Immediate Effects of Median Nerve Mobilization on Nerve Conduction Velocities, Upperlimb Strength and Bimanual Co-Ordination in Normal Healthy Subjects

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Abstract

Background and Objectives: - Neural tissue mobilization is a manipulative technique by which tissues are moved and stretched either by movement relative to surrounding structures or tension development. Mobilization of neural structures dependently or independently improves patient's signs and symptoms. Nervous system adapts to lengthening through increase in intraneural or intramural pressures. Thus the continuum of the nervous system serve its ability to move either alone or through surrounding tissue interface to relieve contributing neural tension to patient's symptoms. This Study assesses the immediate effects of neural tissue mobilization on the Nerve Conduction Velocities, the Bimanual Coordination and the Upper limb Grip Strength in normal healthy individuals. **Materials and Method:-** The participants in the study were normal healthy subjects. These subjects were assessed for their Upper limb Grip Strength, Bimanual coordination and the Nerve Conduction Velocities of the Median Nerve before and immediately after the Median Nerve Mobilization and analysis was done for the same. **Result: -** Data was analyzed by statistical means, standard deviation and students t- test and the results showed significant changes in terms of the nerve conduction velocity, upper limb strength and bimanual co-ordination in normal healthy subjects on an immediate basis. **Conclusion**: - This study concludes that immediate effects of median nerve mobilization on Nerve Conduction Velocities, Bimanual Coordination and Upper Limb Strength in normal healthy subjects are statisticaly significant. Hence immediate relief of discomfort through neural mobilization on these parameters can be obtained.

Keyword- *Nerve Tissue Mobilization, Grip Strength, Nerve Conduction Velocity And Bimanual Coordination*

Introduction

The concepts and technique of mobilization of nervous system are not new. A form of surgical treatment known as nerve stretching was in vogue rate last century in France and England. This tech was usually applied to sciatic nerve or brachial plexus and was used for variety of complains. For e.g. in case of sciatic stretching surgeons made an incision at gluteal fold or lower and attached a hook or placed fingers under sciatic nerve, then firmly pulled the nerve[1]. However how hard to pull and in which direction to pull was matter of great debate. Results were therapeutic dosage should be between 30 lbs and the persons body weight. With forms of ataxy a pull downwards was considered best and for LBA a pull in rostral direction[2].

It is interesting to know that nerve stretching was accepted 100 years ago but it has been understood not more than 30Years and awareness of specific pathways for pain arose little more than 20 years ago and present stage of progression towards an understanding of neuro orthopedic disorder remain into a process[3,4].

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Nervous system cannot avoid being mobilized with any movement related treatment. For e.g. in Hamstring stretch the sciatic nerve, its branches and part of neuraxis and meninges will be moved and tensioned. Even gentlest stretch Mobilize the neural structures of spine and the plexus. Patient's signs and symptoms have been improved with passive and active mobilization techniques[5,6,7].

Neurobiomechanics

A. The Mechanical Interface:

One of the most outstanding features of the neural system is its mobility. Its mobility is such that it can act dependently or independently of the structure it spans. E.g. SLR involves movement and tension of the nervous system in the calf and foot, yet negligible activity in the foot non-neural structures.

However if the SLR was performed including ankle dorsiflexion, the neural structures in the calf and foot will loose their independence from the surrounding structures of the affected by the joint position. Thus the continuum of the nerve system serves its ability to move either alone or be influenced by surrounding.

Mechanical interface is defined as the tissue or material adjacent to the nerve system, that can move independently to the system (Butler 1989) e.g. the supinator muscle is an interface to the post interosseus branch of the radial nerve[8].

B. NERVOUS SYSTEM ADAPTATIONS TO MOVEMENT

Nervous system adapts to lengthening in two ways by Development of tension or increase pressure within the tissues that is increase in intraneural or intermural pressures which occurs as a consequence of elongation

Movement

a. Gross Movements

b. Movement occurying intraneurally between connective tissues and nerve neural tissues.

Gross Movement refers to system as a whole in relation to interface e.g. (1) Peripheral nerve sliding through a tunnel. (2) Median nerve through carpal tunnel (3) dural theca sliding in relation to a segment. Intraneural Movement refers to movement in between connective tissues and nerve neural tissue interfaces. E.g. (1) Fasicle can slide in relation to anoter fascicle in peripheral nerve and nerve roots (2) Nerve fibre can move in relation to endoneurium[9,10].

C. RELATIONSHIP BETWEEN MOVEMENT AND NERVE TENSION

If a body part is moved with other body parts in neutral position there will be less tension in more movements of nerve system relation to interfaces. Conversely if same movement were performed with body parts tension there will be increase intraneural tension but little of movement of the nerve system[11,12].

Materials and Methodology

Study design was Experimental study design. Study was conducted at College of Physiotherapy, Jawaharlal Nehru Medical College, and Belgaum. Sampling method used was Convenient sampling done on a sample size of 60 subjects. Normal healthy subjects of age group 18-22 years were included in the study who were students of Jawaharlal Nehru Medical, Dental, Physiotherapy and Pharmacy College. Students with UL neurological pathologies, cervical pathology, UE Fractures, Local skin lesions and disorders were excluded. Outcome Measure: Hand Dynamometer. Name: Jammar Hand Dynamometer. Model: 5030 Kit. Markings: 0-60 Kgs., Two Hand Cordination Test with electronic Chronoscope. Students Physiograph Neurocare™ 2020 Computerized EMG/NCV/EP Equipment.

Procedure

After obtaining ethical clearance from the committee subjects were selected on the inclusion and exclusion criteria by convenient sampling method. An informed consent was obtained from the students. Each subject was explained in detail the functioning of the equipments used and the purpose of the study and its non-invasive nature. The recordings of each individual PRE and POST Median Nerve Mobilization (Stretch) for Upper Limb Grip Strength was measured with Hand Dynamometer and mean reading noted down in kgs., the Bimanual Cordination was assessed with the Two Hand Cordination Test with electronic Chronoscope

using Stop Watch and the time taken was noted. The nerve conduction velocity was assesd with the Students Physiograph Neurocare™ 2020 Computerized EMG/ NCV/EP Equipment. Neural Stretch ULTT1 (Median Nerve) dominant hand utilizing Shoulder depression, Abduction, Elbow extension, Forearm supination, wrist and finger extension. Nerve mobilization of 2 sets of 20 seconds Grade IV mobilization in same position ULTT2 (David Butler).

Result

Table No.1 – Statistical Analysis of Strength and Nerve Mobilization

	STRENGTH	
Mean± SD	**PRE**	**POST**
	19.6±4.3	**22.6±4.4**
p value	0.0001	
Students t- test value	4.6	
Coefficient of correlation (r)	0.83	

This table shows changes of post median nerve mobilization with the p-value = 0.0001 and the students t-test value = 4.6. The changes in the upper limb strength values immediately after median nerve mobilization were satistically significant.

Table No.2 – Statistical Analysis of Bimanual Coordination and Nerve Mobilization along with time taken to complete the task

	BIMANUAL COORDINATION	
Mean ±SD	**PRE(time taken)**	**POST(time taken)**
	256±57.2	**215±36.3**
p value	0.01	
Students t- test value	2.81	
Coefficient of correlation (r)	0.69	

This table shows significant changes in bimanual coordination with the p-value = 0.01 and the students t-test value = 2.81. The time taken to complete the task was statistically significant.

Table No. 3 –Statistical Analysis of Nerve Conduction Velocity and Nerve Mobilization.

	NERVE CONDUCTION VELOCITY	
Mean ± SD	PRE	POST
	59.7±4.16	62±3.58
p value	0.004	
Students t- test value	3.631	
Coefficient of correlation (r)	0.90	

This table shows significant changes in the nerve conduction velocities in the subjects immediately after median nerve mobilization with p-value=0.004 and students t-test value=3.63.

Discussion

This study intends to find out immediate effect of Median Nerve Mobilization on normal healthy subjects in one single session. The changes in the upper limb strength post median nerve mobilization with the p-value = 0.0001 and the students t-test value =4.6 proved to be highly significant. Study also shows significant changes in the nerve conduction velocities in the subjects immediately after median nerve mobilization with p-value=0.004 and students t-test value=3.631. Significant changes in bimanual coordination with the p-value = 0.01 and the students t-test value =2.81 were observed.

The above result seems to be similar to previous study done by a follower of David Butler on patients — performed stretch just to the very edge of pain and held it for 5 seconds on 50 subjects and found that all the symptoms subsided immediately. Results of that study were increase in the Range Of Motion by two folds. LI Alan Weismantel's (functional manual therapy.) (1978). Also, when directing movement to the soft tissue complex is accomplished towards the resistance

experienced by patients. The resulting mobilization affects nerve, vascular, fascia & muscular tissue. Studies conducted by David Butler show a significant improvement with cervical mobilization and upper limb tension over a period of 14 days, with 70% reduction in their symptoms and improvement in their functional activities.

Upper limb nerve mobilization is widely used treatment method for dysfunction of the upper limbs. Butler reported that upper limb NM suppresses spasm and facilitates muscular tension and the overall recovery of patients with upper limb dysfunction due to brain damage. Park JW also reported significant differences in restoration of muscular power, spasticity, and functional recovery of post stroke hemiplegic patients with upper limb neural mobilization. The tension placed on the neural systems compresses the small blood vessels thus increasing blood flow and axonal transport systems increase the flexibility accelerating the NCV. A randomized control trail (A.S.Likhite, G.M.Balthillaya, Anupama Prabhu 2007) to study the effect of upper limb neural mobilization on vibration threshold and hand grip strength in asymptomatic individuals was done which showed significant results in neural extensibility as measured by elbow extension range of motion but no effect on grip strength was observed with one session of Nerve Tissue Mobilization. Hence in this study two sessions of Nerve Tissue Mobilization were used to compare the baseline and immediate effects. Studying the immediate effects on bimanual coordination and time take to complete a task after neural tissue mobilization is subject which can be further investigated.

Limitations

- Experimental study conducted as a single session
- Normal subjects with no prior pathology

Recommendations

- Present study can be done on a larger sample size
- Further study can be done to investigate the long term effects on patient population.

Ethical Clearance- Taken from institutional ethical committee

Source of Funding- Self

Conflict of Interest - NIL

Conclusion

This study concludes that median nerve mobilization shows significant improvement on Nerve Conduction Velocities, Bimanual Coordination and Upper Limb Strength in normal healthy subjects. Thus the experimental hypothesis is accepted and the null hypothesis is rejected in the present study. As on long term Neural Tissue Mobilization is an important form of treatment technique given by physiotherapist which can bring about significant changes in extensibility, muscle strength, nerve conduction velocities and thus reaction time and relief of pain and discomfort. Hence immediate relief of discomfort through neural mobilization on these parameters needs to be further investigated in patients.

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