

The Role of Balance Training in Preventing Falls Among Individuals with Parkinson's Disease

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Abstract

Keywords:

Parkinson grade 1 2 and 3 patients, balance training, Fullerton Advance Balance Scale, TUG Modified falls efficacy scale.

Background: Postural instability is one of the cardinal sign in Parkinson's disease which can lead to fall in Parkinson's patients; therefore, there is need of balance training programme in Parkinson's patient.

Aim: Aim of the study was to find out the effects of balance training on fall in Parkinson's disease.

Methodology: Parkinson's patients (n=60) of grade 1, 2, and 3 according to Hoehn and Yahr classification between age group of 50-85 years. Pre post experimental study design was selected in which 2 groups were made experimental and control group each (n=30). Individuals were assessed with Fullerton Advance Balance Scale, TUG, and Modified Falls efficacy Scale pre, 2ndweek and post.

Results: Using repeated measures ANOVA comparison between Pre, 2nd week and post intervention values were compared in between experimental and control group. It was found that experimental group values of pre, 2ndweek and post intervention of Fullerton Advance Balance Scale p (0.0001) TUG p (0.0001) Modified falls Efficacy Scale - getting in/out of the bed p (0.0001) are extremely significant. For control group values of pre, 2ndweek and post intervention of Fullerton Advance Balance Scale p (0.9884) TUG p (0.0533) Modified falls Efficacy Scale value for - getting in/out of the bed activity values obtained p (0.9840) are not significant.

Conclusion: The study shows that balance training was effective to reduce risk of fall in Parkinson's patient.

Introduction

Parkinson's disease (PD) is a chronic, progressive disease of the nervous system characterized by the cardinal features of rigidity, bradykinesia, tremor and postural instability. The disease may cause symptoms including movement and gait disturbances; sensory changes; speech, voice, and swallowing disorders. Onset is insidious with slow rate of progression. PD is a very common neurodegenerative disease that affects more than 2% of the population older than 65 years of age. Average age of PD onset is approximately 50-60 years. The term Parkinsonism is used to refer to a group of disorders that produce abnormalities of basal ganglia (BG) function. ⁽¹⁾

Good balance is an imperative skill for daily life that requires the complex integration of sensory information regarding the position of body relative to the surrounding and ability to generate appropriate motor responses to control body movements. ⁽²⁾

Patients with PD demonstrate abnormalities of posture and balance. As the disease progresses, abnormal and inflexible postural responses along with increased body sway are seen. Narrowing of the base of support or competing attentional demands (divided attention situations) increases postural instability. 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. ⁽¹⁾

Patients with PD demonstrate problems with voluntary movement. Akinesia refers to absence of movement. Movements of freezing may occur and are characterized by a sudden break or block in movement. Bradykinesia refers to slowness and difficulty maintaining movement. ⁽¹⁾

Postural instability is one of the cardinal signs in PD. It can be present even at diagnosis; but becomes more severe with disease progression. It represents one of the most disabling symptoms in the advanced stage of the disease as it is associated with increase falls and loss of independence. ⁽³⁾

Falls also occurs due to loss of “righting reflexes” an inability to take corrective measures to prevent fall. Patient with a backward lean develop a tendency to step backwards when they start to walk or when bumped from the front. This is known as retropulsio. ⁽⁴⁾.

Materials and methods

Methodology

Study design: Pre-Post experimental study

Study type: Experimental

Sample size: (n=60) experimental group (n=30) and control group (n=30)

Materials required

Pen

Proprioceptive Balance Board

Swiss ball

Outcome measures

1. Fullerton Advance Balance Scale (FABS) ⁽⁵⁾
2. Timed Up and Go test (TUG) ⁽⁶⁾
3. Modified Falls Efficacy Scale (MFES) ⁽⁷⁾
4. Hoehn and Yahr classification ⁽⁸⁾

Inclusion criteria

1. Parkinson’s patient
2. Grade 1, 2 and 3 (Hoehn and Yahr classification) ⁽⁸⁾
3. Age group of 50-83, both the genders were included.

Exclusion criteria

1. Grade 4 and 5 Parkinson’s patients
2. Any other neurological deficit which causes impairment
3. Festinating gait.

Procedure

The subjects were selected according to inclusion and exclusion criteria. Subjects were explained the purpose of study and intervention program and consent was taken. According to the evaluation form data will be collected in which medical history will be taken, subject were assessed with (FABS), (MFES), (TUG) pre intervention, 2nd week intervention, and post intervention. Intervention programme was of 4 weeks alternate days each week.

Intervention: This was a self-designed protocol & progression was done according to the prognosis of the patient. Intervention was designed for 4 week period alternate days per week.

Warm up for 10 min before every session. Intervention time given was of 30-45 mins, followed by cool down period.

Warm up consisted of general stretches of UE and LE, multi-axial movements of shoulder joint, cervical movement’s flexion, extension, side flexion, rotations.

Protocol for grade 1 and 2 patients: Initially with standing feet together (15-30 sec) proceeding to tandem walking, by 3rd week foam board balance training with (eyes open-eyes close 15-20 secs) progress to movement transition like (sit to stand, half kneeling to standing and stepping), by 4th week Swiss ball activity (forward reach, forward bending to retrieve object from floor, knee extension while sitting on the ball unilaterally), external perturbation.

Protocol for grade 3 patients: Initially starting with general mobility exercise slowly progression towards UE weight shifts in sitting (10 repetition), LE weight shifts (10 repetitions), progression to narrow base of support with eyes open and eyes close. By 3rd week progression of the same exercise on Proprioceptive balance board hold position for 10-30 secs as per patient’s tolerance, 4th week onwards Swiss ball activities only reach outs.

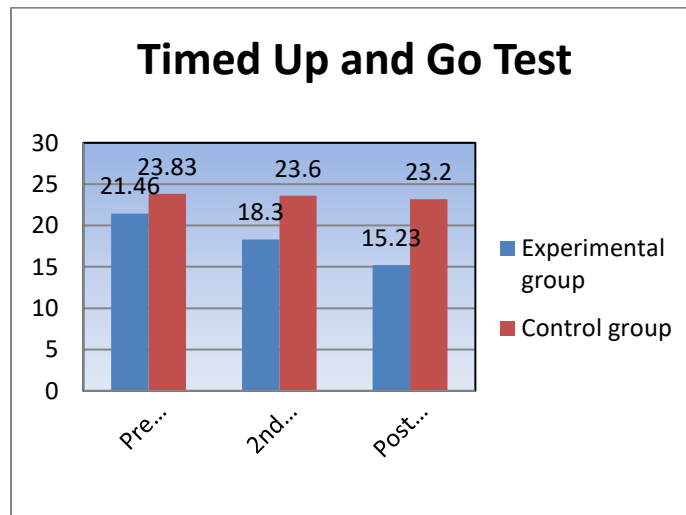
Cool down period consisted of deep breathing exercises, shavasan.

Results

Fig 1: Tug

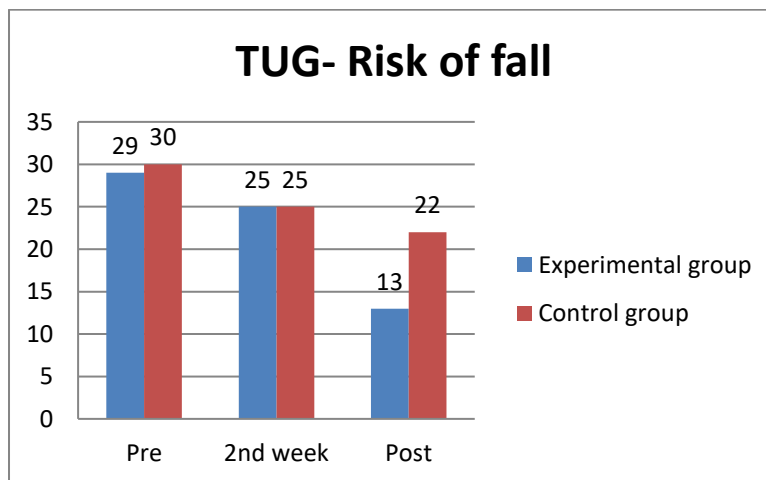
Comparing grade 1, 2 and 3 experimental and control group Parkinson’s patients of Timed Up and Go Test in Parkinson’s patients.

		Experimental Group	p- value	Control group	p- value
TUG	Pre	21.46± 3.76	<0.0001	23.83± 5.93	0.0533
	2 nd week	18.3± 4.37		23.6±5.64	
	Post	15.23± 4.44		23.2±5.35	



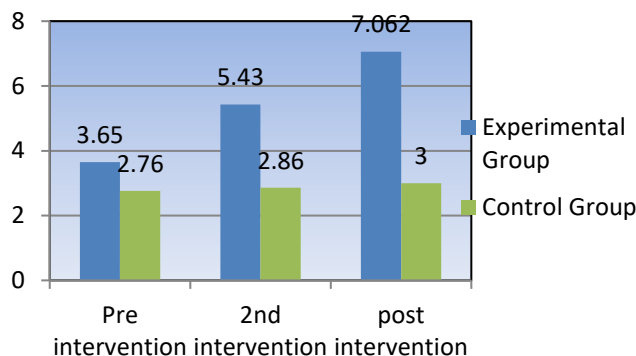
Interpretation: The result obtained for TUG showed extremely significant improvement in experimental group, whereas there was no improvement seen in control group.

Fig 2



Interpretation: The graphs shows reduce risk of fall in Parkinson patient before, mid and post intervention improvement according to the TUG scoring.

Fig 3



Interpretation: There was significant improvement in experimental group whereas there was no significant improvement in control group.

Discussion

The purpose of this study was to investigate the effects of balance training on fall in Parkinson's disease. Self-assign intervention programme was done, according to the Parkinson's grade and capability of the patient. Progression was done in the exercises by 2nd week of intervention as this helped in prognosis of the capability of the patients to carry out more challenging exercises.

The nervous system provides: Sensory processing for perception of body orientation in space provided mainly by the visual, vestibular and somatosensory systems. Sensorimotor integration is essential for linking sensation to motor responses and for the adaptive and anticipatory aspects of postural control. Motor strategies for planning, programming and executing balance response. This study had activated visual, vestibular and somatosensory systems. Exercises like standing with less BOS with eyes open activated visual system, weight shift in UE and LE was given to activate somatosensory system. Somatosensory information has the fastest processing time for rapid responses, followed by visual and vestibular inputs. Vestibular, visual and somatosensory inputs are normally combined seamlessly to produce our sense of orientation and movement. The author David Conradsson and colleagues also concluded in their study that visual sensory exercise has significantly benefited balance and gait abilities when compared with usual care and showed promising transfer effects to everyday living.⁽⁹⁾

Anticipatory balance control was improved by giving reach outs in all directions to touch or grasp the object or therapist hand, using different posture like sitting, standing and sitting on unstable surface like Swiss ball, functional task that involves multiple parts of the body to increase the challenge to anticipatory postural control.

Central nervous system uses three movement systems to regain balance after the body is perturbed; reflex, automatic and voluntary system. Avril Mansfield and colleague concluded in their study saying perturbations based training shows as an effective intervention to improve the ability to older adults to prevent them from falling when they lose their balance.⁽¹⁰⁾ Even in our study perturbation showed significant improvement on balance to prevent risk of fall.

In our study reactive balance control was improved by giving exercises like tandem stance, tandem walking which emphasize the hip strategy. The patient work gradually to increase the amount of sway when standing in different directions while on a firm stable surface. Closed loop control is utilized for precision movements that require sensory feedback such as Swiss ball activities or on a balance beam.

Postural control challenging exercise can even help to improve balance exercise. Jaswinder Kaur, Shweta Sharma and colleagues concluded in their article the benefit of exercises improving balance with subsequent functional improvement in individual. It is possible that intensive exercise contributes to brain repair and hence reversing the progressive functional damage of this disease. In our study postural control exercise were given which were proven statistically significant to improve balance.⁽¹⁾

Control group was undergoing through active joint mobilization techniques, muscle stretching motor coordination exercise were carried out in supine position (bending the left UE while simultaneously extending the right LE), which did not significantly improved balance. Author Nicola Smania, MD with his colleagues in their study also had

the similar intervention for the control group. Their study concluded that there was no significant changes in performance were observed in control group. ⁽¹¹⁾

Conclusion

The study shows that balance training was effective to reduce risk of fall in Parkinson's disease.

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