Original Article

EFFECT OF NEURAL MOBILIZATION ON MONOSYNAPTIC REFLEX – A PRE TEST POST TEST EXPERIMENTAL DESIGN

Vipin Kumar [1*], Manu Goyal [2], N. Rajendran [3], Dr. Narkeesh [4]

M.M Institute of Physiotherapy & Rehabilitation, M.M.University, Mullana, Ambala, Haryana, India[1,2 & 3]. Department of Physiotherapy, Punjabi University, Patiala, Punjab, India[4].

ABSTRACT

Background: Neural mobilization techniques leads to facilitation of nerve gliding, reduction of nerve adherence, dispersion of noxious fluids, increased neural vascularity and improvement of axoplasmic flow. It has pronounced effects on monosynaptic H-reflex, which is an electrically induced reflex analogous to mechanically induced spinal stretch reflex. Thus, it is a reliable tool for the assessment of muscle tone through the excitability of AMNs. **Materials and Methods:** The study was carried out with 30 male and female subjects from MMIPR, MM University Mullana. H-reflex was taken before and after neural mobilization. **Results:** Significant effects on monosynaptic H-reflex were shown after neural mobilization with a mean difference of decrease in H-reflex latency (28.43±2.13 ms to 26.91±1.99 ms; t-value 13.24) and increase in H-reflex amplitude (4.27±2.18 mv to 5.25±2.50 mv; t-value -5.13) and increase in H/M ratio (0.42±0.21 to 0.52±0.25; t-value -5.22).
Conclusion: Neural mobilization has direct effect on nerve conduction as measured by electrophysiological testing, thereby providing evidence to include neural mobilizations as an intervention in altered neurodynamics of the peripheral nerves.

KEY WORDS: NEURAL MOBILIZATION; NEURODYNAMICS; MONOSYNAPTIC H-REFLEX; H/M RATIO

Address for correspondence: Vipin Arya, 189-B, Police line, Barlana road, Sirsa-125055, Haryana.
Email:spice.vipinarya88@gmail.com

Access this Article online

Quick Response code

International Journal of Physiotherapy and Research
ISSN 2321- 1822
www.ijmhr.org/ijpr.html

Published: 11 August 2013
Received: 13 June 2013
Accepted: 20 June 2013

INTRODUCTION

Neural mobilization techniques are passive or active movements that focus on restoring the ability of the nervous system to tolerate the normal compressive, friction and tensile forces associated with daily and sport activities. It is hypothesized that these therapeutic movements can have a positive impact on symptoms by improving intraneural circulation, axoplasmic flow and neural connective tissue viscoelasticity and by reducing sensitivity of abnormal impulse generating sites.[1]

It consists of gliding and sliding techniques. Gliding techniques or 'sliders', are neurodynamic maneuvers that attempt to produce a sliding movement between neural structures and adjacent nonneural tissues and they are executed in a non-provocative fashion. Tensile loading technique is to restore the physical capabilities of neural tissues to tolerate movements that lengthen the corresponding nerve bed. It is important to emphasize that tensile loading techniques are not stretches; these neurodynamic maneuvers are performed in an oscillatory fashion so as to gently engage resistance to movement that is usually associated with protective muscle activity.[1]

Regardless of the underlying construct, it is vital that the nervous system is able to adapt to mechanical loads, and it must undergo distinct mechanical events such as elongation, sliding,

cross-sectional change, angulation and compression. If these dynamic protective mechanisms fail, the nervous system is vulnerable to neural edema, ischemia, fibrosis and hypoxia, which may cause altered neurodynamics.[2, 3]

Neural mobilization is used for treatment of adverse neurodynamic, to restore the dynamic balance between the relative movement of neural tissues and surrounding mechanical interfaces, thereby allowing reduced intrinsic pressures on the neural tissue and thus promoting optimum physiologic function[4-6]. The hypothesized benefits from such techniques include facilitation of nerve gliding, reduction of nerve adherence, dispersion of noxious fluids, increased neural vascularity and improvement of axoplasmic flow.[4-9]

Neural mobilization has pronounced effects on H-reflex, which is an electrically induced reflex analogous to mechanically induced spinal stretch reflex. Its arc is similar to spinal stretch reflex except that it bypasses the muscle spindle, and therefore it is a valuable tool for assessing mono synaptic reflex activity in spinal cord. Thus, it is a reliable tool for the assessment of muscle tone through the excitability of AMNs.[10]

H-reflex is originally described by Paul Hoffmann in 1910 and later given his name, the Hoffmann reflex (H-reflex). It is one of the most studied reflexes in humans and is the electrical analogue of the monosynaptic stretch reflex. It is elicited by selectively stimulating the Ia fibers of the tibial nerve by using slow (less than 1 pulse/second), long-duration (0.5-1 ms) electrical stimulation of the afferent nerve.[11] The H-reflex is an estimate of alpha motor neuron (AMN) excitability when pre-synaptic inhibition and intrinsic excitability of the AMNs remain constant.[12, 13]

MATERIAL AND METHODS

Subjects: 30 male and female subjects of age 25-40 years and BMI 19-25 Kg/m^2 were selected by means of convenience sampling. Exclusion criteria were any recent surgery of back, hip and knee, subjects with neurological symptoms, any recent systemic disease and musculoskeletal conditions, inability to comply with the study protocol due to cognitive impairment.

Procedures H-reflex was evaluated before and after the neural mobilization with Nerve Conduction Study Apparatus (Allengers Scorpio - 2/4 EMG, NCS, EP system, manufactured by Allengers Global Healthcare (P) LTD).

H-reflex evaluation [14]:

Preparation of the skin - In order to reduce the skin impedance, the skin overlying the sites of the recording electrodes were shaved if necessary, the skin was rubbed lightly with sand paper to desquamate the surface and finally was rubbed with alcohol.

Position of the electrodes and their application - The recording electrode (R1) placed over the soleus and the reference electrode (R2) placed over the Achilles tendon. Although the H-reflex can be recorded over any portion of gastrocnemius and soleus muscles, the optimal location that yields the largest H-reflex was two or three fingerbreadth distal to where the soleus meets the two bellies of the gastrocnemius. The tibial nerve was stimulated in the popliteal fossa, with cathode placed proximal to anode and beginning at very low stimulus intensities. Ground electrode (G) placed at half distance between stimulating and recording electrodes Silver chloride surface electrodes were used and the recording electrodes was fixed to the skin by adhesive plaster, which must not be so tight as to impair contraction or the circulation of the muscles (Figure 1).

Position of the patient during recording - The H-reflex latency was recorded while the patient was laid down comfortably in prone lying position on bed in a quiet room. The head maintained in mid position to control the possible effects of asymmetrical tonic reflex. The examined leg was placed mid-way between abduction and adduction at hip joint. The knees was slightly flexed 20° degrees by placing a small cushion under the knee to relax the gastrocnemius to reduce any depressive influence on the H-reflex and ankle was freely positioned in planter flexion outside the plinth.

Stimulation - The H-reflex was elicited by stimulation of the posterior tibial nerve at the popliteal fossa little bit to lateral aspect by stimulating electrode as shown in Figure 1.

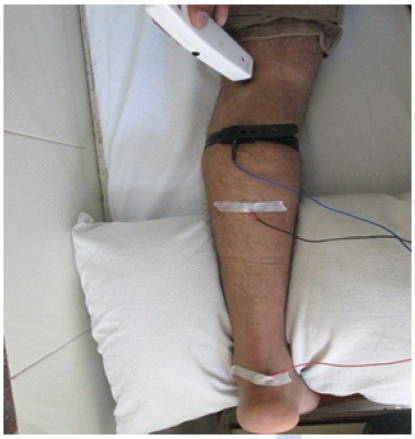


Figure1: Electrode placements

Neural Mobilization

Gliding technique is used as the neural mobilization procedure to the subjects for posterior tibial nerve[1-3].

Procedure – Patient in supine, the leg was supported so that the hip was in approximately 45° flexion and the leg horizontal. The foot was held so that the therapist's fingers can control the ankle, forefoot and toes. Dorsiflexion/ Eversion of the ankle and forefoot and dorsiflexion of the toes are the first movements and these should be taken as far as practicable into the range. Then knee extension was the next movement and while stabilizing the ankle joint and the rest of the limb, release of dorsiflexion of the forefoot and toes was the final movement to release distal tension from the digital nerves and allowed the tibial part to displace in a proximal direction (Figures 2 a & b). Again the hip was flexed to approximately 45° and the leg held horizontal as the starting position. This was to release proximal tension and allow distal sliding. The foot and toes were moved into dorsiflexion/eversion and the toes into dorsiflexion to move the nerve distally in its tunnel.

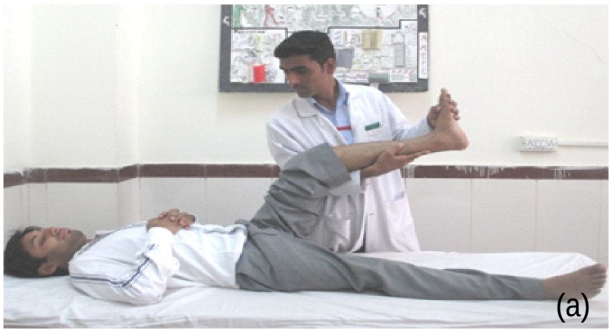
The same procedure was repeated again and again for approximately 10 minutes for the one session of neural mobilization.[15]

Data analysis: Data analysis was done using SPSS 16 software package (Version 16, SPSS Inc. Chicago, USA). Mean and standard deviation were used as descriptive statistics. A t-test was used to evaluate the effect of independent variable (Neural mobilization) on dependent variable (H-reflex).

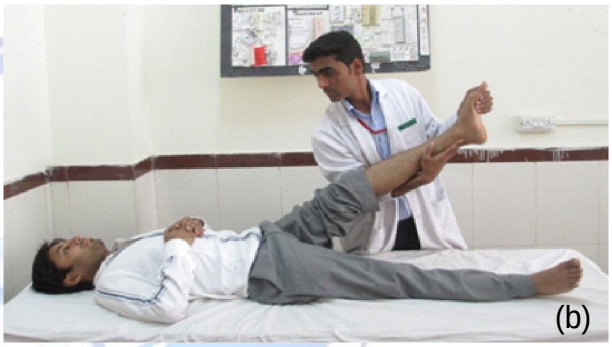
The level of significance was set as $p < 0.05$.

Figure 2 Procedure of Neural Mobilization.

(a) Distal slider, hip and knee flexion with ankle dorsiflexion and finger extension.

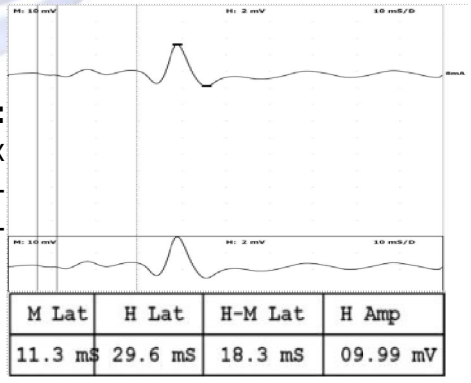


(b) Proximal slider, knee extension with ankle planter flexion and finger flexion.



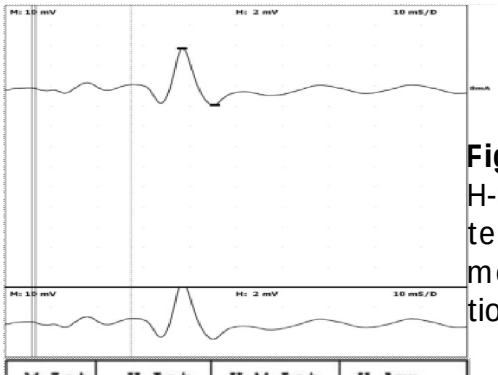
RESULTS

Demographics: 30 subjects were taken with mean age 31.36±5.47 years and height 1.73±0.05 m and BMI 23.33±1.96 kg/m^2.



M Lat	H Lat	H-M Lat	H Amp
11.3 mS	29.6 mS	18.3 mS	09.99 mV

Figure 3: H-reflex before neural mobilization.



M Lat	H Lat	H-M Lat	H Amp
5.8 mS	27.3 mS	21.5 mS	11.21 mV

Figure 4: H-reflex after neural mobilization.

The mean H-reflex latency before and after neural mobilization were 28.43±2.13 ms and 26.91±1.99 ms respectively (t-value is 13.24). The mean H-reflex amplitude before and after neural mobilization were 4.27±2.18 mv and 5.25±2.50 mv respectively (t-value is -5.13). The mean H/M ratio before and after neural mobilization were 0.42±0.21 and 0.52±0.25 respectively (t-value is -5.22).

Variables	Before (Mean±SD)	After (Mean±SD)	t value	p-value (<0.05)
H-reflex Latency(ms)	28.43±2.13	26.91±1.99	13.24	Significant 0
H-reflex Amplitude(mv)	4.27±2.18	5.25±2.50	-5.13	Significant (0.00)
H/M ratio	0.42±0.21	0.52±0.25	-5.22	Significant (0.00)

Table 1 Mean, Standard deviation, t value and p value of latency, amplitude and H/M ratio of H-reflex.

DISCUSSION

The findings of the study indicated that neural mobilization had significant effect on monosynaptic H-reflex as measured by electrophysiological testing. The concept of nerve gliding plays a major role in formulating a treatment plan for nerve mobilization. Shacklock theory of neurodynamics shows the interconnection between nerve mechanics and physiology. Mechanical factors like tension, compression or traction of the neural tissue influence physiological responses in intraneural blood flow, axonal transport, mechanosensitivity and sympathetic activation. In this study the attempt was made to measure the effect of nerve mechanics, following a technique theorized to affect nerve physiology as measured by H-reflex[3]. Tissue mobility, blood circulation and axonal transport, which are necessary for the functional and structural integrity of a neuron, will be increased after the neural mobilization[16]. This comes in agreement with Cleland et al[17] who mentioned that when the nerve root was compressed microcirculation was compromised and the pressure received by the nerve will affect the edema and the demyelination. Neural mobilization was sufficient to disperse the edema, thus alleviating the hypoxia and reducing the associated symptoms and increase the nerve conduction. Our results support this premise and shows significant reduction in H-reflex latency after neural mobilization (Table 1).

According to Bove et al[18] possible explanation can be that strong stretch of the connective tissues due to neural mobilization around the nerve roots activates sensory fibers in the related dorsal root. So, there is a greater amount of Ia afferent inputs resulting in summation at the spinal cord and a greater response from AMNs. Hence, nerve conduction would be improved leading to decrease in H-reflex latency. It is logical that stretch receptors with high thresholds should exist in the nervous system because this would provide an ideal means of protecting the nervous system against excessive mechanical stress.

Changes in the amplitude of the reflex can be explained by atleast three possibilities: first is alteration in the excitability of the motor neurons, second is variation in the amount of neurotransmitter released by the afferent terminals and third is variation in the intrinsic properties of the motorneurons.[19]

Kerr et al[20] studied the response in AMNs excitability of subjects with altered neural tension. They found that the group with altered neural tension demonstrated statistically significant increase in AMNs excitability in slump with neck flexion that is consistent with the findings obtained in the present study which shows significant increase in amplitude due to neural mobilization (Table 1).

Knikou et al[21] stated that the possible neuronal mechanisms might be related to the recruitment of excitatory interneurons or dis-facilitation of inhibitory interneurons projecting to excitatory interneurons in Ia afferents. However, given the indirect nature of the current experiments, a specific neuronal mechanism cannot be assigned. The results of our study are in accordance with study done by Nidhi et al[22] who also found significant increase in H-reflex amplitude and elongation of H/M ratio but not upto significant level after spinal stimulation by medium frequency current (Table 1).

CONCLUSION

Therefore, it is investigated that neural mobilization has a significant effect on monosynaptic reflex. Clinical significance of the study is that neural mobilization was shown to have an excitatory effect on á- motor neurons excitability in normal subjects. Therefore, conditions where there is a pathological decrease in alpha motor neurons excitability; they may benefit from the use of neural mobilization.

REFERENCES

1 Robert J. Nee, David Butler. Management of peripheral neuropathic pain: Integrating neurobiology, neurodynamics and clinical evidence. Physical Therapy in Sport. 2006:7; 36–49.

2 Butler DS. The Sensitive Nervous System. Adelaide, Australia: Noi-group Publications. 2000.

3 Shacklock MO. Clinical Neurodynamics: A New System of Neuromusculoskeletal Treatment. 2005a; 2-29, 98-104,154-158.

4 Butler DS, Shacklock MO, Slater H. Treatment of altered nervous system mechanics.

5 Gifford L., Pitt-Brooke J, Reid H, Lockwood J, Kerr K. Neurodynamics. Rehabilitation of Movement. 1998:159–195.

6 Kitteringham C. The effect of straight leg raise exercises after lumbar decompression surgery: A pilot study. Physiotherapy. 1996; 82:115–123.

7 Coppieters MW, Stappaerts KH, Wouters LL, Janssens K. The immediate effects of a cervical lateral glide treatment technique in patients with neurogenic cervicobrachial pain. J Orthop Sports PhysTher. 2003; 33:369–378.

8 Rozmaryn LM, Dovelle S, Rothman ER, Gorman K, Olvey KM, Bartko JJ. Nerve and tendon gliding exercises and the conservative management of carpal tunnel syndrome. J Hand Ther. 1998; 11:171–179.

9 Scrimshaw S, Maher C. Randomized controlled trial of neural mobilization after spinal surgery. Spine. 2001; 26:2647–2652.

10 Schieppati M. The Hoffmann reflex: a means of assessing spinal reflex excitability and its descending control in man. ProgNeurobiol. 1987; 28:345–376.

11 Zehr EP. Considerations for use of the Hoffmann reflex in exercise studies. Eur J Appl Physiol. 2002; 86:455–468.

12 Capaday C. Neurophysiological methods for studies of the motor system in freely moving human subjects. J Neurosci Methods. 1997; 74:201–218.

13 Palmeiri. The Hoffmann Reflex: Methodological Considerations and Applications for Use in Sports Medicine and Athletic Training Research. Journal of Athletic Training. 2004; 39(3):268–277.

14 Sahar M Adel. Efficacy of Neural Mobilization in Treatment of Low Back Dysfunctions. Journal of American Science. 2011; 7(4):566-573.

15 Sarkari, E. and Multani, N.K. Efficacy of Neural Mobilization in Sciatica. Journal of Exercise Science and Physiotherapy. 2007; 3(2):136-141.

16 Oskay, Meriç A, Kirdi, Firat, Ayhan and Leblebicioglu G. Neurodynamic Mobilization in the Conservative Treatment of Cubital Tunnel Syndrome. Journal of Manipulative and Physiological Therapeutics. 2010; 33(2):156-163.

17 Cleland, J.A., Childs, J.D., Palmer, J.A., & Eberhart, S. Slump stretching in the management of non-radicular low back pain: A pilot clinical trial. Manual Therapy. 2006; 11:279-286.

18 Bove, G., Zaheen, A., & Bajwa, Z. Subjective nature of lower limb radicular pain. Journal of Manipulative and Physiological Therapeutics. 2005; 28:12–14.

19 John e. Misiaszek. The h-reflex as a tool in neurophysiology: its limitations and uses in understanding nervous system function. Muscle nerve. 2003; 28:144–160.

20 Kerr, J.M., Vujnovich, A.L., & Bradman, L. Changes in alpha motor neuron excitability with positions that tension neural tissue. Electromyography Clinical Neurophysiology. 2002; 42:459-471.

21 Knikou M, Conway BA. Modulation of soleus H-reflex following ipsilateral mechanical loading of the sole of the foot in normal and complete spinal cord injured humans. NeurosciLett. 2001; 303:107–110.

22 Nidhi, B., Narkeesh, A. & Khurana. Effect of Spinal Stimulation on Monosynaptic Reflex by Medium Frequency Current. Journal of Exercise Science and Physiotherapy. 2011; 79(2):89-94.

How to cite this article:

Vipin Kumar, Manu Goyal, N.Rajendran, Dr.Nareekesh. Effect of neural mobilization on monosynaptic reflex – A pre test post test experimental design. Int J Physioth Res 2013;03:58-62.