

## EFFICACY OF NERVE FLOSSING TECHNIQUE ON IMPROVING SCIATIC NERVE FUNCTION IN PATIENTS WITH SCIATICA – A RANDOMIZED CONTROLLED TRIAL

## EFICACITATEA TEHNICII NERVE FLOSSING ÎN ÎMBUNĂȚĂȚIREA FUNȚIEI NERVULUI SCIATIC LA PACIENȚII CU SCIATICĂ – STUDIU RANDOMIZAT

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**Key words:** Sciatica; Nerve Flossing Technique; Passive Straight Leg Raise

**Cuvinte cheie:** sciatică, tehnica nerve flossing, ridicarea pasivă a membrului inferior extins

**Abstract. Objective** The purpose of this study was to evaluate the efficacy of nerve flossing technique (NFT) in the relief of pain and sensory symptoms, restoration of spinal mobility and minimizing functional disability. **Design** Randomized Controlled Trial. **Setting** Department of Neurophysiotherapy, Pravara Rural Hospital (Tertiary Hospital), Loni, Tal- Rahata, Dist- Ahmednagar, Maharashtra, India- 413736. **Participants** Thirty-nine participants between 20-55 years of age having clinical diagnosis of sub acute sciatica due to prolapsed and extruded intervertebral disc. **Interventions.** Study group received the nerve flossing technique along with conventional physiotherapy and Control group received only conventional physiotherapy. In NFT technique, participant performs knee extension with neck extension with hold of 5 seconds and then flexes both the knee and neck simultaneously and holds it for five seconds. Total five sets of the above were given for six consecutive days. **Main outcome measures** The outcome was assessed in terms of Visual Analogue Scale (VAS), Sciatica Bothersomeness Index, Passive Straight Leg Raise (PSLR), active lumbar flexion range and Modified Oswestry Disability Questionnaire (MODQ) score. **Results** Study group had statistically significant improvement in VAS score ( $p < 0.01$ ), Sciatica Bothersomeness Index score ( $p < 0.01$ ), PSLR ( $p < 0.01$ ), active lumbar flexion range ( $p < 0.01$ ), and in MODQ score ( $p < 0.01$ ) compared to control group after 6 days of treatment. **Conclusion** Nerve flossing technique can be used with other modalities in the treatment of sub-acute sciatic patients due to prolapsed and extruded disc. **Clinical Trial Registration Number.** PMT/PIMS/RC/2011/09

**Rezumat. Obiective** Scopul acestui studiu este evaluarea eficienței tehnicii de nerve flossing (TNF) pentru reducerea durerii și a simptomelor senzoriale, refacerea mobilității spinale și minimizarea dizabilităților funcționale. **Design** Control aleatoriu. **Locație** Departamentul de Neurofizioterapie, Spitalul Rural Pravare (Spital de gradul trei), Loni, Tal- Rahata, Dist-Ahmednagar, Maharashtra, India- 413736. **Participanți** 39 de participanți cu vârste între 20 și 55 de ani au diagnosticul clinic de sciatică acută cauzată de prăbușirea sau protruzia discului intervertebral. **Intervenții.** Grupului de studiu i s-a aplicat tehnica de nerve flossing, iar grupului de control i s-a aplicat kinetoterapie convențională. În tehnica TNF, participanții execută extensia genunchiului cu menținere de 5 secunde și apoi flexează simultan atât genunchiul cât și gâtul și mențin 5 secunde. S-a făcut un total de cinci seturi din exercițiile menționate anterior, 6 zile consecutive. **Măsurarea rezultatelor** Rezultatele au fost evaluate conform Scalei Analog Vizuale (SCV), Indexul Bothersomeness pentru Sciatică, Ridicarea Pasivă a Piciorului Întins (RPPÎ), gama de flexii lombare active și Chestionarul pentru Disabilitatea Modificată Oswestry (CDMO). **Rezultate.** Grupul de studiu a prezentat o îmbunătățire semnificativă statistic a scorului (SCV) ( $p < 0.01$ ), scorul pentru Indexul Bothersomeness pentru Sciatică ( $p < 0.01$ ), RPPÎ ( $p < 0.01$ ) și la scorul CDMO ( $p < 0.01$ ) în comparație cu grupul de control după 6 zile de tratament. **Concluzie** Tehnica de nerve flossing poate fi utilizată împreună cu alte modalități în tratamentul pacienților cu sciatică sub-acute din cauza prăbușirii și protruziei discului intervertebral. **Numărul de înregistrare al studiului clinic:** PMT/PIMS/RC/2011/09

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## Introduction

Sciatica is one of the most common painful, expensive and disabling conditions [1]. Amongst painful diseases and disorders, it occupies a foremost place by reason of its incidence and prevalence, its production by a great variety of conditions, the great disablement it may produce, and its tendency to relapse; all of which have long ago led to its recognition as one of the great scourges of humanity. The life time incidence of LBP is 50-70% and the incidence of sciatica may be as high as 40%. [2,3] Sciatica is a set of symptoms including radiating pain in the dermatome of a lumbar or sacral spinal nerve root that may be caused by general compression and/or irritation of one of five spinal nerve roots that give rise to each sciatic nerve or the left or right or both sciatic nerves[4]. Sciatica along with back pain accounts for a disproportionate amount of the costs of medical care and disability compensation and is a major cause of pain, disability, and social cost affecting the quality of life in most patients [5].

Based on the duration of symptoms, low back pain with radiating pain can be divided into three stages acute, sub-acute and chronic. Acute sciatica is usually defined as the duration of an episode of sciatica persisting for less than 6 weeks; sub-acute sciatica persists between 6 and 12 weeks; chronic sciatica persists for 12 weeks or more [8]. Sciatica due to disc pathology creates a public health burden because of its high incidence and considerable socioeconomic costs. In approximately 90% of the cases, sciatica is caused by a herniated disc (posterolateral) involving nerve root compression [6, 7]. While sciatica is usually blamed on a bulging intervertebral disc pressing on the sciatic nerve, there may be another culprit like lumbar canal stenosis, spondylolisthesis, spinal tumors, piriformis syndrome, cyst of the hip or lumbar, vascular malformations and intrapelvic aneurysm [8-12].

Herniated disk is a benign disease with a relatively good prognosis causing pain and functional loss over a period of some months. A bulging disc is known as a contained disc disorder. Gel-like center (nucleus pulposus) is still enclosed within the tire-like outer wall (annulus fibrosus) of the disc. A herniated disc is known as non-contained disc disorder in which the nucleus breaks through the annulus. Disc material (protruded or herniated disc) can press against an adjacent nerve root and compress and cause sciatica. Herniated or protruded disc causes both compression and inflammation of the nerve as it contains an acidic, chemical irritant (hyaluronic acid) leading to pain, numbness, tingling and muscle weakness. Due to protrusion of nucleus pulposus chemicals located in the epidural region can seep into the nerve roots through small veins that can connect the epidural space with the intraneural capillaries in the nerve roots. When nucleus pulposus is positioned next to the nerve root, without increasing pressure on the root, the physiology of the nerve root can be profoundly disturbed. This is by way of impaired conduction and development of intraneural oedema and Schwann cell swelling. This is effectively an inflammatory response triggered by the mere presence of a specific foreign substance and occurs in the absence of increased pressure on the neural structure [8, 13].

Various physiotherapy interventions like electrotherapy (laser, mechanical traction, ultrasound, IFT, TENS), manual therapy (neural mobilization, manipulations, massage, stretching), therapeutic exercises and corsets are available to deal with sciatica due to protruded and extruded disc. The currently accepted and wide used treatment used for Sciatica due to protruded and extruded disc based on the results of past research is mechanical traction, TENS and laser. Sciatica is an expensive and time consuming problem in terms of direct health care costs (money) as well as indirect health care costs such as work loss and disability, an intervention giving immediate results in terms of decreasing pain, other sensory symptoms, functional disability and also delay the need for the surgery will be a cost effective option. But evidence for treatments which produce immediate effect in patients with sciatica is still conflicting. Certain promising studies have suggested that neural mobilization techniques are beneficial to patients with compressive neuropathies like carpal tunnel syndrome (CTS), cubital tunnel syndrome and low back dysfunction. An experimental study on rats has been done to find out the efficacy of neural tissue mobilization in sciatica. Despite the array of randomized controlled studies investigating the effectiveness of neural mobilization, consensus regarding its effectiveness, use

and clinical value has not been attained due to heterogeneity among study samples. Nerve Flossing Technique is a safer, beneficial and cost effective conservative treatment option. However, there is limited evidence about the nerve flossing technique in sciatica [14-21]. Therefore the purpose of this pragmatic randomized trial study is to investigate the clinical utility and judge superiority of nerve flossing technique within a specific subpopulation of patients with sciatica of sub-acute stage caused due to disc prolapse and extrusion. The aim of this study was to find out the efficacy of nerve flossing technique on improving sciatic nerve function in patients with sciatica. The primary objective of this study was to investigate the immediate and short term effect of nerve flossing technique (NFT) in the relief of pain, sensory symptoms and restoration of spinal mobility. Secondary objective of this study was to find out the short term effect of nerve flossing technique on sciatica related disability.

## Methods

### *Subjects*

A total of eighty seven participants aged 20 to 55 years with sciatica were screened for the study through the Orthopaedic Department, Pravara Rural Hospital (Tertiary Hospital), Loni, Tal- Rahata, Dist-Ahmednagar, Maharashtra State, India- 413 736 from Jan 2011 to Nov 2011 considering the inclusion and exclusion criteria of which forty two were eligible and agreed to participate in the study. Three of these participants dropped out of the study as they lost follow-up. Study group had 20 participants where as Control group had 19 participants. Criteria for inclusion in the study were participants of Sciatica due to prolapsed and extruded intervertebral disc[22] (sub acute stage) seen on MRI and CT Scan aged between 25 to 55 years [4,8,17] with positive Passive Straight Leg Raise Test ( $30^0-70^0$ ) [23] and only sensory symptoms of sciatica like radiating pain, tingling, numbness. Participants were excluded if they underwent lumbar spine surgery in last 12 months, suffered from sciatica along with muscular weakness, sciatica with vascular disorders and diabetic neuropathy, sciatica due to tumor, acute ligament injury, fractures, Clinical situations where TENS and Mechanical Traction was contraindicated, psychological or psychosomatic disorders, infections and inflammation of the spine, known congenital abnormality of the nervous system and serious comorbidity or indication for immediate surgical intervention [21,23-27].

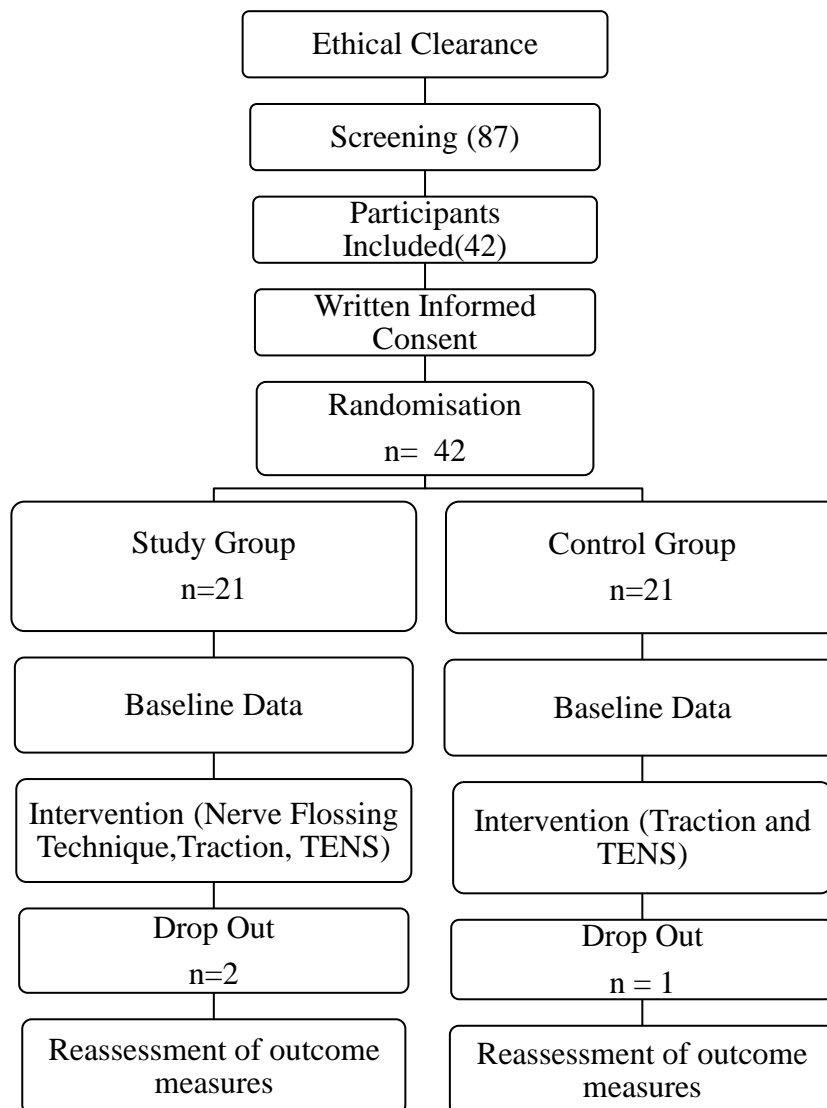
### *Outcome measures*

The outcome measures used in this study were Visual analogue scale which was used to measure the intensity of pain before and after the intervention[28], Sciatica Bothersomeness Index is a scale from 0 to 6, which assesses bothersomeness (0=not bothersome to 6=extreme bothersome) of back and leg symptoms[29], Passive Straight Leg Raise Test (Hip flexion range) which was done passively and the hip flexion range was measured with the help of goniometer as the leg was raised passively until the participant complaints of pain, tingling and numbness[30-32], Active lumbar flexion range was measured using Modified Schober's method[33] and The Modified Oswestry Disability Questionnaire (MODQ) for a patient's functional disability due to low back pain[34].

### *Procedure*

The study received approval from Ethical Committee of Pravara Institute of Medical Sciences Deemed University, Loni.413637, Maharashtra, India. Participants were screened based on the inclusion/exclusion criteria and confirmed the diagnosis of PIVD (disc prolapse and extrusion) on MRI and CT scan. Those willing to participate were briefed about the nature of the study, effect and benefit of the intervention in the language best understood by them and the technique was demonstrated to them and Written Informed Consent was obtained. They were encouraged to clarify questions regarding the study if any. The detailed assessment of participants was taken. Participants were then randomized into two groups' i.e Study (NFT) and Control group using simple random sampling. (Figure 1) Allocation of participants to the two

groups was done on alternate basis. The demographic data, pain rating with Visual Analogue Scale, Sciatica Bothersomeness Index, Passive Straight Leg Raise (hip flexion range) measurement of active lumbar flexion range and MODQ score of the participants were recorded prior to any intervention. Reassessment was done on day 6 after intervention. The two groups were as follows- Study (NFT) group which received Nerve Flossing Technique, Transcutaneous Electrical Nerve Stimulation (TENS) [35, 36] and Mechanical Traction and Control Group which received TENS and Mechanical Traction [26, 37, 38].



*Figure 1 Flow diagram of the procedure used in the study*

Participants received traction three times a week for 15 minutes with 60/20 hold relax time and TENS for all six days for 15 minutes along the area of symptoms [26, 35, 36, 37, 38]. All the participants were advised to remain as active as possible.

The nerve flossing technique was performed actively by the participant sitting on a chair. The participant bent the knee backwards under the chair and lowered the head at the same time and held the position for 5 seconds. [Fig.2]

Then the participant straightened out the leg on the side in which he experienced sciatic pain and at the same time extended the neck. The participant lifted the leg out and up in front until he began to experience pain and did not push beyond that point. As the nerve became less sensitive, he increased the stretching effect by extending the toes of his foot upward toward the shin and held the position for 5 seconds. [Fig.3]

Nerve Flossing Technique was repeated 15 times. Patient was re-evaluated after every set of 15 repetitions. Total five sets of the above were given in the presence of the investigator with a gap of 2 hours between each set. It was continued for six successive days. The physiotherapy intervention was given for six successive days which included traction for only three days, TENS and NFT for all six days. The data, thus obtained were considered for statistical analysis.



**Fig. 2 Starting position of NFT**



**Fig.3 End position of NFT**

## Results

Statistical analysis was done by GraphPad InStat software (Trial version 3.03) using various statistical measures such as a mean, standard deviation (SD) and tests of significance such as paired and unpaired 't' test. The results were concluded to be statistically significant with  $p < 0.05$  and highly significant with  $p < 0.01$ . Unpaired 't' test was used to compare differences between the two groups i.e. the study group (NFT group) and the control group. The baseline characteristics were comparable (Table 1). The visual analogue scale score and Sciatica Bothersomeness Index score showed statistically highly significant difference in the study group participants treated with NFT than control group participants. PSLR score and active lumbar flexion range depicted statistically highly significant difference in the average range of PSLR and lumbar flexion in the study group participants treated with NFT than control group participants. Functional disability in terms of MODQ score showed statistically highly significant difference in the average functional disability in study group participants treated with NFT than control group participants (Table 2, Figure 4).

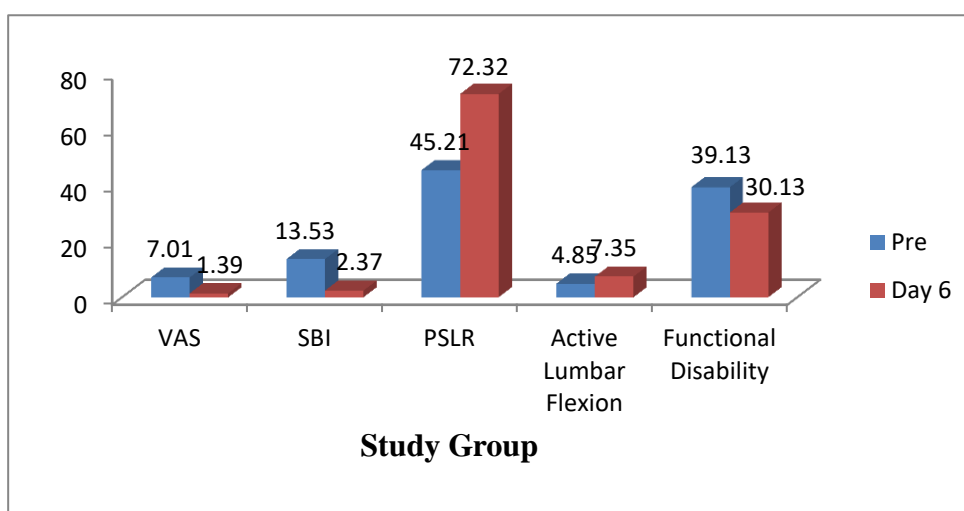
**Table 1: Demographic profile and clinical data of participants of both the groups.**

	Study Group	Control Group	'p' value
Age (years)	42.53±6.99	40.2±7.55	0.33
BMI (kg/m <sup>2</sup> )	24.56±3.05	24.64±2.42	0.92
Duration of symptom (days)	63.63±13.20	62.4±12.58	0.30
MODQ score (0% to 100%)	39.13±10.70	38.75±9.82	0.91
VAS score (1 to 10 cms)	7.01±1.10	6.87±1.08	0.6796

BMI: Body mass index, MODQ: Modified Oswestry Disability Questionnaire, VAS: Visual Analog Scale

**Table 2: Intra group comparison of all outcome measures of study group between pre and post day 6 of intervention.**

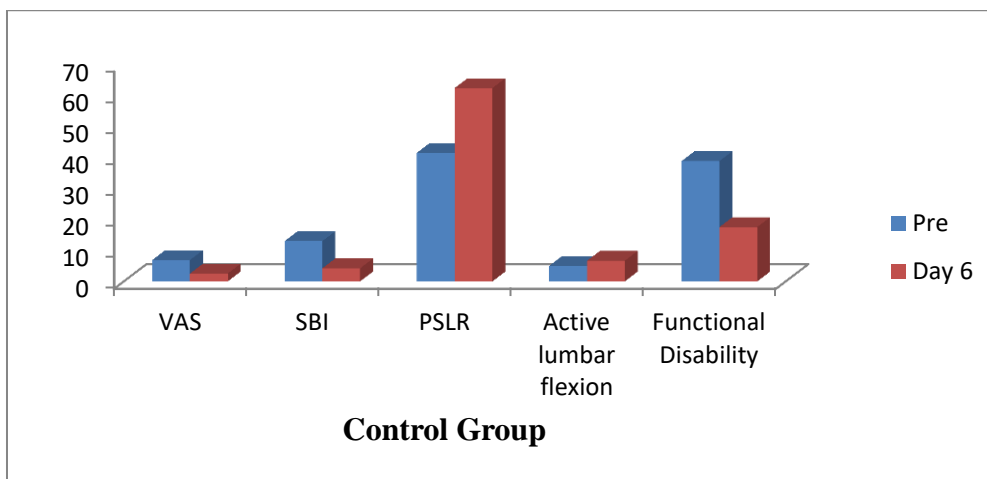
Outcome Measures	Pre	Day 6	't' value	'p' value	Results
VAS	7.01±1.10	1.39±0.59	31.941	<0.01	Highly Significant
SBI	13.53±2.17	2.37±1.12	34.142	<0.01	Highly Significant
PSLR (Hip flexion range)	45.21±6.89	72.32±4.16	27.771	<0.01	Highly Significant
Active Lumbar Flexion	4.85±0.65	7.35±0.58	16.859	<0.01	Highly Significant
Functional Disability	39.13±10.70	30.13±6.85	19.170	<0.01	Highly Significant



**Graph 1: Intra group comparison of all outcome measures of study group between pre and post day 6 of intervention.**

**Table 3: Intra group comparison of all outcome measures of control group between pre and post day 6 of intervention**

Outcome Measures	Pre	Day 6	't' value	'p' value	Results
VAS	6.87±1.08	2.54±0.76	28.360	<0.01	Highly Significant
SBI	12.95±2.50	4.2±0.95	20.137	<0.01	Highly Significant
PSLR (Hip flexion range)	41.4±7.01	62.25±5.68	23.763	<0.01	Highly Significant
Active Lumbar Flexion	5.01±0.61	6.65±0.73	11.794	<0.01	Highly Significant
Functional Disability	38.75±9.82	17.5±3.65	21.447	<0.01	Highly Significant

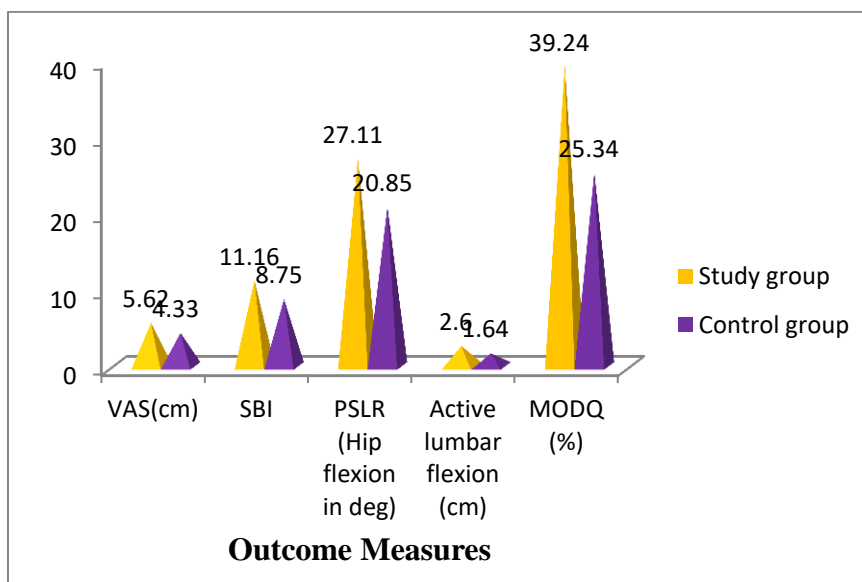


Graph 2: Intra group comparison of all outcome measures of control group between pre and post day 6 of intervention.

Table 4: Inter group comparison of all the outcome measures in both the groups between pre and post day 6 of intervention

Outcome Measures	Study Group Mean ± SD	Control Group Mean ± SD	't' value	'p' value	Results
VAS	5.62±0.77	4.33±0.68	5.583	<0.01	Highly significant
SBI	11.16±1.43	8.75±1.94	4.394	<0.01	Highly significant
PSLR	27.11±4.25	20.85±3.92	4.776	<0.01	Highly significant
Active Lumbar Flexion	2.5±0.65	1.64±0.62	4.235	<0.01	Highly significant
MODQ	30.13±6.85	17.5±3.65	7.238	<0.01	Highly significant

VAS: Visual Analogue Scale, SBI: Sciatica Bothersomeness Index, PSLR: Passive Straight Leg Raise, MODQ: Modified Oswestry Disability Questionnaire.



Graph 3: Improvement in Pain, sensory symptoms, PSLR, active lumbar flexion and functional disability in NFT Group

**Discussion**

Both the groups showed improvement in the relief of pain and sensory symptoms, improving spinal mobility, minimizing functional disability but the study group (NFT) showed greater improvement than control group. The greater relief of pain and improvement in sensory symptoms and spinal mobility might be due to nerve flossing technique which is done actively

and involves large amplitude movements which attempt to take the nerve throughout the available range of motion potentially affecting the nerve both mechanically and physiologically sufficient enough to disperse the edema, thus alleviating the hypoxia and reducing the associated symptoms. NFT also causes proximal sliding of lumbar nerve roots with neck and knee flexion and causes distal sliding of lumbar nerve roots with neck and knee extension and also improve the actual excursion of the sciatic nerve [13]. With a dynamic variation in the pressure (by stretching at one end and relaxing at the other end by neck and knee flexion and vice-versa) evacuation of intraneural edema may be facilitated and also decrease in adhesions and reducing symptoms by allowing the nerve to move freely with minimal increase in tension. This technique may also help to oxygenate the nerve, decreasing ischemic pain. NFT reduces pressure caused by intraneural and extraneural fibrosis which in turn will increase blood circulation and axonal transport which are necessary for structural and functional integrity of a neuron. It could also be because movement may help control pain at a central nervous system level. In the gate control theory [35], stimulation of mechanoreceptors within the joint capsule and surrounding tissues causes an inhibition of pain at the spinal cord. It could also be directly associated with the immobilization reduction in the neurogenic inflammation. In addition, it is hypothesized that the movement of nerve within pain-free variations can help to reduce nerve compression, tension and friction therefore decreasing its mechanosensitivity. Similar results [39] were found in a favor of Neural Mobilizations in a study done by McCracking [40] who conducted a study on LBP with radiculopathy and suggested that neurodynamic treatment techniques has some long term effects in treating patients with non-specific low back pain and lower extremity pain with neural tension dysfunction. Devasahayam Augustine Joshua [41] did a case report of 43-yr-old male patient of discogenic pain with radiculopathy was treated with directional preference exercise and mobilization for four visits. As the patient complained of increased pain during fifth visit, the treatment strategy was reconsidered and neural mobility exercises were added progressively in addition to other exercises during visits fifth through seventh, which gradually relieved the referred pain completely. Study group showed significant improvement in PSLR (Hip flexion range) [30,31, 36] and active lumbar flexion range when compared to control group on day 6 of intervention because the sensory symptoms of sciatica were markedly reduced in study group which were the main cause of reduced PSLR (Hip flexion range) and active lumbar flexion. Hence the proposed reason of the enhancement in disability (MODQ) [21, 45] score might be due to the collective effects of reduction in pain, improvement in PSLR (Hip flexion range) and in this concern improvement in daily activities. Thus the clinical implications are nerve flossing technique provides short-term improvement in pain, sensory symptoms, spinal ROM and functional disability and patients with sciatica will benefit from the addition of nerve flossing to standard treatment for sciatica. The monetary and temporal cost of performing nerve flossing technique is minimal. Incorporating these exercises into a home exercise program is cost-effective. Limitations of the study were limited follow up and the present study has focused only on patients with subacute sciatica due to lumbar disc protrusion and extrusion so the findings are applicable to patients within this category only.

## Conclusion

Nerve flossing technique can be utilized with other modalities in the treatment of sub-acute sciatic patients due to prolapsed and extruded intervertebral disc for the relief of pain and sensory symptoms like tingling and numbness, restoration of spinal mobility and to minimize functional disability.

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*Ethical approval:* Ethical Committee of Pravara Institute of Medical Sciences, Loni, Maharashtra state, India. (PMT/PIMS/RC/2011/09)

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*Conflict of interest:* None declared.



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