Efficacy of Median Nerve Mobilization Versus Upper Trapezius Muscle Stretching on Extensibility of Median Nerve in Young Healthy Individuals: A Randomized Controlled Trial

Shiril R. Nagarkar[1], Varsha S. Nagarkar[2], Divya V. Bagaria[3], Vasant Gawande[4]

[1]Associate Professor & HOD, Department of Kinesiotherapy, Datta Meghe College of Physiotherapy, [2]Associate Professor & HOD, Department of Electrotherapy, Datta Meghe College of Physiotherapy, [3]Senior Consultant Physio Therapist, Director Divya's Physiotherapy & Rehabilitation Centre, Surat, Gujrat, [4]Associate Professor Dept. of Orthopedics, Jawaharlal Nehru Medical College, Datta Meghe Institute of Medical Sciences, Sawangi, Wardha-442001

Abstract

Objective: The purpose of this study was to compare the effect of upper trapezius muscle stretching and median nerve mobilization on median nerve extensibility.

Design: A randomized controlled trial. **Participants**: 80 healthy participants with mean age range () were randomized to two groups who received trapezius muscle stretching & median nerve mobilization.

Outcome Measures: Right and left Elbow Extension Deficit Angle (EEDA) in degrees.

Intervention: Passive stretching of upper trapezius was done 4 times per week, 3 repetitions, 30 sec hold bilaterally. Median nerve mobilization was done 4 times per week, 3 sets of 10 cycles each; 30 sec rest in between bilaterally. Supervised self stretching and nerve mobilization was done 3 times per week, with number of hold and repetitions being the same.

Results: Baseline characteristics including demographic, anthropomorphic and EEDA between groups were comparable. Intragroup comparison of right and left Elbow Extension Deficit Angle (EEDA) were done using Repeated Measure Multivariate ANOVA. Inter group comparison was done using post hoc test Bonferroni. The level of significance was set at $P < 0.05$.

Conclusion: The study concludes that Upper trapezius muscle stretching is effective in improving median nerve extensibility. Both treatment techniques are equally effective.

Keywords: *Median Nerve Mobilization, Trapezius Muscle Stretching, musculoskeletal dysfunction.*

Introduction

Pain is central to the practice of physiotherapy and is the most common symptom for which patients seek health care and is most common cause of physical dysfunction. The musculoskeletal system is composed of 3 subsystems i.e. muscular, articular and neural systems. Janda has asserted that it is impossible to have damage or change in any one system without its being reflected in each of the other 2 systems[1]. The examination of normal compliance to movement should not only involve treatment of muscles and joints but also abnormal responses to mechanical provocation of neural tissue. The physical examination of patients with upper quadrant musculoskeletal dysfunction includes testing for normal movement and extensibility of mobile tissues of articular, muscle and nervous system. Many of these structures have close anatomical relationships and a test for one structure will definitely move adjacent structure or stress them. For e.g, the anatomical locations and orientation of upper trapezius muscle and nerves of brachial plexus. The upper trapezius from its origin at occiput, ligamentum nuchae and seventh cervical spinous process has vertical and more oblique to transverse fiber orientation to its insertion into lateral one third of clavicle, spine of scapula and acromion. The trunks of brachial plexus follow an oblique to transverse course from their origin at C4 to T2 spinal nerves in their path through thoracic inlet region to their emergence from the axilla as peripheral nerves of upper limb[2]. The tests for the movement and length of upper trapezius muscle and neural tissues of upper quadrant share common components of shoulder girdle depression and cervical contralateral lateral flexion. Those with decreased neural extensibility had significantly less measured length of upper trapezius muscle[3].

Need for the Study: The upper trapezius muscle length and upper quadrant neural extensibility is interdependent is proved. But very little literature is available to evaluate whether upper trapezius muscle stretching will influence median nerve extensibility. The asymptomatic individuals were selected for the study as it eliminates commonly encountered confounding variables associated with clinical conditions including concomitant physical therapy interventions (e.g., exercise or modalities) and pain medications. Hence, the need for the study arises.

Aims: To compare the effect of upper trapezius muscle stretching and median nerve mobilization on median nerve extensibility.

Objectives: To assess elbow extension deficit angle (Elbow Extension Deficit Angle)

a. After giving upper trapezius muscle stretching bilaterally.

b. After giving median nerve mobilization bilaterally.

Materials and Method

1. A plinth
2. A universal goniometer
3. A wedge
4. Measuring tape
5. Pressure biofeedback
6. Chair
7. Mirror
8. Stop watch
9. Marker

Study Design: It is a randomized controlled, single rater blinded trial.

Place of Study: Physiotherapy Department of Tertiary care hospital

Sample Size: 80 young healthy individuals (40 in each group).

Inclusion Criteria:

1. Normal young individuals, 15–24 years, 32 having

a. Elbow Extension Deficit Angle [ELBOW EXTENSION DEFICIT ANGLE] in Median Neurodynamic test [MEDIAN NERVE TENSION TEST 1] (600 – 00).10

b. Cervical lateral flexion of 200 – 400 indicating reduced trapezius flexibility.

Exclusion Criteria:

1. Pain and deformity of upper limb, cervical spine or similar history in past.
2. Neurological or vascular pathology in upper limb, cervical spine.
3. Spinal surgery, joint surgery in upper limb.
4. Individuals performing regular stretching exercise

Subjects were recruited from physiotherapy department according to inclusion and exclusion criteria. The purpose and procedure of the study was explained to subjects. An informed consent form was signed by them.

80 subjects were randomly divided into 2 groups, 40 in each, using computer generated randomization chart.

Group 1: Upper trapezius muscle stretching group

They received upper trapezius muscle stretching bilaterally for 1 week.

Group 2: Median Nerve Mobilization group

They received median nerve mobilization bilaterally for 1 week.

Assessment:

Elbow Extension Deficit Angle (Elbow Extension Deficit Angle)[4]: Intra rater and inter rater reliability for Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) assessment was done using ICC on

30 subjects with 10 minutes break in between. The intra rater reliability was 0.895 with 95% confidence interval ranging from 0.833 to 0.941. The inter rater reliability was 0.883 with 95% confidence interval ranging from 0.813 to 0.935

Treatment:

- Passive- Static stretching of upper trapezius muscle
- Supervised self -stretching of upper trapezius muscle
- Median nerve mobilization by therapist
- Supervised self-mobilization of median nerve

Results

Data was analyzed using SPSS software version number 16. Normality for all the parameters was tested using Kolmogorov- Smirnov test. One way ANOVA was used for the comparison of age distribution in all 3 groups and Pearson chi square test for sex distribution. Intragroup comparison of right and left Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) were done. If normally distributed, Repeated Measure Multivariate ANOVA was used and if not normally distributed Friedman's test was used.

In the presence of statistical significance further post hoc analysis was done. For intergroup comparison, if normally distributed then one way ANOVA was used and if statistically significant then post hoc test Bonferroni was applied and if not normally distributed Kruskall Wallis test was used and if statistically significant then post hoc test Dunn's Multiple Comparison was done. The level of significance was set at $P < 0.05$.

Table 1: Intra group comparison of right Elbow Extension Deficit Angle

Right Elbow Extension Deficit Angle	Day 1 pre Median (range)	Day 1 post Median (range)	Day 7 post Median (range)	P value	Significant
Group 1	35(9,60)	30(0,60)	22(0,52)	<0.001	Significant
Group 2	35(5,52)	24(0,44)	15(0,40)	<0.001	Significant

At Repeated Measures Multivariate ANOVA Group 1 and 2 showed significant improvement in right Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) post treatment.

Table 2:

Post hoc test Right Elbow Extension Deficit Angle	Day 1 pre Median (range)	Day 1 post Median (range)	P value	Significant
Group 1	35(9,60)	30(0,60)	<0.001	Significant
Group 2	35(5,52)	24(0,44)	<0.001	Significant

Table 3:

Right Elbow Extension Deficit Angle	Day 1 pre Median (range)	Day 7 post Median (range)	P value	Significant
Group 1	35(9,60)	22(0,52)	<0.001	Significant
Group 2	35(5,52)	15(0,40)	<0.001	Significant
Right Elbow Extension Deficit Angle	**Day 1 post Median (range)**	**Day 7 post Median (range)**	**P value**	**Significant**
Group 1	30(0,60)	22(0,52)	<0.001	Significant
Group 2	24(0,44)	15(0,40)	<0.001	Significant

Both Group 1 and 2 showed significant improvement in right Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) after single session of upper trapezius muscle stretching and median nerve mobilization.

Also group 2 and 3 showed further significant improvement in right Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) when treatment was continued for a week.

Table 4:Inter group comparison of right Elbow Extension Deficit Angle

Right Elbow Extension Deficit Angle	Group 1 Median (range)	Group 2 Median (range)	P value	Significant
Day 1 post- Day 1 pre	-6.5(-30,0)	-6.5(-25,3)	<0.001	Significant
Day 7 post- Day 1 pre	-12.5(-40,0)	-18(-37,-2)	<0.001	Significant

One way ANOVA: Both group 1 and 2 showed significant improvement in right Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE)

Table 5:Inter group comparison of left Elbow Extension Deficit Angle

Left Elbow Extension Deficit Angle	Group 1 Median (range)	Group 2 Median (range)	P value	Significant
Day 1 post- Day 1 pre#	-5(-25,5)	-7.5(-23,3)	<0.001	Significant
Day 7 post- Day 1 pre#	-15(-38,1)	-16(-29,38)	<0.001	Significant

Kruskall Wallis test

Group 1 and 2 showed significant improvement in left Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) after single session of upper trapezius muscle stretching and median nerve mobilization.

After 1 week of treatment of upper trapezius muscle stretching and median nerve mobilization, both group 1 and 2 showed significant improvement, but there was no significant difference between group 1and 2.

Discussion

The results obtained showed statistical significant improvement in elbow extension deficit angle bilaterally in group 1 and 2.

Upper trapezius muscle stretching improved median nerve extensibility in group 2 by following mechanism: During movement, the musculoskeletal system exerts non uniform stresses and movement in neural tissues, depending on local anatomical and mechanical characteristics and pattern of body movement. This leads to mechanical and physiological responses in neural tissues. These responses include neural sliding, elongation, tension and changes in intaneural micro circulation, axonal transport and impulse traffic[5].

The neurodynamics during scapular depression and contralateral lateral flexion of neck are as follows: Scapular depression increases tension in the peripheral nerves of the upper limb by producing an increase in the distance between the neck and arm. The cervical nerve roots move distally with this movement. Proximal sliding of brachial plexus relative to the glenohumeral joint is likely to occur. From the sonographic recordings on the movements of the median nerve in forearm and wrist in vivo, scapular depression moves the nerve proximally[6].

Median nerve mobilization improved neural extensibility in group 2 by following mechanism: All the 80 subjects showed covert response either in terms of asymmetry in Elbow Extension Deficit Angle (ELBOW EXTENSION DEFICIT ANGLE) or site and quality of symptoms bilaterally. Covert response is differentiated to be neural. It is a comparable sign worth treating[7].

C type nerve fibers i.e. substance P and calcitonin gene related peptide exist in the epineurium of peripheral nerves and act as nociceptors in several forms. Strong stretch of connective tissues around the nerve roots activates sensory fibers in related dorsal nerve root. Hence, nociception and stretch through application of forces may arise directly from the nervous system[8].

The nerve distal to adhesion has to compensate for the loss of stretching ability. This can place tension on the nerve by the combination of movements performed during MEDIAN NERVE TENSION TEST 1. As the connective tissues of the nervous system are innervated, movement of neural tissues against adhesions may generate a pain response in the nervous tissue. Two ended slider consisted of elbow and wrist movements in standard[9] MEDIAN NERVE TENSION TEST 1.

Neurobiomechanics during above movements are as follows: Glenohumeral abduction causes increased tension in the brachial plexus and the more distal peripheral nerves of the upper limb. The C5 nerve root slides in a distal direction in the intervertebral foramen. The median nerve at the level of shoulder joint moves as much as 1 cm. Convergence of neural structures occur towards the shoulder joint. The median nerve at wrist slides 8 – 9 mm proximally with abduction[11].

Elbow extension increases the length of the bed of median nerve by 20% which result in an increase in length of the median nerve by 4-5%. The principle of convergence i.e. the neural structures slide towards the joint being moved occurs. Supination produces a small amount of effect. However when it occurs as a part of MEDIAN NERVE TENSION TEST 1 it produces significant effect on nervous system as it is already under tension[12].

Wrist flexion decreases the tension in median nerve and wrist extension increases the tension. The total change in strain in median nerve at the elbow between wrist flexion and extension is 14.8%. At the wrist the total change in strain of the nerve reaches 9.6%. The total longitudinal sliding of the nerve at the elbow between flexion and extension is 5.6mm and at wrist it can reach 19.6mm. Transverse motion of the median nerve at the wrist occurs and has been measured between 1.5 mm and 3 mm[13].

With shoulder in 90 degree abduction, wrist extension combined with elbow flexion cause an increase in tension in distal part of median nerve. The nervous system must undergo 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.

When neural mobilization is used for treatment of adverse neurodynamics, the objective is to restore dynamic balance between the relative movement of neural tissues and surrounding mechanical interfaces. The nerve trunk slides longitudinally in its bed when the limb is moved. When longitudinal movement of a peripheral nerve is restricted, continual trauma results from the normal movements of the limb[14].

Conclusion

Upper trapezius muscle stretching is effective in improving median nerve extensibility. Median nerve mobilization is effective in improving median nerve extensibility. Both treatment techniques are equally effective.

Clinical Implication: Normal length of upper trapezius muscle will help in maintaining median nerve extensibility.

Ethical Clearance: Taken from institutional ethics committee.

Source of Funding: Self.

Conflict of Interest: Nil.

References

1. Hamouda M. The Neural tissue provocation test as a diagnostic tool in the assessment of cervicobrachial pain disorders: A critical appraisal. University of Wales College of Medicine. 2003.
2. Shacklock M. Clinical Neurodynamics : a new system of musculoskeletal treatment. Oxford: Elsevier; 2005
3. Rolf G. The puzzle of pain, loss of mobility, evasive movements and the self-management; 25th March 2002. http://fysio1.inforce.dk/graphics/PDF/PDF-Job.p65.PDF
4. Reisch R, Williams K. Upper limb neurodynamic test-2 Median nerve bias: An investigation of examiner reliability, end range shoulder abduction and symptom response in asymptomatic subjects. Pacific University; school of physical therapy; 2001.
5. Beneciuk JM, Bishop MD, George SZ. Effects of upper extremity neural mobilization on thermal pain sensitivity: A sham controlled study in asymptomatic participants; University of Florida.
6. Sapsford R, Bullock Saxton J, Markwell S. Women's Health: a textbook for physiotherapists. London: W.B Saunders Company; 1998.
7. Yaxley GA, Jull GA. A modified upper limb tension test: An investigation of responses in normal subjects. Australian Journal of Physiotherapy.

1991; 37(3): 143-52.

8. Edgar D, Jull GA, Sutton S. The relationship between upper trapezius muscle length and upper quadrant neural tissue extensibility. Australian Physiotherapy. 1994; 40(2): 99-103.
9. Coppieters M, Stappaerts K, Janssens K, Jullfr. Reliability of detecting onset of pain and submaximal pain during neural provocation testing of the upper quadrant. Physiotherapy Research International; 2002 August; 7(3): 146-56.
10. Vanti C, Conteddu L, Guccione A, Morsillo F. Parazza S, Viti C, Pillastrini P. The upper limb neurodynamic test 1: Intra – and inter tester reliability and the effect of several repetitions on pain and resistance.journal of manipulative and physiological therapeutics. 2010 May; 33(4): 292-299.
11. Herrington, Lee. Effect of different Neurodynamic mobilization techniques on knee extension range of motion in the slump position. Journal of manual and manipulative therapy. 2006; 14(2); 101-07.
12. Bandy WD, Irion JM. The effect of time on static stretch on the flexibility of the hamstring muscles. Phys Ther. 1994 Sep, 74(9): 845-50
13. Grant RJ, Forrester CA, Hides JA. Screen based keyboard operation: the adverse effects on the neural system. Australian Journal of Physiotherapy.1995; 41(2):99-107.
14. World Health Organisation. Child and Adolescent health. www.searo.who.int/en/section13/section1245_4980.htm