



**ORIGINAL RESEARCH PAPER**

**Neurophysiotherapy**

**EFFICACY OF TRANSCRANIAL DIRECT CURRENT STIMULATION (tDCS) AND DUAL TASK TRAINING IN PARKINSON'S DISEASE**

**KEY WORDS:** Parkinson's disease, Balance, Dual Task Training, Transcranial Direct Current Stimulation.

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**ABSTRACT**

The term "Parkinson's disease" refers to a neurodegenerative disease that affects several regions of the brain, including the pigmented nuclei in midbrain and brainstem, the olfactory tubercle, the cerebral cortex, and elements of the peripheral nervous system. It is a neurodegenerative disease characterized by clinical features including resting tremor, rigidity, bradykinesia, and postural instability. Axial symptoms, such as balance impairments, are one of the main predictors of quality of life for individuals with PD and have been shown to increase fall risk. **Methodology:** Parkinson's disease subjects aged 55-80 years, both males and females were included in the study, were conveniently divided into three equal groups- Group A, B and C comprising 10 subjects each, were assessed using Berg Balance Scale for assessment of balance. Group A received Transcranial Direct Current Stimulation (tDCS) along with Dual Task Training; Group B received Dual Task Training whereas Group C received Conventional Physiotherapy. Patients were reassessed after 3 weeks. **Result:** After statistical analysis, when compared in Group A and Group B, a significant difference was found in BBS scores ( $p < 0.05$ ), whereas non significant difference was found in Group B and Group C ( $p > 0.05$ ). While comparing Group A with Group C, BBS was found significant. **Conclusion:** The present study concluded that tDCS combined with Dual task training is more effective when compared to Dual task training alone and Conventional physiotherapy. Thus, tDCS and dual task training should be implemented in physiotherapy protocol of Parkinson's disease patient, and it will be helpful in improving the Balance impairments.

**INTRODUCTION**

Parkinson's disease is a chronic progressive neurodegenerative disorder of insidious onset, characterized by the presence of predominantly motor symptomatology (bradykinesia, rest tremor, rigidity, and postural disturbances).<sup>[1]</sup>

It is a multifactorial disease, with both genetic and environmental factors playing a role. Age is the biggest risk factor for PD, with the median age of onset being 60 years of age. The incidence of the disease rises with age to 93.1 (per 100,000 person-years) in age groups between 70 and 79 years<sup>[2,3]</sup>. Additionally, there are cross-cultural variations, with higher prevalence reported in Europe, North America, and South America compared with African, Asian and Arabic countries.<sup>[4]</sup>

Physiologically, the symptoms associated with Parkinson's disease are the result of the loss of a number of neurotransmitters, mainly dopamine. It is characterized by nigrostriatal cell loss and presence of intracellular  $\alpha$ -synuclein-positive inclusions called Lewy bodies. All these alterations change the function of the basal ganglia system, resulting in Parkinson's main movement disorders. Cell loss in the substantia nigra occurs in a region-specific manner, with the lateral ventral tier of the pars compacta being most affected. It is estimated that at least 50% of the nigral neurons must degenerate to produce symptoms and at autopsy, most cases show more than 80% reduction<sup>[5]</sup>.

The typical pathological manifestations of Parkinson's disease (bradykinesia, rigidity, and reduced amplitude and automaticity of movement) affect the gait patterns of patients with the disease. Patients have reduced gait speed and step length, increased axial rigidity, and impaired rhythmicity<sup>[6]</sup>. The body posture becomes stooped, there is axial and limb rigidity with or without cogwheel phenomenon, tendency for a shuffling gait and lack of arm swing while walking. The bradykinesia may lead to expressionless face (hypomimia) and the amplitudes of hand writing become smaller (micrographia). Around 80% have limb tremor, most commonly a resting pill-rolling type of tremor of the hands.<sup>[7]</sup>

Other gait disturbances than shuffling include blocking, hesitancy and gait festination where steps become progressively smaller and more rapid which may lead to loss of balance and falls.<sup>[8]</sup>

Physiotherapy has a significant importance in a multidisciplinary team focused on the rehabilitation of individuals with PD, with the purpose of maximizing functional ability and minimizing secondary complications through movement rehabilitation within a context of education and to support the person as a whole.

Dual task training aims to improve the ability to do two or more things simultaneously and thus reduce the risk of falling. Dual task training consists of a primary task and an additional secondary task. The two tasks could be performed independently as a single task and have distinct and separate goals<sup>[10]</sup>.

Transcranial direct current stimulation (tDCS) is a neuromodulation technique, which noninvasively alters cortical excitability via weak polarizing currents between two electrodes placed on the scalp. Weak tDCS can result in long-term potentiation (LTP)-like synaptic changes that normally accompany facilitatory effects on cortical excitability, neuroplasticity, and learning. Both immediate effects and after-effects of tDCS can be modulated by dopaminergic and serotonergic agents<sup>[11]</sup>.

**AIM**

To study the role of Transcranial Direct Current Stimulation (tDCS) and Dual Task Training on balance impairment in Parkinson's disease.

**METHODOLOGY**

The study is Quasi-experimental in nature, performed at the University College of Physiotherapy, Faridkot Outpatient Department (OPD), In Patient Department (IPD) Guru Gobind Singh Medical College and Hospital, Faridkot as well as Home based setting and a sample of 30 patients was collected in the period of September, 2020 to March, 2021. The study was

approved by the ethical committee of University College of physiotherapy and faculty of physiotherapy (No. BFUHS/2k21p-TH/4082). Baba Farid University of Health Sciences, Faridkot. Patients included in the study were diagnosed cases of Parkinson's disease both male and female, between the age group 55-80 years, with severity level of Hoehn and Yahr Scale of Stage 1-3 and having ability to independently ambulate indoors without a walking aid. Patients presented with Neurological problem other than P.D. which can affect balance, e.g. Stroke, Cerebellar disorders, Balance disorders (Dizziness, Vertigo), Myelopathy or Myopathy, Orthopedic problems affecting balance:- e.g. History of L/L fractures, Dislocation and Deformities, Artificial limb, Implants, Pain in lower extremities, Hearing and vision impairments affecting balance and Mini-mental state examination score less than 24, Unstable seizures disorders were excluded from the study. Independent Variables in the present study were Transcranial Direct Current Stimulation, Dual Task Training, Conventional Physiotherapy and Dependent Variables were Score of Berg Balance Scale.

**Procedure**

The subjects were selected as per the selection criteria and the written informed consent was taken. The subject's demographic profile and detailed medical history was taken through individual interviewing. Initially a pilot study was done on 6 patients as planned. The data was collected during the time period of September 2020 to March 2021. During this period of 8 months, 68 patients having Parkinson's Disease were screened and considered for inclusion. Out of these 68 patients, 33 patients fulfilled the inclusion and exclusion criteria and thus were included in the study. The selected patients were informed about the nature of the study and after ethical clearance their informed consent was taken. Then they were assessed for balance using Berg Balance Scale (BBS). After that subjects were divided into 3 Groups namely; Group A received Transcranial Direct Current Stimulation (tDCS) along with Dual Task Training, Group B received dual task training alone whereas Group C was a control group received conventional physiotherapy. Subjects of GROUP A were given treatment for 3 days a week for 3 weeks of 20 min session of transcranial direct current stimulation and session of dual task training for 5 days a week for 3 weeks of 45min session. Activities were divided into two phases: Stance activities and Gait activities while Subjects of GROUP B were given treatment for 5days a week for 3 weeks of 45 min session of dual task training and Subjects of GROUP C were given conventional physiotherapy treatment for 5days a week for 3 weeks of 45 min session each. Patients were reassessed after 3 weeks and data was collected.

**Data Analysis And Result**

The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2010) and then exported to data editor page of SPSS version 20 (SPSS Inc., Chicago, Illinois, USA).

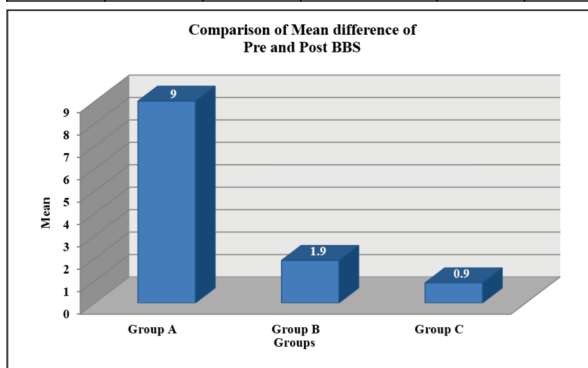
**Table 5.6: Comparison of the mean and standard deviation of BBS scores in Parkinson's patient: Pre and Post treatment between Group A, B and C**

Parameters	Groups	N	Mean	Std. Deviation	p-value
BBS	Group A	10	9.0000	5.41603	0.001 (Sig.)
	Group B	10	1.9000	0.87560	
	Group C	10	0.9000	0.31623	
	Total	30	3.9333	4.77734	

**Tukey's HSD Post Hoc analysis**

Dependent Variable	(I) Group	(J) Group	Mean Difference (I-J)	Std. Error	Sig.
BBS	Group A	Group B	7.10000*	1.41892	0.000
		Group C	8.10000*	1.41892	0.000
	Group B	Group A	-7.10000*	1.41892	0.000
		Group C	1.00000	1.41892	1.000

	Group C	Group A	-8.10000*	1.41892	0.000
		Group B	-1.00000	1.41892	1.000



**Table 5.6: Graphical representation of the mean and standard deviation of BBS scores in Parkinson's patient: Pre and Post treatment between Group A, B and C**

**DISCUSSION**

The aim of the study was to determine the efficacy of transcranial direct current stimulation (tdcs) and dual task training on balance impairment in parkinson's disease. As there were limited studies in the literature which showed the efficacy of tDCS combined with dual task training compared with only dual task training and conventional physiotherapy, present study was focused on it.

On comparing Group A, Group B and Group C, the analysis of BBS values within the group shows that there is statistically significant change in means of BBS values at levels which were taken for assessment. When analyzed from pre-intervention to post-intervention group, the mean values for pre-intervention to post-intervention for BBS came out to be statistically significant showing improvement in BBS scores in all the three groups. Whereas on comparing Group A and Group B, the result demonstrates that the performance of Dual task training combined with tDCS was more efficient in improving the balance (BBS scores) in patients with PD at the end of three weeks than the performance of Dual task training alone. There was a higher statistically significant difference found in Group A as compared to Group B between pre and post treatment applied to patient with PD.

These similar results done by Kaski et al also shows that when tDCS given with physical therapy, increases gait velocity and improves balance, compared with tDCS alone<sup>[12]</sup>

However, there was no significant difference found in BBS scores on comparison of Group B and Group C showing that there was a relatively uniform improvement in balance in patients with Parkinson's disease.

While Group C, which received Conventional physiotherapy treatment, showed a significant difference in BBS scores showing that there was a relative improvement in the balance when compared with Group A.

Joanna et al observed a significant improvement in balance and gait outcomes, Physical Performance Test score, timed activities and trunk rotations both in comparison to the control group and baseline results<sup>[13]</sup>

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