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Influence of Nerve Flossing Technique on acute sciatica and hip range of motion

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ABSTRACT

Background: Sciatica is one of the most common painful and disabling conditions affecting about 40% of low back pain cases and 1.6% - 43% of adult population annually. Many conventional physiotherapeutic modalities have been used to manage sciatica but the effect of Nerve Flossing Technique (NFT), which is a cost effective treatment option in the management of acute sciatica is yet to be investigated. **Aim**: This study was therefore conducted to investigate the influence of NFT on acute sciatica symptoms and hip range of motion. **Methods**: A pretest-posttest control experimental design, involving 32 participants from two hospitals in Lagos state Nigeria, with acute sciatica were randomly assigned into two groups; Group A (Study Group**)** received NFT in addition to Conventional Physiotherapy and group B (Control Group) received only Conventional Physiotherapy. The outcome of the study was assessed using Numeric Pain Rating Scale (NPRS) and Passive Straight Leg Raise (PSLR). **Results:** The result of this study revealed that, both groups were found to have significant improvement in NPRS score (P<0.01) and PSLR value (P<0.01). However, the study group had significant (P<0.01) improvement in both outcome measures when compared to the control group. **Conclusion:** Nerve Flossing Technique reduced acute sciatica and improved hip range of motion hence, can be utilised in the treatment of patient with acute sciatica.

Key words: Nerve Flossing Technique, acute sciatica, conventional physiotherapy, hip range of motion, Numeric Pain Rating Scale, intraneural edema

INTRODUCTION

Sciatica is a set of symptoms which includes radiating pain, tingling sensation, numbness and weakness along the distribution of the sciatic nerve, that may be caused by compression and/or irritation of one or more of the five sciatic spinal nerve roots in one or both lower limbs.[1,2] In approximately 90% of cases, sciatica is caused by a herniated intervertebral disc (postero-lateral) involving nerve root compression or irritation by hyaluronic acid, contained in the disc substance when in contact with the nerve root.[3,4] It can also be caused by lumbar canal stenosis,

spondylolisthesis, spinal tumors, piriformis syndrome, cyst of the hip or lumbar, vascular malformations or intra-pelvic aneurysm.[1,5] The prevalence of sciatica varies from 1.6% in the general population to 43% in a selected working population.[3,6,7] Although the prognosis is good in most patients, a substantial proportion continues to have pain for 1 year or longer.[8]

Physiotherapy treatment of acute sciatica includes cold therapy, rest, manual therapy (spinal manipulation and soft tissue mobilization) and electrotherapy.[9] Other forms of management include aerobic conditioning, core muscle strengthening, stretching of tight structures, mechanical traction and corsets.[10] However, there are still contentions on the physiotherapy treatment protocols which produce a rapid improvement in patients with sciatica.[4,9] Nerve Flossing Technique (NFT) has been suggested by research to relieve acute radiculopathy including sciatica.[4,11,12]

NFT involves movement of peripheral nerves from a mean position along its bed.[13] It can be initiated from either one or both ends of the nerve bed. It has been shown that significantly less nerve excursion occurs during nerve flossing exercise initiated from one end of the nerve bed using a single joint movement, compared to nerve flossing initiated from both ends of the nerve and with multiple joints.[13] However, the underlying mechanisms associated with clinical improvements following nerve flossing technique remain unclear.[14] There are many theories that have been postulated, including physiological effects (removal of intraneural oedema), central effects (reduction of dorsal horn and supraspinal sensitization) and mechanical effects (enhanced nerve excursion).[13,14]

It is anticipated that NFT (sliders) might be effective in the management of acute sciatica, since it has been shown to be effective in the management of neuropathic conditions like carpal tunnel syndrome,[15] low back pain[16] and other radiculopathies.[11,12] However, there is dearth of evidence on its use in the management of acute sciatica. This study was therefore aimed at investigating the influence of NFT in the management of acute sciatica and Hip Range of Motion.

METHODOLOGY

Determination of sample size

The sample size for this study was determined using the mathematical relationship as described by Cohen,[17] in which the minimum sample size for each of the groups was given by the relation:

$$n = \frac{N (Z_\beta + Z_{\alpha/2})^2}{ES^2}$$

Where; n = Minimum sample size for each of the groups,
N = No of groups (N = 2, since there are two groups),
Z_β = Desired power (Typically 0.84 for 80% power),

$Z_{\alpha/2}$ = Measure of statistical significance (typically 1.96 at 95% confidence interval),
ES^2 = Effect size (using Cohen's standard effect size of 1.1) (Appendix IV).
Thus:

$$n = \frac{2 \times (0.84 + 1.96)^2}{(1.1)^2} = 12.96 \approx 13.$$

Therefore, the minimum sample size for each group = 13 participants.

Assessment

Participants were assessed with detailed history taken and physical examination carried out to confirm Sciatica. The confirmation of sciatica was done with a positive Passive Straight Leg Raise between 30° to 70°,[18] positive Flip Sign (trunk extension from sitting on an attempt to fully extend the knee),[19]pain at the back (L_4 to S_3) during digital pressure and radiologist report. They were further screened based on the inclusion/exclusion criteria.

A. Inclusion Criteria

The following criteria were used to select participants for the study:

- Participants who presented with acute sciatica - episode persisting for less than 6 weeks,[4] due to intervertebral disc pathology (bulging disc/disc protrusion, disc prolapsed and extruded disc) as seen in the Radiologist report.
- Participants with positive Passive Straight Leg Raise (PSLR) Test (30^0-70^0).[18]
- Participants with positive Flip Sign - trunk extension from sitting on an attempt to fully extend the target knee.[19]
- Participants who gave informed consent.
- Participants who were ready to suspend pain relieving drugs for the period of the study.

Exclusion Criteria

The following Participants were excluded:

- Participants who have had lumbar spine surgery within the last 12 months.
- Participants who suffered from sciatica

along with vascular disorders and diabetic neuropathy, sciatica due to tumor and fractures.

- ❖ Participants with cervical spine pathology such as fracture, spondylolisthesis, degenerative disc disease and acute ligament injury.
- ❖ Participants with clinical situations where cryotherapy, TENS and back extension exercise were contraindicated.
- ❖ Participants with psychological or psychosomatic disorders, infections of the spine, known congenital abnormality of the nervous system and serious co-morbidity or indication for immediate surgical intervention.

Information relating to age, gender, height, weight and target/affected lower extremity – the more symptomatic or sciatic lower extremity (for Participants with bilateral lower sciatic extremity) were obtained. Adopting the protocol of Akinbo*et al*,[20] the dominant lower extremity was chosen as the target/affected extremity for Participants with similar severity of bilateral symptoms. Lower limb dominance was resolved following the protocol of Fabunmi and Gbiri,[21] by asking the participants to detect the limb with which they: (a) kick a ball with, (b) lead with while climbing stairs (c) lead with from a standing still position. Participants were later asked to demonstrate (b) and (c) above.

Intervention

Participants were enlightened about the study; nature, effect and benefit of participation. They were urged to clarify issues pertaining to the study if any. Written informed consent was obtained from the participants.

Participants were then randomly assigned into two groups; Study (Group A) and Control (group B) respectively. A simple random sampling technique was used to assign participants into 2 groups (group A and B). This was done in phases, through balloting, with each participants picking a slip of paper in a ballot box containing equal papers marked either 'A' or 'B' based on the number of participants present.

NFT was thereafter demonstrated to the study group alone. Passive Straight Leg Raise (hip flexion range of motion) value and Numeric Pain Rating Scale score of the participants were measured/ recorded prior to intervention. Reassessment was done after 2 weeks of six treatment sessions, with all treatment starting on a Monday.

The study group (Group A) received cryotherapy for 10 minutes on the lower back, Soft Tissue Manipulation (stroking and effleurage) to the painful areas for 5 minutes, reverse straight leg raise actively in prone lying position for 10 repetitions by 5 seconds hold and 5 seconds relax, high frequency (100Hz), 4-channel Transcutaneous Electrical Nerve Stimulation (TENS) for 15 minutes to the painful areas of the body and NFT.

The NFT was performed actively with the participant sitting on a chair (figure 1). Adopting the protocol of Pallipamula and Singaravelan,[4] the participant flexed the knee of the target lower extremity backwards beside the chair, as far back as possible and flexed the neck at the same time, holding both the flexed knee and neck in this position for 5 seconds. The participant in turn extended the neck and the knee of the target lower extremity, abducted and flexed the hip until pain was felt and did not push beyond that point. This extended position was equally maintained for 5 seconds. The above procedure NFT was repeated 15 times, for 3 sets with an interval of 5 minutes between each set. As the nerve became less sensitive, the participant increased the stretching effect by dorsiflexing the ankle and extending the toes of the foot upward toward the shin.

The Control (Group B) Group received all the procedures above except the NFT. Participants in both groups received the above treatment plan 3 times weekly for 2 weeks. All the participants were advised to remain as active as possible.

The post treatment protocol used by Akinbo *et al.*[22] was adopted, in which post-test evaluation was performed three days after completion of the last session. This was to avoid the immediate effect of treatment on results. The data obtained was considered for statistical analysis.

Ethical consideration

Ethical approval was sought and obtained from the Health Research and Ethics Committee of the Lagos University Teaching Hospital, Idi-Araba and the National Orthopaedic Hospital Igbobi, Lagos. The above hospitals were made the study centres for the research because they are the major tertiary hospitals in Lagos State, Nigeria with high patient patronage and likelihood of getting the type of patient meant for the study. All participants gave written informed consent.

Statistical analysis

The Statistical Package for Social Sciences (SPSS) version 20 for windows package programme was

used to analyse data. Descriptive statistics of mean and standard deviation, frequency and percentage were used to summarize the results. Chart was utilised for pictorial presentation of results. Paired sample t-test was used to compare the pre-intervention and post-intervention changes in outcome measure variables in each group (group A and B). Independent t-test was used to compare the baseline and outcome measure variables between the two groups. All statistical tests were performed at the 0.05 level of significance ($P \leq 0.05$).

RESULTS

A total of 34 participants were eligible for the study after screening, with each group having 17 participants. However, only 16 participants from each of the groups completed the study and their findings were analysed. This gave an attrition rate of 5.88%. The reasons given for withdrawal by the 2 participants, one each from the study (Group A) group and control (Group B) group, who did not complete the study, were inflexible office schedule and ill health respectively.

Physical and baseline characteristics of participants

Thirteen (40.6%) out of 32 participants were males while 19 (59.4%) were females. Based on groups analysis, 7 (43.8%) out of 16 participants in the study (Group A) group were males while 9 (56.3%) were females. In the control (Group B) group, 6 (37.5%) were males and 10 (62.5%) were females. Based on the limb affectation, participants with left lower limb affectation dominated constituting 17 (53.1%). The analysis showed that right lower limbs of participants in the control group were the least affected (sciatic) limb constituting 6 (37.5%) when compared to the study group (figure 2).

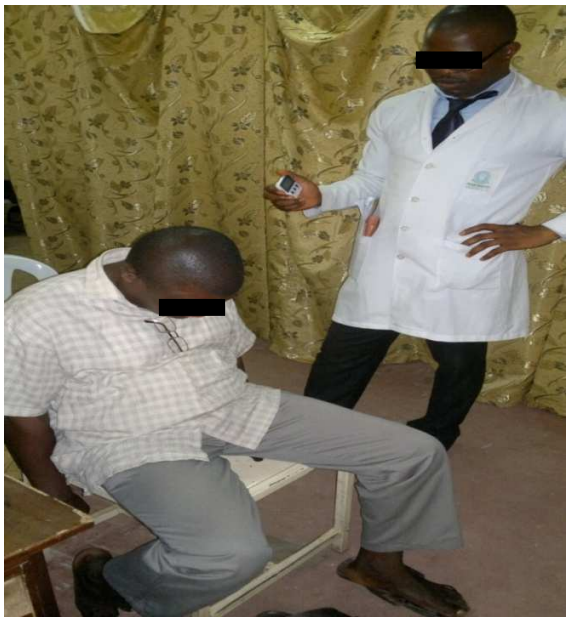
The age, weight, height, Body Mass Index (BMI) and other baseline characteristics of participants in both groups are as shown in table 1. There was no significant difference in the Physical and baseline characteristics of participants in both the study (Group A) and control (Group B) groups.

Within group comparison of outcome measures pre- and post- intervention

The pre- and post- intervention values after 2 weeks revealed that there was a highly significant difference ($P<0.001$) between the pre- and post-treatment scores of Numeric Pain Rating Scale and passive straight leg raise value of participants in the 2 groups (Table 2).

Between group comparison of the mean changes in outcome measures

The mean changes in the pre- and post- treatment scores/ values of Numeric Pain Rating Scale and passive straight leg raise of participants after 2 weeks in both the study group and control group were as shown in table 3. There was a highly significant difference ($P<0.001$) between the study group and control group in the numeric pain rating scale score and passive straight leg raise value.



a. Starting position

b. Ending position

Figure 1: Participant performing Nerve Flossing Technique

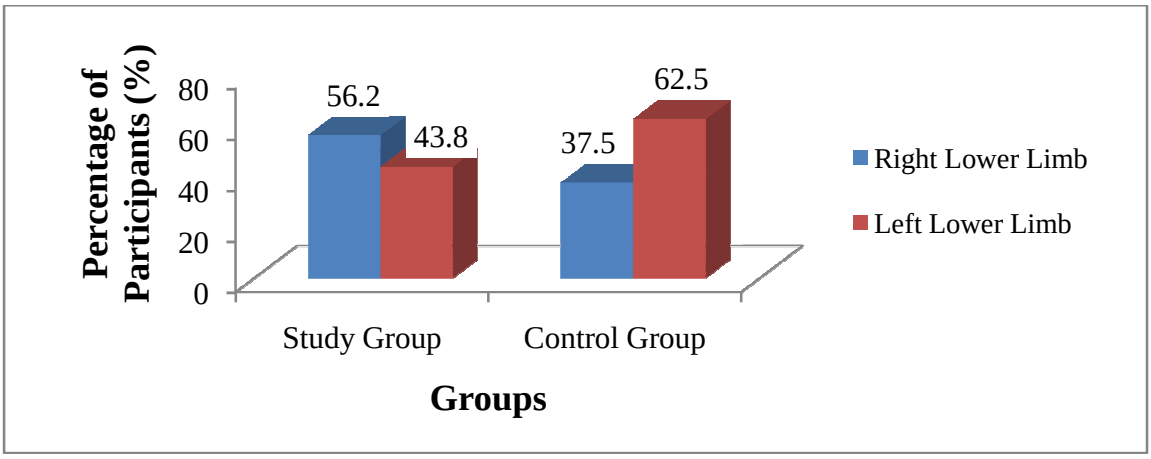


Figure 2: Affected/ target lower limb of participants in both groups

Table 1: Physical and baseline characteristics of participants in both groups

Characteristics	Parameters	Study Group $\bar{X}$ ± SD	Control Group $\bar{X}$ ± SD	t-value	*P*-value
Physical Characteristics:	**Age (years)**	53.50 ± 8.65	51.87 ± 10.29	0.483	**0.632**
	Height (m)	1.66 ± 0.07	1.63 ± 0.09	1.005	**0.323**
	Weight (kg)	71.88 ± 9.86	72.44 ± 8.32	-0.174	**0.863**
	BMI (kg/m^2)	26.21 ± 4.46	27.39 ± 4.11	-0.780	**0.441**
Baseline Characteristic:	**Pre- NPRS**	8.56 ± 1.09	8.00 ± 1.55	1.187	**0.245**
	Pre- PSLR(º)	45.00 ± 5.54	45.38 ± 9.32	0.138	**0.891**

*Significance at p≤0.05

Key

$\bar{X}$ = Mean, SD = Standard Deviation, BMI = Body Mass Index, Pre- NPRS = Pre Numeric Pain Rating Scale Pre- PSLR = Pre Passive Straight Leg Raise

Table 2: Within group comparison of outcome measures pre- and post- intervention

Groups	Outcome Measures	Pre-Intervention $\bar{X}$ ± SD	Post-Intervention $\bar{X}$ ± SD	t-value	*P*-value
Study Group:	**NPRS**	8.56±1.09	1.81±1.60	13.851	<0.001*
	PSLR(º)	45.00±5.54	71.13±3.67	-16.554	<0.001*
Control Group:	**NPRS**	8.00±1.55	4.19±1.42	9.527	<0.001*
	PSLR(º)	45.38±9.32	61.50±6.76	-8.641	<0.001*

*Significance at p≤0.05

Key

$\bar{X}$ = Mean, SD = Standard Deviation, NPRS = Numeric Pain Rating Scale, PSLR = Passive Straight Leg Raise

Table 3: Between group comparison of the mean changes in outcome measures

Outcome Measures	Study Group $\bar{X}$ ± SD	Control Group $\bar{X}$ ± SD	t-value	*P*-value
NPRS	6.75±1.95	3.81±1.60	4.658	<0.001*
PSLR	26.13±6.31	16.13±7.46	4.092	<0.001*

*Significance at p≤0.05

Key

$\bar{X}$ = Mean, SD = Standard Deviation, NPRS = Numeric Pain Rating Scale, PSLR = Passive Straight Leg Raise

DISCUSSION

The result of this study showed that there was a significant difference between the pre- and post-treatment scores of Numeric Pain Rating Scale (NPRS) in participants treated with conventional Physiotherapy protocol, combined with Nerve Flossing Technique. This means that the pain intensity was reduced, thereby signifying an improvement in the condition of the patients. This result agrees with the findings of some previous studies,[4,23] though, none of them worked on acute sciatica. Similar results have equally been produced using the same technique, in cases of Carpal Tunnel Syndrome,[15,24] low back pain[16] and in cervicobrachial neurogenic pain.[25] This consistent result may be due to restoration of neural physiology following NFT which causes a dynamic variation in neural pressure (by stretching at one end and relaxing at the other end), hence leading to evacuation of intraneural edema which might be present in acute sciatica.[13,26] The significant decrease in pain intensity could also be due to stimulation of mechanoreceptors within the joint capsule or through the use of Transcutaneous Electrical Nerve Stimulation- TENS, in pain modulation.[27] This is because movement or TENS may help control pains at the level of the central nervous system. In the gate control theory, stimulation of mechanoreceptors within the joint capsule and surrounding tissues causes an inhibition of pain at the spinal cord.[4,27] It could also be directly associated with the cryotherapy-induced reduction in the neurogenic inflammation.[4,27] In addition, it is hypothesized that the movement of nerve within pain-free variations can help reduce nerve compression, tension and friction therefore decreasing its mechanosensitivity.[28]

In this study, a significant difference was found between the pre- and post- treatment values of passive straight leg raise in participants treated with Conventional Physiotherapy protocol combined with NFT. The clinical implication is that, the hip range of motion (ROM) in participants who received conventional physiotherapy combined with NFT, improved greatly. This means that the combination of NFT with conventional physiotherapy was a better treatment option in the management of participants having reduced hip ROM following acute sciatica. This improvement in hip ROM is presumably related to increase in the length of hamstring musculature,[29] which might have resulted from repeated knee extension. It might have been due to decrease in pain intensity which possibly prevented the participants from achieving the desired ROM. This improvement in hip ROM is in agreement with some previous studies[4,11] which investigated the efficacy of neural mobilisation in a selected Indian population having sciatica.

The outcome of this present study also showed that, there was a significant difference between the pre- and post- treatment scores of numeric pain rating scale in participants treated with conventional physiotherapy protocol. This means that participants in the control group equally improved in terms of pain intensity. This improvement might have been due to the therapeutic gains accompanying conventional physiotherapy, since it is the currently acceptable, widely used treatment protocol in the management of sciatica. These findings agree with an Indian study by Sarkari and Multani[11] which investigated the efficacy of neural

mobilisation in sciatica.

The passive straight leg raise among participants, who received conventional physiotherapy protocol improved significantly. This signifies an improvement in hip ROM. It therefore suggests that, the conventional physiotherapy was equally a better treatment option when compared to NFT combined with conventional physiotherapy protocol. This improvement in hip ROM might have been due to reduced sciatic pain following the intervention. This result is in agreement with the findings of some previous studies[10,16] which investigated the changes in passive straight leg raise in studies designed to compare the effects of NFT and conventional physiotherapy among low back pain patients.

Comparing the scores of Numeric Pain Rating Scale (NPRS) between the study and the control groups, the result of this study revealed that, the study group (participants treated with NFT combined with conventional physiotherapy) improved significantly compared to the control group (participant treated with conventional physiotherapy alone), suggesting a decrease in pain intensity in the study group compared to the control group. This means that the NFT which was the additional therapy to the conventional physiotherapy that both groups received might have been the cause of the improvement in the study group. This finding agrees with the study by Pallipamula and Singaravelan,[4] which investigated an Indian population having sub-acute sciatica and reported that; NFT combined with conventional physiotherapy protocol, is a better and cost effective approach in the management of sub-acute sciatica compared to conventional physiotherapy protocol alone. Also, some previous studies[10-11,16] which ascertained the efficacy of NFT in the management of low back pain (LBP), concluded that NFT combined with conventional physiotherapy was found to be effective in relieving LBP than conventional physiotherapy alone. It was also concluded in cases of Carpal tunnel syndrome[24,30] and nerve-related neck and arm pain [12,25]that incorporating NFT in treatment protocol has added benefit in terms of pain reduction.

Also, further findings from this study revealed that in improving hip range of motion, conventional physiotherapy protocol combined with NFT was the better option, rather than conventional physiotherapy protocol alone. This finding agrees with some previous studies[4,10-11,31] which found out that, NFT combined with Conventional Physiotherapy was more effective in improving the range of Straight Leg Raise (SLR) in cases of; sub-acute sciatica, sub-acute neurogenic LBP, radiating LBP andlumbar/ lower quadrant flexibility difficulty in male soccer players respectively. This technique has equally been found to improve elbow range of motion in cases of cervico-brachial neurogenic pain.[25]

CONCLUSION

Based on the findings of this study, it was concluded that the difference between the two groups of participants was as a result of NFT since no statistically significant baseline difference occurred between the two groups. Hence, for effective reduction of sciatic pain and possible improvement in hip range of motion, NFT should be combined with conventional physiotherapy.

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