

# EFFECTS OF NEURAL TISSUE MOBILISATION AND PNF TECHNIQUE OF HOLD-RELAX ON LOWER EXTREMITY FLEXIBILITY IN POST STROKE PATIENTS

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## ABSTRACT

**Purpose:** The purpose of the study was to study the effects of neural tissue mobilisation and hold-relax technique of lower extremity flexibility in post stroke patients.



**Materials and Methods:** 26 subjects were recruited in the study, 13 in each group. Group A (NDS) received sliders to the sciatic nerve in supine while Group B received PNF Hold-relax to hamstrings in supine. Both the treatment techniques were given in addition the set treatment protocols of the subjects. Popliteal angle was measured before commencing the treatment and after termination of the treatment.

**Results:** No significant results were found between both the groups indicating equal effectiveness of both the treatment techniques.

**Conclusion:** Both, Neural mobilisation and Hold-Relax can be used equally in improving flexibility in post stroke patients.

**KEY WORDS:** Neural Tissue Mobilisation, Hold-Relax Technique, Flexibility, Stroke.

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## INTRODUCTION

Stroke, leading cause of death in India and globally second, is caused as a result of sudden interruption of blood supply to the brain, may it be because of ischemia or haemorrhage in the brain due to various causative factors [1]. According to the current statistics in India, death rate due to stroke is expected to rise from 19% to 36% by the year 2030 [2]. An individual with stroke in the acute stages represents with hypotonia, difficulty or inability to move one side of the body and rarely comatose state due to neurological shock which later is represented as hypertonia, tightness, contractures, muscle

weakness or paralysis, limited range of motion, leading to activity limitations and gait abnormalities. Such neurological disorders also give rise to various mechanical changes in the neuromuscular system of the body. Therefore, it continues to remain a major public health and disability concern.

For an individual to be physically fit and be able to move around freely without any personal barrier, flexibility forms an essential component. Also, flexibility improves motor skills and abilities of an individual which is seen to be affected in this population which in turn affects loco-

-tion-which itself is defined as ability to move from one place to another [3]. Altered flexibility gives rise to alterations in the gait of an individual which affects the locomotion, ultimately which is a basic human necessity.

Hamstrings group of muscle during the stance phase are seen to be acting on the pelvis, stabilising the pelvis thus helping the body propel forward, extending the hip whereas they help in flexing the knee during the swing phase of the gait cycle [4]. Studies have shown that any shortening in this group of muscles will lead to altered mobility of the spine and pelvis, also altering the gait of the individual [5,6] Thus, targeting these group of muscles during the rehabilitation of these individuals should be focused on.

Varied treatment options available for improving the flexibility in these individuals are therapeutic massage, static stretching, ballistic stretching, cryostretching, myofascial release, foam rolling, use of functional training along with the strengthening exercises, neurodynamic studies(NDS), proprioceptive neuromuscular facilitation technique(PNF), muscle energy technique, etc.<sup>(7,8)</sup> Even when the literature has given us enough evidence and varied treatment approaches to limit the long term disability in these individuals due to limited flexibility, it fails to give us the best treatment option available for fastening the recovery and hence limit the disability and activity limitation rate to minimal. Proprioceptive neuromuscular facilitation was seen to be used widely in the study set up and NDS, a newer concept though proved was seen rarely to be used in improving flexibility of these individuals which gave rise to the curiosity of the researchers thus leading to the current study creating the hypothesis of being having one of the techniques better than the other or both the techniques giving the same treatment effect, thus creating the null hypothesis of the study. Thus, current study was carried out with an objective of comparing the changes in the lower extremity flexibility by measuring the popliteal angle of the knee by dividing the subjects in two groups of NDS and PNF respectively.

**Aim:** To study the effects of neural tissue mobilisation and PNF technique of hold relax on

lower extremity flexibility in post stroke patients.

### Objectives:

1. To study the effects of neural tissue mobilisation on lower extremity flexibility in post stroke patients.
2. To study the effects of PNF hold-relax on lower extremity flexibility in post stroke patients.
3. To assess popliteal angle pre and post treatment.
4. To compare the effects of both the techniques.

### MATERIALS AND METHODS

A pilot study was carried out before undertaking the actual study and those subjects were also included in the study. An ethical approval was taken by the ethical committee of the institution before undertaking the study and a written consent was taken from the subjects explaining the entire procedure of the study before recruiting them in the study.

**Trial design:** Experimental RCT study

**Sample size:** A total of 26 subjects were recruited in the study, with 13 subjects in each group. Sample size was calculated considering an allowable error of 20% with the confidence interval set at 95% by the following formula based on the results obtained from the pilot study:

$$n = \frac{(z_{1-\alpha/2})^2 * (SD)^2}{(d)^2}$$

**Participants:**

**Inclusion criteria:** Sub acute to chronic stroke, Moderate hamstring tightness, MAS grade 1+ 2, Use of any assistive device(KAFO/AFO),

**Exclusion criteria:** Presence of any contractures, any recent surgical intervention to the spine or the affected lower extremity, sensory stroke, cognitive/language deficits interfering with comprehension required to participate in the study.

**Setting and location of the study:** Tertiary care hospital and private set ups

**Randomisation:**

**Allocation:** Subjects were allocated in the

groups of NDS and PNF respectively by using the chit method.

**Implementation:** The method of randomisation and allocation of the samples in the study was done by the researchers themselves.

Interventions:

**Neurodynamic sliders:** For subjects recruited in this group, in supine position-the hip position and then extended completely maintain the foot posture thus giving sliders to the sciatic nerve for a duration of 1 minute each for 6 such sets where a 30 seconds rest period was followed by every set [9].



**Proprioceptive neuromuscular facilitation:** Subjects in this group were placed in supine with hip-knee flexed to 90 degrees and then extending the knee so as to take it to the barrier point followed by a strong isometric contraction to the hamstrings where the subject was asked to push the heel down on the examiners hand with maximal force and then passively extending the knee and then repeating the same procedure, Each hold period lasted for 6-10 seconds followed by a relaxation phase of 10-15 seconds for 20 repetitions.

During the entire treatment procedure, the subjects in both the groups were asked not to hold the breath. Both the intervention techniques formed as an addition to the existing planned treatment protocols of the subjects. This study was a one session study, where immediate effects were studied by comparing the outcome measure before commencing the treatment and after the termination of the treatment.

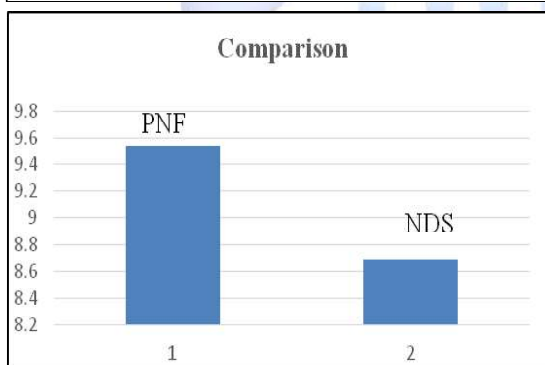
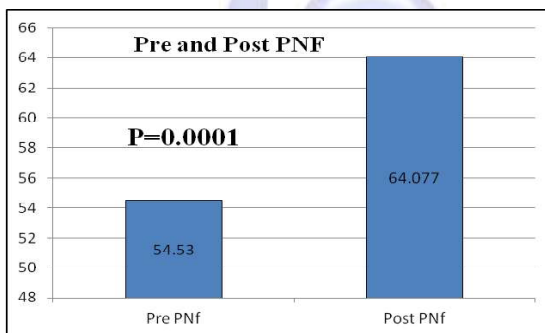
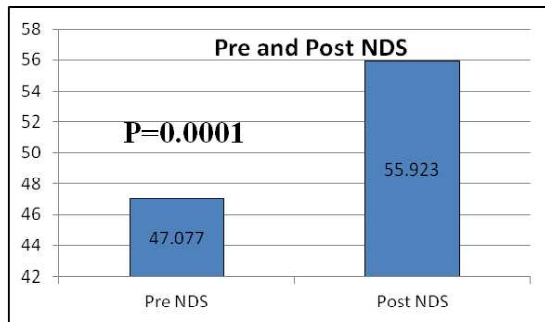
**Outcome measures:** Popliteal angle of the knee was measured with patient lying in supine pre and post the treatment. With the subject lying in supine and hip-knee flexed to 90 degrees, the knee was extended passively and the degree of excursion was measured using goniometry.

**Statistical analysis:** Statistical analysis was done using the software SPSS16. Paired T test was used to analyse the intra-group results whereas Unpaired T test was used to analyse the inter-group results.

## RESULT

SPSS software was used for stastical analysis, the mean value for the NDS group was found to be 47.077 pre treatment and 55.923 post treatment with a standard deviation of 14.88 and 14.96 respectively whereas for the PNF group the mean value pre and post treatment was found to be 54.53 and 64.07 with the standard deviation of 14.087 and 14.280 respectively. When the intra group results were analysed using the Paired T test, the results found were extremely significant with p value being 0.0001 respectively suggesting both the treatment techniques are highly reliable. However, when the inter-group results were analysed using the Unpaired T test, the results found were considered

not significant with p value being 0.6448 suggesting that both the treatment techniques have equal therapeutic effects and thus proving the null hypothesis of the study.



## DISCUSSION

A total of 26 subjects were recruited in the study, which were divided in two groups with 13 in each group. Group A i.e., NDS was given sliders and Group B i.e., PNF was given Hold-relax technique in addition to the set treatment protocols. Popliteal angle was measured before commencing the treatment and after the termination of the treatment. The mean of the pre and post values was compared using a Paired T test for intra-group results and an Unpaired T test for inter-group result. The results were found to be extremely significant in the groups ( $p=0.0001$ ) respectively and not significant in between the groups ( $p=0.6448$ ) suggesting both have equal treatment effects. The study was done over a short course of time considering only one treatment session.

PNF seems to have worked based on the following mechanisms:- Autogenic inhibition, stress relaxation and gate control theory. Each mechanism focuses on the golgi tendon organ. The golgi tendon organs when subjected to a strong isometric contraction and later stretched sense as a harmful stimulus to the body and shows result later as a result of protective mechanism of the body. Along with these underlying pathological mechanisms, other important factor responsible for the changes is the percentage amount of voluntary contraction. Autogenic inhibition gives result as a result of self regulatory mechanism in order to protect other structures. It occurs in the contracted/stretched muscle where a decrease in motor excitability is seen because of inhibitory signals sent from the stretched or the contracted muscles.

Signals causes actions of afferent fibres causing action of inhibitory inter neurons in the spinal cord which would cause the efferent activity to decrease leading to a decrease in nerve excitability. Viscous and elastic changes are seen in the muscles and tendons of the body when they are under constant stress. Hence, when a muscle is stretched for a considerable amount of time or given a considerable amount of contraction, viscoelastic changes happen in the muscles and tendons as a result of creep produced which is defined as an initial rapid increase in strain (deformation) followed by a slower increase in strain at a constant stress over a course of time, thus causing relaxation of the stressed structures and explaining the stress relaxation mechanism. The Gait Control theory is explained considering the pain and pressure. Whenever a muscle or a tendon is subjected to a stretch or a strong contraction (pressure), it gives rise to pain thus stimulating the nociceptors which send inhibitory signals via the afferent to the spinal cord and thus inhibiting the pain via the efferent fibres supplying the muscle/tendons and later resulting in relaxation of the musculoskeletal structures [10].

Musculoskeletal system acts as a mechanical interface to the nervous system of the body which in turn puts pressure on the neural structures with alterations in body posture and dimensions. Thus, any change in the body posture or presentation will alter the mechanics of

the neural elements which comprise of various events like elongation, sliding, cross sectional changes. Musculoskeletal changes taking place as a result of such neurological disorders gives rise to altered mechanics and functioning of the neural system because of the involvement of the mechanical interface of the neural structures. Hypertonia associated with such upper motor neuron lesions leading to tightness and altered attitude of the extremities will further put a pressure on the neural structure(nerves) thus compressing them and altering the blood flow and reducing the nutrition. This will further worsen the muscular symptoms of the patients due to altered physiology of the nervous system. Studies have shown that moving the limb in a way such that the nerve slides and elongates will cause increase in the intra neural blood flow and nutrients of the nerves thus reducing the symptoms [11]. Hence, treating the nerves in a way such that it improves the mobility, blood supply and nutrition of the nerve will help minimise the altered mechanics of muscular system which in turn will help enhance functioning and mobility of the individual.

Study done by Hyun-Kyu Cha and et all on lower limb function post NDS resulted in significant difference in the angle of knee joint, sway, functional reach test [12]. Similarly, significant improvements in the overall functional ambulation of the patients was seen with ability to take daily ambulatory challenges post PNF by a study done by the department of Medical rehabilitation and college of health sciences in Nigeria [13]. Study by Yun-hyeok hin and authors in Korea on hamstring flexibility, Lower limb strength and Gait performance in chronic stroke patients have also shown positive effects. Also, a study has shown that the elasticity and extensibility of the nervous system can be maintained using the neural mobilisation techniques [14].

The fact that both the treatment techniques showed us similar results could be due to the above mentioned pathophysiology.

Thus, current study suggests that even NDS should also be considered as a treatment option when planning rehabilitation of these patients as it gives us similar treatment effects when compared to other technique like PNF which is being widely used.

**Limitations:** Long term effects of the intervention strategies were not seen.

**Future scope of study:** Same study can be undertaken to study the long term effects of the study.

## CONCLUSION

Our study supported the null hypothesis i.e., Both, NDS ad PNF technique of hold relax have equal effects on improving lower extremity flexibility in post stroke patients.

**Clinical Significance:** Both NDS and PNF technique of hold relax should be considered equally when planning the treatment protocols in improving lower extremity flexibility.

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**Conflicts of interest: None**

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