Retention Effect of Dual Task Training on Mobility, Fear of Fall and Quality of Life in Subjects with Parkinson's Disease

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Abstract

Background: Impairment in the ability to perform another task while walking i.e. , dual tasking is associated with an increased risk of fall, diminished mobility, loss of independence leading to decrease in the quality of life among patients with Parkinson's disease. So, the present study aims to determine the retention effect of dual task training on mobility, fear of fall, quality of life.

Method: 30 subjects between the age group of 65-75 years diagnosed with PD were included in the study and were allocated to a single group after fulfilling inclusion and exclusion criteria. Baseline data like age, gender, Hoehn&Yahr stage was noted. Subjects underwent dual task training 5 times a week, for 4 weeks. All the subjects were assessed using Timed Up and Go test, Fall Efficacy Scale and Parkinson's Disease Questionnaire-39.

Results: The dual task training on mobility showed significant improvement in mobility, fear of fall and quality of life in post-test 1. Retention effect (post-test 2) also showed significant improvement but compared to post-test 1 ($p<0.001$), it has reduced ($p<0.05$).

Conclusion: The result of present study shows significant retention effect of dual task training on mobility, fear of fall and quality of life. The results also show that regular training is required for the subjects to maintain the progress achieved.

Keywords: *Dual Task Training, Parkinson's Disease, Mobility, Fear Of Fall, Quality Of Life.*

Introduction

Parkinson's disease (PD) is a progressive multi-system neurodegenerative disease affecting people mainly in later years of life. It is the second most common neurodegenerative disease worldwide with incidence and prevalence on the rise along with changing population demographics[1]. The clinical manifestations of this disorder include resting tremor, muscular rigidity, bradykinesia, and postural instability. Other clinical features include secondary motor symptoms (e.g. Dysarthria, dysphagia, micrographia, shuffling gait), non-motor symptoms (e.g. Autonomic dysfunction, cognitive/ neurobehavioral abnormalities sleep disturbances). These motor and non-motor symptoms can impact function to a variable degree[2].

In addition to these abnormalities, gait impairments and walking limitations are common among people with PD. While gait abnormalities are not pronounced in the early stages of PD, their prevalence and severity increases with disease progression. The consequences of gait impairments in PD are significant and include increased disability, increased fall risk, and reduced quality of life[3].

Cognitive impairment, duration and severity of PD symptoms, particularly freezing, involuntary movements, and walking and postural difficulties, were significantly associated with increased risk of

falls[4].

Patients with PD commonly have difficulties in performing movements, particularly when executing two motor tasks simultaneously. This deficiency is correlated with clinical measures of bradykinesia. This problem is not confined to motor tasks; it is also observed in cognitive tasks or combined cognitive and motor tasks, indicating that perhaps the difficulty in performing two tasks simultaneously in PD is not a purely motor problem[5].

During many activities of daily living, people need to perform more than one task at a time. The capacity to do a secondary task is highly advantageous during walking because it allows for communication between people, transportation of objects from one location to another, monitoring of the environment so that threats to balance can be avoided. Dual task performance is also known as "concurrent performance" and involves the execution of a primary task, which is the major focus of attention, and a secondary task performed at the same time. Gait disturbances have previously been shown to increase in people with PD during the performance of a second motor task[6].

T Wu and M Hallet in their study mentioned that difficulty in performing two tasks simultaneously in subjects with PD is probably due to limited attentionalresources, defective central executive function and less automaticity in performing the tasks and that practice can diminish dual task interference and improve performance in patients with PD[5].

Literature review suggests that quality of life improves with dual task training, but there is the lack of evidence showing the long term effects of dual task training and its retention once the training stopped. Hence, the present study aims to determine the retention effect of dual task training on mobility, fear of fall and quality of life in subjects with PD.

Methods

Participants

30 subjects with PD between 60-75 years of age, male and female were recruited for the study from the Padmashree Physiotherapy Clinic and the outpatient department of ESIC Model Hospital, Bangalore during the period of 2017 to 2018. Subjects were included in the study if their disease severity was 2 or 3 on the Hoehn and Yahr scale[7], MMSE Score $\geq$ 23, taking antiparkinson medications and are able to ambulate independently. Exclusion criteria included coexisting serious chronic medical illnesses (eg, orthopedic, psychiatric, or neurological), severe visual deficits, major depression and dementia. Informed written consent was taken from all the subjects prior to the study. Prior to the intervention, mobility, fear of fall and quality of life were assessed by the Timed Up and Go test, Fall Efficacy Scale and Parkinson's Disease Questionnaire-39[8, 9, 10]. The three outcome measures used have been studied for their reliability and validity for their usage in subjects with PD[11, 12, 13,14]. Subjects were given Dual Task Training 5 times a week for a 4 weeks. At the end of 4 weeks, post-test 1 was done and at 8 weeks, post-test 2 was done using same outcome measures. The intervention was performed on subjects during the self-reported optimal 'ON' period, often 1 hour post medication.

Implementation of intervention

In each training session, subjects completed 5 blocks of 5 minutes of walking (i.e., a total of 25 min of walking in each training session). In each 5-minute block, subjects performed different kinds of secondary tasks: serial subtractions, and coin transfer. The order of the tasks in each 5-minute block is shown in Table-1. The therapist had to guard the subject and provide appropriate feedback (knowledge of result and knowledge of performance during the Dual Task training) [15].

Table 1: Training program protocol

Training	Block 1	Block 2	Block 3	Block 4	Block 5
Duration of walk (Total of 25 min each session)	5 min	5 min	5 min	5 min	5 min
Instruction for task prioritization	None	"concentrate mainly on gait task"	"concentrate mainly on cognitive task"	"concentrate mainly on gait task"	"concentrate mainly on transferring the coins"
Kind of feedback & instructions	None	Knowledge of performance "try to walk fast"	Knowledge of result "in block 2, you did X no. of calculations with Y errors. Try to do better than that"	Knowledge of performance "try to walk fast"	Knowledge of result "in block 5 you transferred X no. of coins, with Y errors, try to transfer more with less error than in block 1"
Progression during training	1. Shortening of break times from 4 min (1 min each between blocks) (1st week) to 2 min (2nd week) to 1 min (3rd week), to no breaks (4th week) 2. Adding obstacles. From 2nd week, 3 boxes were placed. Subjects were asked to walk over the obstacles without touching them. Gradually the numbers of obstacles were increased to 4 and finally 5 in the 3rd and 4thweek of training.				

Results

The distribution of the subjects with Parkinson's Disease according to their gender, disease severity and age is mentioned in Table 2. Data of the pretest, post-test-1 and post-test 2 for the TUG score (Table 3), Falls Efficacy Scale (Table 4) and Parkinson Disease Questionnaire – 39 (Table 5) were calculated using ANOVA (Table 3).

Table-2: Distribution of subjects with Parkinson's disease according to gender, disease severity and age

S. No.	Demographic characters	Gender	F & %
1	Gender	Male	12(40.0%)
		Female	18(60.0%)
2	Hoehn and Yahr stage	II	12(40.0%)
		III	18(60.0%)
3	Age in years	Range, Mean ± SD	61-75, 70.00 ± 4.44

Table-3: Range, mean and SD of outcome measures of mobility (TUG in Sec) among the subjects with Parkinson's disease.

S. No.	Mobility (TUG in Sec)	Range	Mean ±SD	Paired t-test		Repeated measure ANOVA
1	Pre test	13.4-43.0	29.89± 9.28	Pre & posttest-1	t=14.756*, p<0.001	Fratio=4.177*, p<0.05
2	Posttest-1	11.3-40.0	25.91±8.67	Posttest-1 & Posttest-2	t=11.35*, p<0.001	
3	Posttest-2	13.5-44.0	27.40±9.24	Pre & posttest-3	t=3.286*, p<0.05	

Note; * denotes –Significant.

Table-4: Range, mean and SD of outcome measures of fear of fall (FES) among the subjects with Parkinson's disease.

S. No.	Fear of fall (Falls Efficacy Scale)	Range	Mean ±SD	Wilcoxon test		Repeated measure NP-ANOVA, Freidman Test
1	Pre test	33.0-59.0	48.70± 7.61	Pre & posttest-1	z=4.710*, p<0.001	F_r=42.00*, p<0.001
2	Posttest-1	25.0-55.0	38.83±7.82	Posttest-1 & Posttest-2	Z=4.507*, p<0.001	
3	Posttest-2	34.0-58.0	47.26±7.05	Pre & posttest-3	z=1.980*, p<0.05	

Note; * denotes –Significant.

Table-5: Range, mean and SD of outcome measures of quality of life (PDQ-39) among the subjects with Parkinson's disease.

S. No.	Quality of life(Parkinson's Disease Questionnaire-39)	Range	Mean ±SD	Wilcoxon test		Repeated measure NP-ANOVA, Freidman Test
1	Pre test	25.0-132.0	63.30± 25.23	Pre & posttest-1	z=4.767*, p<0.001	Fr=43.197*, p<0.001
2	Posttest-1	16.0-93.0	47.20±20.25	Posttest-1 & Posttest-2	Z=4.576*, p<0.001	
3	Posttest-2	17.0-119.0	60.86±23.97	Pre & posttest-3	z=1.954*, p<0.05	

Note; * denotes –Significant.

Discussion

The present study demonstrates the long term effect of dual task training on mobility, fear of fall and quality of life among subjects with PD. This study moves beyond the previous work by implementing cognitive as well as motor secondary task in the training and also checking the retention effect after 1 month of treatment.

Dual tasks were set up with different levels of complexity. After extensive training, most of the healthy subjects could perform all dual tasks correctly. In contrast, subjects with PD could perform only the simpler dual tasks with greater accuracy. Their findings demonstrated that these subjectshave more difficulty than healthy people in performing dual tasks. However, they could still execute some relatively simple dual tasks correctly after extensive training. Difficulty in performing dual tasks lead to decrease in gait variability, increase in fear of fall that decreases the quality of life[5].

Results of this study show that dual task training improved mobility, fear of fall and quality of life in the subjects post-intervention. Findings are consistent with previous research carried out.Dual task training as a whole task was apparently critical for acquiring attentional control and task coordination strategies. Consistent with this, another study reported reduced activation in brain areas that were initially involved with DT processing after whole-task training, interpreted as an "increase in neural efficiency. In addition to the concept of practicing DT as a "whole task," several additional principles of motor learning support the result of the study[16].

Difficulty in dressing and walking, falls, depression and confusion were PD symptoms, which significantly influenced quality of life scores. Among mobility problems associated with PD, start hesitation, shuffling gait, freezing, festination and difficulty in turning had a significant effect on quality of life score. Taken together the correlation, it suggests that dual task training has a positive effect on quality of life in PD[17]. Fritz and colleagues in a systematic review concluded that individuals with parkinson's disease showed significantly increased gait speed, stride length and gait endurance[18].In another study, Yogev-Seligmann, et al checked the retention effect on gait variability and the authors concluded that dual

task gait training enhances divided attention abilities during walking[15].

Dual task training was found to improve mobility, functional performance and cognition and can be readily implemented for training the subjects to reduce falls[19]. Another study found that dual task training showed significant improvements in body sway during single-support balance and center of gravity alignment during double-support dynamic balance[20].

In this study, at 1 month follow-up (post-test 2), the mean values were higher than the baseline values but were lower than the values at post-test 1 that were taken immediately after the intervention. After post-test 1, though the subjects were advised home exercises like stretching, ROM exercises and gait training for 1 month, it is not sure if the subjects have performed these exercises which could have influenced the scores in post-test 2. This shows that regular practice is required to maintain the achieved results for longer duration.

Findings from this study also provide insights into the effects of practice on dual task performance in subjects with parkinson's disease. Itgenerates new knowledge regarding optimal principles of training to enable subjects with parkinson's disease to overcome debilitating dual task interference during rehabilitation. The major limitation of the present study was that there was no control group. This study sets a platform for future research on its effect on detrimental factors for quality of life in subjects with PD. Further, researchers may also consider giving complex and multiple tasks to see their effect on these subjects.

Conclusion

The results of the present study shows significant retention effect of dual task training on mobility, fear of fall and quality of life. This adds weight to the growing body of literature and sets the stage for clinical implementation of a program that may help to reduce the negative impact of the disease on gait, fear of fall and quality of life.

Ethical Clearance: Taken from Institutional Ethical Committee of Padmashree Institute of Physiotherapy

Source of Funding: Self

Conflict of Interest: Nil

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