



A STUDY TO COMPARE THE EFFECT OF NEUROMUSCULAR FACILITATION WITH ECCENTRIC LOADING VERSUS PASSIVE STRETCHING IN REDUCING PAIN AND SPASTICITY OF PLANTAR FLEXORS OF ANKLE AND FOOT IN PATIENTS WITH STROKE: A RANDOMIZED CLINICAL TRIAL

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KEYWORDS :

INTRODUCTION

Stroke is an acute onset of neurological dysfunction due to an abnormality in the cerebral circulation with resultant signs and symptoms that corresponds to involvement of focal areas of brain. It is characterized as an interruption of the blood supply to brain or hemorrhage into the brain tissue, commonly involving a disruption in the motor, somatosensory, visual, speech, perceptual, cognitive, bowel and bladder dysfunction resulting altered muscle tone, muscle weakness and abnormal movement patterns with consequently limit the ability to perform functional activities such as walking, climbing stairs and self-care¹.

This is third leading cause of death and most common cause of disability among adults. The annual incidence varies regionally between 150-200/lac people with prevalence of 600/lac of which 1/3rd is severely disabled. In India up to 75% of stroke patients remain disabled at one to three weeks after the stroke². Spasticity is a major complain in patients with stroke. In upper limb, it is predominantly in scapular retractors, shoulder adductors and depressors, internal rotators, elbow rotators and wrist and finger flexors³. In lower extremity, spasticity is strong in pelvic retractors, hip abductors, extensors, internal rotators, knee extensors, plantar flexors and toe flexors. This leads to paresis altered muscle activation patterns, abnormal reflexes, disturbances in postural control and balance⁴. Thus patients with stroke will lack the ability to stabilize trunk and proximal joints appropriately with the resultant postural misalignment, balance impairments and increased risk of falling⁵.

The different types of interventions that claim to reduce spasticity following stroke are drug interventions, passive stretching, electrical stimulation, splinting cryotherapy and positioning devices⁶. On the other hand, passive stretching is one of the oldest method been followed to reduce spasticity. Passive stretching when given continuously for more than thirty seconds it results in reduction of gamma motor activity and thereby reduction in stretch reflex. Hence it is useful in spasticity management⁷. In this study an attempt to evaluate the comparative effect of neuromuscular facilitation along with eccentric loading versus passive stretching in reducing pain and spasticity in patients with stroke.

Hypothesis

Experimental Hypothesis [H₁] - There will be significant difference between the effect of neuromuscular facilitation with eccentric loading versus passive stretching in reducing spasticity of plantar flexors of ankle and foot in patients with stroke

Null Hypothesis [H₀] - There will be significant difference between the effect of neuromuscular facilitation with eccentric loading versus passive stretching in reducing spasticity of plantar flexors of ankle and foot in patients with stroke

MATERIALS AND METHODS

Study design

This experimental study was a Randomized Clinical Trial to determine the efficacy of neuromuscular facilitation with eccentric loading versus passive stretching in reducing spasticity of plantar flexors of ankle and foot in patients with stroke

Study subjects

A total of 18 patients (between 45 and 58 years old) with unilateral affected lower limb participated in this study. The participants who met the inclusion criteria underwent a physical examination of spasticity for baseline assessment, which included performing movement of ankle joint and foot.

Inclusion Criteria

- Age between 45-58yr
- Only Male participants included
- Modified Ashworth Scale score 3
- Burnstorm recovery 4th stage of hemiplegia

Exclusion Criteria

- No previous history of trauma to lower limb
- History of trauma to ankle joint
- No Surgical history done at ankle or foot and other joints of lower limb
- No traumatic or idiopathic history to Achilles tendon
- Any deformity of foot
- Bone and joint tumor in lower limb

Outcome Measures

Modified Ashworth Scale

This scale is used to elicit the spasticity of muscle or group of muscle⁸. This scale consists following grades that help to clarify the grade of spasticity as follows:

0= no increase in muscle tone

1= slight increase in muscle tone, manifested by a catch and release or by minimal resistance at the end of range of motion when the affected part in moved in flexion or extension

1⁺ = slight increase in muscle tone, manifested by a catch followed by minimal resistance throughout the remainder (less than half) of the range of motion

2= more marked increase in muscle tone through most of the range of motion, but affected part moved easily

3= considerable increase in muscle tone, passive movement difficult

4= affected part rigid in flexion or extension

Visual Analogue Scale

The visual analog scale is one of the most basic pain measurement tools. It consists of a 10 cm line. The clinician can measure the place on the line and convert into it a score between 0 to 10 where 0 is no pain and 10 is bad as it could be⁹.

Procedure

Application of Moist heat pack (MHP) - After assessing the patient, the subjects were first given hydrocollator pack on spasm/tender point area region for 15 minutes in both groups to warm-up and to improve the extensibility of tissues. The temperature of hydrocollator pack was adequate for the targeted area. The hydrocollator pack was well covered with mackintosh sheet. During

this phase therapist asked the patient about temperature of hydrocollator pack and his/her suitability towards the procedure.

Application of TENS- The patients of group A was prepared according to the electrotherapeutic protocol. The skin resistance was lowered by cleaning the treatment area with soap water and excessive hair was removed if it seemed to reduce the conduction¹⁰ of the current. The negative electrode of the TENS unit will be placed on the (Motor points) of the Tibialis Anterior muscle and the positive electrode insertional site of the Tibialis anterior muscle. The current to be applied at a pulse repetition frequency of 100Hz and duty cycle of 250s, the intensity will be set at a level that each subject should feel but will not be strong enough to induce muscle contraction. The current needs to be applied for 20 minutes continuously.

Application of Passive Stretching- for group B, prolonged stretching was given. For the implementation of stretching of plantar flexors of foot, the position of the patient should be in supine lying position and therapist should be in standing position on the affected side or reference limb. Having positioned himself in a biomechanical effective manner, the therapist clutched the heel of patients affected ankle and gradually performed the stretching. Stretching was performed for plantar flexor so as to maintain the ankle in the dorsiflexed position. The stretch was sustained for 1-2 minutes with a rest period of 1 minute. 10-12 repetitions were performed for thirty minutes¹¹.

Eccentric Loading - In this, the patient stood bearing weight on the involved foot in plantar flexion with the knee slightly bent; the patient then slowly lowered the heel into dorsiflexion to a count of 30. The other leg could be used to assist the patient in returning to plantar flexion. Again, the patient lowered the heel to a count of 30 into dorsiflexion. If too weak to hold the single leg in plantar flexion, the patient stood with the heel off a step as high as possible (which might be neutral) and slowly lowered the heel to a count of 30¹².

Data Analysis

All analysis was obtained using SPSS version 20.0. Demo graphic data of the patients including pain and disability were summarized. Dependent variables for the statistical analysis were Modified Ashworth scale score. A base line data was taken and analyze. Paired and unpaired t-test was used in this study. A level of significance 5% (*) was used to determine the statistical significant.

Table:-1, Showing comparison of VAS score between group A and group B

Groups	Time Period	Mean	S.D	S.E.M
Group-A	Pre	4.31	2.88	1.21
	Post	0.74	0.63	0.37
Group-B	Pre	4.17	2.54	1.12
	Post	2.69	1.47	0.87

Table:-2, Showing comparison of Ashworth scale score between group A and group B

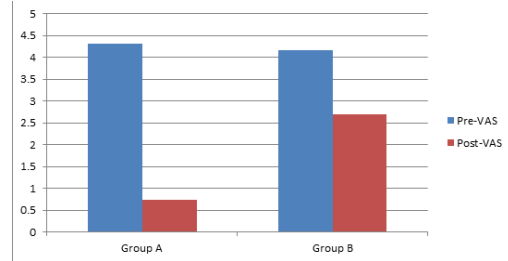
Groups	Time Period	Mean	S.D	S.E.M
Group-A	Pre	3	1.27	1.21
	Post	1	0.32	0.13
Group-B	Pre	3	1.27	0.78
	Post	2	1.03	0.57

Table:-3, Showing comparison of t-test value and p-value of VAS between group A and group B

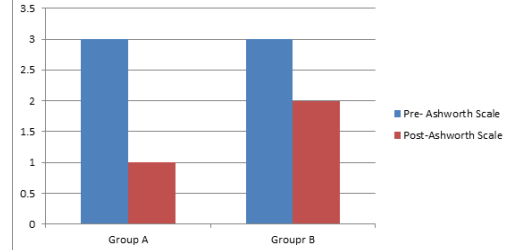
Groups	Time Period	t-test	p-value
Group-A	Pre- Post	13.47	0.000*
Group-B	Pre- Post	17.69	0.173

Table:-4, Showing comparison of t-test value and p-value of Ashworth scale score between group A and group B

Groups	Time Period	t-test	p-value
Group-A	Pre- Post	18.37	0.000*
Group-B	Pre- Post	21.69	0.173



Graph-1, Showing comparison of VAS score between group A and group B



Graph-2, Showing comparison of Ashworth scale score between group A and group B

DISCUSSION

This study provides data for pain and spasticity of persons who had complain of pain with tightness of plantar flexor muscle unilaterally. The data is sparse in between 45-58 age group since it was convenient to find people in this age group who could fit the inclusion criteria in this study.

In this study, there is decreasing in VAS score and Ashworth scale score in both groups. Both treatment approaches TENS with eccentric loading and passive stretching exercises are effective in reducing pain and spasticity in patients with stroke. But TENS with eccentric loading was more effective than passive stretching in order to decrease pain and spasticity.

Data of VAS and Ashworth scale of two Groups, TENS with eccentric loading group and passive stretching exercises program for pre and post interventional study are expressed in terms of mean, S.D and S.E.M is shown in table-1 and 2 respectively. Further application of independent t-test implemented to find the significant difference between pre and post intervention study between TENS with eccentric loading and passive stretching, which revealed significance difference for the 9 patients each group at 5% level of significance.

In group A, p-value was significant i.e., p<0.05 with VAS and Ashworth scale score (0.0000) and (0.0000) respectively. The 4 weeks protocol of TENS with eccentric loading showed difference in order to decrease the pain and spasticity whereas group B, passive stretching showed non-significant difference in decreasing pain and spasticity.

Several studies by different group of researchers were going on to find out the effective technique in the reduction of spasticity and improving the independence of the affected individuals in various neurological conditions. A pilot study¹³ was conducted by Armutlu K et al, 2003 in the school of Physical Therapy, Ankara, Turkey on the effect of Transcutaneous Electrical Nerve Stimulation on spasticity in patients with multiple sclerosis by giving stimulation of frequency 100 Hz and pulse width 0.3 milliseconds for 20 minutes/day for a period of 4 weeks. The results showed significant reductions in spasticity in both extremities. Another study was conducted by Tekeoglu Y et al, 1998 did a study on the effect of TENS in the department of Physical Medicine¹⁴, Van, Turkey on Barthel activities of daily living index score following stroke by dividing the subjects into two groups of 30 each. One group received TENS with a frequency of 100 Hz whereas another group was given placebo

TENS and found that group which received TENS had a remarkable reduction in spasticity.

CONCLUSION

This study revealed that both the experimental group showed the difference in VAS and Ashworth scale scores. But group A, showed the significant difference in VAS and Ashworth scale scores with respect to p-value and t-test value. Finally, this study stated that TENS with eccentric loading is more effective than passive stretching in order to decrease pain and spasticity in patients with stroke.

Conflict of Interest: None

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