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Comparison between proprioceptive neuromuscular facilitation versus mirror therapy enhances gait and balance in paretic lower limb after acute stroke

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Abstract

Background: Cerebrovascular accidents or stroke may occur either due to blood clots which impair blood flow to the brain or any trauma which ruptures the blood vessels causing leakage of blood around the brain. It can adversely disrupt the functioning of the limbs which in turn causes restriction of activity and participation in day to day life. Disability caused by stroke may persist lifelong if proper rehabilitative measures are not taken. However, it is unclear whether Proprioceptive Neuromuscular Facilitation and Mirror therapy also can improve the outcomes.

Aim and Objective: “comparison between the effect of proprioceptive neuromuscular facilitation versus mirror therapy enhancing gait and balance in paretic lower limb after acute stroke”- an experimental study.

Method: 30 participants were randomly allocated into two study groups. Group A - 15 patients were given Proprioceptive Neuromuscular Facilitation along with conventional treatment. Group B-15 patients were given Mirror therapy along with conventional treatment. The treatment was given 15 sessions for 3 weeks and two outcome measures were used. the readings were taken on dynamic gait index (gait) and berg balance scale (balance).

Result: Within group Paired T Test and between groups Unpaired T Test was done. Both groups showed significant improvement in DGI and BBS Within the groups. While we compare both groups there was significant difference in between the groups.

Conclusion: The study shows that both groups were individually effective in improving the gait and balance. Group A Proprioceptive Neuromuscular facilitation is more effective for enhancing gait and balance in paretic lower limb after acute Stroke.

Keywords: Proprioceptive neuromuscular facilitation mirror therapy, stroke

Introduction

Stroke (Cerebrovascular accident [CVA]) is defined as rapidly developing clinical signs of focal disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin ^[1].

Strokes can be generally classified as haemorrhagic or ischaemic and lead to hypoperfusion of a part of the brain tissue. Haemorrhagic strokes occur when a vessel ruptures and blood flows into or around the brain tissue. In ischaemic strokes, hypo perfusion is caused by a blood clot which blocks a vessel in or leading to the brain ^{2]}.

Depending on the stroke location and the size of the affected brain areas, patients experience various degrees of impaired body functions, difficulties in managing activities of daily living (ADL) and restrictions in their social lives ^[3].

Aim and Objectives

Aim

To find out comparison between Proprioceptive Neuromuscular facilitation Versus Mirror therapy enhancing gait and balance in paretic lower limb after Acute Stroke- an Experimental study.

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Objectives

To determine the effect of Proprioceptive Neuromuscular facilitation enhancing gait and balance in paretic lower limb after Acute Stroke.

To determine the effect of Mirror therapy enhancing gait and balance in paretic lower limb after Acute Stroke.

To determine the comparison between Proprioceptive Neuromuscular facilitation Versus Mirror therapy enhancing gait and balance in paretic lower limb after Acute Stroke.

Hypothesis

H₀₁: There is no significant effect of Proprioceptive Neuromuscular facilitation enhancing gait in paretic lower limb after Acute Stroke.

H₀₂: There is no significant effect of Proprioceptive Neuromuscular facilitation enhancing balance in paretic lower limb after Acute Stroke.

H₀₃: There is no significant effect of Mirror therapy enhancing gait in paretic lower limb after Acute Stroke.

H₀₄: There is no significant effect of Mirror therapy enhancing balance in paretic lower limb after Acute Stroke.

H₀₅: There is no significant difference between Proprioceptive Neuromuscular facilitation Versus Mirror therapy enhancing gait in paretic lower limb after Acute Stroke.

H₀₆: There is no significant difference between Proprioceptive Neuromuscular facilitation Versus Mirror therapies enhancing balance in paretic lower limb after Acute Stroke.

Review of Literature

Proprioceptive Neuromuscular facilitation

Wontae Gong 2020 ^[25] Effects of dynamic exercise utilizing PNF patterns on the balance of healthy adults. The total number of participants was 30, and 15 were randomly placed in the training group (TG) and 15 in the control group (CG). The participants in the TG have conducted the 3 sets to 5 sets of dynamic exercise utilizing the proprioceptive neuromuscular facilitation patterns per day, 3 times a week for 6 weeks. The balance was measured by the Terax, a balance-measuring device with force plates. Study concluded that Dynamic trunk stabilization exercise utilizing the proprioceptive neuromuscular facilitation patterns seem to help increase the balance of healthy adults.

Sang-Mo Kim, PT·Young-Min Kim 2020 ^[26] the effects of both lower extremities proprioceptive neuromuscular facilitation training with functional electrical stimulation on the balance and gait of stroke patients. Ten patients with stroke were divided randomly into two groups of five patients each who met the selection criteria. The training was conducted five times a week, for 60 minutes. The experimental group received both lower extremities proprioceptive neuromuscular facilitation training with functional electrical stimulation while the control group received general physical therapy with functional electrical stimulation. Outcome measures were timed Up-and-Go (TUG) and Berg Balance Scale (BBS). The study concluded that Both lower extremities proprioceptive neuromuscular facilitation training with functional electrical stimulation had positive effects on the balance and gait of stroke patients.

Bhatri Pratim Dowarah, Krishna Kanta Sarma 2019 ^[27] To Study the Effects of Butler's Neuromobilisation and Proprioceptive Neuromuscular Facilitation on Lower Limb Sensory Deficits in Chronic Stroke: A Comparative Study 30 chronic stroke patients (minimum 3 months post stroke), 40–

60 years of age, were randomly assigned to Butler's Neuromobilisation and PNF Groups. Treatment sessions was kept equivalent for both the groups (30 min). Data were collected on Day 0, Day 45 and Day 90. Thus it can be inferred that both Butler's Neuromobilisation and PNF are equally effective in improving lower limb sensory deficits in chronic stroke patients.

Shristi Shakya 2018 ^[28] A Study on the Effect of Lower Extremity Proprioceptive Neuromuscular Facilitation Patterns on Stair Ambulation in Stroke Patients. In this study, 30 subjects were recruited based on the inclusion criteria. The therapist performed Proprioceptive Neuromuscular Facilitation patterns i.e. 10 repetitions of each pattern of 3 sets, 3 days per week for 4 weeks, total of 12 sessions. The patient's ability to walk for 6 minutes was analysed via 6-minute walk test. The impact of stroke in

Individual's health and life was analysed using Stroke Impact Scale and ability to ambulate the stairs efficiently was analysed by Timed Up and Down Stairs test before and after the intervention. Study concluded that Proprioceptive Neuromuscular Facilitation patterns had a positive effect on stair ambulation in stroke patients.

Bright Alwin Victor 2018 ^[29] Effectiveness of Proprioceptive Neuromuscular Facilitation (Pnf) with Conventional Therapy Vs Conventional Therapy on Gait Improvement of Subject With Sub-Acute Stroke A Comparative Study. In this study, 12 subjects were recruited based on the inclusion criteria. Study Duration was 3 weeks. outcome measure was time up and go test. Study concluded that no statistically significant difference in gait improving using PNF with conventional therapy when conventional therapy without PNF.

Mirror Therapy

Haticelkizler May 2020 ^[31] the effect of mirror therapy on lower extremity motor function and ambulation in post-stroke patients: A prospective, randomized-controlled study. A total of 42 post-stroke patients (25 males, 17 females; mean age 58 years; range, 32 to 71 years) were included. All patients were randomly divided into two groups as the control group (n=21) receiving a conventional rehabilitation program for four weeks (60 to 120 min/day for five days a week) and as the MT group (n=21) receiving MT for 30 min in each session in addition to the conventional rehabilitation program. The Brunnstrom stages of stroke recovery, Functional Independence Measure (FIM), Berg Balance Scale (BBS) and Motricity Index (MI) scores, Six-Minute Walking Test (6MWT), Functional Ambulation Category (FAC), and the degree of ankle plantar flexion spasticity using the Modified Ashworth Scale (MAS) were evaluated at baseline (Day 0), at post-treatment (Week 4), and eight weeks after the end of treatment (Week 12). Results suggest that MT in addition to conventional rehabilitation program yields a greater improvement in the lower extremity motor function and ambulation, which sustains for a short period of time after the treatment.

Conventional Treatment

Suraj Kumar 2020 ^[37] Comparison between Erigo tilt-table exercise and conventional physiotherapy exercises acute stroke patients: a randomized trial. A total of 110 acute stroke patients (age 51.08 ± 7.48 years, 8.69 ± 4.62 days after stroke) were assigned randomly into two groups, 55 in each for 30 days of conventional physiotherapy (Group A) or Erigo tilt-table (Group B) rehabilitation. The National Institutes of Health Stroke Scale (NIHSS), Mini-Mental Scale

Examination (MMSE), Modified Ashworth Scale were used to measure muscle tone, quality of life (QOL) and muscle strength (MMT), Affected upper (UE) and lower limb (LE) outcomes were assessed at baseline (day 0), after day 30 of the intervention and on 90th day of follow up. Conclusion of the study is both the groups improved with time but the Erigo tilt-table group experienced greater improvement in QOL, NIHSS and muscle strength of the lower limb. Thus, Erigo tilt-table can be used for early rehabilitation of acute hemiplegic patients and improving their quality of life and motor system, resulting in better functional performances.

Review of Dynamic Gait Index

Aroosa Tariq 2019^[41] Analysis of gait pattern deviations among chronic post stroke patients. Patients presenting with both ischemic and hemorrhagic stroke, both genders having age of 25 year to 75 years, patients who had suffered from stroke in past 6 months at time of data collection were included in the study. Dynamic gait index, Modified Ashworth scale, 10 meter walk test and temporospatial characteristics like, step length, stride length, step width and cadence were used as data collection tools. Conclusion Of the study were marked deviations of gait in post stroke population in chronic stage. These included changes in step length, stride length, step width and cadence. There were also changes in the scores of dynamic gait index and 10 meter walk test which showed an alteration in gait speed and adaptability thus limiting the independence of stroke patients.

Review of Berg Balance Scale

Ku, P., Chen, *et al.* 2020^[46] the effects of Ai Chi for balance in individuals with chronic stroke: a randomized controlled trial. A total of 20 individuals with chronic stroke were randomly allocated to receive either Ai Chi or conventional water-based exercise for 60 min/time, 3 times/week, and a total of 6 weeks. Balance performance assessed by limit of stability (LOS) test and Berg balance scale (BBS). Fugl-Meyer assessment (FMA) and gait performance were documented for lower extremity movement control and walking ability, Ai Chi is feasible for balance training in stroke, and is able to improve weight shifting in anteroposterior axis, functional balance, and lower extremity control as compared to conventional water-based exercise.

Methodology

Study Type: Experimental study

Study Setting: general hospitals

Study Duration: Total duration of the study was 1 year.

Sampling Technique: Purposive sampling

Sample Size: 30

N = 30

Group A = 15 PATIENTS (Proprioceptive Neuromuscular Facilitation + Conventional Treatment)

Group B = 15 PATIENTS (Mirror Therapy + Conventional Treatment)

Selection criteria

Inclusion criteria

- Cerebrovascular accident with the onset of more than 6 months
- Age- 45-65 years
- First ever stroke
- Not receiving any other form of physiotherapy for lower limb

- spasticity as per the modified Ashworth scale score <3
- able to walk independently with or without use of walking aids or other support
- Those who were willing to participate in the study and willing to take treatment for ten successive days.

Exclusion Criteria

- Any musculoskeletal disorder impeding lower limb function
- Any neglect of space on the affected side, or any other neurological disease or auditory or visual
- Any other neurological deficits like Parkinson's disease
- Any psychiatric disorders
- History of foot deformity, Spinal deformity.
- History of spinal trauma or head injury.
- Peripheral arterial occlusive disease.
- Non co-operative
- Patients with Unstable vital parameters

Procedure

- Subjects were taken from various hospitals. Those subjects who fulfilling inclusion criteria were asked to sign the written consent form for voluntary participation in the study. They were explained about the nature of the study and intervention.
- On first visit, complete assessment was done according to the Performa. DGI and BBS explained in the local language of Gujarati and Hindi and then pre participation DGI and BBS were documented.
- Subjects who were included in protocol were not permitted to administer any other forms of electrotherapy or other techniques (steroids or acupuncture) during the intervention period.
- A total number of 30 subjects were selected for study.

Patients were randomly divided into two groups of 15 patients in each group.

Each patients of the study was treated for 3 weeks, 5 days per week, 1 day per session.

Group 'A' received Proprioceptive Neuromuscular Facilitation with conventional treatment.

Group 'B' received Mirror therapy with conventional treatment.

Conventional Treatment Protocol to Both the Groups^[37]

All the exercises were done for 10 repetitions, 2 sets with 10 s hold once a day under the supervision of the physiotherapist which includes the following:

- Full range of motion (ROM) exercises – passive and active-assisted range of motion exercises for the lower limb including hip (flexion, extension, abduction and adduction), knee (flexion and extension), ankle (dorsiflexion, plantar flexion, eversion and inversion).
- For spasticity management - Positioning of the limb, prolonged icing, brushing, gentle stroking, and gentle tapping.
- Common mat activities including turning from supine to side-lying to prone and vice versa, prone to prone on an elbow, prone on elbow to prone on hand; prone on hand to quadruped; quadruped to kneeling; kneeling to half-kneeling; half kneeling to standing with support; standing with support to the standing without support.

- Bridging exercises.
- Prolonged and gradually progressive stretching of hamstrings, calf.
- Strengthening exercises included isometrics of the back, quadriceps, and gripping exercises.
- Gentle and controlled weight-bearing exercises.
- Balance and coordination exercises.

Result

The present study conducted to find out comparison between Proprioceptive Neuromuscular Facilitation Versus Mirror therapy enhancing gait and balance in paretic lower limb after acute stroke- An Experimental study.

The study comprised of total 30 subjects with age distribution between 45- 65years. They were divided into 2 groups; 15 in each group.

The data was analysed using statistical package for the social science software (SPSS) 20 version. Before applying statistical tests, data was screened for normal distribution by Shapiro-Wilk test. In this study power was kept at 95% and level of significance was kept at 5%.

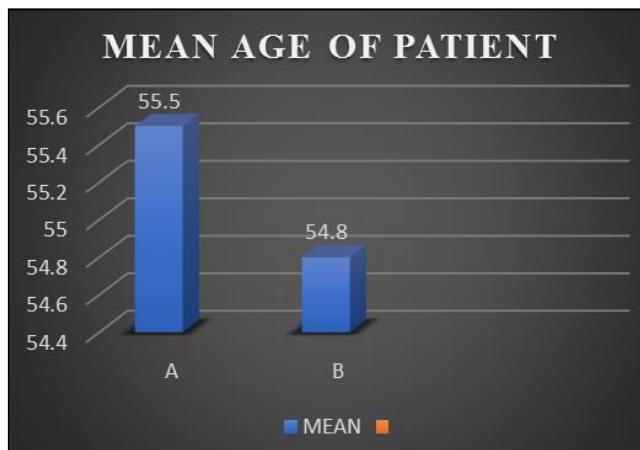
All outcome measures were analysed at base line and after 15 days of treatment, using appropriate statistical test. Changes in outcome measures were analysed within group as well as between groups.

The Outcome measure were

Gait- by Dynamic gait index test&
Balance- byBerg Balance scale

Table 1: Shows mean age of patients in both the groups:

Group	Mean	SD
A	55.5	7.86
B	54.8	8.80



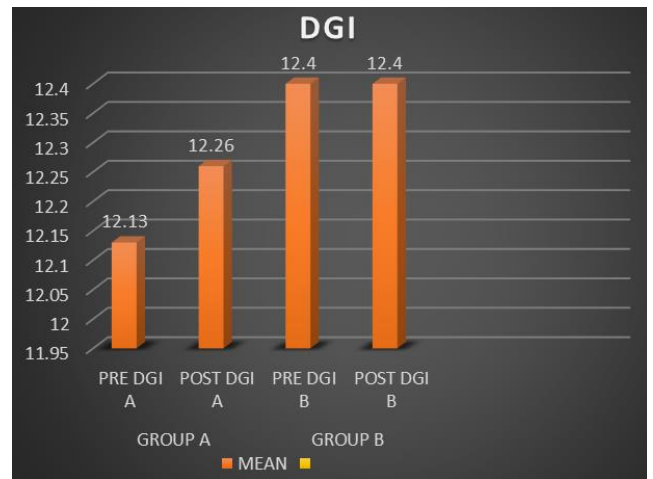
Graph 1: Shows mean age of patients in both the groups:

Table 2: Tests Used To Compare Within and Between Groups

Group	Within the group analysis	Between the group comparison
Group A	Paired T test	Unpaired T test
Group B	Paired T test	Unpaired T test

Table 3: Mean and sd of pre and post dgi within Groups

Groups	Pre-Treatment		Post-Treatment		P Value
	Mean	SD	Mean	SD	
Group A	12.13	2.37	12.26	2.98	<0.001
Group B	12.42.68		12.4	2.15	<0.001

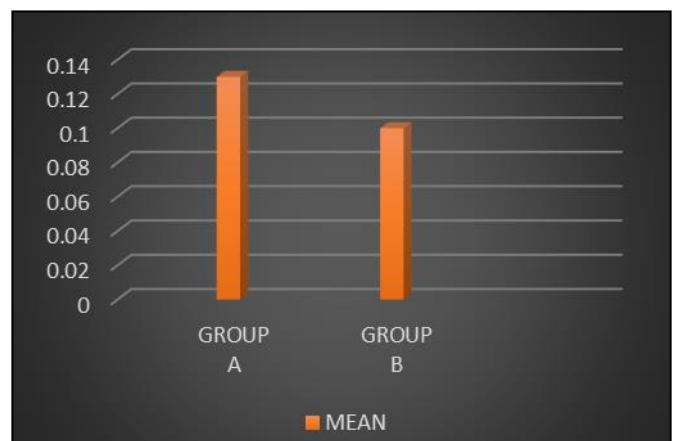


Graph 2: Mean of Pre and Post DGI within Groups

Here the within group comparison of DGI TEST was done by using Paired. T test in all groups, and ‘p’ value was <0.001, which showed statistically 0.Significant difference both the groups. So, both groups showed significant improvement on GAIT in DGI TEST score after intervention.

Table 4: Mean difference of Post DGI between Group A and B

Groups	Difference of Mean	T Value	P Value
Group A	0.13	1.468	0.001
Group B	0.01		



Graph 3: Mean Difference of Post DGI between Group A and B

Here, the between group comparison of DGI was done by using UNPAIRED T TEST. p value was 0.001between two groups. So it showed statistical significant difference in DGI between Groups A and B.

Interpretation of Result

After Analysing The Data Dynamic GAIT Index (DGI).The Difference Of Score In GROUP A 0.13 Mean Difference is and for Group B Mean Difference Is 0.01.

By Analysing The Data For Unpaired T Test The Calculation between GROUP A and Group B For Dynamic GAIT Index (DGI) Test ‘T’ Value Is 1.468 And ‘P’ Value Is. 001. Which Shows That ‘P’ Is <0.05. It Means There Is Significant Difference Present Between the groups DGI of Group A and Group B.

Discussion

The present study was conducted to find out comparison between Proprioceptive Neuromuscular Facilitation Versus

Mirror therapy enhancing gait and balance in paretic lower limb after acute Stroke.

This study was conducted on 30 subjects (male) with age group of 45-65 years and were divided into two groups by mean age of 20.04+ 1.86 in Group A, 21.46 + 2.23 in Group B. baseline measurement for Gait by Dynamic gait index (DGI) and balance by Berg Balance scale (BBS) were taken on day 1.

Conclusion

According to the statistical analysis the study shows that both the Techniques Group A (Proprioceptive Neuromuscular Facilitation) and Group B (Mirror Therapy) were individually effective in improving the GAIT and Balance.

While comparing both the techniques, there is significant difference present in between the groups.

So, Group A Proprioceptive Neuromuscular facilitation is more effective for enhancing gait and balance in paretic lower limb after acute Stroke.

Summary

Comparison Between The Effect Of Proprioceptive Neuromuscular Facilitation Versus Mirror Therapy Enhancing Gait And Balance In Paretic Lower Limb After Acute Stroke"- An experimental study.

A total number of 30 patients were selected for study. Each patient were screened initially by using a simple selection Performa relevant to the inclusion and exclusion criteria, then the selected patients who were willing to participate were randomly divided into two groups of 15 patients in each group.

Group A - 15 patients were given Proprioceptive Neuromuscular Facilitation along with conventional treatment.

Group B - 15 patients were given Mirror therapy along with conventional treatment.

The Treatment was given 15 Sessions for 3 Weeks

Two outcome measures Dynamic GAIT Index (GAIT) and BERG Balance Scale (Balance) were used.

In statistical analysis, analysis of outcome measure of DGI and BBS was done by parametric tests.

Within group Paired T Test and between groups Unpaired T Test was done.

Both groups showed significant improvement in DGI and BBS within the groups.

While we compare both groups there was significant difference in between the groups.

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