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Effectiveness Motor Re-Learning along with Proprioceptive Neuromuscular Facilitation on Improving Functional Mobility in Subjects with Chronic Stroke

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Abstract: ***Aim of the study: The study is aimed to investigate the effectiveness of motor relearning along with proprioceptive neuromuscular facilitation on improving functional mobility in subjects with chronic stroke. Objective of the study: The objective of the study is to enlighten the effectiveness motor relearning along with proprioceptive neuromuscular facilitation in improving functional mobility in subjects with Chronic stroke. Methodology: Study design: Experimental study design. Sample size: 28 subjects with chronic stroke with functional mobility impairment were selected. Procedure: Twenty eight subjects aged 45 to 55 years with stroke under Brunnstrom recovery stage IV and V were selected and assigned into two groups control group and experimental group with 14 subjects each, control group received PNF and the experimental group received PNF along with motor relearning program for a period of 4 weeks. Outcome measures: Extended timed up and go test (ETUG) was used to evaluate the functional mobility before and after the treatment. Results & Conclusion: The paired t test was used for within group analysis. The t values of control group for ETUG components sit to stand, walk 1, turn, walk 2, turn sit, walk speed ware21.469, 9.234, 35.133, 11.259, 14.587, 29.077 and p value were 0.00 through SPSS. 17 version. The paired t test was used for within group analysis. The t values of experimental group for ETUG components sit to stand, walk 1, turn, walk 2, turn sit, walk speed were 19.795, 21.500, 15.985, 14.343, 18.189, 26.858 and p value were 0.00through SPSS. 17 version. The result showed significant improvement in within group analysis. The unpaired t test was used to analysis between groups. The F value of ETUG components walk 2 and turn sit ware 4.731, 8.217 and p value of the same were 0.038, 0.008 respectively. The result showed that there were significant difference between control and experimental group in walk2 and turn to sit components Hence it can be concluded that PNF along with motor relearning show improvement in functional mobility that subjects treated with PNF alone.***

Keywords: Motor re-learning, PNF, Brunnstrom recovery stage, ETUG, Sub-acute stroke

1. The Study's Background

Ischemic stroke is a clinical term for a period of neurological impairment brought on by a focal cerebral, spinal, or ocular infarction; infarction is founded on scientific data. In In other words, symptoms are what define a stroke, and the 24-hour time limit is not required. If there is verifiable proof of CNS infarction.[1] Ischemic stroke is distinguished by a rapid decrease of blood flow to a part of the brain. Comparable loss of neurologic function occurs when the brain is damaged.

Incidence

Due to the rapid escalation of risk factors such hypertension, diabetes mellitus, smoking, and obesity that impact a sizeable section of the adult population, cerebrovascular diseases (CVD) are becoming more common and occurring more frequently in India.

According to the Global Burden of Disease research, of the 9.4 million fatalities in India, 619,000 were caused by stroke, and 28.5 million Disability Adjusted Life Years (DALYs) were lost, demonstrating the significant mortality and morbidity that CVD causes.[3]Therefore, India is likely to experience a serious crisis unless national initiatives are implemented to prevent/control CVD risk factors and enough services are established for the management and rehabilitation of stroke.[4] The fact that 20–30% of stroke cases include individuals under the age of 45 is also a cause for worry.

After a stroke, many individuals still have trouble walking or are unable to walk at all. Many daily activities require the capacity to independently walk. [18] According to reports, just a small percentage of people can walk well enough to carry out their daily tasks. Patients with hemiplegia have been reported to carry a higher percentage of the risk [19]. of body weight on the healthy limb than on the side with the injury.[20]a permanent pelvic retraction in its place, making it challenging for patients to swing the forward impacted lower extremity [21]. The ability of moving body parts to coordinate is crucial. adapted for functional walking,

One method frequently utilized to enhance performance is called Proprioceptive Neuromuscular Facilitation (PNF). the way hemiplegic people walk. Depending on the affected site, different PNF techniques have been employed. The encouragement of pelvic mobility is one of these PNF strategies. management of the pelvis.[5] Due to the fact that the pelvis has been called a "key point of control" for Techniques that target the pelvis and preserve a gait pattern are frequently used.

The Rivermead Mobility Index (RMI), a PRO instrument, is being used more frequently for worldwide research on stroke patients. It assesses mobility, a crucial component of everyday functioning in patients after stroke.

Need of the Study

One of the main reasons for a reduction in functional mobility or impairment is a stroke. Numerous studies have demonstrated the efficacy of several approaches to increase functional mobility. One of these is the PNF and Motor Relearning Programme.

Traditional treatment, PNF, and motor relearning are novel ideas for enhancing functional capacity. Studies demonstrating the efficacy of conventional therapy, PNF, and motor relearning to increase functional mobility in stroke patients are scarce.

This study is necessary to determine the efficacy of conventional therapy, PNF, and Motor relearning Programme in improving functional mobility because there aren't enough studies on improving functional mobility in stroke patients in India using these treatments.

Aim of the Study:

The purpose of the study is to determine how well subjects' functional mobility can be increased. A motor relearning Programme, PNF, and conventional therapy were used to treat stroke patients.

Objective of the Study

The goal of the study is to evaluate how effectively functional mobility can be improved in the participants. Stroke patients were treated with a motor relearning course, PNF, and conventional therapy.

Hypothesis

Null Hypothesis: There is no significance difference between of conventional therapy along with PNF and Motor relearning on improving functional mobility in subjects with MCA stroke ALTERNATE

Alternative Hypothesis: There is significant difference between of conventional therapy along with PNF and Motor relearning on improving functional mobility in subjects with MCA stroke

Operational Definitions:

Stroke:

Cerebral-vascular diseases can be defined as those in which brain disease occurs secondary to a pathological disorder of blood vessel or blood supply. PROPRIOCEPTIVE NEUROMUSCULAR FACILITATION: Hastening the response of the neuromuscular mechanism through stimulation of the proprioceptors; could result in either facilitation or inhibition. MOTOR RELEARNING: Motor relearning program is a set of process associated with practice or experience leading to relatively permanent changes leading in the capability for movement. [7]This process employs unassisted, goal directed practice.

Functional Mobility:

Functional mobility can be defined as the manner in which people are able to move around in the environment in order to achieve daily activities and interact with society EXTENDED TIMED UP AND GO [8]

Test:

The ETGUG test is a practical, objective, assessment tool that can be used in almost any clinical setting with minimal equipment, professional expertise, or training. Additionally, it has the capacity to give the clinician more information since it measures each of the component parts of the test.[9] The scope of application of the test might be enlarged to include implications for prevention strategies in the high-risk geriatric population and in guiding treatment more specifically.

2. Review of Literature

Review for Stroke and Functional Mobility

1) Alex Pollock “et al” 2015 c. (n.d.).
2) Beyaert C “et al” 2015 conducted a study on Gait post-stroke: Pathophysiology and rehabilitation strategies. (n.d.).
3) Hollands KL “et al” 2015 conducted a study on A novel and simple test of gait adaptability predicts gold standard measures of functional mobility in stroke survivors. (n.d.).
4) L. Brewer “et al” 2014 conducted a study on Stroke rehabilitation: recent advances and future therapies despite advances in the acute management of stroke, a large proportion of stroke patients are left with significant impairments. (n.d.).
5) Rajesh Verma “et al” 2011 conducted study to evaluate the effectiveness of the taskoriented circuit class training (TOCCT) with motor imagery (MI) on the gait during thesub acute phase after a stroke. (n.d.).
6) Mohamed Elsayed Khallaf “et al” 2014 conducted the study to find the effect of task specific exercises, Gait training and visual feedback of equinovrous gait among the individuals with stroke. (n.d.).
7) Kamal Narayana “et al” 2012 conducted study to find the improvements in the upper extremity motor recovery of the patients who had a sub acute stroke using Meaning full Task specific training. 1. (n.d.).
8) Chayuri “etal” 2014 conducted study to investigate the effect of intensive gait training with rhythmic auditory stimulation on postural control and gait performance in individuals with chronic hemiparetic stroke. (n.d.).
9) Langhammer B “et al” 2010 conducts study to compare motor re learning versus Bobath to improve quality of movement in subjects with stroke. A. (n.d.).
10) Beverley French “et al” 2010 conducts study to Beverley French determine if repetitive task training after stroke improves functional activity. (n.d.).
11) Gajanan Bhalerao “et al” 2013 conducted study to compare the effectiveness of Motor Relearning program (MRP) versus Bobath approach on Activities of Daily Living (ADL’s) and ambulation at every two week’s interval in Acute Stroke Rehabilitation in first six weeks of training. (n.d.).
12) Santos-Couto-Paz Cc “et al” 2015 conducted the study to find the addition of functional task-oriented mental practice to conventional physical therapy improves motor skills in daily functions after stroke. (n.d.).
13) Straube Dd “et al” 2014 conducted study to find the Effects of dynamic stepping training on non locomotors tasks in individuals post stroke. . (n.d.).

14) Michael A. Gregory "et al" 2016 conducted a study on Group-based exercise combined with dual-task training improves gait but not vascular health in active older adults without dementia. (n.d.).
15) Sarah Richardson "et al"2015 conducted study to outline possible benefits in function from repetitive task-oriented training techniques and document outcomes of a patient who had received PT services >12 months post stroke. (n.d.).
16) Bhaleraogajanan "et al"2015 conducted a study on various neurophysiologic approaches like Proprioceptive neuromuscular facilitation technique i.e. PNF, Bobath's neurodevelopment approach i.e. NDT, Brunnstrom technique and Rood's approach. . (n.d.).
17) Seo Kc "et al" 2015 Conducted study to examine the effects of ramp gait training using lower extremity patterns of Proprioceptive neuromuscular facilitation (PNF) on chronic stroke patients' dynamic balance ability. (n.d.).
18) Kim Ek "et al" 2015 conducted the study to investigate the effect of aquatic Proprioceptive neuromuscular facilitation (PNF) patterns in the lower extremity on balance and activities of daily living (ADL) in stroke patients. (n.d.).
19) Co Akosile "et al" 2011 conducted study to investigate the effect of an 8- weekproprioceptive neuromuscular facilitation (PNF)treatment program on the functional ambulation of post-stroke individuals measured with the Emory Functional Ambulation Profile (EFAP) - a timed-test instrument comprising 5 subtasks. (n.d.).
20) Dildip Khanal "et al" 2013 conducted study to find Effectiveness of Pelvic Proprioceptive Neuromuscular Facilitation Technique on Facilitation of Trunk Movement in Hemiparetic Stroke Patients Thirty hemiparetic stroke patients were randomly divided into two groups. (n.d.).
21) Tatiana Souza Ribeiro "et al" 2014 Conducted study to analyze the effects of a training program based on the Proprioceptive Neuromuscular Facilitation (PNF) method on motor recovery of individuals with chronic post-stroke hemiparesis. . (n.d.).
22) Kumar "et al 2012" conducted study to find The Effect of PNF Technique on Gait Parameters and Functional Mobility in Hemiparetic Patients 30 subjects affected by cerebrovascular accident of ischemic injury took part in the study. (n.d.).
23) Chaturvedi Poonam et al"2015" conduct a study To find correlation of lesion volume with functional outcome and effects of PNF (Proprioceptive Neuromuscular Facilitation) exercises in the improvement of functional outcome in the patients having MCA ischemic stroke. (n.d.).
24) Pernille Botolfsen "et al" 2008 conducted a study to find the Reliability and concurrent validity of the Expanded Timed Up-and-Go test in older people with impaired mobility. (n.d.).
25) Christina D. Faria, "et al" 2012 conducted a study to investigate the intra- and inter rater reliabilities of the Expanded Timed Up and Go (ETUG) test with subjects with stroke and to compare the ETUG scores between subjects with stroke and healthy control subjects. (n.d.).

3. Materials and Methodology

3.1 Materials

- Couch
- Parallel bars
- Stepping board
- Foot stool
- Mirror
- Ball
- Tray
- Walk way with chart instruction described
- Chair with arm rest and without arm rest
- Stop watch

Study design: The study design was experimental study design.

Sampling size: Sample of 28 subjects who came under selection criteria were included in the study.

Sampling method: Convenient sampling technique and randomly allocated.

Study duration: The study duration was 10 weeks

Study method: Subjects were divided into control group and experimental group

Control group: 14 subjects are treated with conventional therapy along with Proprioceptive neuromuscular facilitation

Experimental group: 14 subjects are treated with conventional therapy along with PNF and motor relearning

Selection criteria

Inclusive criteria: Both male and female
Age 35-45
Burne storm recovery stage 4,5¬ Dominant side hemiplegic subjects

Exclusive criteria:
- Perpetual and Cognitive deficits
- Recent surgery of lower limb
- Associated neurological problems like Parkinsonism.
- Any fixed deformity
- Severe respiratory distress and cardiac involvement.
- Medical instability

Study duration: The treatment will be scheduled according to the clinical standards and the subjects in control groups will be given 20 min of PNF along with conventional therapy and subjects in experimental group will be given 30 min of PNF along with conventional therapy and 20 min of Task training program. The treatment will be given 3 times in a week in alternate days for 10 weeks

Parameter:
Outcome measures: ¬ Extended Timed Up and Go Test (ETUG).

Treatment Technique

Proprioceptive Neuromuscular Faclitation)

- Rhythmic initiation of pelvic
- Slow reversal of pelvic
- Agonistic reversal of pelvic PNF elements such as manual contact, stretch, resistance, and verbal cuing were incorporated along with the treatment.

Frequency: 20 min/ session/day

Motor Re Learnng Programme

Task Specific Locomotors Training:

- Sitting to standing:
- With arm rest chair
- Without arm rest chair Walking:
- Walking forward with eye open and closed
- Walking backward with eye open and closed
- Walking sideward with eye open and closed Crossed stepping:
- Side stepping Elevation activities:
- Step up
- Step down
- Lateral step ups
- Stair climbing
- Step over step
- Tandem standing

Community activities:

- Walking on ramps
- Walking on curbs
- Walking on uneven terrain
- Walking over and around obstacles Balance activities:
- Tandem walking on a line ¬ Semi-tandem walking
- Walking on a foam Dual task activity:
- Holding a ball and walk
- Carrying a tray overhead and walk
- Carrying on a conversation and walk Coincident timing required:
- Walking to the doors ¬ Walking across the room Frequency: 20 min/ session/day.

Conventional Therapy

- Stretching.
- Strengthening exercise
- Pelvic bridging
- Active assisted mobilization.
- Active mobilization with minimal and maximal resistance.
- Bed transference training
- Upper limb and Lower limb exercises in sitting and standing position with and without resistance.
- Weight bearing exercises

Study Procedure:

28 subjects were chosen, checked for inclusion and exclusion criteria using a practical sample technique, and then randomly allocated to the control group or the experimental group.

14 people will make up Group A (the control group), and 14 subjects will make up Group B (the experimental group). Both the experimental group and the control group will be given a thorough description of the study.

Group A (control group) participants will receive All subjects will receive the Proprioceptive Neuromuscular Facilitation protocol, which consists of three PNF techniques for the pelvis: rhythmic initiation, gradual reversal, and agonistic reversal, for a total of four weeks (10 sessions). Ten minutes will be allotted for each technique.

Extended Timed Up-Go Test (ETUG) findings are obtained [51, 52].and stop watches were used to record the timings for each job for the pre-test and post-test in both the control and experimental group, and a determination was reached.

4. Data Analysis and Results

The study comprised of two groups, control group and experimental group, with 14 subjects in each group. For the both group age range was between 45 and 55. Statistics was done by using SPSS.17 version. The paired t test was used for within group analysis. Pre and post mean with standard error mean, t values and p values of control group for ETUG components sit to stand, walk 1, turn, walk 2, turn sit, walk speed are given in the table1. Their p value was 0.00. The result showed there were significant improvement in within group analysis for control group.

Within Control Group Analysis

Component of ETUG	Pre Mean Value ± Standard Error Mean	Post mean Value± Standard Error Mean	T Value	Significance (p Value)
SIT TO STAND	10.1200 ±0.20545	7.5200±0.22640	21.469	0.0
WALK 1	10.7600±0.11580	8.5667±0.19752	9.234	0.0
TURN	9.8533±0.22822	7.5533±0.22036	35.133	0.0
WALK 2	11.4600±0.2466	8.8933±0.23227	11.259	0.0
TURN & SIT	10.4067±0.34219	7.6733±0.28174	14.587	0.0
WALKSPEED	52.6000±0.51594	40.2067±0.69189	29.077	0.0

T values and p values of the experimental group for the ETUG components of sit to stand, walk 1, turn, walk 2, turn sit, and walk speed were provided in Table 2 for the experimental group's pre and post means with standard error means. Their p values are computed using SPSS version 17 to be 0.00. The outcome showed that the experimental group's within-group analysis had significantly improved.

Table II: Within Experimental Group Analysis

Component of ETUG	Pre Mean Value ± Standard Error Mean	Post mean Value± Standard Error Mean	T Value	Significance (p Value)
SIT TO STAND	10.3733 ±0.14225	5.8000±0.16036	19.795	0.0
WALK 1	11.0933±0.19651	5.8000±0.17968	21.500	0.0
TURN	10.0067±0.2588	5.06673±0.15096	15.985	0.0
WALK 2	10.3467±0.34598	5.3000±0.12459	14.343	0.0
TURN & SIT	10.5267±0.29592	4.6800±0.11050	18.189	0.0
WALKSPEED	52.3467±0.78527	26.6467±0.42391	26.858	0.0

Unpaired t test was used to compare the pre – post values of both the group. The pretest values of both the control and experimental group for the ETUG components sit to stand, walk 1, turn, walk 2, turn sit, walk speed outlining the f value and p value were given in table 3. The result showed that there was no homogeneity among the group.

Table III: Intra Group Analysis Pre-Values

Components of ETUG	Control Post Mean Value ± Standard Error Mean	Experimental Post Mean Value ± Standard Error Mean	F Value	Significance 'p' Value
SIT TO STAND	10.1200 ±0.20545	10.3733 ±0.14225	3.310	0.88
WALK 1	10.7600±0.11580	11.0933±0.19651	5.615	0.25
TURN	9.8533±0.22822	10.0067±0.2588	0.182	0.673
WALK 2	11.4600±0.2466	10.3467±0.34598	3.008	0.094
TURN & SIT	10.4067±0.34219	10.5267±0.29592	.280	0.601
WALKSPEED	52.6000±0.51594	52.3467±0.78527	2.137	0.155

The posttest values of both the group were calculated. The mean values, F value and p value of ETUG components sit to stand, walk 1, turn, walk 2, turn sit, walk speed are given in table 4. The result showed that there was significant difference between control and experimental group in walk2 and turn to sit components only. Remaining components were not significant. It concludes that the experimental group showed good improvement than the control group.

Table IV: Intra Group Analysis Post Values

Components of ETUG	Control Post Mean Value ± Standard Error Mean	Experimental Post Mean Value ± Standard Error Mean	F Value	Significance 'p' Value
SIT TO STAND	7.5200±0.22640	5.8000±0.16036	2.208	0.165
WALK 1	8.5667±0.19752	5.8000±0.17968	0.196	0.662
TURN	7.5533±0.22036	5.06673±0.15096	2.389	0.133
WALK 2	8.8933±0.23227	5.3000±0.12459	4.731	0.038
TURN & SIT	7.6733±0.28174	4.6800±0.11050	8.217	0.008
WALKSPEED	40.2067±0.69189	26.6467±0.42391	3.953	0.057

5. Discussion

Patients who have suffered a stroke become entirely dependent and have permanent cognitive, motor, and sensory problems. Following a stroke, functional mobility is changed for a variety of reasons. a lack of capacity to conduct basic movements like walking, sitting, or standing, and turning is typical among stroke victims. PNF and MRP are seldom ever used to enhance patient's functional mobility after a stroke.

Herman Kabat is' proprioceptive neuromuscular facilitation is a method for improving functional mobility through carefully planned interventions and continual analysis of sensorimotor function. Functional mobility and motor function are greatly enhanced by the synergic patterns and techniques used. According to Janet and Carrshepered, moor relearning has a number of internal processes connected to practice and experience that result in long-term modifications in the capacity for skilled behavior. Control mistake identification and repair requires a large amount of practice, feedback, and high-level information processing.

This work on enhancing functional mobility is supported by a 2023 study of Kusum Agarwal "ET AL" with 28 post-stroke patients, which found that physical therapy programming employing task-oriented training in MRP enhances the functional mobility and gait-related activities.

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