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A COMPARATIVE STUDY ON COMBINED EFFECT OF DUAL TASK TRAINING WITH STRENGTHENING EXERCISE VERSUS TAI CHI WITH AROM EXERCISE IN PARKINSON'S DISEASE

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R. Priya[*1], R. Vishnupriya[1], D. Kannan[2], R. Ferdinand[3], M.P. Thenmozhi[4], S.Kohilavani[5], K Anantharaj[6], S. Sathyapriya[7]

Corresponding Author:

[*1]MPT Student, JKK. Munirajah Medical Research Foundation, College of Physiotherapy, Komarapalayam, The Tamilnadu Dr. M.G.R Medical University, Chennai, India E-Mail: priyarajamani623@gmail.com

Authors:

[1]Principal, JKK Munirajah Medical Research Foundation, College of Physiotherapy, Komarapalayam, The Tamilnadu Dr. M.G.R Medical University, Chennai, Tamil Nadu, India

[2,,3,4,5,6,7]Professors, JKK Munirajah Medical Research Foundation, College of Physiotherapy, Komarapalayam, The Tamilnadu Dr. M.G.R Medical University, Chennai ,Tamil Nadu, India

ABSTRACT

Background: Parkinson's disease is a degenerative neurological condition that primarily affects movement and various bodily functions. The condition involves the gradual deterioration and damage of neurons in specific areas of the brain. Motor symptoms such as rigidity, slow movement (bradykinesia), tremors and postural instability are cardinal symptoms of Parkinson's disease. Objective of the study was to compare the combined effect of dual task training with strengthening exercise versus Tai chi exercise with AROM exercise to improve balance and gait in people with Parkinson's disease. **Methodology:** This study has quasi-experimental design involving two groups with pre-test and post-test measurements. 30 patients with Stage 3 Parkinson's disease aged between 50-65 years both males and females are selected. Group A received Dual Task training with strengthening ex's whereas Group B received Tai Ch exercises AROM ex's. Dynamic Gait Index scale (DGI) and Tinetti Balance scale were measured on first day (Week 1) and last day (Week 12) of intervention. The pre-test and post-test scores were analyzed and the findings were presented in tabular form. **Results:** While both groups demonstrated notable improvements in balance performance, Group A exhibited a statistically significant enhancement in functional balance compared to Group B (p<0.0001). **Conclusion:** The study concluded that there is improvement on balance. Mean while the effect on balance is more effective in group A than group B.

Keywords: Parkinson's disease, Dual task training, Tai chi exercise, Dynamic Gait index scale, Tinetti Balance scale.

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INTRODUCTION

Parkinson's disease is a degenerative neurological condition that primarily affects movement and various bodily functions. It was originally identified by James Parkinson in 1817 and referred to as"ShakingPalsy"[1].The condition involves the gradual deterioration and damage of neurons in specific areas of the brain. The neurons in this area produce dopamine .Dopamine plays a crucial role in regulating movement and its decline leads to abnormal brain activity, resulting in movement-related problems and other symptoms [2]. Motor symptoms include rigidity, slow movement (bradykinesia), tremors and postural instability. Non motor symptoms such as loss of smell, constipation, sleep disorders, mood changes, and blood pressure fluctuations can occurs years before motor symptoms[3]. Parkinson's disease has two hallmark pathophysiological processes: the abnormal aggregation of alpha synuclein that leads to Lewy pathology, and the degeneration of dopaminergic neurons in the substantia nigra pars compacta[4]. The death of these neurons reduces available dopamine in the striatum, which in turn affects circuits controlling movements in the basal ganglia. By the time motor symptoms appear, 50-80 percent of all dopaminergic neurons in the substantia nigra have degenerated.

Dual Task (DT) performance involves the execution of two tasks (Primary and Secondary) at the same time. Most of the daily living activities (ADL) require DT performance to efficiently accomplish different task in everyday life like shifting objects from one place to other, monitoring the environment and judging the threats and balancing effect to transfer self. Strengthening exercises involve activities that make your muscles work harder, which helps to increase their strength, size, power, and endurance. These exercise offer several health benefits, including are reduced risk of injury, improved overall health and sleep quality, enhanced metabolism, and a better quality of life.

Tai Chi is a traditional Chinese practice that combines gentle, flowing movements with deep breathing and mental focus. It is often used as a form of stress relief and physical exercise. TaiChi can be performed either standing or seated, making it especially suitable for individuals with balance issues or lower limb limitations. The practice helps improve posture, flexibility, coordination, and balance, while also promoting mental well-being by reducing stress, anxiety, and depression. AROM exercise involve moving your joints through this full ROM using only the strength of your own muscles, without any external help. These exercises are beneficial for enhancing flexibility, strength, posture, mobility and circulation.

MATERIALS AND METHODS

The study was conducted at JKKMRF College of Physiotherapy outpatient department. The patient was informed about the whole procedure and treatment method. A written consent was obtained from their voluntary participation in this study. There were 30 patients of stage III PD were selected based on the inclusion & exclusion criteria & they will be divided into 2 Groups (Group A &Group B).Group - A was treated with Dual task training with strengthening exercises and Group - B was treated with Tai chi exercise with AROM exercise. A pre test and post test was conducted for the Group A &B on DGI scale &

Tinetti balance scale for Parkinson's disease. The study was conducted for a period of 3 months, 5 days a week, 1 hour per session with 10 minutes rest period.

Inclusion criteria: Age is being atleast 50 to 65 years old, Both male and female, Mild to moderate stage 3 (hoehn and yahr scale), Ability to walk10m without assistanc, Pt having cognitive function (i.e) MMSE – atleast18, Mild difficulty in ADL, Fear of fall.

Exclusion criteria: Uncontrolled symptomatic orthostatic hypotension, Cerebellar dysfunction, Uncontrolled DM, Patient with recent fracture and joint replacement, Visual and auditory impairments, Any cardiovascular Problems, Skin ulcers & allergy, Patient with peripheral vascular disease, Patient with peripheral nerve injury.

Procedure:

GROUPA

Group A was treated with Dual task training with strengthening exercises on Parkinson's disease. Duration: 30 mints per session.

Procedure:

1. Semi stands with catching a ball.
2. Tandem stand with memorize flash card images.
3. Catching or throwing a ball while walking.
4. Walking while turning head side to side or up & down.
5. Eight circle walking counting numbers.
6. Side walking with dumbbells.

Strengthening exercise:

1. Clock reach exercise
2. Chair assisted leg squat
3. Spot marching

GROUP B:

Group B was treated with Tai Chi exercise with AROM exercise on Parkinson 's disease.
Duration: 30 mins per session.
Procedure: TaiChi exercise and AROM exercise

Statistical Analysis: Descriptive statistics for Dynamic Gait Index Scale–Group A and Group B

GROUP	DGI	Mean	Standard Deviation	Paired 't' value
Group A	Pretest	18.47	1.92	20.493
	Posttest	22.47	1.30	
Group B	Pretest	18.60	1.80	7.341
	Posttest	20.73	1.03	

Table 1: Group A and B Pre Post Analysis in DGI

DescriptivestatisticforDynamicGaitIndexScalein GroupAshowsthatthepaired't'testvaluesof pre vs post test values of Group A was 20.493 at 0.05% level which was greater than tabulated 't'values2.14.Group B shows that paired 't' test values of pre vs posttest values of Group B Was 7.341 at 0.05% level which was greater than tabulated 't' values 2.14. This showed like there in significant difference between pre vs post test results of Group A and Group BorDGI. This exposed that there was significant improvement in post test mean values in response to DGI in GroupAand Group B.

RESULT–DGI (POST TEST ANALYSIS)

DGI	Mean	Mean difference	Standard Deviation	Unpaired‘t’ value
Group A	4.00	1.80	0.80	5.051
Group B	2.13		1.13	

Table 2: Group A and B mean difference in DGI

The Unpaired ‘t’ value of 5.051 was greater than the tabulated unpaired ‘t’ value of 2.4 which showed that there was statistically significant difference at 0.0001 level between Group A and Group B. The pre vs post test mean of Group A was 4.00 and the pre vs post test mean of Group B was 2.13and the mean difference of Group A and Group B was 1.80 which showed that there was significant improvement in DGI score of Group A than Group B.

Descriptive statistics for Tinetti Balance scale- Group A and Group B

GROUP	Tinetti Balance scale	Mean	Standard Deviation	Paired‘t’value
Group A	Pre test	20.00	1.73	11.368
	Post test	24.00	1.69	
Group B	Pre test	20.20	1.66	20.546
	Post test	22.07	1.62	

Table 3: Descriptive analysis of Tinetti Balance scale- Group A and Group B

Descriptive statistics for Tinetti Balance Scale in Group A shows that the paired ‘t’test values of pre vs post test values of Group A was 11.368 at 0.05% level which was greater than tabulated ‘t’values2.14. Group B shows that paired ‘t’test values of pre vs posttest values of Group Bwas20.546 at0.05% level which was greater than tabulated ‘t’values 2.14.This showed like there in significant difference between pre vs post test results of Group A and Group B for Tinetti Balance Score. This exposed that there was significant improvement in post test mean values in response to Tinetti Balance Score in Group A and Group B.

RESULT–Tinetti Balance Scale (Posttest analysis)

Tinetti Balance score	Mean	MeanDifference	Standard Deviation	Unpaired‘t’ value
Group A	4.00	2.13	1.36	5.870
Group B	1.87		0.35	

Table 4: Tinetti Balance Scale of Group A and B

The Unpaired 't'value of 5.870 was greater than the tabulated unpaired 't' value of 2.4 which showed that there was statistically significant difference at 0.0001 level between Group A and Group B. The pre vs post test mean of Group A was 4.00 and the pre vs post test mean of GroupBwas2.13and the mean difference of Group A and Group B was 1.87 which showed that there was significant improvement in Tinetti Balance score of Group A than Group B.

RESULT

The study which was concluded for a period of 3 months intervention, Based on the statistical analysis the results of this study showed that there was significant improvement in both groups. The result also showed that the subject who participated in experimental Group A had shown good improvement on balance and gait than in Group B.

DISCUSSION

The aim of this study was to compare the combined effect of Dual Task training with strengthening exercise versus Tai chi with AROM exercise in Parkinson's disease. A total number of 30 subjects with the effect of Dual Task Training with strengthening exercise versus Tai chi with AROM exercise by Quasi sampling method after considering the inclusion and exclusion criteria. The information contents were obtained from individually.

Dynamic Gait Index Scale and Tinetti Balance Scale were taken as the parameter. Pre test data were collected for group A and group B for Parkinson's disease patients were subjected to the effect of Dual Task Training with strengthening exercise versus Tai chi with AROM exercise for a period of 3 months. The paired 't' test was used to compare the pre vs post test result of Group A and Group B separately.The unpaired 't' test was to compare the mean difference of Group A and Group B .

In the analysis and interpretation of DGI scale, the Unpaired 't' value of 5.051 was greater than the tabulated unpaired 't' value of 2.4 which showed that there was statistically significant difference at 0.0001 level between Group A and Group B. The mean of Group A was 4.00 and Group B was2.13and the mean difference of Group A and Group B was 1.80 which showed that there was significant improvement in DGI score of Group A than Group B.

In the analysis and interpretation of Tinetti Balance scale, the Unpaired 't' value of 5.870 was greater than the tabulated unpaired 't' value of 2.4 which showed that there was statistically significant difference at 0.0001 level between Group A and Group B. ThemeanofGroupAwas4.00andGroupBwas2.13 and the mean difference of Group A and Group B was 1.87 which showed that there was significant improvement in Tinetti Balance score of Group A than Group B.

A study conducted by Somyakanta Sahu (2018) assessed by dual task training in Parkinson's disease to reduce the fall reduction. The results of the study supports the present study where the participants balance and gait improved in terms of Tinetti fall efficacy scale[5] .A study conducted by DiyangLyu (2018) was assessed the effect of Tai Chi and conventional rehabilitation therapy for stroke survivors. The result of the study supports the current study where the patients balance training was improved in terms of DGI score in Stroke patients[6].A study conducted by Muhammed Iqbal (2020) was examined the effect of dual task specific training to improve gait

performance in chronic stroke patients. The result of the study supports the current study where the patients balance was improved in chronic stroke patients[7].

Physiological effects of dual task training with strengthening exercise:

Dual-task practice enhances motor automaticity, reducing cognitive overload during movement by strengthening neural control in regions like the parietal cortex, cerebellum, and prefrontal areas [8].Dual task training enhance the physiological effects of Neuroplastic& Neurochemical Effectsin the Intensive exercise promotes dopamine D_2 receptor upregulation in the striatum, improving motor control; similarly, aerobic and dual-task regimes increase functional connectivity in anterior putamen–sensorimotor cortex network [9].

Physiological effects of Tai Chi with AROM exercise:

Neurofunctional Connectivity of 12-week Tai Chi–based action-observation training enhanced connectivity within motor–sensori motor networks (e.g. medial prefrontal cortex, parietal and temporal junctions), correlated with improved motor and cognitive outcomes. Tai Chi includes a strong cognitive/attentional component—learning and recalling movement sequences—which improves executive function, working memory, attention, and emotional well-being (MoCA scores, mood, quality of life). Long-term practice thickens cortical regions (e.g. precentral gyrus, insula, frontal and temporal areas), enhancing brain volume and delaying neurodegenerative decline. Studies demonstrate improvements in MoCA, emotional domain of QoL, and reduced depression in Tai Chi groups versus controls[10].

CONCLUSION

The study which was conducted for a period of 3 months of intervention, based on statistical analysis, the result of this study showed that there was significant improvement in both groups. The results also showed that the subjects who participated in Group A had shown good improvement on balance than the Group B.Based on the results, this study concluded that there was improvement on balance. Meanwhile the effect on balance is more effective in Group A than Group B.

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Conflict of Interest: The authors declare no conflict of interest.

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