EFFECT OF PROPRIOCEPTIVE TRAINING ON BALANCE AMONG PARKINSON PATIENTS

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INTRODUCTION

Parkinson's disease (PD) is a neurodegenerative illness that causes progressive extrapyramidal motor impairment, which is predominantly caused by the loss of dopaminergic nigrostriatal function[1]. Tremor, bradykinesia, stiffness, gait, and balance issues are some of the motor signs of parkinsons disease[2]. Proprioception is integrated by the central nervous system to provide an overall representation of body position, movement, and acceleration. Parkinson disease is expected to affect 100 to 200 people per 100,000 people over the age of 40[3].

Proprioception is the conscious knowledge of one's body and limbs. In healthy adults, proprioceptive process increases. Training triggers proprioceptive and motor learning processes at the same time, resulting in short-term neuroplastic alterations that improve motor performance[5]. In the importance of position sense for controlling motor, treatments are concentrating for motor they also should recognize to regain joint position sense training[6]. There are many studies based upon proprioception but no one has told the importance of training proprioception and its uses[7].

Somatosensory disorders such as poor proprioception and tactile perception, changed diminished proprioceptive function are all linked to Parkinson's disease[8]. Increased active and passive joint position sense mistakes, as well as raised detection thresholds for position and passive motion sense, are all signs of impaired proprioception in Parkinson's disease[9]. Because of the potential benefits of somatosensory training on motor performance, this method has sparked a lot of interest. There have been various proposals for proprioceptive or somatosensory-based training. They usually focus on proprioceptive and tactile afferent signals to improve motor function[10].

Controlling the body's centre of mass (CoM) over its base of support in order to establish postural stability and direction is known as balance[11]. Balance management necessitates active brain processes that integrate information from all levels of the neurological and musculoskeletal systems, both when moving (dynamic balance) and when standing still (static balance). Although modest balance issues, degree and kind balance impairments worsens as the disease progresses[5]. Because of striatal dopamine depletion in the nigrostriatal dopamine pathway[12], the disease affects resting muscle tone and voluntary movement[13]. In Parkinson's disease, walking becomes less automatic, necessitating more attention, especially for difficult tasks including turning, walking between obstacles, and dual-tasking[14]. Humans can normally walk efficiently and balance perfectly while thinking or carrying goods at the same time, while patients with PD frequently fail this dual-task walking[15].

The efficient functioning of central balance systems is required for upright postures such as sitting, standing, or walking[16]. Efferent routes send communication for balancing by the muscles, while afferent impulses of many origins, including signals from the periphery, play a significant role in triggering and guiding responses[17].

Destruction to central systems of any pathway will result in a failure to keep the COG inside the B O S. The vestibular system sends signals to the CNS about the place and signs of the head.The visual process provide data on the head's position and motion in relation to the supporting surface[20]. The somatosensory system feeds the CNS location, as well as information about the relationships between body segments[21]. Each sense supplies the CNS with unique information regarding the relationships between body segments.

The use of proprioceptive information is facilitated by exercise. Facilitating usage in proprioceptive feedback improves in people with Parkinson's disease[23]. Balance problems have been linked to impaired sensory processing in parkinsons disease. The goal of this study is to carefully outline the several forms of balance deficits in parkinsons disease, as well as underlying reasons these impairments[25]. In patients, a good knowledge of balance deficits might aid in managing balance disorder and the falls prevention.

In parkinson rehabilitation program, more concentration is given to motor recovery, but research proves that there is proprioception loss is also present in parkinsonism.

The proprioception loss may affect the postural control in motor control of parkinsonism.

There are sparce studies on effect of proprioceptive training in parkinsonism.

So, this study tries to find the effect of proprioceptive training in parkinson patients.

METHODOLOGY

This study was done as Quasi Experimental study with Pre and Post test type.Subjects were selected by Convenient sampling with two groups of subjects as Group A = 15 Group B = 15 Study done for 12 weeks at SRM Medical Hospital and Research Centre, Kattankulathur and Pain and Stroke Rehabilitation Centre.

Patients Aged around 50 years and above with Modified Hoehn and Yahr scale of stage 3 (On Medications) and who are able to walk are included in this study. Subjects with systemic or metabolic diseases,Presence of any brain lesions ,Mini-Mental State Examination score <26 and Subjects unwilling to participate were excluded.

PROCEDURE:

Ethical Clearance Number: 2873.From SRM Institutional Ethical Committee. Participants are selected on a certain criteria.

Group A = 15 (Experimental group) is given conventional physiotherapy along with proprioceptive training.

Group B = 15 (Control group) is given only conventional physiotherapy.

After 12 weeks post test is conducted.

TREATMENT PROTOCOL

GROUP – A INTERVENTION

(Proprioceptive training and conventional physiotherapy)

PROPRIOCEPTIVE TRAINING:

- The subject's balance was instructed to stand on mat surface, which diminishes the standard of surface position.
- On a period of three months, exercises were given for 20 minutes, 5 days/week.
- The balance activity sequence was maintained throughout all therapy sessions.
- The following is the order of the activities: Warm up your upper and lower limbs for 2 to 3 minutes, then repeat the same series of movements with one foot near then stand in one foot and one foot below for five minutes.
- Participants was instructed to close his eyes for the next 5 minutes and repeat the same series of exercises. To assure the subject's safety, a helper was enlisted.
- Finally, the subject was allowed to open his eyes if he sensed extreme imbalance, and at the end of five minutes were used for dynamic exercises such as catch and throw.

CONVENTIONAL PHYSIOTHERAPY:

2-3 Minutes:

- Static standing balance

5 Minutes: Tandem standing

5 Minutes: Same set of exercises with eyes closed

3-5 Minutes: Dynamic balance training: catch and throw the ball to the therapist.

GROUP- B INTERVENTION

(CONVENTIONAL PHYSIOTHERAPY)

The subjects were trained using the Conventional physiotherapy as explained in the end of Experimental Group A-Intervention.

OUTCOME MEASURES

1. **BERG'S BALANCE SCALE**

   The BBS is a 14-task scale used to measure balance for patients with balance deficits. It measures balance in all positions from sitting to standing.

2. **MULTIDIRECTIONAL REACH TEST**

   Here a inch tape is placed on a wall and the patients should extend their upper limb and reach to the maximum points. This should be done in all four directions to measure the balance. Patients maximum reach is calculated in all directions. Assistance is provided for patients safety.

3. **CLINICAL TEST FOR SENSORY INTEGRITY AND BALANCE**
It is used to evaluate the role of sensory process in balance. There are six conditions in this test. One is used with goggles; another one is used with mat. There are few challenges that are combined with eyes closed. Assistance is provided for patients.

DATA ANALYSIS:

TABLE 1:
GROUP- A MEAN BEFORE AND AFTER TEST VALUES

	TEST	SIGNIFY	STANDARD DEVIATION	MEAN DIFFERENCE	SIGNIFICANCE
CTSIB 1	PRE TEST	23.93	1.83	-1.93	0.000
	POST TEST	25.87	1.77		
CTSIB 2	PRE TEST	21.93	2.43	1.93	0.000
	POST TEST	23.87	2.64		
CTSIB 3	PRE TEST	21.40	1.99	-2.133	0.000
	POST TEST	23.53	1.92		
CTSIB 4	PRE TEST	22.27	2.96	-1.93	0.000
	POST TEST	24.20	2.65		
CTSIB 5	PRE TEST	23.47	2.26	-1.93	0.000
	POST TEST	25.40	2.29		
CTSIB 6	PRE TEST	21.60	2.29	-1.40	0.000
	POST TEST	23.0	2.20		

($p<0.05$)

Table 1: shows improvement in CTSIB 1 23.93 ±1.83 and 25.87±1.77, CTSIB 2 pre-test and post test is 21.93±2.43 and 23.87±2.64 CTSIB 3 pre test and post test is 21.40±1.99 and 23.53±1.92, CTSIB 4 pre test and post test is 22.27±2.96 and 24.20±2.65, CTSIB 5 pre-test

and post-test is 23.47±2.26 and 25.40±2.29, CTSIB 6 pre-test and post-test is 21.60±2.29 and 23.0±2.20.

TABLE 2:
GROUP- A MEAN BEFORE AND AFTER TEST VALUES

	TEST	SIGNIFY		MEAN DIFFERENCE	SIGNIFICANCE
BERGS BALANCE TEST	PRE TEST	34.20	7.25	-2.93	0.000
	POST TEST	37.13	7.78		
MULTI DIRECTION REACH TEST 1- FRT	PRE TEST	25.20	2.60	-1.60	0.000
	POST TEST	26.80	2.43		
MULTI DIRECTIONAL REACH TEST 2 - BRT	PRE TEST	4.47	1.55	-1.27	0.000
	POST TEST	5.73	1.87		
MULTI DIRECTIONAL REACH TEST 3- LRR	PRE TEST	28.67	3.43	-1.27	0.000
	POST TEST	29.93	3.41		
MULTI DIRECTIONAL REACH TEST 4- LRL	PRE TEST	17.73	2.96	-1.40	0.000
	POST TEST	19.13	3.07		

Table 2: shows improvement in BBS 34.20 ±7.25 and 37.13±7.78, MDRT 1-FRT 25.20± 2.60 and 26.80 ± 2.43, MDRT 2-BRT 4.47±1.55 and 5.73±1.87, MDRT 3-LRR 28.67±3.43 and 29.93±3.41, MDRT 4-LRL17.73±2.96 and19.13±3.07.

BAR DIAGRAM-I:

GROUP A- A MEAN BEFORE AND AFTER TEST VALUES

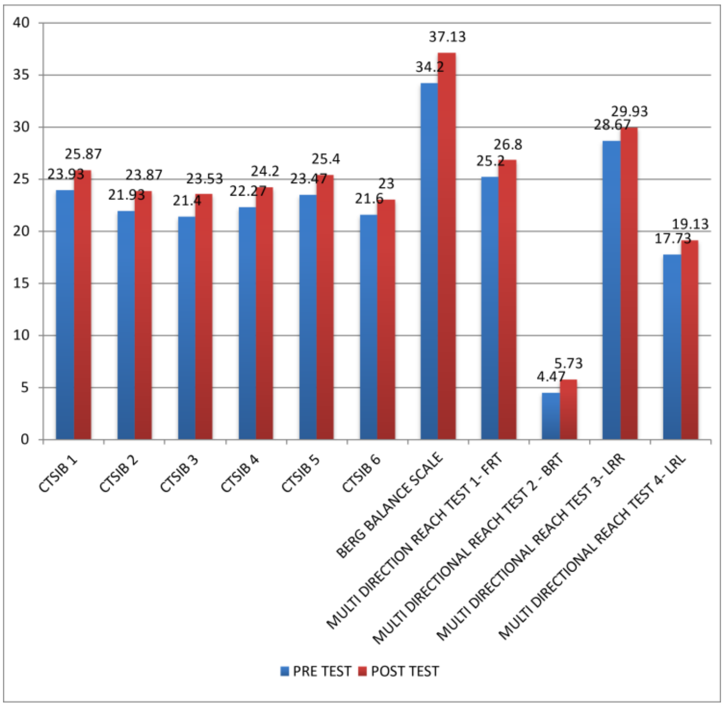


TABLE 3:

GROUP B: A MEAN BEFORE AND AFTER TEST VALUES

	TEST	SIGNIFY		MEAN DIFFERENCE	SIGNIFICANCE
CTSIB 1	PRE TEST	22.07	2.40	-0.40	0.465
	POST TEST	22.47	2.97		
CTSIB 2	PRE TEST	23.80	1.90	-0.20	0.607
	POST TEST	24.00	2.20		
CTSIB 3	PRE TEST	22.533	3.02	0.07	0.774
	POST TEST	22.47	2.7		
CTSIB 4	PRE TEST	21.67	2.19	0.47	0.204
	POST TEST	21.20	1.78		

CTSIB 5	PRE TEST	22.53	2.7	0.20	0.595
	POST TEST	22.33	2.44		
CTSIB 6	PRE TEST	20.60	3.04	0.07	0.818
	POST TEST	20.53	2.9		

(p<0.05)

TABLE 3: Shows that there is statistical significance (p value less than 0.05) shows improvement in mean values of CTSIB 1 pre- test and post -test is 22.07 ±2.40 and 22.47±2.97, CTSIB 2 pre-test and post test is 23.80±1.90 and 24.00±2.20, CTSIB 3 pre test and post test is 22.53±3.02 and 22.47±2.7, CTSIB 4 pre test and post test is 21.67±2.19 and 21.20±1.78, CTSIB 5 pre-test and post-test is 22.53±2.7 and 22.33±2.44, CTSIB 6 pre-test and post-test is 20.60±3.04 and 20.53±2.9.

TABLE 4:

GROUP B: A MEAN BEFORE AND AFTER TEST VALUES

	TEST	SIGNIFY		MEAN DIFFERENCE	SIGNIFICANCE
BERGS BALANCE TEST	PRE TEST	37.80	7.84	0.20	0.531
	POST TEST	37.60	8.11		
MULTI DIRECTION REACH TEST 1- FRT	PRE TEST	25.60	2.61	1.27	0.001
	POST TEST	24.33	2.74		
MULTI DIRECTIONAL REACH TEST 2 - BRT	PRE TEST	4.47	1.64	0.20	0.334
	POST TEST	4.27	1.71		
MULTI DIRECTIONAL REACH TEST 3- LRR	PRE TEST	27.07	3.59	0.47	0.089
	POST TEST	26.60	4.01		
MULTI	PRE	19.27	2.79	0.53	0.015

DIRECTIONAL REACH TEST 4- LRL	TEST				
	POST TEST	18.73	2.74		

TABLE 4: shows improvement in BBS 37.80 ±7.84 and 37.60±8.11, MDRT 1-FRT 25.60± 2.61 and 24.33 ± 2.74, MDRT 2-BRT 4.47±1.64 and 4.27±1.71, MDRT 3-LRR 27.07±3.59 and 26.60±4.01, MDRT 4-LRL19.27±2.79 and18.73±2.74.

BAR DIAGRAM- II:

GROUP B: A MEAN BEFORE AND AFTER TEST VALUES

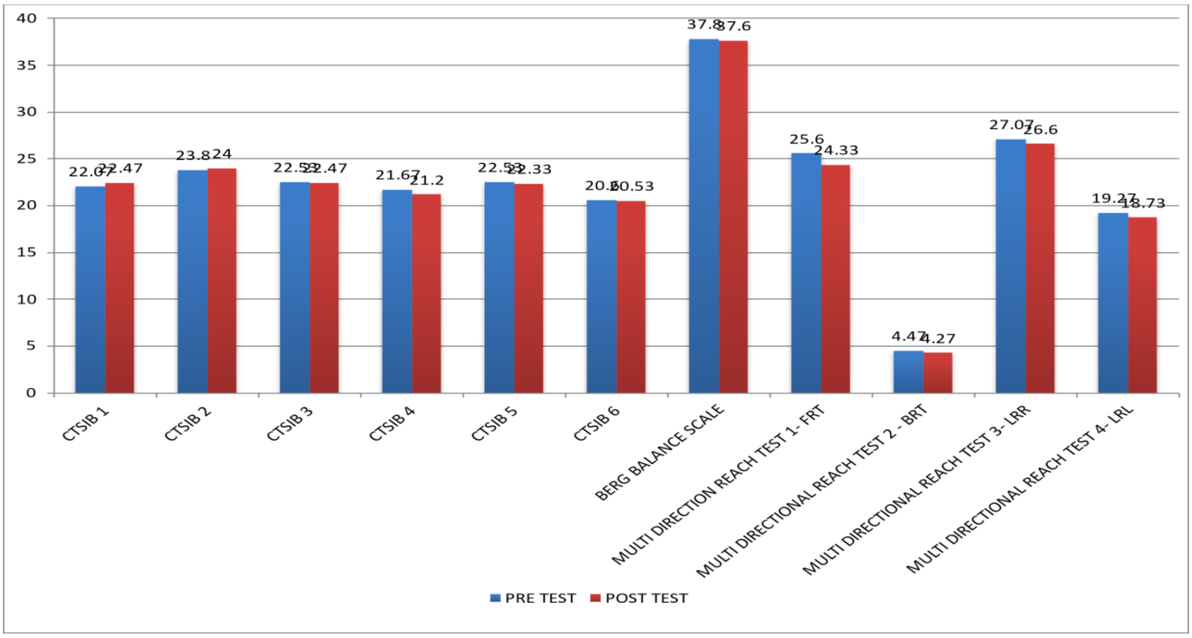


TABLE 5:

AFTER TEST MEAN VALUES OF BOTH GROUPS:

	POST TEST	SIGNIFY		MEAN DIFFERENCE	SIGNIFICANCE
CTSIB 1	GROUP A	25.87	1.77	3.40	0.001
	GROUP B	22.47	2.97		
CTSIB 2	GROUP A	23.87	2.64	-0.13	0.882
	GROUP B	24.0	2.20		
CTSIB 3	GROUP A	23.53	1.92	1.07	0.222

	GROUP B	22.47	2.70		
CTSIB 4	GROUP A	24.2	2.65	3.00	0.001
	GROUP B	21.2	1.78		
CTSIB 5	GROUP A	25.4	2.29	3.07	0.001
	GROUP B	22.3	2.44		
CTSIB 6	GROUP A	23.0	2.20	2.47	0.014
	GROUP B	20.53	2.90		

(p<0.05)

Table 5: Shows values of CTSIB-1 25.87±1.77 and 22.47±2.97, CTSIB-2 23.87±2.64 and 24.0±2.20, CTSIB-3 23.53±1.92 and 22.47±2.70, CTSIB-4 24.2±2.65 and 21.2±1.78, CTSIB-5 25.4±2.29 and 22.3±2.44, CTSIB-6 23.0±2.20 and 20.53±2.90. There is statistical significance. The post- test values of Group A experimental showed improvement when compared to Group B control group respectively.

TABLE 6:

AFTER TEST MEAN VALUES OF BOTH GROUPS:

OUTCOME	TEST	MEAN	SD	MEAN DIFFERENCE	SIGNIFICANCE
BERGS BALANCE TEST	GROUP A	37.13	7.78	-0.47	0.873
	GROUP B	37.6	8.11		
MULTI DIRECTION REACH TEST 1- FRT	GROUP A	26.8	2.43	2.47	0.014
	GROUP B	24.33	2.74		
MULTI DIRECTIONAL REACH TEST 2 - BRT	GROUP A	5.73	1.87	1.47	0.033
	GROUP B	4.27	1.71		

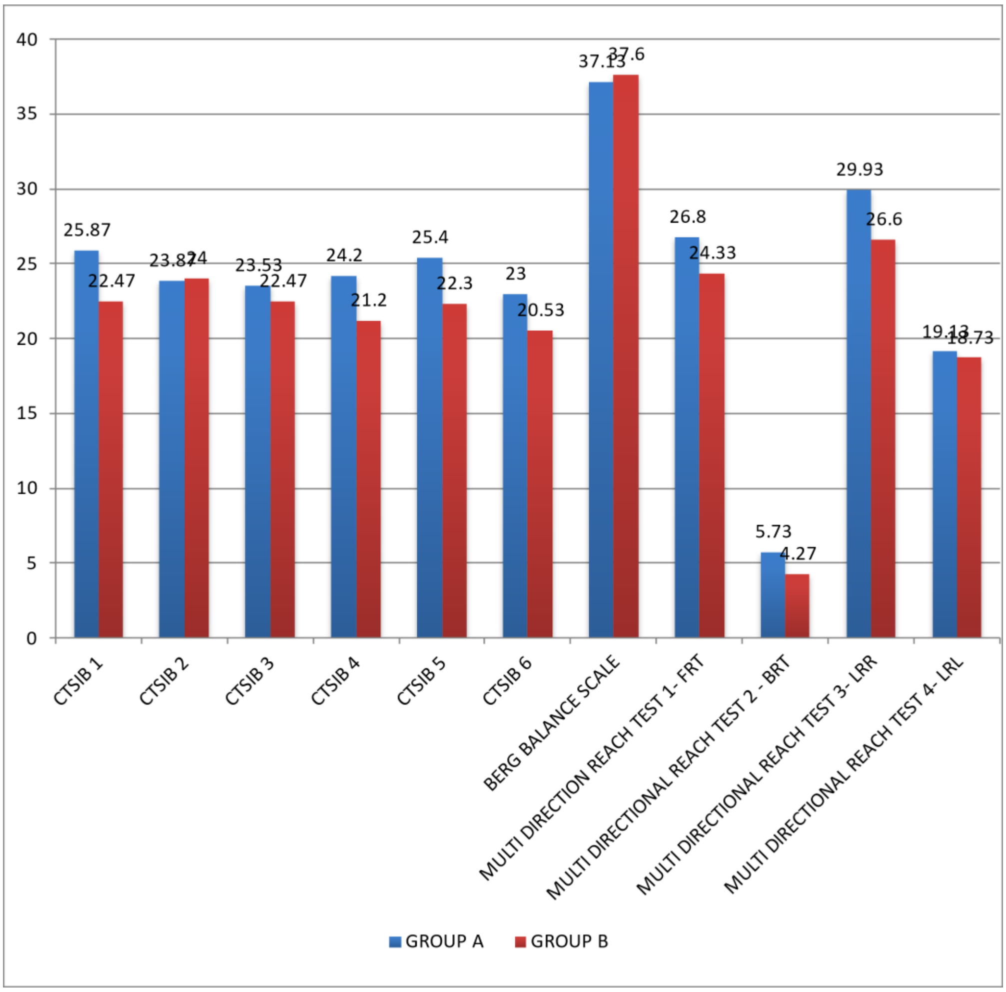
MULTI DIRECTIONAL REACH TEST 3- LRR	GROUP A	29.93	3.41	3.33	0.021
	GROUP B	26.6	4.01		
MULTI DIRECTIONAL REACH TEST 4- LRL	GROUP A	19.13	3.07	0.40	0.709
	GROUP B	18.73	2.74		

(p<0.05)

Table 6: Shows mean value BBS 37.13 ±7.78 and 37.6±8.11, MDRT 1-FRT is 26.8 ±2.43 and 4.27±1.71, MDRT 2-BRT is 5.73±1.87 and 4.27±1.71, MDRT 3-LRR is 29.93±3.41 and 26.6±4.01, MDRT 4-LRL is 19.13±3.07 and 18.73±2.74.There is statistical significance (p value less than 0.05). Experimental showed improvement when compared to Group B control group respectively.

BAR DIAGRAM-III:

AFTER TEST MEAN VALUES OF BOTH GROUPS:



DISCUSSION:

Both the groups were assessed by using CTSIB, Bergs balance scale(BBS), Multi directional reach test(MDRT) as a pre-test measure. Experimental group underwent proprioceptive in combination with conventional physiotherapy and the control group was given only conventional physiotherapy. This study was done to find out the result of proprioceptive exercises on dynamic balance among parkinson patients. Statistical analysis shows significant improvement in proprioceptive training with conventional physiotherapy.

When comparison is done between the before and after test values of CTSIB, BBS, and MDRT within the experimental group, the result shows higher results in group a ($p<0.05$). Accordance to this, experimental group subjects when trained using the proprioceptive training protocol in combination with conventional physiotherapy, this helps the patient to improve joint position, joint stability and can also helps to improve mobility and balance among parkinson patients.

When comparison is done between the before and after test values of CTSIB, BBS and MDRT within the control group, the result shows that there is higher results in group b ($p<0.05$). The conventional physiotherapy included general physiotherapy exercises in relation to the functional impairments in parkinsons. The conventional physiotherapy used in control group showed a significant improvement in the proprioceptive training on dynamic balance among Parkinson patients.

The results showed that there is increase in <0.005 group a. Where as (Group A) mean value of CTSIB pre test value is 25.87, 23.80, 23.53, 24.2, 25.4, 23.0 and post test value is 22.47, 24.0, 22.47, 21.2, 22.3, 20.53 then followed by group B mean value of MDRT pre test value is 26.8, 5.73, 29.93, 19.13 and post test value is 24.33, 4.27, 26.6, 18.73 where both the Group MDRT value has showed difference in pre and post test mean values but still the experimental Group A showed more difference when compared to conventional Group B. But the post test mean value of BBS scale showed mild difference. When compared to other CTSIB and MDRT this scale has showed that the disability level with minimal difference.

The findings of this study show that balancing exercises designed to excite and assist peripheral proprioceptors improve balance in people with Parkinson's disease[13]. The findings of CTSIB score in this study shows that there may be an increases in the integration of peripheral sensory inputs and proprioceptive inputs that would have helped to improve the impaired balance .2- The peripheral and sensory proprioceptors would have improved and helped to maintain equilibrium and would have facilitated proprioceptors which showed as an improvement in balance.

States that, Difficulty terminating locomotor actions such as walking, running, or turning during walking is thought to be one of the major factors that predisposes people with PD to slips, trips, and falls[8]. The inability to achieve the highest possible score in these tasks could be related to an inability to finish sequence of events. In this study, we noticed an increase in the Berg's balance score. This improvement in score reveals that this intervention trained the functional activity which helped to improve balance . Statistically BBS showed significant increase in Group A comparing Group B.

In this study, MDRT showed increased score in all directions except in the Backward reach test. The patients showed difficulty in reaching backward movement. Many patients aren't able to perform without assistance. This may be the reason for slight change in backward reach test alone when compared with scores of other directions in Group A when comparing it with group B.

The study proves that sensory-specific balance exercises, such as training on unsteady support surfaces with transitions between sensory environments, will result in greater postural stability than general activity interventions among Parkinson patients.

This study has limitation such as study duration was less and study population was less. For future studies its recommended that this study can be done in patients in other stages of yoehn and yahr scale,this training can be given in sitting positions,Same training can be trained in Swiss balland this training can be given to neurological conditions other than Parkinsonism

CONCLUSION

The study concluded that there is effect of proprioceptive training on dynamic balance among Parkinson patients

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