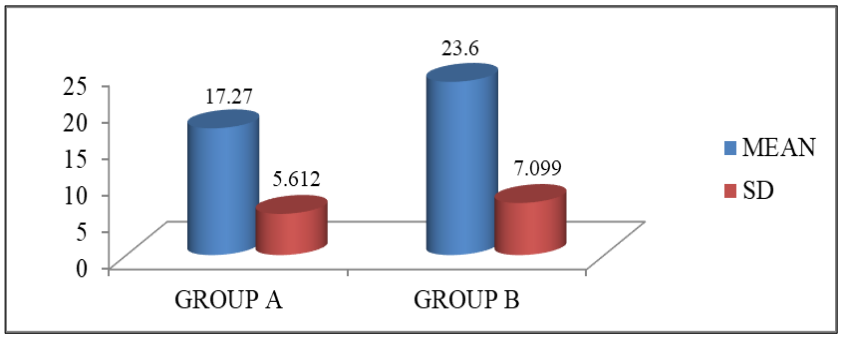
Interpretation

The mean UPDRS pre test value for Group A was 43.33 and Group B obtained 42.40. The mean difference of 0.93 (t = 0.7915, p = 0.4353) was not significant. These results indicate the similarity of scores from the beginning of the study.

2. Between Groups: UPDRS

Table: 2 Between-Group Comparison of Post-Test Unified Parkinson's Disease Rating Scale (UPDRS) Scores

Group	Mean	N	SD	SEM	Mean Diff	SD Diff	T	P
A	17.27	15	5.612	1.45	5.33	1.487	2.710	0.0113
B	23.60	15	7.099	1.83				



Graph: 2 Comparison of Post-Test UPDRS Scores Between Group A and Group B

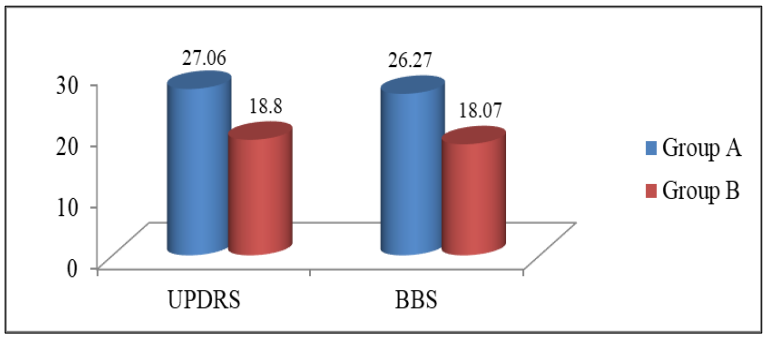
Interpretation

The mean post intervention value in Group A was 17.27 and Group B was 23.60. Between-group mean difference was 5.33, which was statistically significant with t = 2.710 and p < 0.05 was 0.0113. Results showed markedly greater UPDRS scores of Group A after intervention than Group B. The results indicate that balance training had more beneficial effects than resistance training in ADLs, gait, and functional performance compared to Parkinson's disease patients.

3. Mean Improvement

Table 3: Mean Improvement in Unified Parkinson's Disease Rating Scale (UPDRS) Scores

	Group	N	Mean
UPDRS	A	15	27.06
	B	15	18.80



Graph: 3 Comparison of Mean Improvement in UPDRS Scores Between Group A and Group B

Interpretation

The mean UPDRS score was greater in Group A (27.06) than in Group B (18.80). Group A showed better enhancement in activities of ADLs, gait, and overall functional performance, indicating that balance training can significantly improve functional outcomes of individuals with PD in their daily life, leading to greater benefits than resistance training activities.

Discussion

There was no difference in the scores on the UPDRS when comparing Group A (balance training) and Group B (resistance training) at pre-intervention versus at baseline. The average UPDRS score for Group A was 43.33 ± 2.04, and Group B had mean 42.40 ± 1.34, with a mean difference of 0.93, t = 0.7915, p = 0.4353. These findings indicate that at primary stage of research both groups exhibited demographic and clinical similarity when compared on the disease severity, motor symptoms, and balance and functional ability. This similarity of baseline is critical for ensuring internal validity of the study. This enables Portney and Watkins, 2015 [14] to ascribe post-intervention differences in motor function and balance outcomes to the training interventions instead of to prior imbalances. Matching start points between groups also mitigates the danger of bias and increases confidence in the causal interpretation of intervention effects.

Post-intervention comparison of the UPDRS between Group A (balance training) and Group B (resistance training) indicated substantial gain in UPDRS scores favoring the balance training group. Group A had a mean post-test score of 17.27 ± 1.45, and Group B had a (worse) mean score of 23.60 ± 1.83. Between them, the mean difference is 5.33 (t-value 2.710; p-value 0.0113), suggesting that balance training yielded a better motor symptom change and better function impairment on a daily basis, and balance recovery enhanced motor output. This result corroborates King *et al*., 2013; [14] Canning *et al*., 2012 [15] supporting the effectiveness of task-specific, sensorimotor-based training compared to strength-based exercise in PD when assessing functional outcomes. Balance training probably engages several systems, proprioception, postural reflexes, and anticipatory control, which are frequently compromised in Parkinson's disease and cannot always counter by resistance training alone. Allen *et al*., 2010 [16] highlighting marked gains in postural control, mobility, and functional independence post-balance-specific training in people experiencing Parkinson's, in which balance focused training improves postural control, mobility and functional independence in affected individuals with Parkinson's disease. Balance training has been reported to improve sensory-motor integration and postural strategies which are frequently compromised in PD, mainly associated with basal ganglia dysfunction (Horak *et al*., 2009) [17]. Thus, although both programs did achieve statistically significant benefits on UPDRS scores in groups, balance training was discovered to be a more effective, independent treatment strategy for motor dysfunctions associated with PD.

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