INTI JOURNAL | eISSN:2600-7320
Vol.2022:01

Comparison of the Effects of Task Oriented Balance Training Versus Blindfolded Balance Training in Patients with Parkinson's Disease

Sudha N.[1*], V. Rajalaxmi[2]

[1]Freelance Physiotherapist, India [2]Vice Principal, Faculty of Physiotherapy, Dr. MGR Educational and Research Institute, India

***Email:** sudharajanbpt@gmail.com

Abstract

Objectives: The purpose of this study was to find the efficacy of task oriented balance training and blindfold balance training to improve postural balance in patients with Parkinson's disease.

Materials and Methods: A comparative study was done with 20 samples. The study was conducted in kriston clinic. The duration of treatment was 8 weeks. Both male and female individuals with Parkinson's disease in concern about falling, instability and balance problem, between the age group of 50-55 were included. PD with other neurologic diagnosis, severe impairments, cardiac problem, uncooperative are excluded. The measurements were taken using Unified Parkinson's Disease Rating Scale (UPDRS) and Berg balance scale (BBS).

Based on inclusion and exclusion criteria and outcome measures, 20 subjects with Parkinson disease (PD) were divided into two groups. Group A- 10 subjects were treated by using Blind folded balance training and Group B-10 subjects were treated by using Task Oriented balance training. Before the onset of treatment protocol, the technique was explained to the patients and informed concern was taken from the patients. The baseline measurements were taken by using Unified Parkinson's Disease Rating Scale (UPDRS) and Berg balance scale (BBS). The procedure was done by performing Blind folded balance training for 4 times a week for 8 weeks for group A and Task Oriented balance training is performed for 4 times a week for 8 weeks for group B. After the study, pre and post test measurement were taken and compared using Unified Parkinson's Disease Rating Scale (UPDRS) and Berg balance scale (BBS).The collected data were tabulated and analyzed using IBM SPSS VERSION 20.0 SOFTWARE. The collected data were analyzed and tabulated with the descriptive and inferential statistics. For the descriptive statistics, the mean and standard deviation were calculated and for the inferential statistics, the parametric variables were treated with t-test. The results were tabulated and the results were plotted accordingly.

Results: On comparing pre test and post test values within the Group A and B on Unified Parkinson's Disease Rating Scale (UPDRS) and Berg balance scale (BBS) shows significant difference in mean values at $p < 0.005$.

Conclusions: This study concluded that blindfolded balance training is effective in improving Balance in Parkinson's disease patients with balance impairment, when compared to task oriented balance training.

Submission: 11 November 2021; **Acceptance:** 13 March 2022

Keywords

Parkinson’s disease (PD), Blindfolded balance training, Task oriented balance training

Introduction

Parkinson’s disease is the second most common neurodegenerative disorder after the Alzheimer’s disease (Alves et al., 2008), it is caused by the progressive degeneration of dopaminergic neurons in the substantia nigra pars compacta, reduced striatal dopamine, and the presence of lewy bodies (Muslimović et al., 2005; Yang et al., 2018). PD characterized by the cardinal features of rigidity, bradykinesia, tremor, and postural instability (Yeole et al., 2017). The primary neurotransmitter dopamine is responsible for transmitting the appropriate information for the correct control of movement (Carlsson & Carlsson, 2006). Clinical symptoms appear when there is a 40% to 60% reduction of nigral neurones and striatal dopamine (De Goede et al., 2001). Parkinson's disease is affecting 1% to 2% of the population older than 65 years (Švehlík et al., 2009). More than 10 million people worldwide are living with PD. Incidence of Parkinson’s disease increases with age, but an estimated four percent of people with PD are diagnosed before age 50. Men are 1.5 times more likely to have PD than women (Marras et al., 2018). The prevalence in India was roughly 10% of the global burden, that is, 5.8 lakes (Dorsey et al., 2018). From India, crude prevalence rates (CPR) between 6 and 53/100,000 have been reported. Above the age of 60 years, the PRs were higher, being 247/ 100,000 (Razdan et al., 1994).

The term “balance control” refers to a multisystem function that strives to keep the body upright while sitting or standing and while changing posture. Balance control is needed to keep the body appropriately oriented while performing voluntary activity, during external perturbation, and when the support surface or environment changes. Faulty balance control mechanisms may contribute to fall-related injuries, restriction of gait patterns, and decreased mobility. These disabilities lead to loss of functional independence and social isolation.

Altered gait and postural instability is very close in Parkinson’s disease patients (Tan et al., 2011) and despite pharmacological medication or surgical intervention for PD patients usually show deterioration in mobility. Therefore several non-pharmacological rehabilitation were proposed (Morgan & Fox, 2016; Mestriner, 2016), however the physical therapy techniques used the parameters and methods adopted to evaluate their effects, didn’t show any congruent result (Pickering et al., 2007).

The impairment of sensory integration has been suggested to influence balance control in PD (Tan et al., 2011). Patients are unable to perceive the upright or vertical position, which may indicate an abnormality in processing of vestibular, visual, and Proprioceptive information contributing to balance (Yeole et al., 2017). Also present an inability to adopt movement strategies to contrast changing sensory conditions that reflects a problem in sensory-motor adaptation (Nallegowda et al., 2004). Recent studies (Reynard & Terrier, 2015; Jacobs & Horak, 2006) supported the role of visual deprivation as a potential driver in using alternative sensory strategies to control dynamic equilibrium and stabilize gait. In particular, rehabilitative training based on the enhancement of sensorial input could be essential to improve balance and gait in PD patient (Lefaivre & Almieda, 2015).more attention should be given to adopting rehabilitation strategies which improve postural responses by means of sensorial integration afferences (Nallegowda et al., 2004). To improve the ability of older people to perform daily tasks, an exercise program was developed focusing on functional tasks of everyday life, tasks that are affected early in the aging process (Hirasing et al., 1997). The performance of functional task, however is more complex and involves interplay of cognitive, perceptual, and motor functions and is closely linked to the individual’s dynamic environment (Mulder, 1991). Recent study proposed that Sensorimotor training through Blindfolded Balance Training (BBT) could be a novel effective therapy to improve gait in PD patients by maximizing central nervous system compensation through balance perturbations. March on foam would make inputs less reliable, so with eyes closed the subject would have to rely more on the vestibular system to maintain balance (Samoudi et al., 2015).

The UPDRS was to provide a comprehensive, practical an easy to administer scale that can be used across all patients regardless of severity. The scale consists of 13 items and the score ranges from a minimum of zero (best) to 52 (worse). The Minimal Clinical Important Change (MCIC) was determined as a score between 2.3 and 2.7 (Shulman et al., 2016; Schrag et al., 2006). The Berg balance scale (BBS) is used to objectively determine a patient's ability (or inability) to safely balance during a series of predetermined tasks. It is a 14 item list with each item consisting of a five-point ordinal scale ranging from 0 to 4, with 0 indicating the lowest level of function and 4 the highest level of function and takes approximately 20 minutes to complete. It does not include the assessment of gait. This study aimed to investigate the efficacy of a blindfolded balance training (BBT) to compare the Task-oriented balance training in the improvement of balance in people with PD.

Material and Methods

This is an experimental study of comparative (pre and post) type that was conducted in the KRISTON clinic Chennai, Tamil Nadu, India and it took nearly 8 weeks to complete the study. 20 samples were selected and participants were screened to ensure that they followed by inclusion criteria. Parkinson’s patients with age group between 50 to 55 years, Hoehn and Yahr scale 2-3 stage and having risk of fall and poor balance, Both the genders are equally preferred and the patients should be medically stable. The 20 participants included in the study were then randomly allocated, either into blind folded balance training (BBT) or task oriented balance training using lottery method with ten participants with each group. Blind folded balance training and task oriented balance training is used for different needs, body parts, intensities before the onset of treatment protocol, the training was explained to the patient and informed concern is taken from the patient. The baseline measurements were taken by using unified Parkinson disease rating scale (UPDRS) and berg balance scale (BBS). The participants of the blind folded balance training group (GROUP A – BBT) and task oriented balance training (GROUP B – TOBT) received exercises for 45 minutes, once in a day, weekly 4 times for 8 weeks. After the 8 weeks the post-test measurement were taken and compared using unified Parkinson disease rating scale and berg balance scale.

Flow Chart:

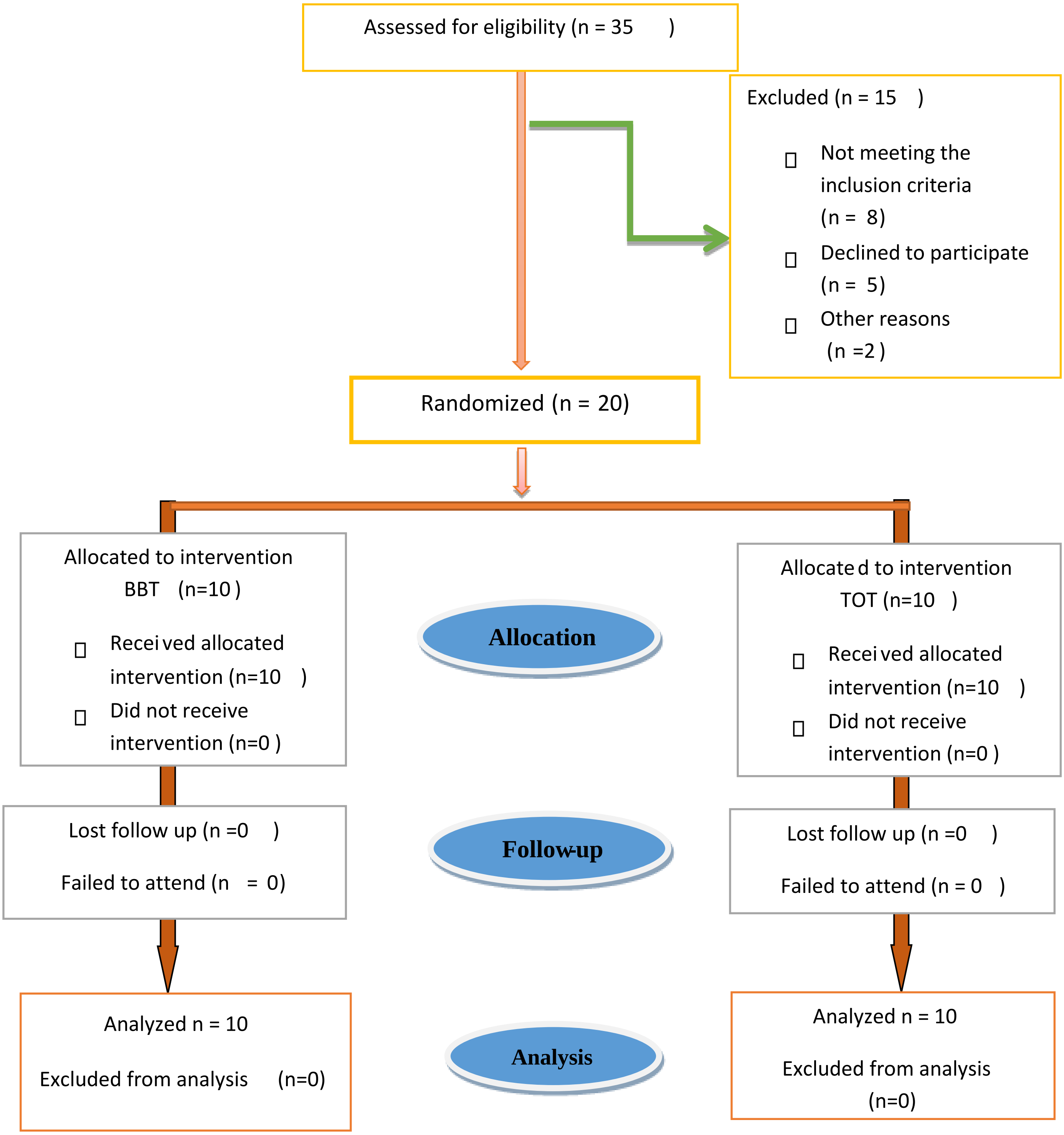


Figure 1: Flow diagram of the progress through the phrases of a parallel randomized trial of two groups

The collected data were tabulated and analyzed using IBM SPSS VERSION 20.0 SOFTWARE. The collected data were analyzed and tabulated with the descriptive and inferential statistics. For the descriptive statistics, the mean and standard deviation were calculated and for the inferential statistics, the parametric variables were treated with t-test. The results were tabulated and the results were plotted accordingly.

Results and Discussion

Table 1 and Figure 1 show the comparison between the pre-test values of Group A and Group B, the pre-test value of UPDRS are 86.80 and 87.10, while BBS are 27.80 and 27.50.

Table 1. Comparison between pre-test value of group A and group B.

SI NO	OUTCOME	GROUP A (PRE-TEST)	GROUP B (PRE-TEST)
1	UPDRS	86.80	87.10
2	BBS	27.80	27.50

Figure 1. Comparison between pre-test value of group A and group B

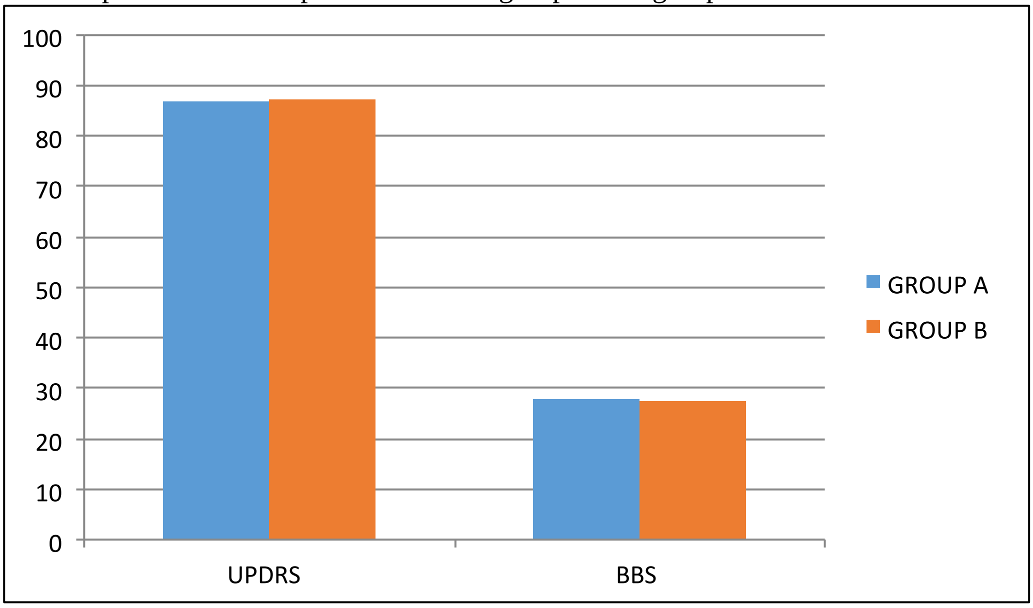


Table 2 and Figure 2 shows the comparison between the pre and post-test of UPDRS, BBS in the blindfolded training group. The mean values of UPDRS are 86.80 are 66.00, while BBS are 27.80 are 44.20. The UPDRS, BBS in the blindfolded training group has the P value < 0.005, which is significant.

Table 2. Comparison between pre and post of UPDRS, BBS in Group-A (Blindfolded training)

S.no	GROUP-A (blindfolded)	MEAN		STANDAD DEVIATION		PAIRED "t"	"p" value
		PRE-TEST	POST-TEST	PRE-TEST	POST- TEST	Value	
1.	UPDRS	86.80	66.10	4.58	1.10	17.772	0.000
2.	BBS	27.80	44.20	1.31	2.65	-22.364	0.000

Figure 2. Comparison between pre and post of UPDRS, BBS in Group-A (Blindfolded training)

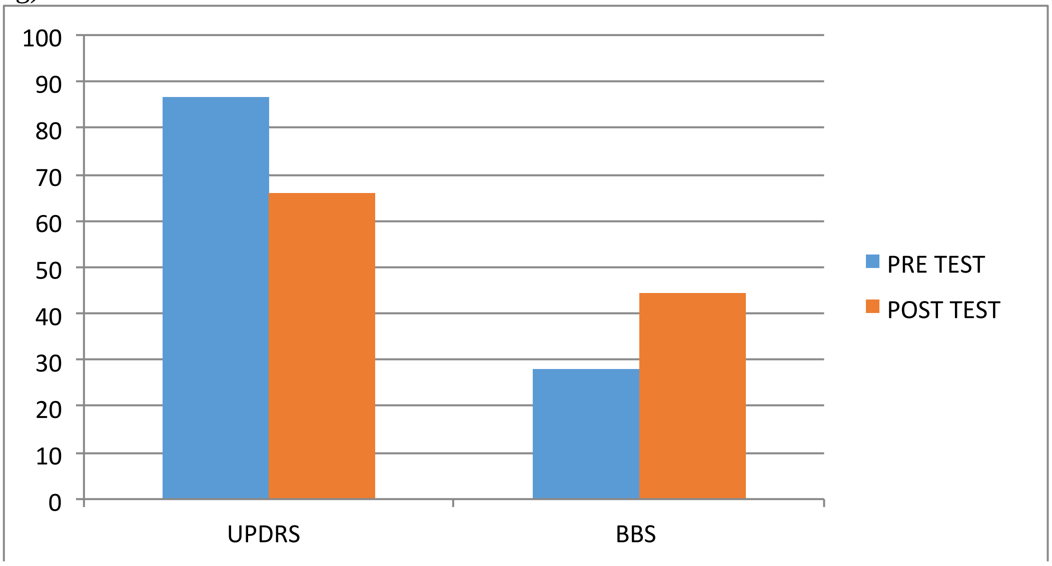


Table 3 and Figure 3 show the comparison between the pre and post-test of UPDRS, BBS in the task oriented training group. The mean values of UPDRS is 87.10 and 74, while BBS are 27.50 and 34.80. The UPDRS, BBS in the task oriented training group has the P value < 0.005, which is significant.

Table 3. Comparison between pre and post of Group-B (Task Oriented Training)

S.no	GROUP-B (task oriented)	MEAN		STANDA D N DEVIATIO		PAIRED “t” Value	“p” value
		PRE-TEST	POST-TEST	PRE-TEST	POST- TEST		
1.	UPDRS	87.10	74	4.30	0.816	10.78	0.000
2.	BBS	27.50	34.80	1.58	1.54	-21.79	0.000

Figure 3: Comparison between pre and post of UPDRS, BBS in Group-B (Task Oriented Training)

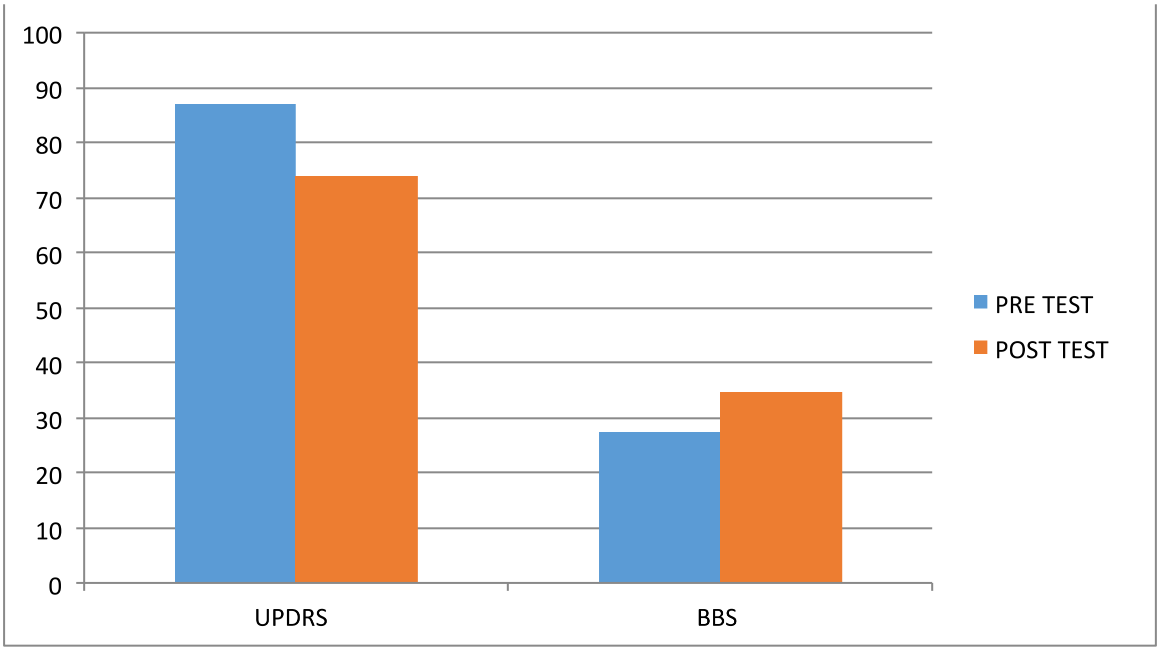
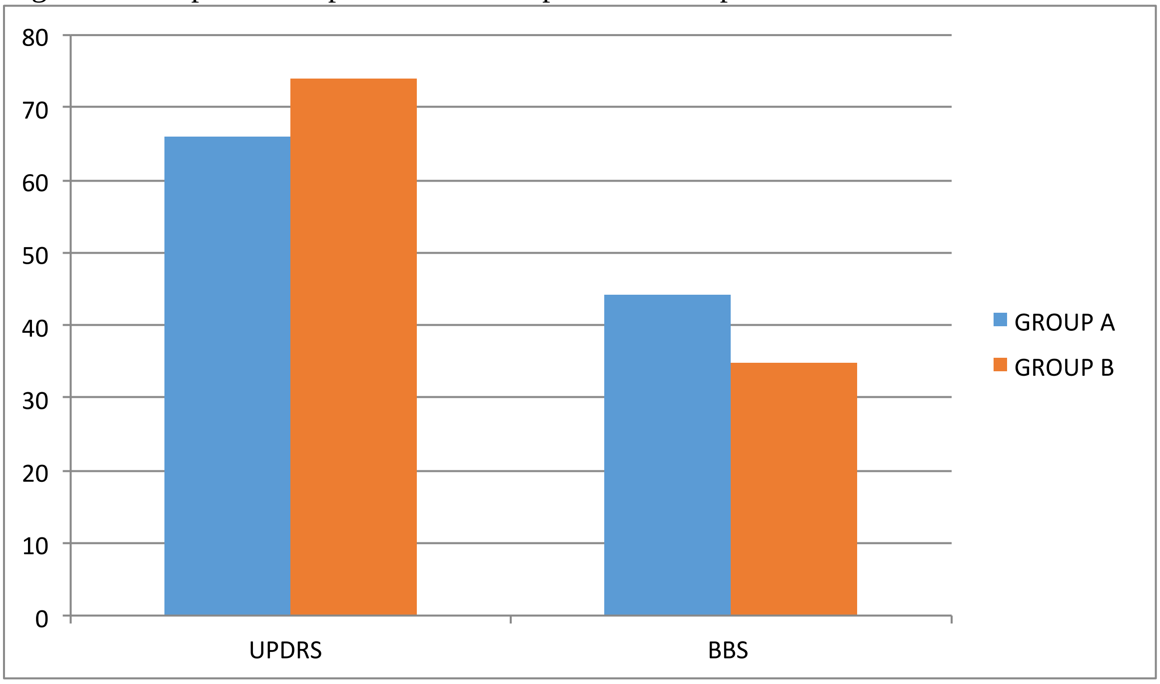


Table 4 and Figure 4 show the comparison between the post-test values of UPDRS, BBS between the blindfolded training and task oriented training group. Post-test values in blindfolded training group are 66.10 and 74 for UPDRS, while for BBS are 44.20 and 34.80. A post-test value of UPDRS, BBS of blindfolded training group and the task oriented training group has the P value < 0.005, which is significant.

Table 4: Comparison of Post Test of Group-A and Group-B

S.NO	POST TEST	MEAN		STANDARD DEVIATION		independent "t" test	"p" value
		GROUP A	GROUP B	GROUP A	GROUP B		
1.	UPDRS	66.10	74	1.10	0.816	-18.23	0.000
2.	BBS	44.20	34.80	2.65	1.54	9.661	0.000

Figure 4: Comparison of post test of Group-A and Group-B



On comparing between the pre-test values of Group A and Group B, the pre-test values of UPDRS are 86.80 and 87.10, while BBS are 27.80 and 27.50. On comparing between the pre and post-test of UPDRS, BBS in the blindfolded training group. The mean values of UPDRS are 86.80 and 66.00, while BBS are 27.80 and 44.20. The UPDRS, BBS in the blindfolded training group has the P value < 0.005, which is significant.

On comparing between the pre and post-test of UPDRS, BBS in the task oriented training group. The mean values of UPDRS are 87.10 and 74, while BBS are 27.50 and 34.80. The UPDRS, BBS in the task oriented training group has the P value < 0.005, which is significant.

On comparing between the post-test values of UPDRS, BBS between the blindfolded training and task oriented training group. Post-test values of UPDRS, BBS in blindfolded training group are 66.10 & 74 (UPDRS), 44.20 & 34.80 (BBS). A post-test value of UPDRS, BBS of blindfolded training group and the task oriented training group has the P value < 0.005 which is significant.

Parkinson's disease is the most common neurodegenerative disorder. Instability and fear of falls in Parkinson's disease significantly affects the quality of life, especially among the elderly patients.

The purpose of this study is to find the effectiveness of blind folded balance training and task oriented balance training as intervention in balance control in patient with Parkinson's disease. After the intervention of blindfolded balance training statistical analysis shows improvement in standing balance, dynamic balance and postural control which was observed from the patient who participated in the study.

Reduction of double stance phase in PD patients treated with BBT but not with traditional rehabilitation (Tomlinson et al., 2012). The double stance phase's decrease is likely due to an improvement of postural stability, reflecting the patients' ability to transfer their weight correctly in preparation for stepping (Dingenen et al., 2013). The double stance phase is expression of good balance control and requires the integration of sensory information from visual, somatosensory, and vestibular sources. This ability to integrate somatosensory information resulted affected in PD Parkinson's Disease patients. This deficit could be compensated by the vestibular system (Horak, 1996; Mergner, 1998; Muller et al., 2013).

Blindfold balance training represents a complementary rehabilitative strategy based on visual deprivation and Proprioceptive perturbation in recovery of gait in PD patients, in short time window, likely involving vestibular system and its connections with motor area. Blindfold balance training consisted of balance and waking exercises aimed at stimulating dynamic postural control and improving balance reactions. The main activity of the balance exercise was to march in place on a foam cushion blindfolded and walk blindfolded on a treadmill with speed increasing from 1km/hr to 3km/hr with supervision (Tramontano et al., 2016).

We hypothesize that the vestibular-spinal stimulation would contribute to the subsequent correct facilitation of Anticipatory Postural Adjustment (APA), that is, acquired motor reflexes that are necessary to perform voluntary movements.

In other words, the vestibular system can primarily induce modulation of antigravitary muscles and balance reactions (Peppe et al., 2007), which in turn can be learned and used by feed-forward mechanisms prior to voluntary movements.

Our results support the hypothesis that visual deprivation and proprioceptive perturbation could be compensated using other sensory strategies as vestibular system and that this approach may be useful to improve gait in PD patients. Our findings support the introduction of complementary rehabilitative strategies based on sensory motor stimulation in the traditional PD patient's rehabilitation program helping to achieve better functional outcomes in shorter time (Tramontano et al., 2016).

We found that BBT was able to indicate a global improvement of gait modifying not only the double support phase but also the stance phase and swing phases of gait. Thus, the BBT seems to speed up the efficacy of PT in rehabilitation of the gait targeting (Tramontano et al., 2016). Further studies are needed to investigate the long-term efficacy of BBT and to investigate the Neuro physiological circuits and mechanism.

Conclusion

This eight weeks study results showed improvement in blindfolded balance training group in comparison with task oriented balance training group. Balance was improved after training sessions in the Parkinson's disease patients in both the groups. However, the group that had blindfolded balance training showed significantly better performance in balance rather than the group, which received task oriented balance training.

Thus this study concludes that blindfolded balance training is effective in improving Balance in Parkinson's disease patients with balance impairment, when compared to task oriented balance training.

Conflict of Interest

Authors declare no conflict of interest.

References

Alves, G., Forsaa, E. B., Pedersen, K. F., Gjerstad, M. D., & Larsen, J. P. (2008). Epidemiology of Parkinson's disease. Journal of Neurology, 255(5), 18-32.

Muslimović, D., Post, B., Speelman, J. D., & Schmand, B. (2005). Cognitive profile of patients with newly diagnosed Parkinson disease. Neurology, 65(8), 1239-1245.

Yang, K., Shen, B., Li, D. K., Wang, Y., Zhao, J., Zhao, J., Yu, W., Li, Z., Tang, Y., Liu, F., Yu, H., Wang, J., Guo, Q., & Wu, J. J. (2018). Cognitive characteristics in Chinese non-demented PD patients based on gender difference. Translational Neurodegeneration, *7*(1), 1-9.

Yeole, U. L., Hulyalkar, S. S., Gharote, G. M., Panse, R. S., Pawar, P. A., Kulkarni, S. A., & Yeole, U. (2017). Correlation of functional capacity and balance in patients with Parkinson's disease, Arq Neuropsiquiatr, 79(8), 1-10.

Carlsson, A., & Carlsson, M. L. (2006). A dopaminergic deficit hypothesis of schizophrenia: the path to discovery. Dialogues in clinical neuroscience, 8(1), 137.

De Goede, C. J., Keus, S. H., Kwakkel, G., & Wagenaar, R. C. (2001). The effects of physical therapy in Parkinson's disease: a research synthesis. Archives of Physical Medicine and Rehabilitation, 82(4), 509-515.

Švehlík, M., Zwick, E. B., Steinwender, G., Linhart, W. E., Schwingenschuh, P., Katschnig, P., Ott, E., & Enzinger, C. (2009). Gait analysis in patients with Parkinson's disease off dopaminergic therapy. Archives of Physical Medicine and Rehabilitation, 90(11), 1880-1886.

Marras, C., Beck, J. C., Bower, J. H., Roberts, E., Ritz, B., Ross, G. W., Abbot, R. D., Savica, R., Van Den Eeden, S. R., Willis, A. W., & Tanner, C. M. (2018). Prevalence of Parkinson's disease across North America. NPJ Parkinson's Disease, 4(1), 1-7.

Dorsey, E. R., Elbaz, A., Nichols, E., Abd-Allah, F., Abdelalim, A., Adsuar, J. C., ... & Murray, C. J. (2018). Global, regional, and national burden of Parkinson's disease, a systematic analysis for the Global Burden of Disease Study. The Lancet Neurology, 17(11), 939-953.

Razdan, S., Kaul, R. L., Motta, A., Kaul, S., & Bhatt, R. K. (1994). Prevalence and pattern of major neurological disorders in rural Kashmir (India in 1986). Neuroepidemiology, 13(3), 113-119.

Tan, T., Almeida, Q. J., & Rahimi, F. (2011) Proprioceptive deficits in Parkinson's disease patients with freezing of gait. Neuroscience, 192, 746-752.

Morgan, J. C., & Fox, S. H. (2016). Treating the motor symptoms of Parkinson disease. CONTINUUM: Lifelong Learning in Neurology, 22(4), 1064-1085.

Mestriner, R. G. (2016□. Physiotherapy and occupational therapy and mild to moderate Parkinson disease. JAMA Neurology, 73(7), 894-894.

Pickering, R. M., Grimbergen, Y. A., Rigney, U., Ashburn, A., Mazibrada, G., Wood, B., Gray, P., Kerr, G., & Bloem, B. R. (2007). A meta- analysis of six prospective studies of falling in Parkinson's disease. Movement Disorders, 22(13), 1892-1900.

Nallegowda, M., Singh, U., Handa, G., Khanna, M., Wadhwa, S., Yadav, S. L., Kumar, G., & Behari, M. (2004). Role of sensory input and muscle strength in maintenance of balance, gait, and posture in Parkinson's disease: a pilot study. American Journal of Physical Medicine & Rehabilitation, 83(12), 898-908.

Reynard, F., & Terrier, P. (2015). Role of visual input in the control of dynamic balance: variability and instability of gait in treadmill walking while blindfolded. Experimental Brain Research, 233(4), 1031-1040.

Jacobs, J. V., & Horak, F. B. (2006). Abnormal proprioceptive-motor integration contributes to hypometric postural responses of subjects with Parkinson's disease. Neuroscience, 141(2), 999-1009.

Lefaivre, S. C., & Almeida, Q. J. (2015). Can sensory attention focused exercise facilitate the utilization of proprioception for improved balance control in PD? Gait & Posture, 41(2), 630-633.

Hirasing, R. A., Van Zaal, M. A. E., Meulmeester, J. F., & Verbrugge, H. P. (1997). *Child Health in the Netherlands: Facts and Figures*. TNO Prevention and Health, Division Public Health and Prevention, PO Box 2215, 2301 CE Leiden.

Mulder, T. (1991). A process-oriented model of human motor behavior: toward a theorybased rehabilitation approach. Physical therapy, 71(2), 157-164.

Samoudi, G., Jivegård, M., Mulavara, A. P., & Bergquist, F. (2015). Effects of stochastic vestibular galvanic stimulation and LDOPA on balance and motor symptoms in patients with Parkinson's disease. Brain stimulation, 8(3), 474-480.

Shulman, L. M., Armstrong, M., Ellis, T., Gruber- Baldini, A., Horak, F., Nieuwboer, A., Parashos, S., Post, B., Rogers, M., Siderowf, A., Goetz, C. G. (2016). Disability rating scales in Parkinson's disease: critique and recommendations. Movement Disorders, 31(10):1455-65.

Schrag, A., Sampaio, C., Counsell, N., & Poewe, W. (2006). Minimal clinically important change on the unified Parkinson's disease rating scale. Movement Disorders: Official Journal of the Movement Disorder Society, *21*(8), 1200-1207.

Tomlinson, C. L., Patel, S., Meek, C., Herd, C. P., Clarke, C. E., Stowe, R., Shah, L., Sackley, C., Deane, K. H. O., Wheatley, K., & Ives, N. (2012). Physiotherapy intervention in Parkinson's disease: systematic review and meta-analysis. Bmj, 2012, *345*.

Dingenen, B., Staes, F. F., & Janssens, L. (2013). A new method to analyze postural stability during a transition task from double-leg stance to single-leg stance. Journal of Biomechanics, 46(13), 2213-2219.

Horak, F. B., Frank, J., & Nutt, J. (1996). Effects of dopamine on postural control in parkinsonian subjects: scaling, set, and tone. Journal of Neurophysiology, 75(6), 2380-2396.

Mergner, T., & Rosemeier, T. (1998). Interaction of vestibular, somatosensory and visual signals for postural control and motion perception under terrestrial and microgravity conditions—a conceptual model. Brain research reviews, 28(1-2), 118-135.

Müller, M. L., Albin, R. L., Kotagal, V., Koeppe, R. A., Scott, P. J., Frey, K. A., & Bohnen, N. I. (2013). Thalamic cholinergic innervation and postural sensory integration function in Parkinson's disease. Brain, 136(11), 3282-3289.

Tramontano, M., Bonnì, S., Martino Cinnera, A., Marchetti, F., Caltagirone, C., Koch, G., & Peppe, A. (2016). Blindfolded balance training in patients with Parkinson's disease: a sensory-motor strategy to improve the gait. Parkinson's Disease, 2016, 6.

Peppe, A., Chiavalon, C., Pasqualetti, P., Crovato, D., & Caltagirone, C. (2007). Does gait analysis quantify motor rehabilitation efficacy in Parkinson's disease patients? Gait & Posture, 26(3), 452-462.