Research Paper E-ISSN NO : 2455-295X | VOLUME : 9 | ISSUE : 5 | MAY 2023

EFFECTIVENESS OF BLIND FOLDED BALANCE TRAINING IN PARKINSON'S DISEASE SUBJECTS.

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ABSTRACT:

Parkinson's disease (PD) is characterized not only by classical parkinsonism motor symptoms, but also by a range of non-motor features including autonomic, cognitive, psychiatric, and behavioral dysfunctions.3 Patients can survive up to a decade after diagnosis, but as PD progresses most patients experience severe physical and mental disabilities which impair their ability to live independently. Although Patients with PD get the best available medications, they still experience a declining of body function, daily activities, participation and weakening in mobility. Methodology: 30 subjects who fulfills the inclusion criteria are selected for the study. All the 15 subjects to experimental group and 15 subjects to control group underwent for pre intervention assessment with berg balance scale (BBS) and Timed Up & Go test (TUG). Then subjects in experimental group was received blindfolded balance training for 20 repetition of each exercise for 3 sets and 4 session / week for 4 weeks. The subjects in control group received the convention physiotherapy management of single leg standing, tandem standing, tandem walking and walking in all the direction for 10 meters for 4 session / week for 4 weeks. Then all the 30 subjects underwent post intervention assessment with berg balance scale and timed up 7 go test. Berg Balance Scale to assess the balance and risk of fall. Timed Up & Go test used to assess the mobility function of the subjects. According to data analysis ,a significant difference was found in both the experimental and control group between pre and post values of Berg balance scale and timed up & go test (<0.0001*) . There was significant difference in the mean value of pre and post assessment values. But the statistical mean values are more significant in experimental group than the mean value of control group. The study concluded that the blindfolded balance training is effective in improving the balance and functional mobility of the individual with Parkinson.

KEYWORDS:

BLINDFOLD BALANCE TRAINING, PARKINSON DISEASE, BERG BALANCE SCALE, TIMED UP & GO TEST.

INTRODUCTION

Parkinson disease (PD) described by James Parkinson in his 1817 publication, "Essay on the Shaking Palsy"[1]. Parkinson's disease is the second most common progressive neurodegenerative disorder after the Alzheimer's disease.[2] PD is characterized not only by classical parkinsonism motor symptoms, but also by a range of non-motor features including autonomic, cognitive, psychiatric, and behavioral dysfunctions.[3] Patients can survive up to a decade after diagnosis, but as PD progresses most patients experience severe physical and mental disabilities which impair their ability to live independently.[4] In addition, the medical cost of PD is one of the highest among neurological diseases. Thus, this disease poses an increasingly high physical, emotional, social, and economic burden on patients, their families and countries.[5]

PD affects 1-2 per 1000 of the population at any time. PD prevalence is increasing with age and PD affects1% of the population above 60 years.[6] PD incidence is usually comprised between 10 and 50/100,000 person-years, and its prevalence between 100 and 300/100,000 population.[7,8] Pathologically 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. The primary neurotransmitter dopamine is responsible for transmitting the appropriate information for the correct control of movement[9]

Potential risk factors including genetic and non genetic factors include environmental toxins, drugs, pesticides, brain microtrauma, focal cerebrovascular damage, and genomic defects.[10] PD characterized by the cardinal features of rigidity, bradykinesia, tremor, and postural instability.[11]Difficulty in walking is a pathognomonic sign of Parkinson's disease (PD).[12] PD patients' gait is characterized by small shuffling steps, stooped posture, and reduced arm swing. As disease progresses, these features worsen, treatment efficacy wanes, and gait impairment becomes increasingly disabling.[13] Gait disorders, balance impairment, falls, and fall-related injuries are also present in PD patients.[14]The balance disorders observed in patients with PD are mainly related to the disruption of the feed forward anticipatory

adjustments and normal postural synergies due to the basal ganglia dysfunction. [15]Balance dysfunction (BD) and Postural instability (PI) are the common incapacitating symptoms of PD, Untreated BD and PI can lead to increased frequency of falls and injuries which in turn increases the chance of developing Comorbidity and disability by causing alterations in postural control strategies during standing tasks and when performing voluntary movements.[16,17,18] Balance dysfunction and PI are also associated with a loss of equilibrium, sudden falls, progressive loss of independence and immobility.[19,20,21] Balance dysfunction and PI usually occur in the middle later stages of the disease and became a clinical concern since they are not easily amenable to treatment with medication.[22,23] Although Patients with PD get the best available medications, they still experience a declining of body function, daily activities, participation and weakening in mobility.[24] Traditional physiotherapy intervention in Parkinson's disease to improve balance are strengthening exercise, coordination training ,gait training, PNF.

The impairment of sensory integration has been suggested to influence balance control in Parkinson's Disease. Recent studies supported the role of visual deprivation (blindfolded) as a potential driver in using alternative sensory strategies to control dynamic equilibrium and stabilize gait.[25] PD patients showed central deficit in reorganizing sensory information for postural control which induces a delay in balancing strategy adaptation. These sensory processing impairments could be enhanced in PD by means of dedicated strategies during PT programs. In particular, rehabilitative training based on the enhancement of sensorial input could be essential to improve balance and gait in PD patient.[26]

These assumptions indicated that more attention should be given to adopting rehabilitation strategies which improve postural responses by means of sensorial integration inferences. However, several questions remain unanswered, particularly regarding training methods as well as intensity and duration and specific exercises need to improve gait and balance control in PD. Here we introduced specific dynamic exercises performed with visual deprivation in order to stimulate reweighting of sensory information in the context of dynamic activity.[27] 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.[28] We hypothesized that rehabilitation therapy based on sensory-motor stimulation could contribute to acquisition of compensative strategies to improve balance, given the important role that the visual and proprioceptive depri-vation has in sensory substitution.[29] This study aimed to investigate the efficacy of a blindfolded balance training (BBT) in the improvement of balance and walking function in people with PD compared to patients who underwent physical therapy program.

MATERIALS & METHODS

Patient who are willing to participate in this study were screened for inclusion and exclusion criteria with the opinion of Neurologist. They were explained about the safety and simplicity procedure and information consent was obtained from each patient before the intervention. A total 30 Parkinson patients were selected from apollo district headquarter hospital, Chittoor, AP, India, after concern referral for the study using purposive sampling method in quasi experimental design. The details and the purpose of the study were explained to all the patients. The subjects those who falls under the inclusion criteria: first onset of Parkinson, age group: 50 – 80 years, sub acute Parkinson's disease subjects with complaints of balance impairment, Hoehn and yahr grade 2 and 3, cooperative and willing to participate, could stand independently without support. exclusion criteria: inability to understand and follow the commands, Hoehn and yahr grade 4 and 5, systemic illness: cardio vascular diseases, patients with any other neurologic disease. were participated in the study. Then the eligible subjects was allocated to experiment group (n=15)and control group (n=15). After allocation of the subjects in both the groups then all subjects underwent pre intervention measurement with berg balance scale for balance, timed up & go test for walking function.

Berg balance scale to measures balance in older adults. This scale has Scoring of five-point scale, a range of 0-4. 0: lowest level of function 4: highest level of function. Highest possible score is 56 Score of < 45 indicates a greater risk of falling. The item in this scale is 1. Sitting to standing 2. Standing unsupported 3. Sitting unsupported 4. Standing to sitting 5. Transfers 6. Standing with eyes closed 7. Standing with feet together 8. Reaching forward with outstretched arm 9. Retrieving object from floor 10. Turning to look behind 11. Turning 360 degrees 12. Placing alternate foot on stool 13. Standing with one foot in front 14. Standing on one foot.

Timed up & go test to Measure of function with correlates to balance and fall risk. Equipment required : Stopwatch, Standard Chair, Measured distance of 3 meters (10feet). Patient instruction: my command for this test are going to be ready, set, go. You may use the arms of the chair to stand up or sit down. Once you are up, you may take any path you like, but I want you move as quickly as you feel safe and comfortable until you pass this piece of tape with both feet. Turn around and walk back to the chair. I will stop the clock when your back touches the back of the chair. You will complete one practice run and two that are counted. Therapist instruction: start timing on the word go and stop timing when the subject is seated again correctly in the chair with their back resting on the back of the chair. The subject wears their regular footwear, may use any gait aid that they normally use during ambulation, but may not be assisted by another person. There is no limit. They may stop and rest(but not sit down) if they need to. Interpretation: ≤ 10 seconds = normal, ≤ 20 seconds = good mobility, can go out alone, mobile without gaid aid, ≤ 30 seconds = problems, cannot go outside alone, requires gait aid.

All the two outcome measures were taken before and after

the treatment in both the groups. Then all 15 participant was performed blindfolded balance training on steppers. The therapist had explained clearly about the starting and ending position, verbal cues, intervention to the parkinsons subjects. Then subjects was blindfolded and made the subject to stand in a upright position and instructed the subject to do alternate leg march in supervision of therapist for 20 repetition then followed rest has given for 1 minute. A block with 15 inch height and width is placed in front the subject and instructed the subjects to climb with alternate leg for 20 repetition then rest has given for 1 minute. Then block was placed backside of subjects and instructed the subjects to climb with alternate leg for 20 repetition then rest has given for 1 minute. Then block was placed towards right side of subjects and instructed the subjects to climb sideways with right leg for 20 repetition then rest has given for 1 minute. Then block was placed towards left side of subjects and instructed the subjects to climb sideways with left leg for 20 repetition then rest has given for 1 minute. All the exercises had performed for 3 sets and 4 session / week for 4 weeks. Along with the blindfold the subjects were instructed to walk forward for 10 meters, walk backward for 10 meters, walks right sideward for 10 meters and walks left sideward for 10 meter with appropriate verbal feedback given by the therapist during the task. While performing the exercise the therapist gave appropriate verbal cues about position, direction and activity to the subjects to complete the task successfully. The subjects in control group (n=15) was received the conservative management of single leg standing for 5 minutes each leg, tandem standing for 5 minutes each leg front and back and tandem walking forward for 10 meters, walk backward for 10 meters, walks right sideward for 10 meters and walks left sideward for 10 meter with appropriate verbal feedback given the therapist during the task and squats for 10 repetition of 3 sets. While performing the exercise the therapist gave appropriate verbal cues about position, direction to the subjects to complete the task successfully. After completion of 4 weeks of intervention again post test measurement was taken with berg balance scale for balance, timed up & go test for walking function.

STATISTICAL ANALYSIS

All the outcomes were analyzed using SPSS.25 software. The data were statistically analyzed, mean and standard deviation was calculated by using paired t- test the pre and post test mean value of berg balance and timed up & go test was significant p value <0.001. One way Anova were used to analyze the variance between the experimental group and control group.

RESULT

Results of this study were in favour of blindfolded balance training received by experimental group shows reduction of the risk of fall by improvement in balance and also helps in improvement of functional mobility in Parkinson subjects than the subjects received conservative management in the control group. In control group the Berg Balance scale Pre-Test mean value = 44.87, SD= 1.060 Post-test mean=49.00, SD=1.254, t-test value= 16.163 and p= <0.001, for Timed Up & Go test Pre-test mean value= 23.60,SD= 1.844, Post-test mean=13.73, SD=1.438, t-test value=16.430and p=<0.001 hence post test value shows statistically significant than pre test values in table 1. In experimental group the Berg Balance scale Pre-Test mean value = 46.07, SD= 1.100 Post-test mean=52.80, SD=1.568, t-test value= 18.802 and p= <0.001, for Timed Up & Go test Pre-test mean value= 24.33,SD= 2.257, Post-test mean=8.60, SD=0.986, t-test value= 27.868 and p=<0.001 hence post test value shows statistically more significant than pre test values in table 2. when compared to the experimental group values are statistically less significant in the control group (graph 1 & 2). The of variance and Pearson correlation was stated in table 3. In this study where both the outcome measure shows more significant difference in their mean value according to the statistical values which indicate that blindfolded balance training in experimental was very effective than the control group in Parkinson subjects

TABLE 1

PRE-TEST AND POST-TEST VALUES OF CONTROL GROUP

OUTCOME MEASURES		MEAN	STANDARD DEVIATION	t- VALUE	p- VALUE
BERG BALANCE SCALE	PRE-TEST	44.87	1.060	-16.163	<0.001
	POST-TEST	49.00	1.254		
TIMED UP & GO TEST	PRE-TEST	23.60	1.844	16.430	<0.001
	POST-TEST	13.73	1.438		

TABLE 2

PRE-TEST AND POST-TEST VALUES OF EXPERIMENTAL GROUP

OUTCOME MEASURES	MEAN	STANDARD DEVIATION	t- VALUE	p- VALUE

BERG BALANCE SCALE	**PRE-TEST**	46.07	1.100	-18.802	<0.001
	POST-TEST	52.80	1.568		
TIMED UP & GO TEST	**PRE-TEST**	24.33	2.257	27.868	<0.001
	POST-TEST	8.60	0.986		

TABLE 3

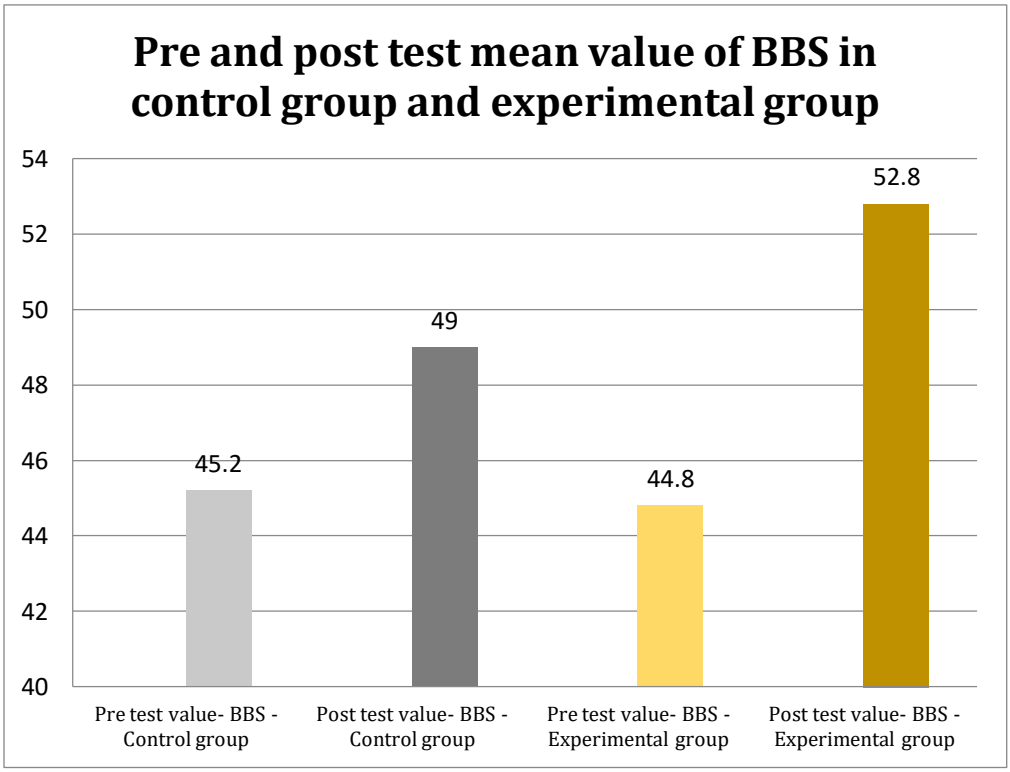
ANALYSIS OF VARIANCE AND PEARSON CORRELATION OF POST-TEST VALUES OF CONTROL AND EXPERIMENTAL GROUP

Experimental group					
Variance		**Pearson correlation**	**Variance**		**Pearson correlation**
Pre test value- BBS	**Post test value- BBS**		**Pre test value- TUG**	**Post test value- TUG**	
1.209	2.457	0.505	5.095	0.971	0.288

Control group					
Variance		**Pearson correlation**	**Variance**		**Pearson correlation**
Pre test value- BBS	**Post test value- BBS**		**Pre test value- TUG**	**Post test value- TUG**	
1.123	1.571	0.644	3.4	2.066	0.010

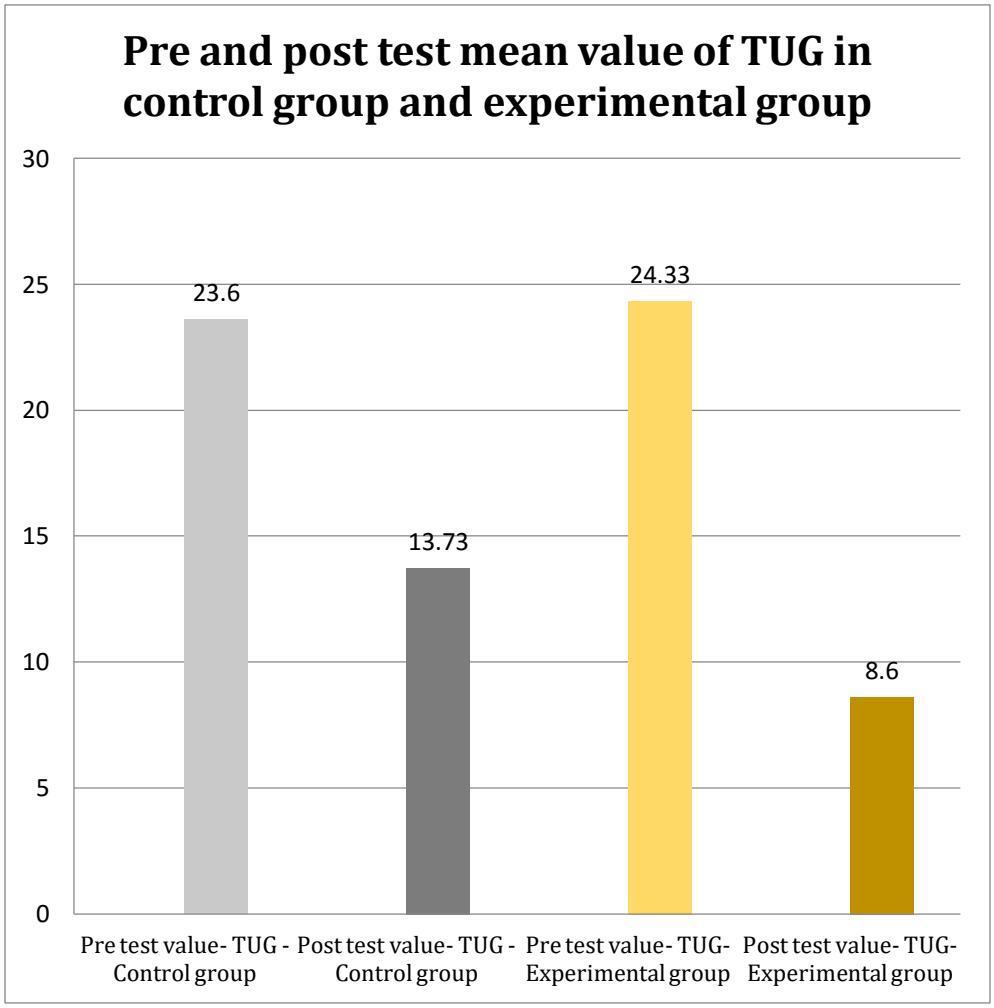
GRAPH 1

REPRESENTING PRE-TEST AND POST-TEST VALUES OF BERG BALANCE SCALE IN CONTROL GROUP AND EXPERIMENTAL GROUP.



GRAPH 2

REPRESENTING PRE-TEST AND POST-TEST VALUES OF TIMED UP & GO TEST IN CONTROL GROUP AND EXPERIMENTAL GROUP.



DISCUSSION

The current study aimed to evaluate the effect of blindfold balance training in patients with parkinsons disease. 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.

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).

The treadmill induces a body acceleration that is mediated by the visual system, but to maintain the balance is visual deprivation condition the response to this acceleration should be compensated by vestibular-spinal tract. Moreover, the vestibular-spinal tract is thought to play a significant role during the execution of voluntary forward steps in the double stance phase (L.R. Bent et al., 2005). In other words, the vestibular system can primarily induce modulation of antigravitary muscles and balance reactions (M. Nallegoda et al., 2004) which in turn can be learned and used by feed-forward mechanisms prior to voluntary movements.

According to the statistical value the strong evidence suggesting the blindfold balance training is very effective in improving individual static and dynamic balance as well as helps in improving the dynamic functional mobility during standing and walking in Parkinson subjects. In this

study the statistical values obtained in the experimental group who are underwent the blindfolded balance training is very significant in the pre test and post test mean values of the berg balance scale and timed up and go test than control group underwent the conservative management is significant in the pre test and post test mean values of the berg balance scale and timed up and go test values. But when compared to the control group the statistical values obtained in the experimental group are very significant in the pre test and post test mean values of berg balance scale and timed up and go test. The limitations in this study were all the participants of this study were recruited from a single geographical location, the study did not used metronome while doing balance training. the recommendations were similar study can be done blindfolded balance training combined with metronome will obtain better result for balance functional rehabilitation. further study will be using blindfold treadmill training along with metronome.

CONCLUSION

This four weeks study results showed improvement in blindfolded balance training group. The study result showed that blindfold balance exercise had significant improvement in balance and significant increase in functional mobility in experimental group than the control group in the subjects with Parkinson disease.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

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

REFERENCES

1. Parkinson J An Essay on the Shaking Palsy. London: Sherwood, Neely, and Jones; 1817. [Google Scholar]

2. Lebouvier T, Chaumette T, Paillusson S, Duyckaerts C, Bruley des Varannes S, Neunlist M, Derkinderen P. The second brain and Parkinson's disease. Eur J Neurosci. 2009 Sep;30(5):735-41. doi: 10.1111/j.1460-9568.2009.06873.x. Epub 2009 Aug 27. PMID: 19712093.

3. Kalia LV, Lang AE. Parkinson's disease. Lancet. 2015;386(9996):896–912.

4. Rubenstein LM, DeLeo A, Chrischilles EA. Economic and health-relatedquality of life considerations of new therapies in Parkinson's disease.Pharmacoeconomics. 2001;19(7):729–52.

5. Park, JH., Kim, DH., Kwon, DY. *et al.* Trends in the incidence and prevalence of Parkinson's disease in Korea: a nationwide, population-based study. *BMC Geriatr* **19,** 320 (2019). https://doi.org/10.1186/s12877-019-1332-7

6. Tysnes OB, Storstein A. Epidemiology of Parkinson's disease. J Neural Transm (Vienna). 2017 Aug;124(8):901-905. doi: 10.1007/s00702-017-1686-y. Epub 2017 Feb 1. PMID: 28150045.

7. A. Ascherio *et al.* Prospective study of caffeine consumption and risk of Parkinson's disease in men and womenAnn Neurol(2001)

8. A. Ascherio *et al.* Pesticide exposure and risk for Parkinson's diseaseAnn Neurol (2006)

9. Sudha, N. and V., Rajalaxmi (2022) *Comparison of the Effects of Task Oriented Balance Training Versus Blindfolded Balance Training in Patients with Parkinson's Disease.* INTI JOURNAL, 2022 (01). pp. 1-11. ISSN e2600-7320

10. Emamzadeh FN, Surguchov A. Parkinson's Disease: Biomarkers, Treatment, and Risk Factors. *Front Neurosci*. 2018;12:612. Published 2018 Aug 30. doi:10.3389/fnins.2018.00612

11. Sudha, N. and V., Rajalaxmi (2022) *Comparison of the Effects of Task Oriented Balance Training Versus Blindfolded Balance Training in Patients with Parkinson's Disease.* INTI JOURNAL, 2022 (01). pp. 1-11. ISSN e2600-7320

12. T. A. Boonstra, H. van der Kooij, M. Munneke, and B. R.Bloem, "Gait disorders and balance disturbances in Parkinson's disease: clinical update and pathophysiology," *Current Opinion in Neurology*, vol. 21, no. 4, pp. 461–471, 2008.

13. C. J. Hass, M. Bishop, M. Moscovich et al., "Defining the clinically meaningful difference in gait speed in persons with Parkinson disease," *Journal of Neurologic PhysicalTherapy*, vol.38, no. 4, pp. 233–238, 2014.

14. T. A. Boonstra, H. van der Kooij, M. Munneke, and B. R. Bloem, "Gait disorders and balance disturbances in Parkinson's disease: clinical update and pathophysiology," *Current Opinion in Neurology*, vol. 21, no. 4, pp. 461–471, 2008.

15. Chong RK, Horak FB, Woollacott MH. Parkinson's disease impairs the ability to change set quickly. J Neurol Sci 2000;175:57–70.

16. Brod M, Mendelsohn GA, Roberts B. Patients' experiences of Parkinson's disease. J Gerontol B Psychol Sci Soc Sci. 1998;53(4):213–22.

17. Ashburn A, Stack E, Pickering RM, Ward CD. Predicting fallers in a community-based sample of people with Parkinson's disease. Gerontology. 2001;47(5):277–81.

18. Ashburn A, Fazakarley L, Ballinger C, Pickering R, McLellan LD, Fitton C. A randomised controlled trial of a home based exercise programme to reduce the risk of falling among people with Parkinson's disease. J Neurol Neurosurg Psychiatry. 2007;78(7):678–84

19. Smania N, Corato E, Tinazzi M, Stanzani C, Fiaschi A, Girardi P, et al. Effect of balance training on postural instability in patients with idiopathic Parkinson's disease. Neurorehabil Neural Repair. 2010;24(9):826–34.

20. Mak MK, Pang MY. Balance confidence and functional mobility are independently associated with falls in people with Parkinson's disease. J Neurol. 2009;256(5):742–9.

21. Mak MK, Pang MY. Fear of falling is independently associated with recurrent falls in patients with Parkinson's disease: a 1-year prospective study. J Neurol. 2009;256(10):1689–95

22. Adkin AL, Frank JS, Jog MS. Fear of falling and postural control in Parkinson's disease. Mov Disord. 2003;18(5):496–502.

23. Allen NE, Sherrington C, Paul SS, Canning CG. Balance and falls in Parkinson's disease: a meta-analysis of the effect of exercise and motor training. Mov Disord. 2011;26(9):1605–15.

24. Tinetti ME, Baker DI, McAvay G, Claus EB, Garrett P, Gottschalk M, et al. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. N Engl J Med. 1994;331(13):821–7

25. A. M. De Nunzio, A. Nardone, and M. Schieppati, "The control of equilibrium in Parkinson's disease patients: delayed adaptation of balancing strategy to shifts in sensory set during a dynamic task," Brain Research Bulletin, vol. 74, no. 4, pp. 258– 270, 2007.

26. S. C. Lefaivre and Q. J. Almeida, "Can sensory attention focused exercise facilitate the utilization of proprioception for improved balance control in PD?" Gait & Posture, vol. 41, no. 2, pp. 630– 633, 2015.

27. M. Nallegowda, U. Singh, G. Handa et al., "Role of sensory input and muscle strength in maintenance of balance, gait and posture in Parkinson's disease," American Journal of Physical Medicine & Rehabilitation, vol. 83, no. 12, pp. 898–908, 2004.

28. G. Samoudi, M. Jivegard, A. P. Mulavara, and F. Bergquist, "Effects of stochastic vestibular galvanic stimulation and LDOPA on balance and motor symptoms in patients with Parkinson's disease," Brain Stimulation, vol. 8, no. 3, pp. 474– 480, 2015.

29. H. C. Stronks, A. C. Nau, M. R. Ibbotson, and N. Barnes, "The role of visual deprivation and experience on the performance of sensory substitution devices," Brain Research, vol. 1624, pp. 140–152, 2015.