Physiotherapy and Occupational Therapy Journal
Volume 3 Number 1, January - March 2010

Immediate effects of longitudinal vs. Transverse tibial nerve massage on vibration perception thresholds and thermal perception thresholds in asymptomatic subjects: A pilot randomized clinical trial (UTRN 014427448-2101200878203)

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ABSTRACT

Purpose of study: To compare the immediate effects of two techniques of nerve massage- longitudinal and transverse, for tibial nerve on the vibration and temperature thresholds in the foot in asymptomatic subjects. **Materials and methods:** 48 subjects of either sex (34 male, 14 female), with mean age 23.6 ± 4.8 years, volunteered to participate by incidental sampling after giving informed consent. The side of the leg for first intervention was chosen by simple random sampling and the choice of first intervention (longitudinal or transverse nerve massage) was allocated in a concealed manner using block randomization. One intervention was a longitudinal nerve massage (to either side) while other was a transverse nerve massage (to the other side). One tester administered the nerve massage techniques while an independent blinded observer measured the outcome measures. Both the interventions lasted for 2 minutes each. The techniques were applied for 10 reps and 2 sets. Pre, immediate post intervention and post intervention- 5 mins assessment of vibration thresholds, heat thresholds and cold thresholds of the sole of the foot were assessed using a Vibrotherm® (Biothesiometer) by the blinded observer.

Results: Tibial nerve transverse massage technique reduced the vibration thresholds (2.1± .84 volts) in the foot significantly better (p=.000) than that of the longitudinal nerve massage. Transverse massage technique also reduced the heat thresholds- 6.4 ± 1.8 degrees Celsius (p=.054) and increased the cold thresholds- 4.8 ± 2.2 degrees Celsius (p=.87) clinically but not statistically significant (p >.05). Both effects were however reversible within five minutes (p <.05). There was no effect of side of dominance (p=.14) in all the subjects studied. **Conclusion:** Transverse nerve massage technique was significantly better than the longitudinal massage technique in reducing the vibration thresholds for tibial nerve. Clinically, transverse nerve massage technique also reduced the heat thresholds and increased the cold thresholds for tibial nerve in the subjects studied.

Keywords: Neurodynamics, nerve massage, quantitative sensory testing, randomized controlled trial

INTRODUCTION

Nervous system and its role in pain production has been increasingly identified and addressed in musculoskeletal physical therapy practice using neurodynamic assessment and treatment methods which focus on nerve mobility- both intraneural (between neural connective tissue sheaths) and extraneural (between nerve and its surrounding structures).[1]

Symptoms arising from peripheral nerves have been categorized into positive symptoms (dysesthetic pain such as hyperalgesia, allodynia, tingling, numbness, paresthesia and/or shooting pain) and negative symptoms (with neurological deficits such as sensory loss, motor loss and reflex loss) and appropriate management was indicated to suit individual cases with clinical reasoning.[2]

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(Received on 22.04.10, accepted on 19.05.10)

Neurodynamic method encompasses manual techniques which address and/or treat nerve mobility (both intraneural and extraneural) in both directions- longitudinal and transverse.[3] Traditionally neurodynamics, as it was developed consisted of techniques which focused on longitudinal nerve mobility testing and treatment, and hence termed as "neural tension tests".[4] Much later the emphasis shifted course to transverse mobility, which was detected by manual palpation of the nerve along its course, owed its contribution to development of "nerve massage" techniques.[4]

Over the course of clinical manual therapy practice, newer techniques have been developed modifying the existing neurodynamic techniques when performed in different combinations and in different sequence of moving the joints crossed by the nerve. One technique which thrives on the neural movement along its interface structures without an increase in its "tension" was termed as "slider" techniques. The slider techniques improve gliding without compromising the nerve circulation or increasing nerve tension.[5]

Sliders and tensioners are two techniques which form an integral part of comprehensive neurodynamic assessment and treatment in manual therapy which addresses symptoms originating from peripheral nerves. Biomechanically, the slider technique stretches the nerve at one end while relaxing at another; the tensioner technique stretches the nerve at both the ends and/or joints.[6]

Soft tissue mobilization and massage had been shown to improve tissue flexibility and mobility by increasing nutrition and relieving adhesions. Whilst various techniques of massage like kneading and effleurage was extensively studied using application on muscles, tendons and ligaments, deep transverse friction massage as advised by Cyriax,[7] was being increasingly used for a variety of soft tissue conditions.

Neuromechanics[8,9,10] and neurophysiology were two interdependent and interrelated phenomena which formed the basis for neurodynamic assessment and treatment methods. There were numerous studies on neurodynamic assessments including normal responses,[11,12,13,14,15,16,17] movements' combinations for neurodynamic tests,[18,19,20,21,22,23] in symptomatic subjects,[24,25,26,27,28,29,30,31,32,33,34,35,36] and also as comparison between normals and symptomatic subjects.[37,38] Other studies on neurodynamic treatment effects were on nerve gliding exercises for carpal tunnel syndrome,[39,40,41,42,43,44,45,46,47,48,49] cubital tunnel syndrome,[50,51] radial tunnel syndrome,[52] lateral epicondylitis,[53,54] thoracic outlet syndrome,[55,56] cervical cord compression,[57] cervical radiculopathy,[58] cervicobrachial pain syndrome,[59,60,61,62] non radicular low back pain,[63] lumbar nerve root irritation,[64] lower extremity symptoms[65] and lumbar spine surgery.[66]

The concept of nerve and its mobility (both intraneural and extraneural), which assumes nerves as similar to that of any other soft tissues, proposed neural tissue metabolism much similar to that of any other tissue. Reduced mobility had the tendency to lead to accumulation of extracellular fluid, metabolites, and other tissue end products which need to be removed and circulated for proper nerve function. Massage techniques directed at other tissues might also have had their effects on the nerves indirectly which was less documented and/or less studied in the literature.

Statement of problem

Studies comparing effects of nerve massage in lower limb could not be retrieved from the existing literature. The comparative effects of the two techniques of nerve massage (longitudinal and/or transverse nerve massage) on vibration and temperature thresholds were also not documented in literature.

Purpose of study

To compare the effects of one session application of two nerve massage techniques-longitudinal and transverse massage for tibial nerve on vibration and temperature (heat and cold) thresholds in asymptomatic subjects.

Hypothesis of study

The effects of the two nerve massage techniques on vibration and temperature thresholds would be different in asymptomatic subjects.

MATERIALS AND METHODS

Study Design

Randomized Controlled Trial, with observer and tester blinded.

Study Setting

Health Lounge, Dept of Medicine, Kasturba Medical College Hospital, Attavar, Mangalore.

Study Duration

Four months, from August to November 2007.

Sampling

Volunteers were recruited on incidental sampling.

Sample size

48 subjects of either sex (34 male, 14 female), with mean age 23.6 ± 4.8 years, volunteered to participate by incidental sampling after giving informed consent.

Subjects

Volunteers were described about the conduct of the study and its significance for assessment and treatment implications in patients with lower extremity complaints.

Inclusion criteria

Subjects were deemed eligible if they did not have any symptoms in lower limb or low back region for the past 6 months (from day of assessment by tester).

Exclusion criteria

Excluded subjects consisted of inability of subjects to understand and/or co-operate during quantitative sensory testing and/or manual nerve mobility testing (on palpation) and/or treatment.

Tester

The primary investigator was an Assistant professor in Musculoskeletal and Manual Therapy, Dept of Physiotherapy, Kasturba Medical College, Mangalore, and Co-investigator was a Professor of Medicine, Kasturba Medical College, Mangalore. Independent blinded observer was an intern in physiotherapy who was trained by the primary investigator for assessment and recording of quantitative sensory testing findings.

Testing Instruments

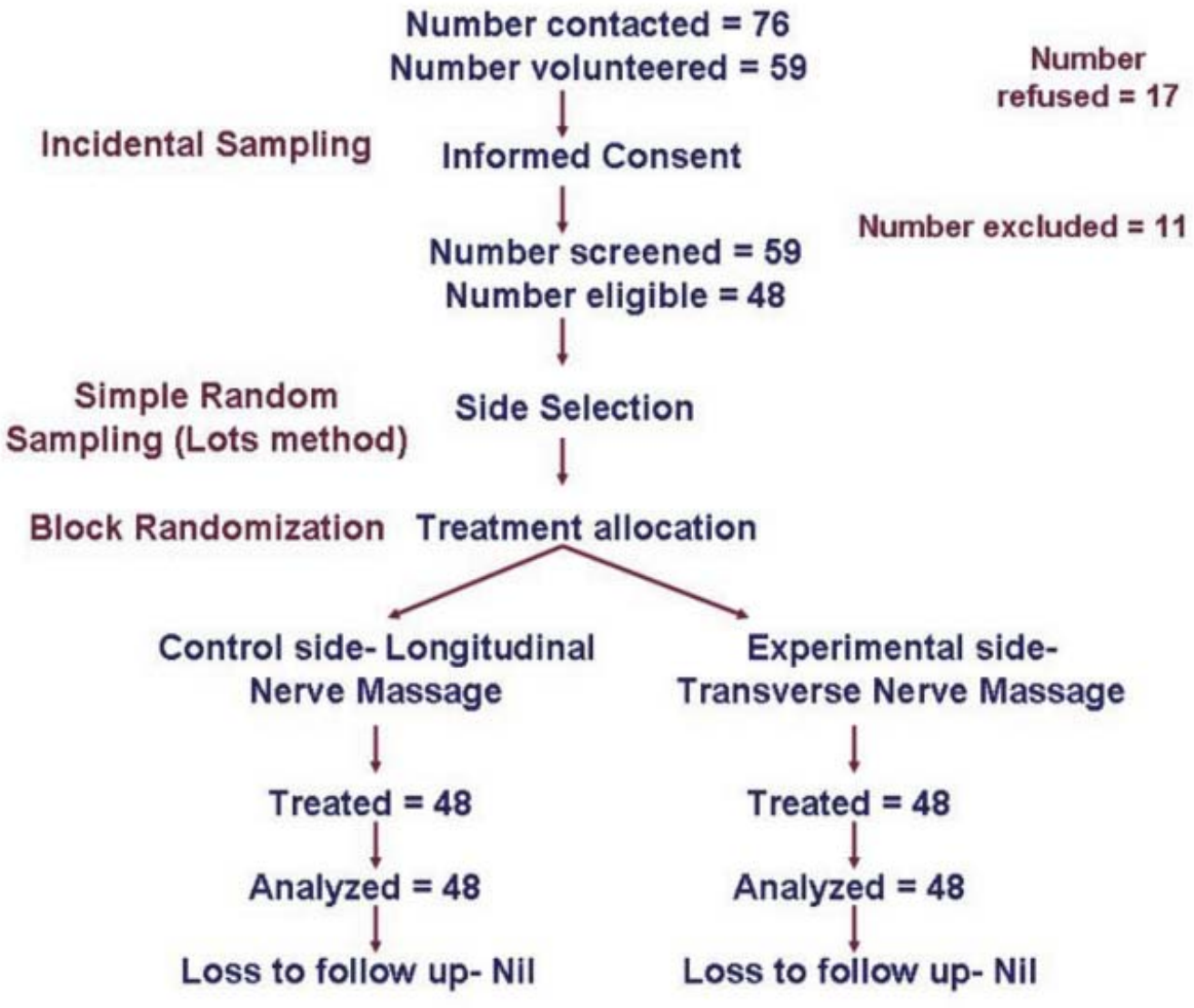
Vibrotherm™ Biothesiometer (Diabetic Foot Kare India, Chennai).

The assessment of vibration thresholds and temperature thresholds were done based on the instructions provided in the manual. After choosing the setting, the transducer probe is placed at one of the three sites in the sole of the foot (in a randomly selected order) and then instructed to report when he/she starts feeling the onset of sensation of vibration/ heat/ cold. The intensity knob was adjusted gradually, noting for the subject's response throughout the testing procedure. The point when the subject felt the onset of sensation, the reading on the digital scale of the biothesiometer would indicate the value of sensory threshold for that tested sensation. Three values were thus obtained which were then averaged to get a single value for that side for that sensation.[68] Biothesiometer assessment of quantitative sensory testing was validated highly and studied extensively for its high reliability and responsiveness.[69] Quantitative sensory testing was even proven to be better than nerve conduction studies in diagnosis and prognosis in peripheral nerve disorders.[70] Pilot intra and inter tester reliability was studied for the blinded observer for the biothesiometer prior to the actual study.

PROCEDURE

The side of the subject's leg was first chosen by simple random sampling (lots method) and the choice of first intervention (longitudinal or transverse nerve massage) was allocated in a concealed manner using block randomization (blocks of two for every 10 subjects). The subject's leg was administered either of the two techniques first, followed by the other technique next on the other leg.

Fig 1: CONSORT Flow Chart showing the flow of participants through the study



Tibial nerve longitudinal nerve massage technique:

The therapist stood at the side to be treated with the subject lying supine on a plinth. The therapist first manually palpates along the course of the tibial nerve both distoproximally and proximodistally for identifying the subcutaneous course of the tibial nerve from the popliteal fossa to the foot. Then the therapist applied distal to proximal directed force on the tibial nerve in short segments starting from upper leg and progressing to middle and lower leg segments. The hand position of the therapist was that the proximal hand localized the nerve (by manual palpation) while the distal hand applied the force for massage towards the proximal hand. The massage was applied with the finger pads of 2nd, 3rd and 4th digits of the distal hand with the wrist slightly shifting from ulnar deviation to neutral during the technique. Two sets of ten repetitions of the technique was done at each segment. Total of six sets with each consisting of ten repetitions was thus applied to that side, with the intervention lasting 4 mins.

Tibial nerve transverse nerve massage technique:

The initial preparatory procedure was the same as that for the longitudinal nerve massage technique. Transverse nerve massage technique was applied with the finger tips of the 2nd, 3rd and 4th digits of the therapist's distal hand, while his wrist was shifting from flexion to extension during the technique application. Similar dosage was applied for this technique thus achieving equal treatment duration of 4 mins.

DATA COLLECTION

One tester administered the neurodynamic techniques while an independent blinded observer measured the three outcome measures. Pre, immediate post intervention and post intervention- 5 mins assessment of vibration thresholds, heat thresholds and cold thresholds of the sole of the foot were assessed using a Vibrotherm® (Biothesiometer) by the blinded observer. Only one trial was taken for each of the sites.

DATA ANALYSIS

The between side (intervention group- slider vs. tensioner) analysis of three outcome measures (vibration threshold, heat threshold, cold threshold) at three levels of measurement (pre, immediate post, post 5 min intervention) were analyzed using repeated measures ANOVA at 95% confidence interval using SPSS 12.0.1 for Windows.

DISCUSSION

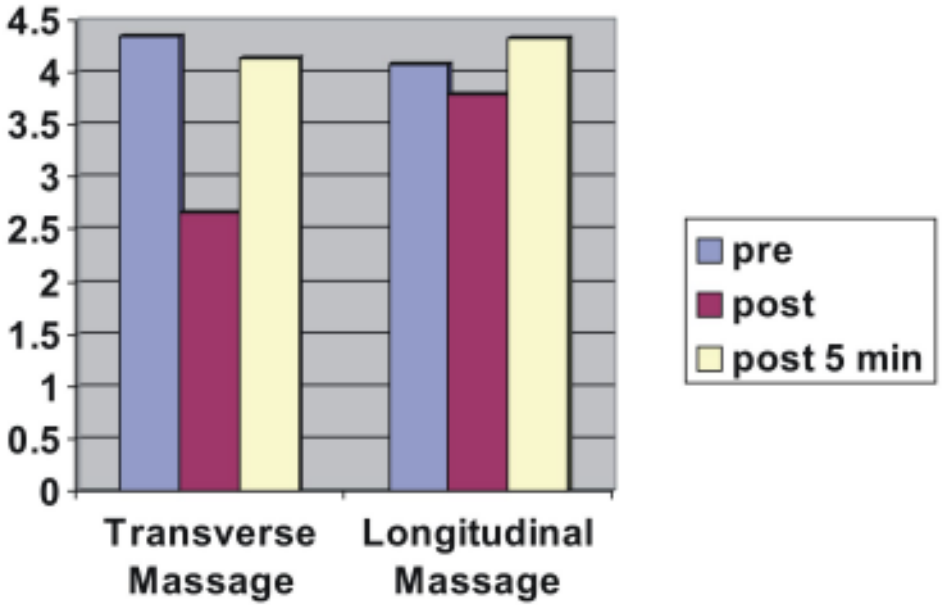
Our study found that responses were different between the sides of lower extremities in the three outcomes (vibration threshold, heat threshold and cold threshold) which was attributable to the intervention and not due to the influence of lower limb dominance (p>.05). The study reported better effects in favour of the transverse nerve massage

RESULTS

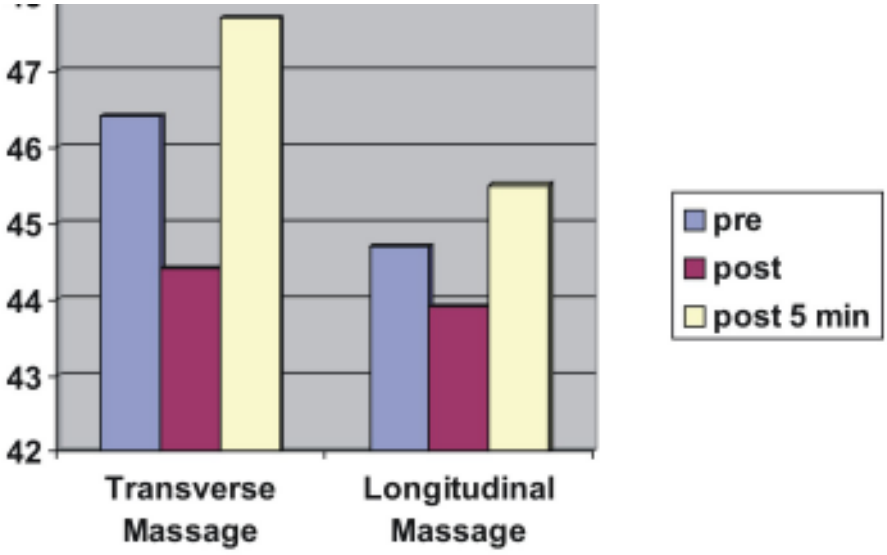
	Tibial nerve Transverse Massage intervention Mean ± SD			Tibial nerve Longitudinal Massage intervention Mean ± SD			P value
	Pre	Post	Post 5 min	Pre	Post	Post 5 min	
Vibration threshold (Volts)	4.33 ± 2.1	2.66 ± 1.2	4.12 ± 1.8	4.08 ± 1.9	3.78 ± 2.1	4.32 ± 1.9	.000**
Heat threshold (Degree Celsius)	46.4 ± 8.8	44.4 ± 14.8	47.7 ± 8.2	44.7 ± 10.3	43.9 ± 13.3	45.5 ± 11.1	.054
Cold threshold (Degree Celsius)	28.6 ± 11.7	30.9 ± 18.8	29.2 ± 9.6	24.4 ± 12.9	28.7 ± 8.3	27.1 ± 7.4	.087

**- significant at p <.05 level.

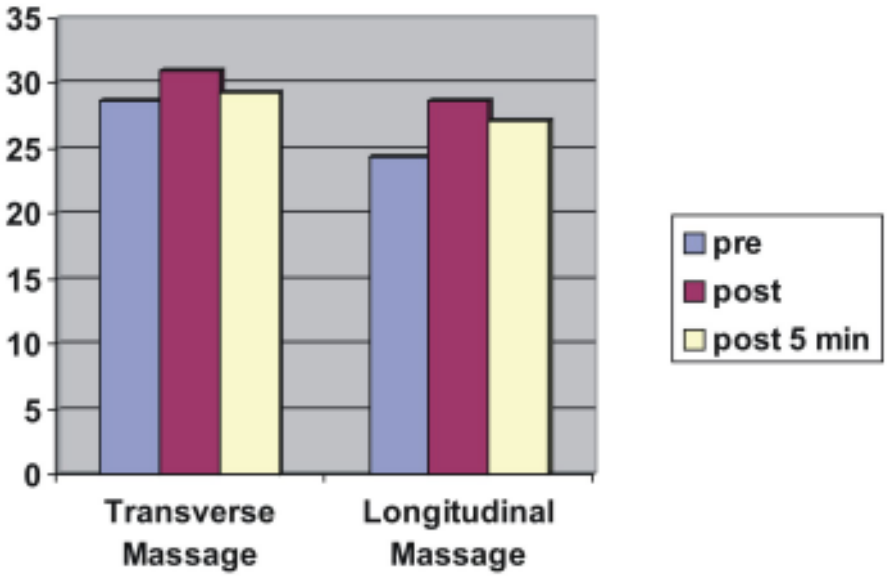
Graph 1 showing pre, post and post 5 min changes in vibration thresholds in both the intervention sides- transverse and longitudinal nerve massage techniques



Graph 2 showing pre, post and post 5 min changes in heat thresholds in both the intervention sides- transverse and longitudinal nerve massage techniques



Graph 3 showing pre, post and post 5 min changes in cold thresholds in both the intervention sides- transverse and longitudinal nerve massage techniques



technique which biomechanically would be produced in slider techniques and was also well tolerated by the subjects.

The following could be considered as the limitations of our study;

The study was done on asymptomatic subjects only, thus the results and findings could not be applied to symptomatic population.

Incidental sampling and also included age group could not have produced representative sample of the actual asymptomatic population.

Interventions were done on the same subject for minimizing between-subject differences of age, gender, occupation, lifestyle and other anthropometric factors, but this could have affected external validity of our findings further.

The dosage of the intervention used in the study was not validated in earlier studies and hence another dosage or combination of techniques would have produced different results.

Both the techniques had their own beneficial effects in that they involve soft tissue mobilization together with nerve mobilization which might have some other indirect effects.

The following are the significance of our study findings;

The study is the first of its kind, especially done on the lower limb and has future implications for further studies to actually measure the mechanics of the other lower extremity nerves during nerve massage techniques in normal subjects and/or in neuropathic pain subjects using ultrasonography.[71]

The study was having very high internal validity due to blinding of testers about the outcomes and also observer blinding for interventions.

CONCLUSION

Tibial nerve transverse massage technique reduced the vibration threshold significantly better than the tensioner technique in asymptomatic subjects studied. Clinically these techniques also reduced the heat thresholds and increased cold thresholds in the subjects which were not statistically significant.

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1. Place of Publication	:	Delhi
2. Periodicity of Publication	:	Quarterly
3. Printer's Name	:	**Asharfi Lal**
Nationality	:	Indian
Address	:	3/258-259, Trilok Puri, Delhi-91
4. Publisher's Name	:	**Asharfi Lal**
Nationality	:	Indian
Address	:	3/258-259, Trilok Puri, Delhi-91
5. Editor's Name	:	**Asharfi Lal** (Editor-in-Chief)
Nationality	:	Indian
Address	:	3/258-259, Trilok Puri, Delhi-91
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