Original Article

COMPARATIVE STUDY ON THE EFFICACY OF STRATEGY TRAINING PROGRAM OVER CONVENTIONAL BALANCE PROGRAM FOR RESTORATION OF BALANCE IN PATIENTS WITH PARKINSON'S DISEASE

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ABSTRACT

Background and introduction: The term "Parkinson's Diseases" is equated to "paralysis agitans" and is considered as primary "Idiopathic" form of the disease. Balance instability results from alteration at the clinical information processing level, rather than dysfunction of inputs. Strategy training program with conventional balance program and conventional balance program alone are executed to Parkinson's diseases to improve balance. The objectives of the study were to find out the effect of conventional balance program, strategy training program with conventional balance program, and strategy training program with conventional balance program over conventional balance program when delivered on patients with Parkinson's disease.

Method: Thirty subjects with moderate Parkinson's disease participated in the study and were randomly assigned into two groups. Group 1 received strategy training program with conventional balance program. Group 2 received conventional balance program. The balance was charted out using Berg Balance Scale before the intervention was delivered. The intervention duration was 4 weeks and at the end of the 4th week balance was reassessed using Berg Balance Scale and statistical analysis executed.

Results: Based upon rank and using Mann Whitney test P-value is derived. The smaller the P value (<0.0001) found in post-test of both groups than P value of (<0.015) of pre- test of both groups. So there is significant effect in group 1 after the delivery of intervention.

Conclusion: The study concluded that strategy training program more effect on rehabilitation of patients with Parkinson's diseases and helps in improving the balance.

KEYWORDS: Parkinson's diseases; Balance; Ankle and hip strategy; Conventional balance program.

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INTRODUCTION

Parkinsonism described in its entirety over year's ago is equated to "paralysis agitans", hence termed "Parkinson's disease".[1] James Parkinson a British physician in 1817 first described and named the disease. The disease is described in our age old Indian system of medicine of Ayurveda. Modern Ayurveda describes it as Kampavata (or tremor due to vata). The prevalence rate is higher in Western Countries, lower among Chinese, Afro-American, Indians and lowest among Nigerians.[2] In India prevalence rate of Parkinson's diseases is per 100,000 populations are 14 in North India, 27 in South, 16 in East, 363 for Parsis in Mumbai. Parkinson's diseases is a neurodegenerative disorder of unknown etiology causing disability increased mobility and reducing the quality of life.[3,4] Ehringer and Hornykiewicz in 1960 reported deficit of dopamine in patients with Parkinson's diseases.[5]

Purde Martin in 1967 recognized that balance disorder were inherent feature of Parkinson's Diseases.[6] The progressive loss of dopaminergic cells in the pars compacta of the substantia nigra in the mid-brain alters in the brainstem results in increased extremity and truncal tone, motor in coordination, leading to imbalance, individual with Parkinson's diseases suffer loss of balance, decreased flexibility, poverty of movement and poor movement confidence. [7-13]

The presence of postural instability separates mild Parkinson's diseases (Hoehn and Yahr stages 1 and 2) from moderate and severe Parkinson's diseases (Hoehn and Yahr stages 3-5), quality of life inexorably deteriorates for patients with moderate or severe Parkinson's diseases.[14] Rehabilitative management cannot alter the primary process, but have important effect on the secondary impairment and the functional disability that ensue. Levadopa has been used successfully in treating Parkinson's diseases since long time. [15, 16] Levodopa is the cornerstone of management and is usually with a pheripherals dearboxylase inhibitor namely carbidopa that helps to reduce the peripheral side effects of levodopa.[17] The value of physiotherapy has been recognized even in the pre-levodopa era, and its important role in the rehabilitation of Parkinson's diseases.[18] As medical professionals, we take balance for granted in our lives and in lives of the people around us. Balance is the ability to maintain the body's center of mass over its base of support.[19] Good balance exists as multiple systems interacts flawlessly and automatically, providing accurate and exact information to our nervous system. Nicholai Bernstein, a Russian investigator argued, it would be difficult for brain independently to regulate the number of motions of the many mechanical linkages of the body and activities associated muscle groups.[20] Hence hypothesized that nervous system organized movement in a hierarchical manner, with higher levels of the nervous system activating lower level synergies, which are a group of muscle constrained to act together as a unit.

Gurfinkel proposed the reorganization in neural control of posture was the result of the functioning of central programmes which coordinate the activity of different muscle group during postural control. Automatic postural responses or strategies are set of functionally organized, responses that act to keep the body in the state of equilibrium[21, 22]. Evidences support the hypothesis that balance is controlled by neurally programmed synergies, and coupling of muscles served the function of stabilizing ankle sway, the response termed the 'sway synergy [23, 24]. The ankle strategy was first patterns for controlling upright sway. The ankle strategy restores the center of mass, to a position of stability through body movement centered primarily about the ankle joints. Motion of the platform in the backward direction causes the subject to sway forward. Muscle activity being after perturbation, onset in gastrocnemius followed by hamstring finally paraspinal muscle [23]. When retraining the use of ankle strategy during self initiated sway, patient are asked to practice swaying back and forth, and side to side, within small ranges, keeping the body straight and not bending at the hip or knees. The ankle strategy also called ankle sway, uses the length of the foot as a lever to correct for minor loss of balance. In the ankle strategy, activation of muscle is from the floor up or distal to proximal [26] Hip strategy controls the motion of the center of mass by producing large and rapid motion at the hip joint with anti phase rotation of the ankle [25]. Activation of muscle is from trunk down or proximal to distal. Ankle and hip strategy were the specific balance strategy training.

Aims and Objectives: The objective of the study is to analyze the effectiveness of conventional training program, conventional training along with strategy training program and compare the efficacy of conventional training program along with strategy training program over conventional training program on restoration of balance in Parkinson's patients.

MATERIAL AND METHODS

Population: All the subjects suffering from primary Parkinson's disease who referred for physiotherapy treatment were selected for the study.

Setting of the Study: The study was conducted in the department of physiotherapy in Florence rehabilitation center, Bangalore.

Sample and sampling technique: Thirty subjects were included from 38 Parkinson's patients referred for physiotherapy, as per the inclusion and exclusion criteria of the study. Selected 30 subjects were randomly divided into two equal groups with 15 subjects in each group by lottery method.

Inclusion criteria: Primary Parkinson's disease**,** Both male and female genders, Age group between 40-60 yrs, Grading 3 on Hoehn and Yahr scale and Grade poor, fair on functional balance grade.

Exclusion criteria:

Sensory deficits, Auditory deficits,

Non – ambulant patients, Cognitive deterioration, Secondary Parkinson's diseases and Parkinsonism – plus syndrome

Randomization and allocation of treatment: Group-1 was the experimental group, it comprised of 11 male and 4 female subjects. The frequency of treatment was 20 sessions, 5 sessions a week for 4 consecutive weeks with 45 minutes each session. Group- 2 was control group, it comprised of 11 male and 4 female subjects. These subjects were given conventional balance program, the frequency and duration of treatment was same like Group -1.

Method of data collection:

Written consent was taken from the subjects after explaining the study. All the patients who volunteered for the study were grade 3 on the Hoehn and Yahr staging. Functional balance grade and Berg Balance scale grade was evaluated and collected the data before and after the training program to find out the outcome of training.

Selection of Tools:

Berg Balance scale, Hoehn and Yahr grading, Functional balance grade.

Material Used:

Mat, Table or chair, Paper and Pencil, Stop watch or timer and Chair with arm support.

PROCEDURE

Group-1 Experimental group was given strategy training and conventional balance program. The patient performs a set of exercise while standing on a mat to avoid the slipper feel of the floor and to have a comfortable base of support. The patient is asked to stand with stationary base of support then starting with exercises sit-to-stand-to-sit, raising from chair, heel raises, and toe offs, knee squats, or bending knees and then coming up, standing and sidekicks (shown in figure 2), front kicks (shown in figure 5), back kicks, marching on spot or marching (shown in figure 4), and leg lifts. Each of exercises was performed for repetition of 10 times each.

The patient was instructed to practice ankle strategy on a broad surface. Clients were asked to sway slowly in anterior/ posterior, right/ left, first to and from midline, progressing to passing midline, and finally progressing to sway toward the periphery without return to midline. Head and pelvis should travel in the same direction at same time. Clients can practice standing near a wall with a chair/table in front of them, swaying forward to touch the chair/table with their stomach (leading with the pelvis) and backward to touch the wall with the back of their head. Cues are given not to bow to the table/chair and not to touch the wall with the buttocks Hip strategy is practiced on a narrow surface. The head and pelvis travel in opposite direction to counter balance each other, in a forward bow/ backward bending motion foe anterior/posterior sway. Using the wall and table/chair, client can be cued to bow to touch the nose with table/ chair while simultaneously touching the wall with the buttocks (Shown in figure 3). Relaxation exercises in between the treatment was incorporated at times when the patients feel fatigue or tired.

Group- 2: control group performed conventional balancing exercise program. General exercise program included. The patient is asked to sit comfortably in the chair, slow rhythmic deep breathing exercise is incorporated at the starting of session and at times the patient feels fatigue or tired. The patient performs a set of exercise while standing on a mat to avoid the slipper feel of the floor and to have a comfortable base of support. The patient is asked to stand with stationary base of support then starting with exercises sit-to-stand-to-sit, raising from chair, heel raises, and toe offs, knee squats, or bending knees and then coming up, standing and

sidekicks, front kicks, back kicks, marching on spot or marching and leg lifts. Each of exercises was performed for repetition of 10 times each. (Shown in figures 1, 2, 3, 4)

Fig.1: Leg side kicking

Fig. 2: Leg front kicking

Fig.3: Marching

Fig. 4: Ankle, Hip Strategy training

Statistical Analysis:

Mann Whitney test and Wilcoxon signed rank test, Z-value and p-value is used to find the significance of Berg Balance Scale, rank, sum of rank between pre and post treatment sessions.

RESULTS

The data collected were classified then tabulated and analyzed in the form of tables and graphs, hence concluded using statistical analysis. The samples are matched with respect to age sex and are similar with respect to occupation, chief complaints and treatment.

The p-value of both groups pre test and post test has been drawn using Mann-Whitney test, (z-value) for Berg Balance Scale. When compared group 1 and group 2, the p value (<0.0001) of post test for both groups were lesser than the p value (<0.015) of pre test of both groups. There is significant improvement in the group 1 after the delivery of intervention. The rank for group1 is 345.00 and group 2 is 120.00 is based using Mann Whitney test (z-value).

Group 1

3.6% of male are at risk of getting Parkinson's disease within the age group of <=55.

3.6% of female are at risk of getting Parkinson's disease within the age group of <=55.

Total of 7.2% of both male and female are at risk of getting Parkinson's disease within the age group of <=55.

15% of male are at risk of getting Parkinson's disease within the age group of 56-60

3.3% of female are at risk of getting Parkinson's disease within the age group of 56-60

Total of 18% of both male and female are at risk of getting Parkinson's disease within the age group of 56-60.

Group 2

3.6% of male are at risk of getting Parkinson's disease within the age group of <=55.

1.6% of female are at risk of getting Parkinson's disease within the age group of <=55.

Total of 5.4% of both male and female are at risk of getting Parkinson's disease within the age group of <=55.

15% of male are at risk of getting Parkinson's disease within the age group of 56-60

5% of female are at risk of getting Parkinson's disease within the age group of 56-60

Total of 20% of both male and female are at risk of getting Parkinson's disease within the age group of 56-60.

Age (yrs)	Strategy training program and Conventional balance training (Group 1)			Conventional balance program (group 2)			Grand Total
	Male	Female	Total	Male	Female	Total	
<=55	2	2	**4**	2	1	**3**	7
56-60	9	2	**11**	9	3	**12**	23
Total	11	4	**15**	11	4	**15**	30

Table 1: Showing intra group analysis of percentage of both the genders being affected in group1 and group2.

Functional balance grade	Group1	Group2	Total
Poor	4	4	8
Fair	11	11	22
Total	15	15	30

Table 2: shows percentage of grade of patient with functional balance grade at risk of developing Parkinson's diseases in both the groups.

Groups	Time interval	No. of subjects	Mean	Std. Deviation	Wilcoxon signed rank test (z-value)	p-value
Group 1 Strategy training program and Conventional balance program.	Pre test	15	32.07	1.831	3.437	<0.001
	Post test	15	46.2	1.612		
Group 2 Conventional balance program	Pre test	15	30.53	1.302	3.431	<0.001
	Post test	15	40	1.363		

Table 3: shows inter group comparison of mean and standard deviation using Berg Balance Scale.

Berg Balance scale		N	Mean Rank	Sum of Ranks	Wilcoxon signed rank test (z-value)	p-value
Synergy and Conventional exercises	Negative Ranks	0	-	-	3.437	<0.001
	Positive Ranks	15	7.5	119		
	Ties	0				
Conventional exercises	Negative Ranks	0	-	-	3.431	<0.001
	Positive Ranks	15	8	120		
	Ties	0				

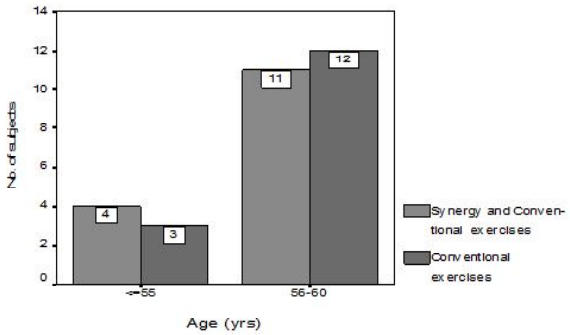
Table 4: shows rank and sum of ranks using Wilcoxon signed rank test and p-value is derived.

Scale	Study group	No. of subjects	Mean	SD	Mann-Whitney test (z-value)	p-value
Hoehn and Yahr Scale	Synergy and Conventional	15	3	0	-	-
	Conventional exercises	15	3	0		
Berg Balance scale (Pre- test)	Synergy and Conventional exercises	15	32.07	1.831	2.438	<0.015
	Conventional exercises	15	30.53	1.302		
Berg Balance scale (Post-test)	Synergy and Conventional exercises	15	46.2	1.612	4.736	<0.0001
	Conventional exercises	15	40	1.363		

Table 5: Comparison using Berg Balance scale between the groups, The p-value of both groups of pre- test and post- test has been drawn using Mann-Whitney test for Berg Balance Scale.

Scale	Study group	N	Mean Rank	Sum of Ranks	Mann-Whitney test (z-value)	p-value
Hoehn and Yahr Scale	Synergy and Conventional exercises	15	15.5	232.5	-	-
	Conventional exercises	15	15.5	232.5		
Berg Balance scale (Pre- test)	Synergy and Conventional	15	19.3	289.5	2.438	<0.015
	Conventional exercises	15	11.7	175.5		
Berg Balance scale (Post- test)	Synergy and Conventional	15	23	345	4.736	<0.0001
	Conventional exercises	15	8	120		

Table 6: shows rank and sum of rank for Berg Balance Scale for both the groups 1 and 2 of pre-test and post test

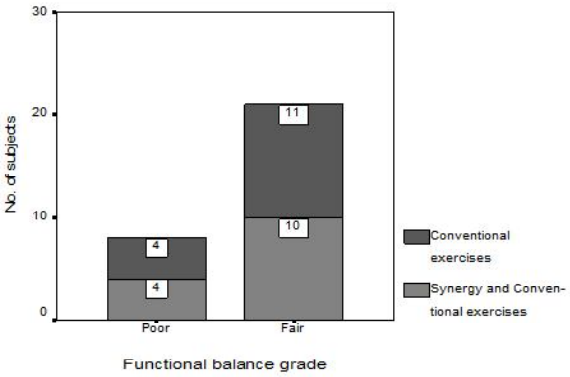


Graph1: Showing the number of subjects at risk for developing Parkinson's disease. Graph shows the number of subjects at risk for developing Parkinson's disease, within the age group of <=55 and 56-60 in both the group1 and group2.

In group 1: 26% of grade poor are risk of developing Parkinson's disease.73% of grade fair are risk of developing Parkinson's disease.

In group2: 26% of grade poor are risk of developing Parkinson's disease. 73% of grade fair are risk of developing Parkinson's disease.

Total of 26% of grade poor are risk of developing Parkinson's disease. 73% of grade fair are risk of developing Parkinson's disease.



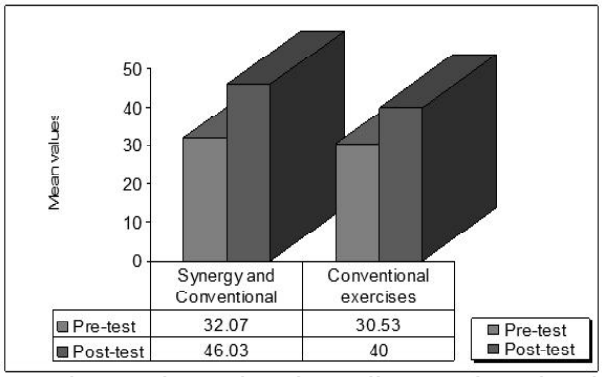
Graph 2: shows that equal percentage of subjects are at risk of developing Parkinson's disease in Synergy and Conventional exercise and conventional exercises.

Group1 is Synergy (strategy training program) with conventional exercise or balance program

Group2 is conventional exercises or balance program.

Graph 3: shows mean value of Pre and Post test of both the group1. Synergy (strategy training program) and Conventional balance program and group 2. Conventional exercises (conventional balance program. The mean value of pre test of group 1 is 32.07 and post test mean value is 46.03. In group2 mean value of pre test of group 2 is 30.53 and post test mean value is 40.

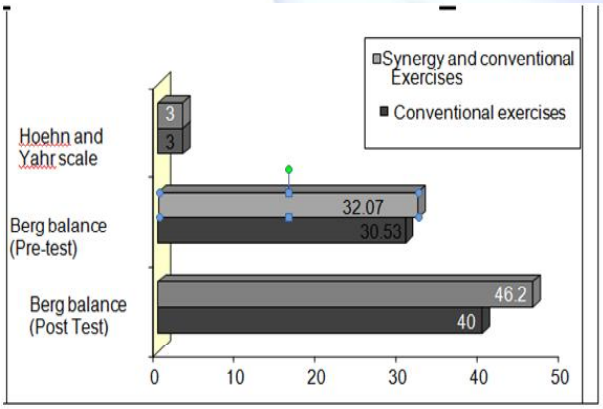
This shows the mean value of group 1 is significantly higher than the mean value of group 2.



Based upon the rank, using Wilcoxon signed rank test (z-value) 3.437 p-value (<0.001) of group 1 has been derived. Based upon the rank, using Wilcoxon signed rank test (z-value) 3.431 p-value (<0.001) of group 2 has been derived. Mean rank for group 1 is 7.50 and sum of ranks is 119.00 and mean rank for group 2 is 8.00 and sum of ranks is 120.00.

The smaller the p-value shows significant improvement .The p-value for post test for both groups is <0.0001and z-value 4.736 and p-value for pre test for both groups is <0.015 and z-value 2.438. It shows post test is significant than pre test for Berg Balance Scale and both the groups show significant improvement.

The mean for Hoehn and Yahr Scale for both the groups is 3 for 15 numbers of subjects.



Graph 4: shows mean values for Hoehn and Yahr Scale and Berg Balance Scale for Pre test and Post test for both the groups 1 and 2.

The mean value for Hoehn and Yahr Scale is 3.The mean value of pre test of Berg Balance Scale for group 1 is 32.07 and mean value of pre test of Berg Balance Scale for group 2 is 30.53..The mean value of post test of Berg Balance Scale for group 1 is 46.2 and mean value of pre test of Berg Balance Scale for group 2 is 40.

Based upon the rank and using Mann Whitney test (z-value) P-value is derived. The smaller the P value (<0.0001) found in post-test of both group 1 and group 2 than 2 P value of (<0.015) of pre- test of both group 1 and 2. So there is significant effect in the group 1 after the delivery of intervention. The rank for group1 is 345.00 and group 2 is 120.00 is based using Mann Whitney test (z-value).

DISCUSSION

Parkinson's disease is the most common degenerative disease of the basal ganglia. Disorder of the basal ganglia frequently leads to impaired mobility and falls. Parkinson's disease is common, and gait and balance difficulties in this condition are major clinical problems. Controlling the body's position in space for the purpose of balance and orientation requires motor co-ordination processes that organize muscle throughout the body into coordination movement strategies.

In this study we have tried to find out the effects of conventional balance program, conventional balance program with strategy training program and conventional balance program with strategy training program over conventional balance program. The balance parameter using Berg Balance Scale is measured in both the groups. The present study suggest that conventional balance program with strategy improves balance, when tested before and after the intervention. Comparison of inter group 1 and 2 shows that group 1 had more significant improvement in balance p-value (0.015).

Intra group showed analysis of age within the age group of <=55 and 7.2% of both gender were are at risk of developing Parkinson's diseases in group 1.Total of 18% of both male and female are at risk of getting Parkinson's disease within the age group of 56-60. In group 2 total of 5.4% of both male and female are at risk of getting Parkinson's disease within the age group of <=55.Total of 20% of both male and female are at risk of getting Parkinson's disease within the age group of 56-60.

On group analysis in group 1 and group 2, conventional balance program with strategy training was effective in improving the balance in patients with Parkinson's diseases, is suppor-

-ted by previous researchers. Conventional balance exercise has shown improvement in many of the clinical conditions. These balancing exercise show improvement in stroke patients, risk of falls in elderly people, risk of falls in older women, multiple sclerosis, Parkinson's diseases patient and its supporting evidence are follows. Ryosuke Shigemastsu et al: stated dance based aerobic exercise improved balance. Campbell A. J et al: stated home based exercise was delivered to older women to prevent falls. Gehlsen et al: stated static balance, dynamic balance improved balance in people with history of falls. O' Sullivan S and Schmitz: stated balance training in Parkinson's patients when delivered showed improvement in balance in Parkinson's patients.

Strategy training program involving ankle, hip strategy training in group of people has shown improvement in balance. Strategy training program along with general balancing program have reported to improve balance to considerable limits. Nashner L M stated that ankle sway that control balance by neurally programmed synergies brings about improvement in balance. The ankle sways to control balance in Parkinson's diseases. Jennifer C Nitz et al: stated that specific balance strategy training and control exercises interval had significant improvement in balance as compared to control exercise intervention. Shumway Cook A et al: stated a combination of activities along with strategy training exercises when delivered improved balance and functional ability in addition to reducing risk of falls.

The program of physical therapy in Parkinson's disease comprises of repetitive exercises directed at improving the balance. Both the balance group experimental and control group benefited from the intervention with significant increases in balance. Individual group analyses indicated that those participants receiving the strategy training did better than the conventional training. Such intervention encouraged increased speed range of motion, in addition improved flexibility and balance. Retraining strategies for balance control involve patient to recover, sensory and motor strategies to meet the demands of balance required for functional task. Balance training program, conducted under proper supervision, is enjoyble, effective, and a relatively safe way to improve balance in persons with Parkinson's diseases. The goal leads to development of multi joint coordinated movement, a sensitive task for the feet to hold, balance the heavy mass of bodies and the head.

CONCLUSION

Our brains receive information from sensory receptors located in eyes, increases joints muscles and skins-all providing information for balance. The difficulty ties in determining what factors affect balance and contribute to falls and what factors can be addressed to reduce future falls and improve balance in Parkinson's disease patients.

Many studies have shown that as balance becomes gradually more impaired, the risk of falling also increases. The results showed that the use of conventional balance program with strategy training program for balance has shown to improve balance in the Parkinson's patients. The data analysis found a significant difference between conventional balance program and conventional balance program with strategy training program. This study supports the use of conventional with strategy training to improve balance in patients with Parkinson's diseases with moderate disability.

Limitation of Study: The limitation of the study include small sample size, less treatment duration, subjects selected were only those who were moderately disabled. Therefore, generalization of the scores was difficult.

Recommendation: This study can be done with a lager sample size; with more aged people and increased duration treatment. More balance variables can be studied with effect of yoga, meditation, and aerobic and dance-aerobic exercise. The study can be included with strengthening program for ankle muscle and then training for ankle-hip strategy. This Study can be done on risk of falls in older people and follow up also recommended.

Conflicts of Interest: None

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