International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Impact Factor (2012): 3.358

The Effect of Nervous Tissue Mobilization on Pinch & Grip Strength

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Abstract: ***Background & Purpose of the Study:*** *hand is important sensory part our body. Nervous tissues need to be in optimum functional state for various hand functions. Nervous 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 varius hand functions is not studied .Thus this study aims at doing so. 1. Effect of nervous tissue mobilization on grip and pinch strength. 2. Effect of nerve specific mobilization on grip & pinch strength.* ***Methodology:*** *subjects with only 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.* ***Outcome measures:*** *pinch strength by using pinch meter, grip strength using Jamar hand dynamometer. 60 subjects were randomly assigned into three groups median nerve, ulnar nerve & radial nerve bias groups. All patients were evaluated for baseline data of the above mentioned outcome measure.* ***Results:*** *Data analyzed using paired 't' test .Extremely significant improvement seen in Pinch & Grip strength (p-<0.001) in all nerve groups. Repeated measure ANOVA (P-0.0036) has given statistically very significant difference in pinch strength with greater improvement in median nerve. Repeated measure ANOVA has not given significant difference for grip strength (p-0.7882) among 3 groups.* ***Conclusion:*** *Neural tissue mobilization is effective in improving pinch & grip strength.*

Keyword: grip, pinch strength, hand, neural mobilisation

1. Introduction

Grip & Pinch strength of upper extremity is required for functional activities. It is widely accepted that grip strength and pinch provides an objective index of the functional integrity of upper extremity. Literature is available, supporting correlation of pinch &grip strength with neurological functioning. Integrity of nervous tissue needed for maximum outcome of grip and pinch strength. Nervous tissue is a continuum. Its physical & Physiological integrity is needed for optimum functioning[1].Neural mobilization techniques developed by David Butler are effective interventions. These techniques can mobilize various nervous tissues of upper as well as lower extremity. Literature is available to support the influence of mobilization on sensory component1b.ulnar, median& radial are three major nerves of upper quadrant[1], which are long and have to cross various mechanical interfaces. In routine tasks, these structures have chance to get compromised as posture has significant influence on their extensibility. Hence this study aims at mobilization of these three longest nerves of upper quadrant in normal and look for its influence on distal component i.e Hand.

2. Material and Methodology

Institutional Ethics committee approval was taken .Total 60 subjects who were clinically asymptomatic between ages 20-30 years were selected. Subjects with previous history of neurological or musculoskeletal involvement, entrapment pathologies were excluded .subjects were randomly assign to sham control group and experimental group. Subjects involved in vigorous stretching or active strengthening schedule were not involved in the study. Baseline evaluation of pinch strength was done using pinch meter and grip strength was done using Hydraulic hand Dynamometer. Assessment of grip strength done according to guidelines given by American society of hand Therapists[2,3].subjects were evaluated for Ulnar ,Median and Radial nerve tension tests using tensioner technique of provocation test[4]. Subjects only with positive test are included in the study. Stretching of nervous tissue done using Butler's mobilization technique. Mobilization Participants in the sham NM group received a treatment consisting of manoeuvres that mimic the NM treatment but believed not to stress the neural tissues in the upper extremity. The sham NM consisted of passively positioning the participants in the following consecutive positions: (1) a neutral cervical spine (0° of lateral flexion), (2) 45° of shoulder abduction without scapula depression, and (3) 45° of shoulder external rotation combined with 45° of elbow flexion with forearm pronation. This was immediately followed by 10 cycles of passive wrist flexion/extension at a rate of approximately 6 seconds per cycle (3seconds into extension and 3 seconds into flexion upon moving.

From wrist flexion to extension, an initial sense of resistance was used as a sign to alternate directions. Following the 10th cycle, a static hold was maintained while in wrist flexion for 10 seconds. Neural mobilization was given for ulnar and radial nerve bias as per the literature19.. .similar mobilization for ulnar and radial component given as per the standard techniques. Frequency used is of 10-15repetations of involved components with grade III & IV. Reassessment of pinch and grip strength done immediately after mobilization.

3. Results& observation

Table 1: changes in grip &pinch strength in all nerve bias

M	edian		Ulnar		Radial	
	grip	pinch	grip	pinch	grip	pinch
pre	46.5	13.55	48	13.35	48.5	12.2
post	56.5	14.85	54.75	14	54.5	13
	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*	<0.001*

*statistically significant

Table 2: comparison of grip strength in all nerves

	Median	Ulnar	Radial
mean	56.5	54.75	57.5
SD	11.48	11.42	11.45
SEM	2.56	2.3	2.56
p	>0.10	>0.10	>0.10

Table 3: comparison of pinch strength in all three nerve bias

	median	ulnar	radial
mean	14.85	14	13
SD	1.95	1.58	0.97
SEM	0.48	0.35	0.21

Table 4: comparison of pinch strength in all three nerve bias

	Mean diff	Q value	P value
MedianVs Ulnar	0.85	2.34	>0.05
Median Vs Radial	1.85	5.1	<0.01*
Ulnar Vs Radial	1	2.76	>0.05

*statistically significant

Data analyzed using paired 't' test .Extremely significant improvement seen in Pinch & Grip strength (p-<0.001) in all nerve groups. Repeated measure ANOVA (P-0.0036) has given statistically very significant difference in pinch strength with greater improvement in median nerve .Repeated measure ANOVA has not given significant difference for grip strength (p-0.7882) among 3 groups

4. Discussion

Neural mobilization is advocated for treatment of neurodynamic dysfunction. To date, the primary justification for using neural mobilization has been based on a few clinical trials and primarily anecdotal evidence. Following a systematic review of the literature examining the therapeutic efficacy of neural mobilisation, 10 RCTs discussed in 11 studies were retrieved. A majority of these studies concluded a positive therapeutic benefit from using neural mobilization. However, in consideration of their methodological quality, qualitative analysis of these studies revealed that there is only limited evidence to support the use of neural mobilization.[5]

Pinch and grip strength depends on various factors including muscle strength and neuromuscular co-ordination. Normal extensibility and elasticity of nervous tissue is an important component. Butler mobilization is an effective technique.

A nerve when passing close to a joint is usually contained in a tunnel or attached with collagen fibres or fascia to the surrounding musculoskeletal components. Nerves run along a longitudinal axis in the upper limb thus mobilisation given during treatment cause breaking of the cross linkages. The nerves move towards the joint that is moving. The larger the amplitude of movements at a joint, more of the sliding phenomenon of the nerve occurs at the joint. Thus, large amplitude movements maintain the mobility of the joint as well as a nerve.

Nervous tissue mobilization helps to re-established the dynamic equilibrium of neural tissue and normalize the physiological function[6] .Vesicle clustering increases in responses to applied stretch. (Scott siechen et al.PNAS 2009)[7]. F- Actin polymerization (Scott Siechen et al. PNAS 2009)is seen with stretch. One possible effect of stretch on axons is the enhanced ion flux through stretch sensitive ion channels (GlogauerM,etal.J of cell sci 1997-98). In particular, ca2+ influx can trigger increased Actin polymerization, force generation, regulation and downstream signalling cascades, as well as mediate vesicle localization under the membrane from which they are released. Mechanical stimulation using low frequency, low intensity ultrasound has been shown to excite neurons in mouse brain by activating voltage gated sodium and calcium channels. Slow elongation cause structural changes in the form of -Modifications in Myelin sheath, Axon regeneration, Deposition of Endoneurial Collagen (Hara Y et al.ExpNeurol 2003).The nodes of ranvier open further as do the Schmidt-Lanterman clefts which affects the levels of local cytoplasm(Butler 1991 Mobilisation of nervous system Churchill Livinstone).

Mechanical Stimulation (Tyler WJ,etal.PLOS ONE 2008) using low frequency ,low intensity ultrasound has been shown to excite neurons in mouse brain by activating voltage gated sodium & calcium channels.
Muscle stretch thus might enhance the release of neurotransmitters either by elevating internal calcium concentrations or by increasing the sensitivity of transmitter release to calcium in the nerve terminal.(BM Chen and Grinnell SCIENCE 1995). Non neural component-During a neural tissue mobilization there is a stretch of the muscular component, which leads to an increase in the initial length of the muscles and hence there is a better contraction. (Frank Starling's Law- The force of contraction is proportional to the initial length)

Neurophysiological effect of spinal manipulations have been previously reported in the literature20Studies indicate that mobilization of nervous tissue increases peripheral blood flow, implying a physiological shift toward parasympathetic dominance (Kornberg).improved neurological properties is indicative of improved grip, pinch strength. Improvement obtained in pinch strength of median nerve group .in our study assessment of pinch strength done using thumb and lateral two digits which are mainly supplied by median nerve.This study gives insight of effect of optimum neural mobility on functioning of peripheral extremity .Hence for improving hand function, neural mobilisation can be considered as treatment option.which could be applicable for various pathologies.

Conflict of interest-None

Funding –Nil

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