Original Article

Effects of dynamic posturographic balance training versus conventional balance training on mobility and balance in elderly

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Objective: To determine the effects of dynamic posturographic balance training versus conventional balance training in improving mobility and balance in elderly.

Methodology: Forty subjects between 50 to 80 years of age were selected via non-probability convenience sampling technique, for this randomized controlled trial. Both females and males with no major co-morbid conditions and cognitive impairments were recruited and randomized via coin toss method into two equal groups: Dynamic Posturographic balance training (DPG) group and Conventional balance training (CBT) group. The DPG training was provided via Biodex Balance System (Static & Dynamic). Both groups received interventions 3 times (35 to 45min each day) a week for 8 weeks, after which terminal assessment was done. Data were collected on demographic profile, balance via berg balance score and mobility by using Timed Up and Go Test. Independent samples t test was used to check difference between CBT group and DPG Group and repeated measures Analysis of Variance (ANOVA) was used for within-group analysis.

Results: Baseline analysis of Berg balance scale and timed up and go test between two groups showed no significant difference with (p 0.805 & 0.251, respectively). After 8 weeks of intervention, there was significant difference between the groups in both variables (p 0.019 & 0.001, respectively).

Conclusion: Dynamic posturographic balance training was more effective in improving dynamic balance and mobility in elderly population in comparison to conventional balance training. (Rawal Med J 201;42:522-527)

Key words: Berg balance score, conventional balance training, dynamic posturography, Timed up and go test.

INTRODUCTION

Balance is the ability to maintain the body's center of mass over its base of support.[1] Balance is control by multiple system of the body like vision, proprioception, vestibular and motor. One or all of these elements can be particularly affected by increasing age as well as by disease, injury or certain drugs. The strength and power of lower extremities musculature, balance & postural control are affected by aging process and these are considered main risk factors for falls.[2] Financial impact of health care and quality of life can be improved by preventing falls and improving the balance.

Numerous exercise regimes have been utilized in management of balance problems including resistance training, balance training, endurance training and combination of all such programs.[3] Hence these physical exercises are considered to be one tool, effective for preventing falls in the older population.[4] A meta-analysis has confirmed the effectiveness of exercise in decreasing the possibility of falls in the elderly and resultant decrease in health care costs.[5] Another systematic review reported that muscle strengthening and balance exercises produced a respective 20% and 51% reduction in the relative risk rates for falls in the elderly.[6] Moreover these interventions are safe and improve clinical balance outcomes in older people.[7] The effectiveness of stability training,[8] dynamic proprioceptive exercises[9] and visual feedback training[10] have been documented. A reduced risk and fear of falling is attributed with increasing dynamic balance.[11-13] Significant improvement in balance parameters was observed following dynamic posturographic balance training on functionally unstable ankles[14] and Parkinson's disease.[15]

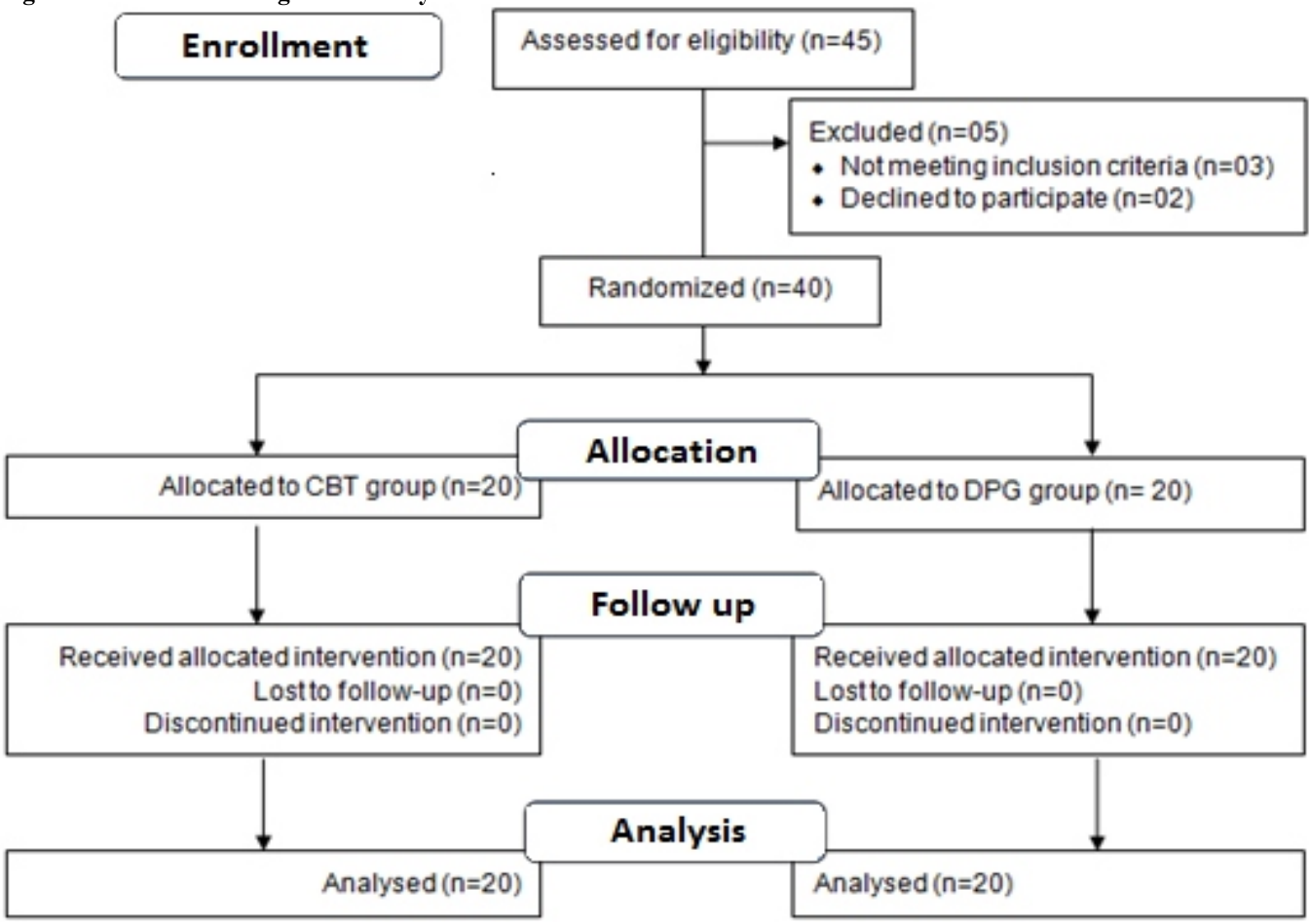
For the last two decades, Dynamic posturography

has been used by the clinicians for the measurement of neuromuscular and somatosensory control.[16] As an assessment tool, these dynamic posturography systems have been used in a variety of populations worldwide but due to unavailability of such systems in Pakistan it has not been used in training of older people. Also there is a scarcity of published data regarding the utility of such systems. Hence this study was conducted to determine the effect of dynamic posturographic balance training on mobility and balance of elderly in comparison to conventional balance training regime.

METHODOLOGY

This randomized control trial was conducted in Foundation University Institute of Rehabilitation Sciences, in collaboration with department of physical medicine and rehabilitation, Fauji Foundation Hospital, Rawalpindi, Pakistan from July 2016 to October 2016. A sample of 40 subjects was selected using Non probability convenience sampling technique and was randomized into Dynamic posturographic balance training (DPG) group (n=20) and Conventional balance training (CBT) group (n=20) using simple randomization via Coin toss method (Figure 1). The inclusion criterion was normal individuals of both genders having age between 50 to 80 years. The exclusion criteria was established as individuals having any musculoskeletal conditions (fractures, severe arthritis, etc.), vestibular problems, neurological conditions like epilepsy, Parkinson, Alzheimer's, impaired cognition, other systemic diseases or co-morbidities and osteoporosis. Ethical approval for study was obtained from Ethics Review committee of Foundation University and written informed consent was obtained from every subject.

Figure 1. CONSORT Diagram of study.



The DPG group received Dynamic Posturographic balance training via Biodex Balance System SD Model 950-440 (Biodex, Inc., Shirley, NY, USA). DPG group training included side to side and anterio-posterior weight shift training exercise, limits of stability training exercise and weight bearing training exercise. The CBT group was provided with conventional balance training including bilateral weight shifting, bilateral trunk rotation, reaching out of base of support in different direction etc. Initial assessment was done on all participants at baseline before intervention. Both groups received interventions 3 times a week (30 to 45 min per session) for 8 weeks after which terminal assessment was done. Data was collected on demographic profile of subjects, on balance via berg balance scale (BBS) and on mobility by using Timed Up and Go Test (TUG).

Data were analyzed by using SPSS version 20.0. Shapiro-Wilk Test of homogeneity was used to evaluate homogeneity between groups for berg balance scale and Timed up and go test for which P value was computed. Non-significant values of Shapiro-wilk test justified the use of parametric test to assess difference between groups. Independent sample t-test was used to check difference between CBT group and DPG Group and repeated measures ANOVA was used for within-group analysis. Confidence interval was set at 95% for statistical testing based on which P value of less than 0.05 was considered statistically significant.

RESULTS

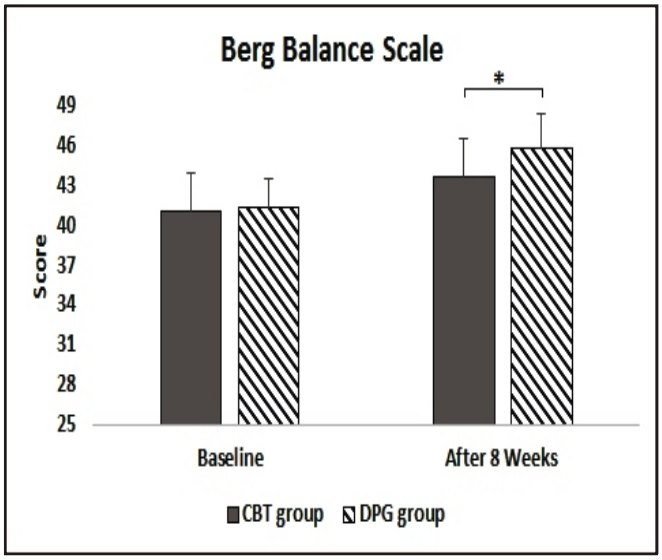
Demographic data including age, weight, height, body mass index (BMI) and gender distribution is shown in Table 1, which shows uniform distribution of all variables between CBT group and DPG group ($p<0.05$).

Table 1. Demographics distribution between groups.

Variable	CBT Group (n=20)	DPG Group (n=20)	P-Values
Age (Years ± SD)	63.0 ± 7.54	61.8 ± 7.39	0.614
Weight (Kg ± SD)	74.48 ± 8.30	71.88 ± 5.45	0.249
Height (m ± SD)	1.63 ± 0.076	1.60 ± 0.060	0.187
BMI (Kg/m^2 ± SD)	28.25 ± 4.22	28.14 ± 2.30	0.917
Gender Distribution			
Males	35 % (n=7)	45% (n=9)	0.518
Females	65% (n=13)	55% (n=11)	

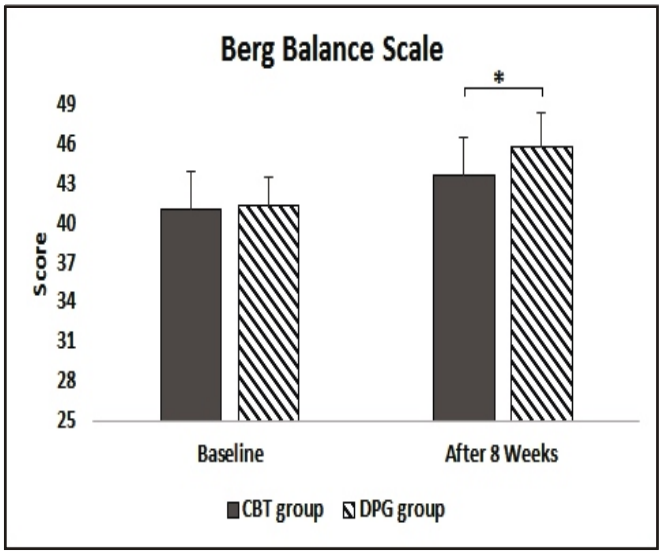
Baseline analysis of Berg balance scale & timed up and go test between CBT group and DPG group also showed no significant difference with p values of 0.805 & 0.251, respectively. After 8 weeks of intervention there was significant difference between CBT group & DPG group in both variables i.e. BBS & TUG with p values computed as 0.019 & 0.001, respectively (Figure 2 & 3).

Fig. 2. Independent Samples t-test results of BBS between CBT group & DPG group.



* Statistically significant result with P value <0.05

Fig. 3. Independent Samples t-test results of TUG between CBT group & DPG group.



* Statistically significant result with P value <0.05

Within-group analysis showed significant difference between baseline assessments and assessments after 8 weeks in CBT group and DPG group on berg balance scale (p values of 0.001 and <0.001, respectively).

Table 2. Pair-wise comparison of BBS and TUG assessments in CBT group and DPG group.

Variable	Assessment Point	CBT Group		DPG Group	
		Mean Diff	P value	Mean Diff	P value
Berg Balance Scale (BBS)	Baseline Assessment – 02 weeks Assessment	**0.778**	**0.008**	**1.450**	**<0.001**
	02 Week Assessment- 04 Week Assessment	0.611	0.855	1.550	<0.001
	04 Week Assessment – 06 Week Assessment	0.556	0.861	0.800	0.004
	06 Week Assessment 08 Week Assessment	0.500	1.000	0.700	0.001
	Baseline Assessment – 08 Week Assessment	**2.444**	**0.001**	**4.500**	**<0.001**
Timed Up and Go Test (TUG)	Baseline Assessment – 02 weeks Assessment	**0.854**	**0.025**	**1.331**	**0.001**
	02 Week Assessment- 04 Week Assessment	1.049	0.001	0.825	0.030
	04 Week Assessment – 06 Week Assessment	0.752	0.099	1.590	0.002
	06 Week Assessment 08 Week Assessment	0.852	0.014	0.884	<0.001
	Baseline Assessment – 08 Week Assessment	**3.507**	**<0.001**	**4.630**	**<0.001**

Similarly for TUG; within-group analysis revealed, significant improvement in both groups with P values of <0.001. The improvement was more marked in DPG group compared to CBT group as shown in Table 2.

DISCUSSION

The results of this study showed that balance training regimen can significantly improve balance and mobility in the elderly. Training with dynamic posturography system is used to develop proprioception and balance as well as an outcome determinant to assess the progress during treatment.[17] Results of study have shown that after 8 weeks of training there was marked improvement in both groups as shown by p values (Table 2) on BBS and TUG but this improvement was more in DPG group in comparison to CBT group as shown by 4.5 points improvement in DPG group in contrast to CBT group which only improve 2.44 points on BBS. This was found to be same for TUG as shown by decrease of 4.63 sec in DPG group compared to CBT group, which was only 3.50 sec. Also post hoc analysis revealed that significant improvement occurred in both groups after two weeks of intervention but after that no significant improvement was observed between assessment points in CBT group. In contrast the DPG group was significantly improved at each data point. This shows superiority of dynamic posturographic balance training over conventional balance training regimes.

Although literature has shown the evidence of reduced falls and improved balance with exercise

interventions but its effects need to be explored further. There has been reported 25% drop in risk of falling in those studies that have exclusively followed balance training as part of the training regimen[18,19].

In the current study conventional balance training also showed improvement in balance and mobility supported by RCT which was done to measure the effects of balance training versus physiotherapy on older adults having mobility problems; significant improvement was observed in scores of ten meter timed walk test (TWT) and BBS in balance training group as compared to control group.[20]

The results of the current study are similar in improvements in dynamic balance and reduction of fall and fall risk.[21] The effects of DPG balance training were compared with balance training on wobble board in older adults, it was found that it produced greater improvements in gait characteristics of balance and hence supporting the current study.[22] The findings of the current study are in accordance with another study on 88 community dwelling older adults, in which Biodex balance training (DPG balance training) resulted in patients' improvement in perceived balance and mobility during functional activities.[23] Recently, another study comparing the effects of Virtual reality balance training and Biodex balance training reported significant increase in the mean overall balance (dynamic limits of Stability) in both groups.[24] The study limitation was that it was conducted with small sample size so the results may vary with larger sample.

CONCLUSION

It is concluded that dynamic posturographic balance training is more effective in improving dynamic balance and mobility and in turn reduction of falls in elderly population in comparison to conventional balance training.

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