International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 09 Issue: 04 | April - 2025 SJIF Rating: 8.586 ISSN: 2582-3930

Effect of Integrated dual task training and Consecutive dual task training on Balance and Gait velocity among Parkinson's disease patients: A Comparative study

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Acknowledgment: None

Author contribution: Concept and design—Aiman, Senthil Kumar, Priyadharshini; Data collection— Aiman, Senthil Kumar; Data analysis—Aiman, Priyadharshini; Drafting manuscript— Aiman, Senthil Kumar, Priyadharshini; Final review— Senthil Kumar, Priyadharshini; Submission and Revisions—Senthilkumar, Aiman.

Declaration of conflicting interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article

Funding: Not applicable

Ethical approval and informed consent statements: This study was approved by the Institutional Scientific review board (REF no:04/002/2023/ISRB/SR/SCPT). All the participants were provided with the information sheet and informed consent form prior to the commencement of the study

Data availability statement: The data supporting the findings of this study are not publicly available due to ethical reasons. Access to the data may be restricted to protect participant privacy or confidentiality.

Abstract:

Background: In this study, Parkinson's disease patients underwent evaluation of gait velocity and balance concerning Integrated dual task training (IDTT) and Consecutive dual task (CDTT) training. The Berg Balance Scale and 10-meter Walk Test (10MWT) were utilized for assessment. Participants were randomly assigned to either Integrated dual task training (IDTT) or Consecutive dual task training (CDTT) groups based on pre-test results. Post-test evaluations aimed to measure improvements in balance and gait velocity. This research explores innovative methods of rehabilitation using both the dual task training, offering promising guidelines for future therapeutic approaches.

Objective: To compare the effect of Integrated dual task training (IDTT) and Consecutive dual task training (CDTT) on balance and gait velocity among Parkinson's disease patients.
Methods: Subjects diagnosed with Parkinson's disease underwent assessment of motor symptoms, functional mobility, and balance. Pre-tests using the Berg Balance Scale and 10MWT were conducted to gather baseline data. Participants were randomly divided into Integrated dual task training (IDTT) or Consecutive dual task (CDTT) training groups, with treatment occurring four days a week for eight weeks. Pre- and post-test assessments measured outcomes using the 10MWT and Berg Balance Scale and effectiveness of intervention was evaluated.
Results: The study revealed significant improvements in gait velocity and balance following IDTT. Statistical analysis indicated a notable difference between pre- and post-test measurements.

Conclusion: Based on the study results, it can be concluded that IDTT significantly improves balance and gait in people with Parkinson's disease.

Keywords: Parkinson's disease, dual task, gait velocity, balance.

1 Introduction

Parkinson's disease (PD) is a chronic neurodegenerative condition that decreases dopamine levels, leading to damage in the nerve cells of substantia nigraz [1]. According to the authors of a 2018 article, the prevalence of Parkinson's disease has significantly increased over the past 26 years. The number of patients rose from an estimated 2 million (with a 95% confidence interval of 0–3 million) in 1990 to approximately 6 million (with a confidence interval of 5–73 million) in 2016 [2].

Non-motor impairments in Parkinson's disease include cognitive issues, autonomic dysfunction, dementia, and behavioural disturbances. Motor impairments consist of bradykinesia, muscular rigidity, rest tremor, and postural and gait issues, characteristic of parkinsonism [3]. Research has demonstrated that Parkinson patients are less able to do everyday activities like walking, shifting, getting out of a chair, and climbing stairs, as well as fine motor tasks like holding a pencil. For adequate mobility, these tasks are thought to be necessary [4].

Dopamine transporter single-photon emission computed tomography (DaT SPECT) is a reliable diagnostic tool for Parkinson's disease, detecting reduced uptake of a radioactive tracer binding to dopamine transporters in the basal ganglia. It offers high specificity (98–100%) and accuracy (98–100%) for diagnosing nigrostriatal cell loss in patients [5]. Lundin-Olsson was the first to show that older people who stop walking while having conversations are more likely to fall than those who can continue walking [6].

Dual tasking is the ability to perform two or more physical and mental tasks concurrently. Elderly people may see a reduction in their capacity to perform multitask. This could result in falls during routine tasks that need maintaining balance. Several studies have demonstrated the benefits of dual-task training for older adults who have a history of falls, Parkinson's disease (PD), or stroke. These individuals can improve their balance and reduce their chance of falling [7].

The capacity to carry out two or more mental and physical tasks at the same time is referred to as dual tasking. Since ageing affects both cognitive and physical functions, older adults may experience declines in their ability to perform dual tasks effectively, which could lead to falls during activities of daily living that require balance maintenance. Falls cause fractures, fall-related anxiety, and significant morbidity, which is a serious threat to older adults' quality of life. As a result, therapies aimed at lowering the risk of falls while performing two tasks at once have received a lot of attention. Numerous studies have shown how dual-task training helps older adults who are at high risk of falling, such as those with a history of falls, Parkinson's disease (PD), or stroke, improve their balance and lower their risk of falling [8]. In integrated dual task training (INDT) it includes cognitive and motor task (balance) exercises were done simultaneously. In consecutive dual task training balance exercises and cognitive tasks were performed separately. Cognitive task was initiated

immediately after each motor task (balance exercise-cognitive task-balance exercise-cognitive task). Balance exercises were performed standing up and cognitive tasks were performed while sitting [9].

2 Methods

This study utilized a comparative design to assess the effectiveness of interventions (Integrated dual task training and Consecutive dual task training). Subjects were recruited from old age homes based on predefined inclusion and exclusion criteria. Convenient sampling was employed to select a sample size of 30 participants. Inclusion criteria specified individuals of both genders aged 60 to 85 years without cardiac issues or dementia (as assessed by the Mini-Mental State Examination with a score of ≤24). Exclusion criteria comprised participants unable to stand or walk independently, those who had undergone surgical treatment for Parkinson's disease, and individuals with respiratory or cardiac problems.

2.1 Study Procedure

Thirty subjects with Parkinson's disease were divided into two groups each group (15 each group). Both groups underwent pre-test and post-test assessing Berg balance scale and 10MWT (10-meter walk test). Integrated dual task training groups receive activities includes cognitive and motor task (balance) exercises were done simultaneously such 10-m backwards walk while talking, walking in 8 shaped paths between 2 chairs while listening to music. Remember 5-simple words given at the beginning of the session while sit-down stand-up game simultaneously.
Participants receive training for 45 minutes. Consecutive dual task training group received motor task and cognitive task which is performed separately for example tandem walking and pronouncing vowels after walking, standing on a soft surface with eyes closed and visual imagery games in sitting eyes closed, participant is asked to stand on single leg and while sitting repeat tongue twisters for 6-times. These therapeutic games in both the groups are designed to engage the participants in improving the balance and gait velocity. Throughout the treatment protocol, subjects' progress and adherence to the intervention will be monitored.

3 Result

The pre-test and post- test values were analysed using paired and unpaired t test suggested that Integrated dual task training had significant improvement with a mean (1.1180) in improving gait velocity and mean (44.33) in improving balance than Consecutive dual task training with a mean of (1.1820) in improving gait velocity and mean (36.27) in improving balance among people with Parkinson's disease with a p-value of <0.0001.

4 Discussion

The study's findings contribute to the growing body of evidence supporting the use of dual-task training as a therapeutic intervention for individuals with PD. Both INDT and CDTT were found to be effective in improving gait velocity, which is a crucial aspect of mobility and independence. Slower gait speed has been associated with an increased risk of falls and reduced quality of life in PD patients [10-12]. By enhancing gait velocity through dual-task training, these interventions may potentially mitigate the negative consequences of gait impairments and improve overall functional ability. The results of this study are consistent with previous research that has demonstrated the benefits of dual-task training in improving gait parameters and cognitive-motor integration in individuals with PD [13,14]. Dual-task training addresses the challenges faced by PD patients in performing simultaneous cognitive and motor tasks, which are often encountered in daily life activities. By incorporating cognitive and balance exercises, both INDT and CDTT likely facilitated the integration of cognitive and motor processes, leading to improved dual-task performance and gait velocity.

While both training approaches yielded positive outcomes, the specific advantages of INDT and CDTT may differ. INDT, which involves simultaneous execution of cognitive and balance exercises, more closely mimics real-life situations where individuals are required to perform multiple tasks concurrently. This type of training may better prepare patients for the cognitive-motor demands of daily activities, potentially leading to greater functional improvements and transfer of skills to real-world settings [14]. On the other hand, CDTT, where cognitive and motor tasks are performed separately but

consecutively, may be more suitable for individuals with severe cognitive or motor impairments. By separating the tasks, CDTT reduces the cognitive load and postural instability risks associated with simultaneous performance [15].

This study focused on gait velocity and balance as primary outcomes, other relevant factors, such as cognitive function, dual-task performance, and fear of falling, should also be considered in future research. Dual-task training may have broader implications beyond physical measures, potentially influencing cognitive processes, confidence, and overall quality of life in individuals with PD. Furthermore, future studies should investigate the long-term effects of INDT and CDTT, as well as the potential for combining these approaches with other interventions, such as medication management or deep brain stimulation.

In conclusion, this study contributes to the growing evidence supporting the efficacy of dual-task training in improving balance and gait velocity in individuals with Parkinson's disease. Integrated dual-task training (INDT) is more effective when compared to consecutive dual-task training (CDTT) demonstrated positive outcomes, offering potential therapeutic approaches for addressing the cognitive-motor integration challenges faced by PD patients. While further research is warranted to explore the long-term effects, underlying mechanisms, and potential combinations with other interventions, this study highlights the importance of incorporating dual-task training in the rehabilitation and management of Parkinson's disease.

5 Conclusion

From the results obtained, the study concludes that Integrated dual task training shows significant effect on participants with Parkinson’s Disease compared to Consecutive dual task training group, by comparing the values using (BBS) Berg balance scale and 10-meter walk test (10MWT).

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Table 1 Pre-test and post-test values for IDTT and CDTT group using both 10-meter walk test and berg balance scale:

Outcome	Group	Values	Mean	Sd	t-value	p-value
10m walk test	IDTTT group	Pre-test	1.2133	0.0659	5.5675	<0.0001
		Post-test	1.1180	0.0094		
	CDTT group	Pre-test	1.3000	0.0278	9.3510	<0.0001
		Post-test	1.1820	0.0380		
Berg balance scale	IDTT group	Pre-test	34.87	6.41	7.6482	<0.0001
		Post-test	44.33	6.03		
	CDTT group	Pre-test	30.80	3.36	28.4871	<0.0001
		Post-test	36.27	3.51		

Table 2 Post-test values for both IDTT and CDTT group:

Outcome	Group	Values	Mean	Sd	t-value	p-value
10m walk test	IDTT group	Post-test	1.1180	0.0094	6.3281	<0.0001
	CDTT group	Post-test	1.1820	0.0380		
Berg balance scale	IDTT group	Post-test	44.33	6.03	4.4753	<0.0001
	CDTT group	Post-test	36.27	3.51		