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### The effect of neural tissue mobilization on cylindrical grip strength in old adults

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#### ABSTRACT

Background & Purpose of the Study: Neural tissue mobilization has been reported to be an effective intervention for conditions like carpal tunnel syndrome though benefits are still under research. The effect of nervous tissue mobilization on various hand functions is not studied. Also, no interventions have been made for increasing the grip strength in old healthy adults within 40-60 years of age. Hence, this study. Methodology: A total of 100 subjects, both males and females with at least a single positive neural tissue tension test were included in the study whereas those with previous history of any neurological & musculoskeletal pathology were excluded from study. Subjects were evaluated for baseline data, grip strength measurements were taken before and after the mobilization using the Hydraulic Hand Dynamometer. Neural tissue mobilization was given for nerves with positive tension tests. Results: On data analysis, an increase was seen in the cylindrical grip strength after mobilization in both, males and females with affected neural tissue tension. With only median nerve involvement, there was a significant increase in the grip than that with ulnar and radial nerve involvement. Conclusion: Neural Tissue Mobilization techniques can be used for improving the grip strength in old adults.

**Keywords:** Neural tissue mobilization, Hand, Cylindrical grip, Dynamometer

#### INTRODUCTION

The upper limb, particularly the hand function is one of the most essential function in daily life. The hand has a central role in many activities of daily life like eating, writing, typing, etc. Grip strength is an important component of hand rehabilitation because it assesses dysfunction and recovery [4]. Grip strength provides an objective index of the functional integrity of upper extremity. [11] It measures the force applied by the hand when

gripping, which represents the combined strength of the intrinsic and extrinsic muscles of the hand and the interaction between them. Grip strength is the activation of muscles of fingers and thumb acting against the palm for the purpose of transmitting force to an object. A total of 35 muscles are involved in movement of the forearm and hand. Many of these are involved in gripping activities. In gripping activities, the flexor muscles in the hand and forearm create the grip strength,

while the extensor muscles of the forearm stabilize the wrist. [12] It is directly affected by the neural, muscular and skeletal system and thus, is a reliable and valid measurement of hand strength and used extensively in the assessment of hand function. [4] It is proportional to height and weight in healthy subjects and is affected by gender and age. It has a curvilinear relationship with age, as it improves from childhood to adolescence, reaches a peak at 25-39 years of age, and declines gradually with advancing age. [11]

Decline in grip strength with age is attributed to due to factors including changes in height, weight, lean body mass forearm circumference area, hand size, and bone density as well as other factors such as decreased physical activity, reduced use of handgrip muscles declines in muscle efficiency, and diminished capacity of other systems of the body. Movement control in humans due to aging is about the changes in muscles, motor neurons, nerves, sensory functions, gait, fatigue, visual and manual responses in men and women as they get older but who do not have any neurological or neuromuscular disorders. With aging, neuromuscular movements are impaired since over all force production of muscles is reduced. In routine tasks, the neural structures have a chance to get compromised as posture has significant influence on their extensibility. [3]

Neural Tissue mobilization techniques developed by David Butler are effective interventions. When neural mobilization is used for treatment of adverse neurodynamics, the primary theoretical objective is to attempt 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. 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. [3] These techniques can mobilize various nervous tissues of the body. Ulnar, median, and radial nerves are the three major nerves of upper extremity, which are long and have to cross various mechanical interfaces like bone or a tunnel or collagen fibers or fascia surrounding them. [3]

The Hydraulic Hand Dynamometer is one of the reliable tools for assessment of grip strength. The second rung is the recommended handle position.

This study aims at mobilization of these three nerves and finding out its effect on the cylindrical grip strength and thereby the hand function of an individual.

## **MATERIALS & METHOD**

Sampling Population: Individuals within 40-60 years of age group, both males and females ready to participate in the study.

Sampling Method: Purposive Sampling

Sample Size : 100

Study Setting : Subjects are taken from in and around Pune, and Navi Mumbai

Type of study : Experimental study

Materials used : Hydraulic Hand Dynamometer for recording the cylindrical grip strength before and after mobilization.

### **Selection Criterion**

#### **Inclusion Criterion**

- Subjects within 40-60 years of age group (Both Males and females)
- Subjects who have at least a single positive ULTT of one side
- Subjects who were ready to participate in the study

#### **Exclusion criterion**

- Subjects with a recent history of musculoskeletal conditions of the upper limb including soft tissue injuries and/or fractures.
- Subjects with neurological symptoms anywhere in the body
- Subjects involved in vigorous stretching or active strengthening regime.

#### **Assessment of grip strength**

- According to the guidelines given by the American society of Hand Therapists (ASHT)
- The subject seated with the arm adducted at the side.
- The elbow flexed to 90°, the forearm in midprone (neutral), and the wrist positioned at 15-30° of extension (dorsiflexion) and 0-15° of ulnar deviation.
- The dynamometer's dial turned away from the subjects, while the base of the dynamometer gently supported.

- Grip duration of at least 3 seconds was taken and the average of 3 trials were the test score. A rest period of at least 15 seconds was provided between grip repetitions.
- Standard instructions were given “This test will tell me your maximum grip strength. When I say go, grip as hard as you can until I say stop”

### Procedure

- Baseline evaluation of subjects was done.
- A written consent was taken from the subjects.
- Subjects were evaluated for Ulnar, Median, and Radial nerve tension tests using the ULTT
- Grip strength of subjects was calculated using Hand Dynamometer and assessment was done according to the guidelines provided by American Society of Hand Therapists.
- Neural tissue mobilization was done by direct mobilization of the nerve using upper limb tension tests, following the assessment.
- 10-12 repetitions were given at each interface and further sensitization was done, adding each component.
- Grip strength was checked again and noted down.
- Comparison was done of values of grip strength before and after mobilization.

### METHOD

Mobilization of nervous tissue was done using direct treatment of nervous tissue according to Butler’s mobilization techniques:

In each position, 10-12 repetitions were given in the available range at various tissue interfaces before further sensitizing the nerve

### Starting position

For right side, the subject lies to the right side of the bed with the scapula free of the bed. The legs and trunk are angled to the left of the bed so that the patient feels relaxed and supported. A pillow under the head if required. The examiner's left thigh rests against the patient's right shoulder and his hands support the patient's arm at the elbow and wrist.

### Median Nerve

Using the thigh, shoulder girdle depression is achieved, abduction to 110 is maintained. Right hand supporting the subject’s wrist and elbow supported by the examiner’s left hand. Elbow extension is done, forearm supinated, wrist and finger and thumb extension and contralateral side cervical flexion is added for further sensitization



For Radial Nerve, shoulder girdle depression using the thigh, abduction to 10, medial rotation, elbow extended, forearm pronated, wrist flexion,

ulnar deviation and finger and thumb flexion, contralateral side flexion of cervical spine.



Ulnar Nerve, shoulder girdle depression, lateral rotation and abduction (10-90), elbow flexion, forearm supination, wrist extension and radial

deviation with fingers and thumb extension followed by contralateral side cervical spine flexion



## RESULTS

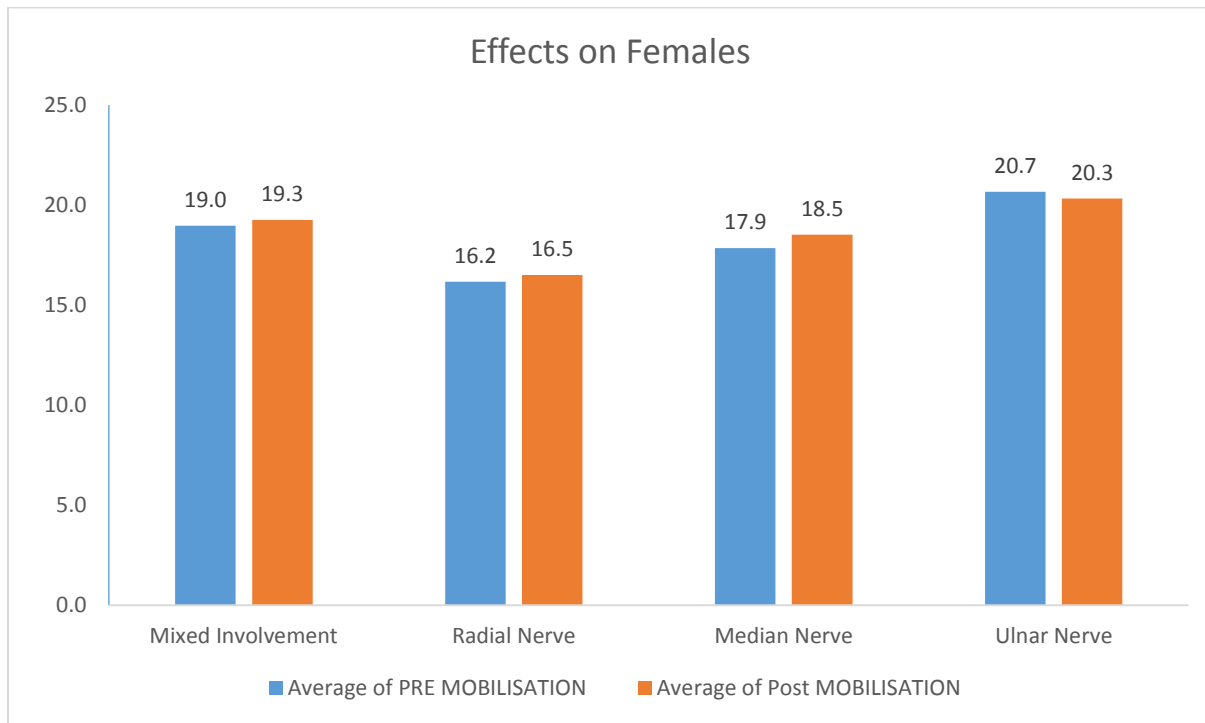
A total of 100 subjects (37 females and 63 males) in the age group of 40 and 60 years who were clinically asymptomatic, with at least a single positive ULTT were given neural tissue mobilization and grip measurements were done

using hand dynamometer before and after mobilization.

Statistical analysis was done using Analysis Of Variance (ANOVA) Test for males and females separately and the findings are as follows-

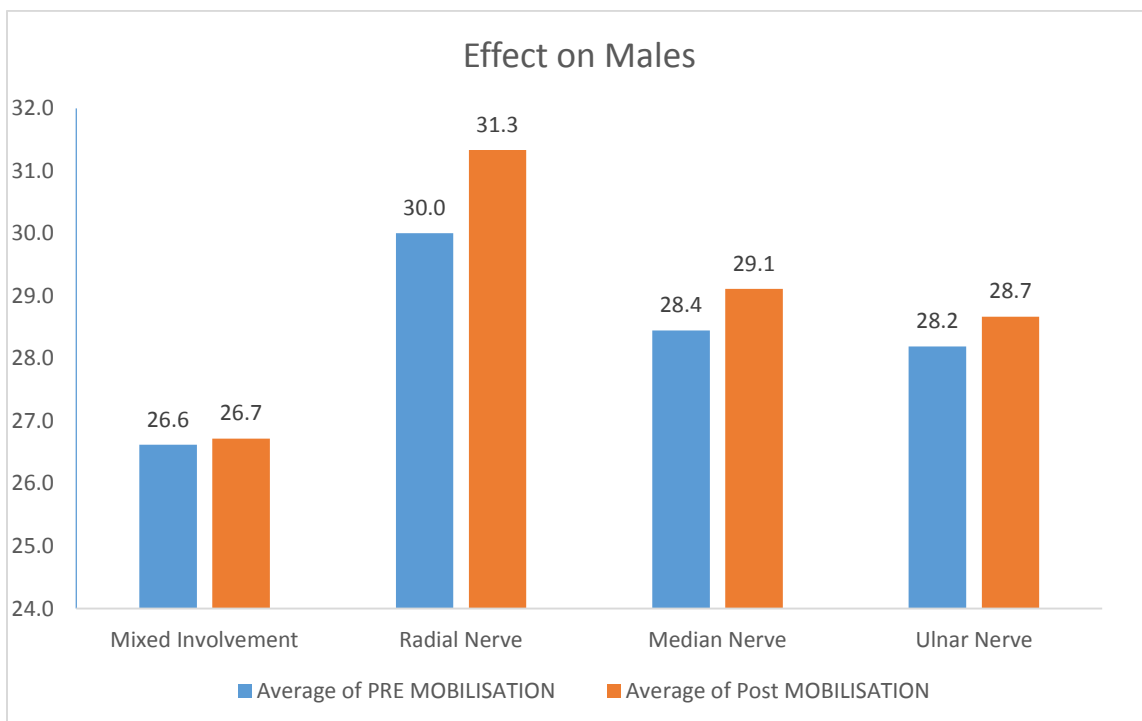
**Table 1 shows difference in the mean values before and after mobilization, their p values and statistical significance for single nerve involvement of median, radial, ulnar and mixed involvement respectively.**

<b>For Female Group</b>			
<b>Test Groups</b>	<b>Average of PRE MOBILISATION</b>	<b>Average of Post MOBILISATION</b>	<b>Mean Difference</b>
Mixed Involvement	19.0	19.3	0.3
Radial Nerve	16.2	16.5	0.3
Median Nerve	17.9	18.5	0.7
Ulnar Nerve	20.7	20.3	-0.3



#### For Male Group

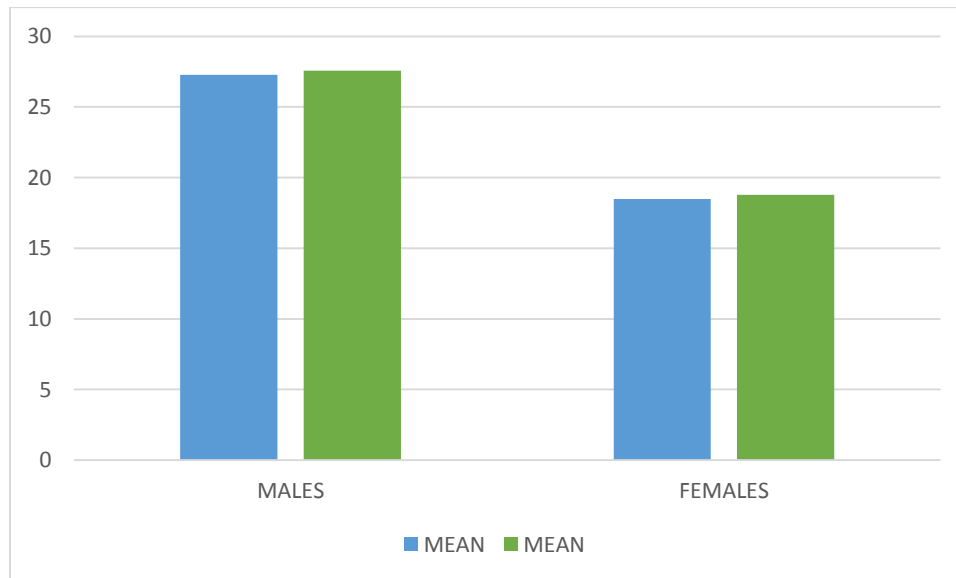
Test Groups	Average of PRE MOBILISATION	Average of Post MOBILISATION	Mean Difference
Mixed Involvement	26.6	26.7	0.1
Radial Nerve	30.0	31.3	1.3
Median Nerve	28.4	29.1	0.7
Ulnar Nerve	28.2	28.7	0.5



- Reading 1 (Median Nerve) shows extremely significant difference in the grip strength post mobilization with a two tailed p value of 0.0001
- Reading 2 (Radial Nerve) shows no quite significant difference in the grip strength with two tailed p value of 0.09
- Reading 3 (Ulnar Nerve) shows no significant difference in the grip strength post mobilization with a two tailed p value of 0.76
- Reading 4 (Mixed Involvement) shows no significant difference in grip strength post mobilization with a two tailed p value of 0.1

**Table 2 shows difference in mean values before and after mobilization, p values and their statistical significance for males and females seperately**

MEAN					
	PRE	POST	DIFFERENCE	p VALUE	SIGNIFICANCE
MALES (63)	27.28	27.57	0.29	0.0096	VERY SIGNIFICANT
FEMALES (37)	18.49	18.77	0.28	0.0332	SIGNIFICANT



The above graph shows that there is a very significant increase in grip strength in males and a significant increase in grip strength after mobilization in females as well with p values of 0.0096 and 0.0032 respectively.

## DISCUSSION

- The present study was an experimental study including 37 females and 63 males in the age group of 40 and 60 years, done to find out the effect of neural tissue mobilization on grip strength, with mobilization given to the involved nerve/nerves. Measurements of grip strength were done according to the guidelines given by the ASHT.
- This study shows that there is a significant difference in the means of grip strength before and after mobilization in males and females.
- Also, this study shows that clinically there is a difference in the means of grip strength before and after mobilization of all the nerves while statistically, there is no significant difference in grip strength when only radial and only ulnar nerve are involved with p values of 0.09 and 0.76 respectively.
- There is a significant increase in grip strength in subjects with affected median nerve after mobilization, suggesting the adverse mechanical tension in median nerve is relieved by gliding of the nerve and the muscles supplied by median nerve i.e Flexor Digitorum Superficialis, Flexor Digitorum Profundus, Flexor Pollicis Longus,

Pronator Quadratus, Flexor Carpi Radialis, palmaris longus are affected by this adverse tension while gripping activities. This can also be due to the position adopted during grip testing, of the wrist extension and ulnar deviation and the respective muscles working for attaining the position, which are stabilized while the muscles of median nerve participate in active contraction. Thus giving a better grip strength in subjects.

- A similar study was conducted by Dr. Dabholkar Tejashree and Dr. Dabholkar Ajit in which a total of 60 subjects within 20-30 age group with single positive neural tissue tension test were included in the study. Subjects were randomly assigned into - median nerve, ulnar nerve & radial nerve bias groups, and were further divided into 2 groups. Patients were evaluated and assessment of grip strength was done. One group received stretching interventions by Butler's mobilization method and the other group received passive movements consisting movements that mimic neural mobilization treatment. Grip and pinch strength were immediately assessed after mobilization by using pinch meter and Jamar hand dynamometer. Data was analyzed and extremely significant improvement was seen in Pinch & Grip strength in all nerve groups. Statistically very significant difference was found in pinch strength with greater improvement in

median nerve while no significant difference was found for grip strength among 3 groups.

## CONCLUSION

Neural tissue mobilization techniques are effective in increasing the grip strength in males and females (Males > Females) with affected neural tissue tension. With only median nerve involvement, they are more effective than that when ulnar and radial nerve involvement. Hence, these techniques can be used for increasing the grip strength.

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