



STUDY TO COMPARE THE EFFECT OF PERTURBATION EXERCISES VERSUS PROPRIOCEPTION EXERCISES TO IMPROVE BALANCE WITH CHRONIC STROKE PATIENT

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INTRODUCTION & BACKGROUND

Stroke is known as cerebral vascular accident. When the brain stops receiving blood supply consciousness is lost within second and permanent damage occur with motor, speech, language, swallowing, perception, cognition, emotional status, bladder, bowel impairments^[1,2] Cerebral flow represents approximately 17 percent of available cardiac output. It supplies by vertebral basilar artery and carotid arteries^[2]. Moreover, patients with hemiplegia suffer with sensory disorders and decreased balance ability. They tend to smaller weight load on the paretic leg when in standing position and these results in asymmetrical posture which seriatim negatively affects their activities of daily living, gait and movements^[3]. Stroke patient suffer from balance disability due to various causes, such as loss of muscle strength, restricted joint movement, change in muscle tone, sensory changes and loss of coordination. Hemiplegic patients with balance disorder show longer recovery times than those without balance disorder^[4]. Proprioception is a sense of body position that perceived both conscious and unconscious levels sensation: static limb position reflects the recognition of orientation of body part, whereas kinesthesia is the recognition of rates of movement. Good proprioception and co – ordination mean that all the components of musculoskeletal fitness are in balance to overcome any overloading on structures and this is important in maintaining dynamic joint stability^[5]. On other hand, Perturbation based balance training intervention that include repeated postural perturbation to evoke rapid balance reactions, facilitating the individual to improve control of these reactions with practice^[6]. This study will include both perturbation exercise and proprioceptive exercise to evaluate which exercise is more beneficial for improving the balance in stroke.

KEY WORDS: - stroke, perturbation exercise, proprioceptive exercise, improve balance.

METHOD

Method of study is experimental study and data collected from various physiotherapy O.P.D in and around the Surat city. Data collection started in July 2018 and completed in march 2019. Study includes 20 subjects with chronic stroke, who were with Brunnstrom motor recovery stage at 3 or more, who can stand with or without assistance and berg balance score between 21 – 40 [medium fall risk]. Subjects with group A received 20 minutes manual perturbation exercise with 20 minutes conventional treatment. Additionally, perturbation exercises gave in sitting position, kneeling position and in standing position. 2-minute rest was given between each successive stage. However, group B subjects received 20 minutes proprioceptive exercise for affected extremity and 20 minutes conventional treatment. proprioceptive exercise done in sitting position with active dorsiflexion movements, weight bearing in standing position then with reach outs and one leg standing. Moreover, 2.5-minute rest was given between each successive stage. In addition to this conventional treatment include stretching exercise, active assisted exercise, core strengthening exercise, reaching exercise and forward and side walking exercises. Furthermore, both groups were evaluated before and after 4 weeks of training with BBS and TUG.

RESULT

Within group comparison of BBS Group A and Group B

Table: Pre and post comparison of BBS in Group A (Paired t test)

Group A (BBS)	Mean	SD	Mean improvement	t value	P value
PRE BBS	35.80	3.393	9	-11.619	0.003
POST BBS	44.80	4.315			

From the available analysis of Group, A BBS apparent improvement in BBS pre- post treatment score found (mean improvement =9). The p Value calculated from the available result was(0.003<p) which mean there has been a significant level of improvement.

Table: pre and post comparison of BBS in Group B (Paired t test)

Group B(BBS)	Mean	SD	Mean improvement	t value	P value
PRE BBS	33.70	3.433	6.9	-5.721	0.037
POST BBS	40.60	5.082			

From the available analysis of Group, A BBS apparent improvement in BBS pre post treatment score found (mean improvement=6.9). The p Value calculated from the available result was(0.003<p) which mean there has been a significant level of improvement.

Within group comparison of TUG

Table: Pre and post comparison of TUG in Group A (Paired t test)

Group A TUG	Mean	SD	Mean improvement	t value	p value
PRE TUG	21.90	5.527	6.4	16.00	0.000
POST TUG	15.50	5.380			

From the available analysis of Group, A TUG apparent improvement in TUG pre- post treatment score found (mean improvement=6.4). The p Value calculated from the available result was(0.000<p) which mean there has been a significant level of improvement.

Table: Pre and post comparison of TUG in Group B (Paired t test)

Group B TUG	Mean	SD	Mean improvement	t value	p value
PRE TUG	22.60	5.461	4.2	5.442	0.000
POST TUG	18.40	4.881			

From the available analysis of Group B TUG apparent improvement in TUG pre- post treatment score found (mean improvement=4.2). The p Value calculated from the available result was(0.000<p) which mean there has been a significant level of improvement.

Between group comparison of BBS and TUG

Table: Comparison of BBS between Group A and Group B (Independent t Test)

Outcome measures	Group A		Group B		Mean improve ment	P value
	Mean	SD	Mean	SD		
BBS	8.60	2.757	7.60	3.658	1	0.499

The calculated p-value was found to be 0.499 > 0.05 which indicates that there was no significant difference between the value of Group A compared to Group B. Thus, the result of the comparative analysis of BBS value for Group A versus Group B were not statistically significant.

Table: comparison of TUG between Group A and Group B (Independent t Test)

Outcome measures	Group A		Group B		Mean improvement	P value
	Mean	SD	Mean	SD		
TUG	6.40	1.285	4.20	2.440	2.2	0.021

The calculated p-value was found to be $0.021 < 0.05$ which indicates that there was significant difference between the value of Group A compared to Group B. Thus, the result of the comparative analysis of TUG value for Group A versus Group B were statistically significant.

DISCUSSION

The purpose of present study was to compare the effectiveness of manual perturbation exercise versus proprioceptive exercises on balance with chronic stroke patients. The primary finding was that a 4-week intervention programmed for both groups improved balance and out of two training manual perturbation exercise group is show statistically significant difference in TUG test. As balance is required for all functional activity of daily living and Ambulatory ability, the present study is about the rehabilitation for balance with chronic stroke patients. Static and dynamic balance and Weight shifting capabilities are impaired after stroke; Balance is challenging area in patients with stroke. Most commonly major focus of treatment session is upper limb, lower limb and walking rehabilitation and less attention given to balance after stroke. So, the present study was done to add beneficial information regarding balance rehabilitation. [7,10] The study was done on total 20 patients were divided into two groups. Group A (manual perturbation) and Group B (proprioceptive exercise). Group A received conventional training along with manual perturbation exercise and in Group B conventional therapy along with proprioceptive exercise to improve balance. Both Group and A and B were similar at baseline characteristic of BBS and TUG. From normality testing of BBS pre score data were obtained, it's was found that the data showed that there was normal distribution ($0.921 > 0.05$) so parametric test was used to check baseline Characteristics. Normality of TUG pre score data showed that there was a normal distribution ($0.219 > 0.05$). So, data suggested both groups were same at baseline level. Paired sample t test was used to know within group improvement for BBS and TUG in both groups which showed significant improvement in both Groups as well in 46 both outcome measures. Independent t test was used for between group analyses for all outcomes which showed not significant improvement with BBS ($0.315 > 0.05$), where else statically signification in TUG ($0.021 < 0.05$) in group A. After application of all the above-mentioned tests, it was found that there was no clinically significant difference between both Group A and Group B for all outcome measure but statistical difference showed in Group A in outcome measure of TUG.

One of the hypotheses of the present study was weather manual perturbation exercises improves balance or not in chronic stroke patients. And the result of the present study shows that manual perturbation exercises are effective to improve balance as there was significant improvement in overall score of BBS (< 0.03) and TUG (< 0.000). Within

group analysis revealed statistically significant between pre and post 4 week. Similar studies from the evidence database showed that the results in line with the present study for Berg Balance Scale and Time Up and Go Test.

Chandan Kumar, Nawaj Pathan^[7] had done experimental study on Effectiveness of Manual perturbation Exercises in improving Balance, Function and Mobility in stroke patients in 30 chronic stroke patients. They selected outcome measures like BBS, TUG in their study. Results showed that more improvement in BBS, TUG scores in manual perturbation Group A than conventional Group B but not in FIM. Avril Mansfield, Anthony Aquil^[8] had done experimental study on perturbation training to promote safe independent mobility post-stroke, participants were assigned in two group. They selected outcome measure BBS, TUG, ABC, Mini-BES. Result suggested perturbation is effective, this training has the potential to not only prevent fall, but also improve safe independent mobility and engagement in daily activities for those with stroke.

Avri Mansfield, Jennifer^[9] conducted study to examine Does perturbation-based balance training prevent fall? Systemic Review and meta-analysis. Total 8 studies involving 404 participants were included. Participants who completed perturbation-based balance training were less likely to report a fall and reported fewer fall than those in the control groups.

In the present study, Group A received Manual perturbation technique for the balance. The result of this study also showed that there was significant improvement in group A for Berg balance scale and Time Up and Go test. Manual perturbation exercises improve balance through increase in the coordinated multi-joint movements which are effective in maintaining the postural control. Furthermore, the manual perturbation exercises facilitate the balance through the Reactive Balance Control which is important in improving the balance in upright position. Muscles in the Leg and trunk are activated synergistically during recovery of stability in combination with the multi-joint coordination. Balance training is effective with perturbation exercise training that increases nerve conduction velocity, which in turn reduces the time required for muscle activation in postural control.

Hence, Manual perturbation exercises were shown to have a positive effect on increasing the ability to Control Reactive balance through that feedback control mechanism and unconscious motor response to afferent nerve stimulation required for dynamic joint control^[12] that was improving balance in the chronic stroke patients.

One of the hypotheses of the present Study was whether proprioceptive exercises improve balance in chronic stroke patients. And the result of present study shows that proprioceptive exercises are effective to improve balance as there was significant improvement in overall scores of BBS (<0.000).

Similar studies from the evidence database showed that the results in line with the present study for Berg Balance Scale and Time Up and Go Test. Yu-Hyung Park, Yu-Mi Kim et al.^[10] done experimental study on An Ankle Proprioceptive Control Program Improves Balance, Gait Ability of Chronic stroke patients on 30 chronic stroke patients. They had taken outcome measure TUG, GAITRite instrument. Result showed that significant improvement in TUG, gait speed and cadence, step length, and stride length were observed on the paretic side.

Seung Hun Chae, You Lim Kim et al.^[11] had done experimental study on effects of phase proprioceptive training on balance in patients with chronic stroke on 30 stroke patients. Outcome measures taken were BBS, TUG, ABS scale instrument. Result showed that significantly greater scores were obtained in all three outcome measures in proprioceptive group than the control group.

Pawel kipper, Alfonc Baba et al.^[12] et al had conducted study on proprioceptive Based Training for stroke recovery. Proposal of new treatment modality for rehabilitation of upper limb in neurological diseases on stroke patients. Outcome measures taken were dynamometer, F-M UE, FIM were administered. Result suggested that clinical changes

of voluntary muscle contraction after perturbation exercises but not significant improvement in FIM and F-M UM. The findings of this preliminary research revealed that PBT feasible intervention to improve the motricity of upper limb in stroke survivors. Kim K J,^[13] et al had conducted experimental study to implement combine muscle strengthening and proprioceptive exercise to examine the effects of combine exercise on functional ankle instability, 30 adult males and female's patient. The result of this study showed applying combined muscle strengthening and proprioceptive exercises to those who have functional ankle instability is more effective than applying only muscle strengthening exercise. In the present study, Group B received proprioceptive exercises. The result of this study showed that there was significant improvement in Group B after pre and post measurement of BBS ($0.037 < P$) and TUG ($0.000 < P$).

So, from all studies done on proprioceptive exercises found that the balance achieved through increase of joint position senses and strengthening of ankle dorsiflexors muscles. Research confirmed improvements in balance ability of stroke patients after participating in proprioception training in terms of muscle activity, the involved muscles contract to maintain balance during one leg standing. This continued stimulation facilitates increased muscles spindle sensitivity through gamma-motor neurons, which is then transferred to motor neurons that activate muscle fibers resulting in improved motor output. This was found to have a positive effect on joint stability.

In a present study proprioceptive exercises improve through feed forward control mechanism and provide information on the movement and location of individual body parts. This mechanism assists in correcting and maintaining posture, and controlled and coordinated movements between the head, body, upper and lower limbs. Moreover, afferent nerve input through the cerebral cortex is improved, which allows for more effective response to external agitation while walking. In conclusion, proprioceptive training is effective in patients with chronic stroke with reduced balanced ability. This study investigated the effect of proprioceptive exercises on the recovery of balance and gait abilities of hemiparetic patients with stroke. The proprioceptive exercises focusing on somatosensory sense for the recovery of stroke patient's balance abilities. As per literature available MDC (minimal detectable change) for BBS in patients with chronic stroke is 5 and in present study for Group A pre and post treatment showed 9 and Group B 6.9 result showed significant statistical as well clinical improvements within both group for outcome measure of BBS.^[17] MDC for TUG in patients with chronic stroke is 3 and in present study for Group A pre and post treatment showed 6.4 and Group B 4.2 result showed significant statistical as well clinical improvements within both group for outcome measure of TUG.^[17]

One of the hypotheses of present study was, whether there is significant difference between perturbation exercises and proprioceptive exercises on balance or not; analysis showed that there was no difference in overall scores of BBS and statistical difference showed in scored of TUG between both the groups. Result of present study showed that both groups showed average BBS scores of 35.80 ± 3.3 before the intervention which was within the range of medium risk of fall. After the intervention, the average improved to 44.60 ± 4.3 in Group A and 40.60 ± 5.0 in Group B. Average TUG score of 21.90 ± 5.527 before the intervention which was within the of risk of fall. After the intervention, the average improved to 15.50 ± 5.38 in Group A and 18 ± 4.88 in Group B. The improvement in both groups exceeded the range of risk for falling. Result of the present study showed that there is no between group difference in outcome measure of BBS ($0.499 > p$) and statistical present in outcome measure of TUG ($0.021 < P$).

Where else, difference between Group A and Group B is 2.2 it's suggested there no clinical signification between both Groups in outcome measure of TUG.

Balance is an essential part of daily living. Whether the require feedback or feed forward postural adjustments, there is impairment to the timing, magnitude and sequencing of muscle activation following stroke. The muscle activation pattern is dependent on the extent of motor control impairment and the strategies used by the stroke patients to compensate for the impairments. The central nervous system uses a variety of mechanisms to improve muscle

activation patterns needed for postural responses following stroke. ^[12] The neural control of volitional movements and perturbation-evoked reactions differs in fundamental ways. These differences suggest that effective training of changing-insupport reaction requires administration of balance perturbation, rather than simply training volitional movements. ^[14] Several previous studies postulated that the stabilizing responses are primarily of vestibular rather than proprioceptive origin. Proprioceptive feedback is essential not only for transmitting force, position and movement senses under human movement but also assist neural activation. In balance, these contributions are suppressed as training proceeds. Concomitant to the reduced cortical control a gradual shift towards sub cortical control during balance. Moreover, in situation when strong activation is desired to achieve high muscle stiffness the feed-forward control, already initiated by segmental stretch reflexes. However, these reflex contributions are controlled for the short and medium latency component by spinal mechanisms. The later responses have been shown to be under sub cortical or cortical control. ^[15] There is clear relation between somatosensory senses and measurement of balance. In stroke Dynamic balance and functionality was more affected than static balance, and showed the strongest association with BBS and TUG. Improvement of the dynamic balance scores which are BBS and TUG were seen to improve in present study and thus resulting in improving balance scores in both groups.

CONCLUSION

comparison between two groups suggested that there was no clinically significant difference between perturbation exercise group and proprioceptive exercise group for TUG and BBS test. Hence, it suggested that both treatment protocol was effective in improvement of balance with chronic stroke patients.

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