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EFFECT OF OTAGO EXERCISES ON BALANCE AND GAIT AFFECTION IN PATIENTS WITH PARKINSON'S DISEASE - AN INTERVENTIONAL STUDY

Physiotherapy

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ABSTRACT

Background and purpose : Parkinson's disease (PD) is a long term degenerative disorder of the basal ganglia that mainly affects the motor system. The most obvious symptoms are rigidity, shaking, slowness of movement, gait abnormalities like "freezing of gait" and poor postural balance that together causes difficulty in walking. The most recognize type of static deformity is the classic stooped simian appearance, with flexion of the hip and knees and rounding of the shoulder. The OTAGO programmed is a commonly implemented exercise programme aimed at improving strength, balance and gait. To find out the effectiveness of otago exercise for improving balance and gait in PD.

Methodology : 20 patients with Parkinson's disease with age group from 45-65 years were included. All the patients with Parkinson's disease were given a 6 weeks protocol of otago exercise to improve balance and gait.

Results : BBS (p=0.000) and DGI (p=0.000) Showed significant improvement in the both outcome measures in Parkinson's participants. DGI is more improved than BBS in Parkinson's patients.

Conclusion : The results of the present study suggest that both balance function (BBS) and gait function (DGI) are Improve but Gait function (DGI) is more Improve than balance function (BBS) of the Parkinson's subjects. This study provided evidence to support the otago exercise in the short-term management of Parkinson's participants.

KEYWORDS

Otago exercise, Parkinson's disease, functional balance, functional gait, strengthening exercise

INTRODUCTION

Parkinson's disease is a chronic, progressive, neurodegenerative disease for which there is no known cure. It is the second most common neurodegenerative disease, exceeded only by dementia.[1,2]The most common age of onset is after 50, though it can affect younger individuals.[3]

The basal ganglion (BG) are a collection of interconnected grey matter nuclear masses deep within the brain. Output is channeled primarily through the Globus pallidus and the substantia nigra to the thalamus and back to the cortex, completing the loop. They are both direct and indirect pathways. The direct pathway facilitates BG output to the thalamus and motor areas of the cortex while the indirect pathway provides disinhibition of the sub thalamic nucleus, and in turn suppression of some movements.[4]

Parkinson's disease has traditionally been characterized by four cardinal features (Bradykinesia, rigidity, tremor and postural instability which are responsible for balance, postural instability and gait impairment[5].

Postural adjustments are task and context specific muscle activations used to maintainbalance.[6] Postural adjustments can be broadly categorized into two groups: anticipatory and ongoing postural adjustments, and reactive postural adjustments. Anticipatory and ongoing postural adjustments occur immediately prior to and during a volitional movement, as an integral part of that movement.[7]

Most people with Parkinson's disease will develop reduced balance at some stage,[8] and balance problems tend to worsen with increased disease severity.[9,10] Balance is often tested clinically using the postural stability item of the Unified Parkinson's Disease Rating Scale (UPDRS),[11] where the individual is rapidly pulled backwards at the shoulders. Those with poor balance reactions either do not respond or must be caught by the assessor, or take an abnormally large number of backward steps to recover. Balance is also required for reaching and other tasks where the individual must control movements of their body to achieve a task without falling.[12] While reduced balance is considered to be a motor impairment on its own, other problems including bradykinesia, rigidity, dyskinesia, shuffling gait, narrowed base of support, stooped posture and cognitive impairment can all compound the balance problem and impede taskperformance.[13] Individuals with poor balance are more likely to fall, have poor mobility, difficulty performing daily activities and reduced quality of life.[13,14]

Freezing refers to difficulty starting or continuing movement and is a disabling and frustrating problem experienced by many people with Parkinson's disease.[15]

FALLS AND FALL RISK IN PARKINSON'S DISEASE

Falls are a major problem for many people with Parkinson's disease (PD).[16]Reduced balance is known to be an important risk factor for falls in this population[17-19]Balance requires maintenance of the body's centre of mass within the limits of the base of support while sitting or standing, and control of the centre of mass while moving to a new base of support during walking or running.[20] Balance is often assessed with tasks designed to make controlling the centre of mass over the base of support difficult[21]. Therefore balance can be measured indirectly by tests of the individual's ability to perform balance-related activities, particularly in individuals with impairedmobility.[22]

Risk factors for falls

Risk factors for falls in the general older population include impaired gait, reduced balance, lower limb weakness, poly pharmacy, foot problems, peripheral sensory deficits and visual and hearing deficits.[23,24-27]

THE OTAGO EXERCISE PROGRAM

The OTAGO programme is a commonly implemented exercise programme aimed at improving strength, balance and gait with an average 35% falls rate reduction reported in community dwelling older.[28]Postural control involves the interaction of musculoskeletal and neural systems and is mediated by central processes dependent on peripheral sensory inputs, mostly from the visual, proprioceptive, and vestibular systems. Numerous additional properties, including higher-order balance mechanisms (i.e. anticipatory postural adjustments) and sensory re-weighting (adaptability to changing environmental and task conditions) are also required.[29]

MATERIAL AND METHODOLOGY

RESERCH DESIGN	**:** Interventional study
STUDY POPULATION	**:** Patients with Parkinson's disease
STUDY SIZE	**:** 20 patients
STUDY DURATION	**:** 6 months

TREATMENT DURATION : 6 weeks (36 sessions)

SELECTION CRITERIA

INCLUSION CRITERIA-

1. Age 45 to 65 years
2. No previous diagnosis of vestibular dysfunction.
3. History of fall
4. Sufficient cognitive ability to participate, as indicated by MMSE score of 24 or higher.

EXCLUSION CRITERIA-

1. Acute illness without significant underlying instability.
2. Medications Side effects
3. Musculoskeletal disorder affecting postural stability
4. Neurological disorder affecting postural stability
5. Disability in visual, auditory sensations and vestibular organs
6. Defects in extremities
7. Fracture in past years

OUTCOME MEASURES:

1. DYNAMIC GAIT INDEX
2. BERG BALANCE SCALE

- **EXERCISE PROGRAM PRESCRIPTION**
- The starting level is determined by the amount of ankle cuff weight the person can use to perform 8 to 10 good quality repetitions before fatigue. This needs to be assessed for each muscle group on each leg.
- The person does the exercises slowly through the functional range of active joint movement.

TABLE-1: STRENGHTENING EXERCISE

STRENGTHENING EXERCISES	NO. OF REPETITIONS FOR STRENGTHENING AND PROGRESSION					
	Day 1-2	Day 3-5	Day 5-12	Day 13-20	Day 21-28	Day 29-36
Knee Extensors (front knee strength)		Resistance with 5grams*10 repetitions	Resistance with 1kg*10 repetitions	Resistance with 1.5kg*10 repetitions	Resistance with 2kg*10 repetitions	Resistance with 2.5kg*10 repetitions
Knee Flexors (back knee strength)		Resistance with 5grams*10 repetitions	Resistance with 1kg*10 repetitions	Resistance with 1.5kg*10 repetitions	Resistance with 2kg*10 repetitions	Resistance with 2.5kg*10 repetitions
Hip Abductors (side hip strength)		Resistance with 5grams*10 repetitions	Resistance with 1kg*10 repetitions	Resistance with 1.5kg*10 repetitions	Resistance with 2kg*10 repetitions	Resistance with 2.5kg*10 repetitions
Ankle plantar flexors (calf raises)		Resistance with 5grams*10 repetitions	Resistance with 1kg*10 repetitions	Resistance with 1.5kg*10 repetitions	Resistance with 2kg*10 repetitions	Resistance with 2.5kg*10 repetitions
Ankle dorsi flexors (toe raises)		Resistance with 5grams*10 repetitions	Resistance with 1kg*10 repetitions	Resistance with 1.5kg*10 repetitions	Resistance with 2kg*10 repetitions	Resistance with 2.5kg*10 repetitions

- The person's eye stay looking ahead
- The person knows that it is easy to make lower limb balance adjustments such as recovery step, while doing the exercise.

TABLE-2: BALANCE EXERCISES

BALANCE RETRAINING EXE	NO. OF REPETITIONS FOR BALANCE RETRAINING EXERCISE AND PROGRESSION					
	DAY 1-2	DAY 3-5	DAY 5-12	DAY 13-20	DAY 21-28	DAY 29-36
Knee bends		10 repetitions with support	10 repetitions withhold and support	10 repetitions withhold and support	10 repetitions withhold and no support	3*10 repetitions withhold and no support
Backwards walking		10 steps*4 times with support	10 steps*5 times with support	10 steps*5 times with no support	10 steps*5 times with no support	10 steps*7 times with no support
Walking and turning around		2 times with support	5 times with support	5 times with no support	5 times with no support	5 times with no support
Sideways walking		10 steps*2times with support	10 steps*5 times with support	10 steps*5 times with no support	10 steps*5 times with no support	10 steps*5 times with no support
Tandem stance (heel toe stand)		10 sec with support	20 sec with support	30 sec with support	30 sec with no support	30 sec with no support
Tandem walk (heel toe walk)				Walk 10 steps with support	Walk 10 steps with no support	Walk 20 steps with no support
One leg stand		10 sec hold with support	10 sec hold with support	10 sec hold with no support	20 sec no hold	30 sec no hold and support
Heel walking				10 steps 4 times with support	10 steps 4 times with support	10 steps 4 times with no support
Toe walking				10 steps 4 times with support	10 steps 4 times with support	10 steps 4 times with no support
Heel toe walking backwards					Walk 10 steps with support	Walk 10 steps with no support
Sit to stand		5 times with support	5 times with minimum support	10 times with minimum support	10 times with no support	10 times with no support
Stair walking					10 steps with support	10 steps with no support

RESULT AND INTERPRETATION

For the statistical analysis, data were obtained before the treatment and after the 6 weeks of treatment. BBS score was taken for functional balance before intervention & after 6 weeks, DGI score was taken for functional gait before intervention & after 6 weeks. Paired t test- was used for the comparison between the pre and post values of outcome measures within the groups. The significance level adopted for the statistical tests was <0.05 and CI was kept at 95%.All statistical tests were performed using SPSS Version 16 software.

TABLE: 3 MEAN OF AGE

MEAN	MINIMUM	MAXIMUM	SD
57	47	65	5.91

TABLE: 4 INTRA GROUP COMPARISON FOR BALANCE AND GAIT

OUTCOME MEASURES	PRE		POST		t-Value	P-Value
	MEAN	SD	MEAN	SD		
BBS	46	3.79	50	3.92	13	0.000
DGI	13	3.58	20	2.35	16	0.000

Intra Group Analysis: The above table shows the intra-group

comparison of BBS for functional balance and DGI for functional gait. The comparison was done through **paired t test**. The p value comparing pre and post treatment scores of BBS is 0.000 while for DGI is 0.000. The p value is < 0.05 which shows that both groups are significant in improving functional balance and functional gait.

DISCUSSION

Purpose of the study is to find out the efficacy of otago exercise program in improving balance and gait affection in patients with Parkinson's disease. Otego exercise was given in 36 sessions. The outcome measures were berg balance scale (BBS) for functional balance and Dynamic gait index (DGI) for functional gait.

Paired t test shows p value <0.05 in both the outcome measures for suggesting that the treatment protocol has been significant in improving the balance and gait. Pre-Post p value of DGI was more than the pre-post p value of BBS. So here gait was more improved than balance in Parkinson's participants.

Parkinson's disease (PD) is a long term degenerative disorder of the basal ganglia that mainly affects the motor system. The symptoms generally come on slowly over time. The most obvious symptoms are rigidity, shaking, slowness of movement, gait abnormalities like "freezing of gait" and poor postural balance that together causes difficulty in walking. The most recognize type of static deformity is the classic stooped simian appearance, with flexion of the hip and knees and rounding of the shoulder. The motor symptoms of the disease results from the death of cells in the substantia nigra, a region in the mid brain. This results in lack of dopamine in this region and results in formation of lewy bodies. All the above motor symptoms produce balance and gait abnormalities in patients with Parkinson's disease. Postural stability is a key component of functional mobility. Balance problems and resulting falls are major factors determining quality of life, morbidity and mortality in Parkinson's disease.

Balance can be defining as control of the body's center of mass over its base of support in order to achieve postural equilibrium and orientation. The term "balance control" refers to a multi system function that strives to keep the body upright while sitting or standing and while changing posture. Balance control id 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.

Theoretically, in patients with Parkinson's diseases, postural instability may be the result of faulty processing in three main distinct processes: (i) Sensory organization, in which one or more of the orientation senses (visual, vestibular and somatosensory) are involved and integrated with in the basal ganglia. (ii) Motor adjustment process, which provides a properly scaled neuromuscular response. (iii) Background muscle tone, known to be hypertonic in Parkinson's patients.

Otago exercise program was designed specially to prevent falls. It consists of set of leg muscles strengthening and balance retraining exercises progressing in difficulty and a walking plan. The exercises are individually prescribed. The otago exercise program was helpful in walking, standing erect and control of the body when it moves in a small range of area, and regaining balance when moving unconsciously. The hip strategy is used when the body moves faster as the velocity increases along with the distance; Otago exercise helped walking posture with regard to movement correction and muscle activation pattern and the helped with balance control with regard to the base of support. The OEP is a home-based balance and strength retraining program. The exercises consisted of the following strengthening exercises: knee extensor (four levels), knee flexor (four levels), hip abductor (four levels), ankle plantarflexors (two levels), and ankle dorsiflexors (two levels). The balance retraining exercises consisted of the following: knee bends (four levels), backwards walking (two levels), walking and turning around (two levels), sideways walking (two levels), tandem stance (two levels), tandem walk (two levels), one-leg stand (three levels), heel walking (two levels), toe walking (two levels), heel toe walking backwards (one level), and sit to stand (four levels).

CONCLUSION

The results of the present study suggest that both balance function (BBS) and gait function (DGI) are Improve but Gait function (DGI) is more Improve than balance function (BBS) of the Parkinson's subjects. This study provided evidence to support the otago exercise in the short-term management of Parkinson's participants.

REFERENCES

1. Access Economics (2007) Living with Parkinson's disease: Challenges and positive steps for the future. Parkinson's Australia.
2. Strecker K, Schwarz J (2008) Parkinson's disease: Emerging pharmacotherapy. Expert Opinion on Emerging Drugs 13: 573-591.
3. 3. Marsden CD (1994) Parkinson's disease. Journal of Neurology, Neurosurgery and Psychiatry 57: 672-681.
4. Susan O SulivanPT,EdD : Physical rehabilitation, 5th edition
5. Hughes A, Daniel S, Kilford L, Lees A (1992) Accuracy of clinical diagnosis of idiopathic Parkinson's disease: A clinico-pathological study of 100 cases. Journal of Neurology, Neurosurgery and Psychiatry 55: 181-184.
6. Horak FB (2006) Postural orientation and equilibrium: What do we need to know about neural control of balance to prevent falls? Age and Ageing, The Prevention of Fall-related Fractures: Emerging Research Dimensions 35 Supplement ii: 7-11.
7. Melvill Jones G (2000) Posture. In Kandel E, Schwartz J, Jessell T (Eds) Principles of Neural Science (4th edn). New York: McGraw-Hill.
8. Klawans H, Topel J (1974) Parkinsonism as a falling sickness. Journal of the American Medical Association 230: 1555-1557.
9. Beckley DJ, Bloem BR, Van Dijk J, Roos R, Remler M (1991) Electrophysiological correlates of postural instability in Parkinson's disease. Electroencephalography and Clinical Neurophysiology 81: 263-268.
10. Bloem BR, Hausdorff JM, Visser JE, Giladi N (2004) Falls and freezing of gait in Parkinson's disease: A review of two interconnected, episodic phenomena. Movement Disorders 19: 871-884.
11. Fahn S, Elton R (1987) Unified Parkinson's Disease Rating Scale. In Fahn S, Marsden C, Calne D, Goldstein M (Eds) Recent developments in Parkinson's disease, vol 2. Florham Park, NJ: Macmillan Health Care Information, pp 153-164 and 293-304.
12. Stack E, Ashburn A, Jupp K (2005) Postural instability during reaching tasks in Parkinson's disease. Physiotherapy Research International 10: 146-153.
13. Bloem BR, van Vugt JP, Beckley DJ (2001) Postural Instability and Falls in Parkinson's Disease. In Ruzicka E, Hallett M, Jankovic J (Eds) Advances in Neurology: Gait Disorders, vol 87. Philadelphia: Lippincott Williams and Wilkins, pp 209-223.
14. Franchignoni F, Martignoni E, Ferriero G, Pasetti C (2005) Balance and fear of falling in Parkinson's disease. Parkinsonism and Related Disorders 11: 427- 433.
15. Giladi N, McMahon D, Przedborski S, Flaster E, Guillory S, Kostic V, Fahn S (1992) Motor blocks in Parkinson's disease. Neurology 42: 333-339.
16. Wood BH, Bilclough JA, Bowron A, Walker RW. Incidence and prediction of falls in Parkinson's disease: a prospective multidisciplinary study. J NeurolNeurosurg Psychiatry 2002;72(6):721-725.
17. Latt MD, Lord SR, Morris JG, Fung VS. Clinical and physiological assessments for elucidating falls risk in Parkinson's disease. MovDisord 2009;24(9):1280- 1289.
18. Kerr GK, Worringham CJ, Cole M, Lacherez P, Wood J, Silburn P. Predictors of future falls in Parkinson's disease. Neurology 2010;75:116-124.
19. Robinson K, Dennison A, Roalf D, et al. Falling risk factors in Parkinson's disease. NeuroRehabilitation 2005;20:169-182.
20. Winter DA. A.B.C. (Anatomy, Biomechanics and Control) of Balance during Standing and Walking. Waterloo, Ontario: Waterloo Biomechanincs, 1995.
21. Lord SR, Ward J, Williams P. The effect of exercise on dynamic stability in older women: a randomized controlled trial. Arch Phys Med Rehabil 1996;77:232-236.
22. Howe T, Rochester L, Jackson A, Banks P, Blair V. Exercise for improving balance in older people. Cochrane Database Syst Rev 2007;Issue 4:Art No.: CD004963.
23. Robinson K, Dennison A, Roalf D, Noorigian j, Cianci H, Bunting-Perry L, Moberg P, Kleiner-Fisman G, Martine R, Duda J (2005) Falling risk factors in Parkinson's disease. NeuroRehabilitation 20: 169-182.
24. Bueno-Cavanillas A, Padilla-Ruiz F, Jiminez-Moleon J, Peinado-Alonso C, Galvez-Vargas R (2001) Risk factors in falls among the elderly according to extrinsic and intrinsic precipitation causes. European Journal of Epidemiology 16: 849-859.
25. Lord SR, Menz H, Tiedemann A (2003) A physiological profile approach to falls risk assessment and prevention. Physical Therapy 83: 237-252.
26. Tinetti M, Speechley M, Ginter S (1988) Risk factors for falls among elderly persons living in the community. New England Journal of Medicine 319: 1701-1707.
27. Campbell AJ, Borrie M, Spears G (1989) Risk factors for falls in a communitybased prospective study of people 70 years and older. Journal of Gerontology 44: M112-M117.
28. Thomas S, Mackintosh S and Halbert J. Does the 'Otago exercise programme' reduce mortality and falls in older adults?: a systematic review and meta-analysis. Age Ageing 2010; 39(6): 681–687.
29. Horak FB. Postural orientation and equilibrium: what do we need to know about neural control of balance to prevent falls? Age Ageing 2006; 35(Suppl 2): ii7–ii11.