Original Article

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Effectiveness of Cervicothoracic Mobilisation on Grip Strength in Subjects with Impingement Syndrome

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Abstract

Aim and Objective: Shoulder joint is the most common joint to be effected by the degenerative process of the body. As it offers more mobility than stability, overuse injuries not only affect the shoulder joint but also exert their effect to distal segments of the limb. Due to the anatomical linkage with the spine, any abnormality at the shoulder is thereby suspected to affect the spinal biomechanics and the associated nervous system functioning. Researchers have postulated hand muscle weakness to be an associated finding in subjects with shoulder joint pathologies and thus the following study was aimed at determining the effectiveness cervicothoracic mobilization and hand grip exercise on grip strength in subjects with impingement syndrome. **Method:** 20 subjects with history of impingement syndrome for at least 4 weeks and positive Neers and Hawkins Kennedy test were randomly assigned into two groups of 10 subjects each. Group A underwent cervicothoracic mobilization and group B received hand grip strengthening protocol for 1 month, thrice a week and once a day. Readings for grip strength were taken by a hand held dynamometer before starting and after the intervention i.e. after one month. **Data Analysis:** Statistics were performed using Graph pad. Intra group and inter group analysis was done and Mann Whitney test was used to analyze and compare the intervention scores. Significance level was set at p d" 0.05. **Results:** Though both the groups improved significantly, group A, cervicothoracic mobilization group resulted in more significant hand grip strength improvement when compared with group B, the hand grip exercise group. **Discussion and Conclusion:** results conclude that apart from the standard hand grip exercises, cervicothoracic mobilization can be effectively used to enhance the grip strength in subjects with impingement syndrome.

Keywords: Cervicothoracic junction; Hand grip; Supraspinatus tendinitis; Impingement syndrome.

Introduction

Neck pain and shoulder pain are one of the most controversial topics in medicine. The disorder involving both physical and psychological disturbances remains a poorly understood and challenging clinical entity. Generalized shoulder pain and neck pain are common problems that are difficult to treat and are frequently recurrent. Researchers have shown that long-term shoulder pain can lead to a considerable restriction of work and leisure activities.[1]

Rotator cuff tear, periarthritis, bursitis and impingement syndromes are few of the most commonly occurring shoulder pathologies and being one of the most vulnerable joints to be affected by the degenerative and overuse injuries, rotator cuff tendinitis or supraspinatus tendonitis at the shoulder has been estimated to be the cause of shoulder pain in about 7% to 25% of the general population with an incidence at 10 per 1,000 per year, peaking at 25 per 1,000 per year among those 42 to 46 years of age.[2]

Impingement syndrome refers to a pathological condition in which there is irritation and inflammation of the supraspinatus tendon secondary to abrasion against the under surface of the anterior one

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third of the acromion. It is commonly seen in overhead athletes.[3]

Sobel *et al* (1997) found that restricted mobility in the cervicothoracic spine in patients with shoulder pain did not seem to recover significantly even after 26 weeks. In another study it was found that the reduced relative mobility at levels C7-T1 and T1-T2 significantly predicted neck-shoulder pain and the symptomatic weakness in the hands and it was estimated that 14% of neck-shoulder pain and 15% of weakness in the hands was due to reduced mobility.[4]

Cervical spine manipulation and rib raising techniques have been widely used to treat the hand muscle weakness but due to the risk involved in the cervical spine manipulation and difficulty in mastering the technique by general population, investigators suggested the use of cervicothoracic spine mobilization as an intervention in management of patients with shoulder pain. Therefore the following was done to determine the effectiveness of cervicothoracic spine mobilization on grip strength and to compare its effectiveness with the hand grip exercises.

Methodology

All the subjects were divided randomly into two groups A and B on the basis of inclusion and exclusion criteria. Each group have 10 subjects and their consent was taken after complete explanation of the procedure and its outcomes. Initial readings of grip strength were recorded by a hand held jamar dynamometer at the same time.

To record the grip strength the subject was seated in a chair with forearm supported and the upper limb positioned according to the recommendations of the American Hand Society of Hand Therapists *i.e.* shoulder adducted and neutrally rotated, elbow 90° flexed, forearm in neutral position, and wrist slightly extended (0-30°).

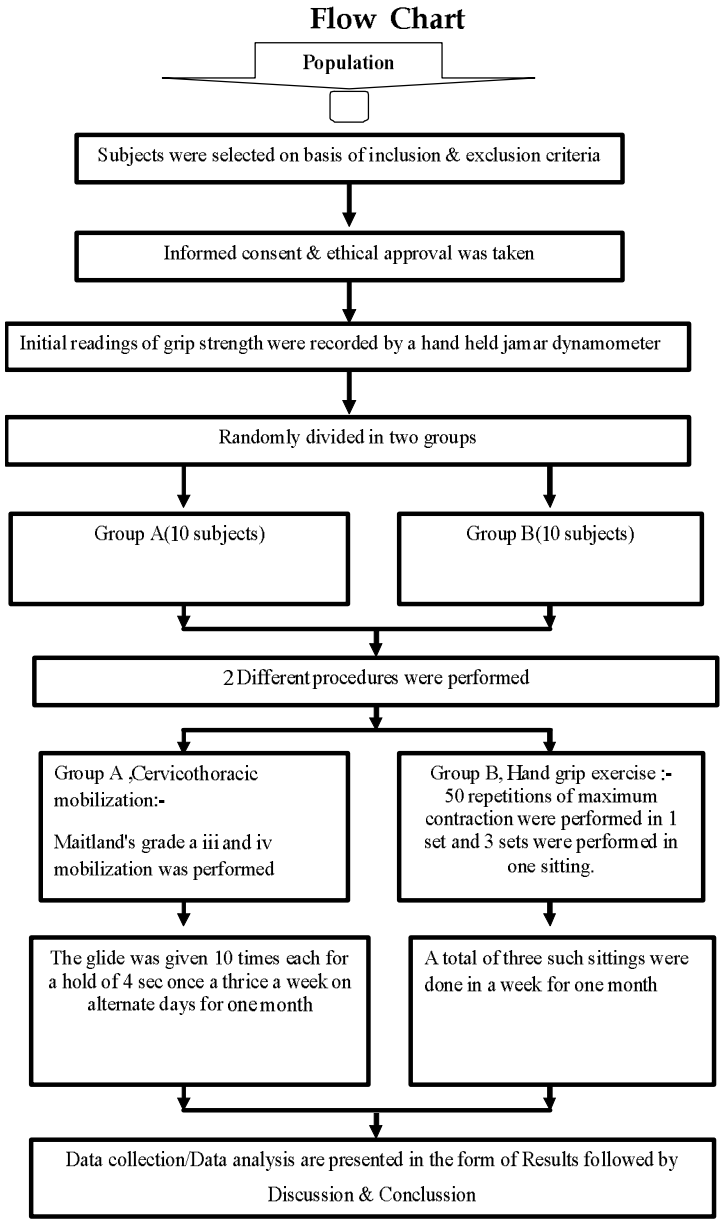
The subject was told to squeeze the handles of the dynamometer together with as much force as possible and make a total of three attempts in the above mentioned position, thereafter the mean of these readings was recorded in kgs. To control for fatigue, the subject was asked to take a rest period of 30 sec between each attempt.

The subject of group A *i.e.* cervicothoracic mobilisation group was made to lie prone on a couch with hands under the forehead and region of cervical and upper thoracic spine exposed. Next C5, C6, C7, T1, spinous processes were palpated. The palpation was done in a cranio caudal direction, with the therapist standing at the head end and first palpating the occipital protuberance, dip of C2 and further removing the slack, palpating the spinous processes and descending down. The shoulder and elbow of the therapist was aligned 90° to the subjects spine. The spinous processes were palpated using the thumb of the therapist and were marked with a permanent marker.

Next, Maitland's grade a iii and iv mobilization was performed (under the supervision of the guide) in postero- anterior direction 10 times each for a hold of 4 sec once a thrice a week on alternate days for 1 month. Subsequently lateral glide of grade iii and iv (on the day, spinous process) was given opposite to the affected side with subjects lying in prone, hands by the side and therapist standing on the affected side with arms perpendicular to the level of the spine of the subject that is to be mobilised. The glide was given 10 times each for a hold of 4 sec once a thrice a week on alternate days for 1 month.[5]

Data collection

The mean reading for hand grip was taken at the end of four weeks by a hand held



hydraulic Jamar dynamometer.

For group B *i.e.* hand grip exercise group, subject was asked to follow the following hand grip strengthening protocol with a hand grip exerciser. 50 repetitions of maximum contraction were performed in 1 set and 3 sets were performed in one sitting. A total of three such sittings were done in a week for one month.

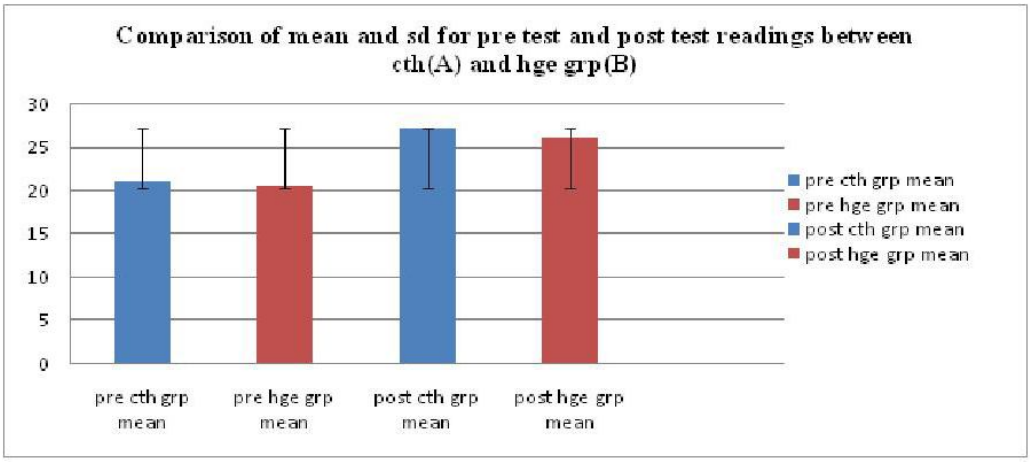
To use the exerciser, subjects were seated in a chair with forearm supported and shoulder adducted, elbow 90° flexed, wrist 20° in extension and 5° ulnar deviation and, were instructed to squeeze the springs together.

The fingers should be squeezed as tightly as possible, to get the greatest possible benefit. The subjects were made to exercise with only three springs for the first week, four springs for the second week, five springs for the third week and six springs for the fourth week. The mean readings for grip strength were taken after four weeks by a hand held jamar dynamometer. At the end of one month, pre test and post test hand grip strength scores obtained were used for the data analysis.[6]

Table 1

Variables	Pre treatment Mean ± St. Deviation	Post treatment Mean±St. deviation	Between Group p value
Cervicothoracic mobilization(A)	21.06 ± 0.56	28.32 ± 1.37	= 0.05
Hand grip exercise(B)	20.46 ± 1.33	26.06 ± 0.97	
Within Group p value	= 0.05	= 0.05	

Fig 1: Comparison of mean and standard deviation for pre test and post test readings for cervicothoracic and hand grip exercise group



Data analysis

Statistics were performed using Graph pad. Intra group and inter group analysis was done and Mann Whitney test was used to analyze and compare the intervention scores. Significance level was set at p d" 0.05.

Results

Table1:Comparison of mean, standard deviation, and p value for pre treatment and post treatment values of cervicothoracic mobilization group (group A) and hand grip exerciser group (group B).

Discussion

The present study was done on 20 individuals, divided into 2 groups of 10 subjects each according to the inclusion criteria. The end result was formulated on the basis of changes in grip strength values measured by a hand dynamometer in the two groups i.e Group A and Group B.

Most impotent finding of this study reveals that both the gost roups were found to be significantly improved in hand grip scores however, groupA (cervicothoracic mobilization group) improved more significantly than group B (hand grip exercise group).

The possible explanation for improvement in group A *i.e*. cervicothoracic mobilization group can be attributed to the reversal of the abnormal anatomical, physiological or biomechanical dynamics of the contiguous vertebrae that adversely affect function of the nervous system. According to Pickar biomechanical changes caused by spinal mobilization are thought to have physiological consequences by means of their effects on the inflow of sensory information to the central nervous system. Muscle spindle afferents and Golgi tendon organ afferents get stimulated which can lead to increased muscle recruitment and thereby increased muscle strength.[7]

As the rotator cuff is innervated by nerves arising from the mid and lower cervical spine, it is theorized that dysfunction of the spinal

joints adversely affects nerve endings, causing inhibition of nerve function and affecting the rotator cuff. This is congruent with research which describes how there could be a decrease in muscular activity due to interference with the nerve supply of a muscle by means of a spinal joint fixation. In light of this, one could hypothesize that removal of a cervical joint dysfunction by manipulation, could increase motor unit recruitment and muscular activity of the muscles supplied by that cervical level and therefore possibly strengthen the muscles involved. This supports the improvement in strength of gripping muscles after the mobilization of C5-T1 cervical spines because the forearm and hand muscles are mainly supplied by the C5- C8 cervical segments.[8]

The improvement in group B *i.e.* hand grip exercise group can be attributed to the neural and muscular adaptations taking place in the contractile structure of the muscle. Although it takes 8 weeks for full strengthening to take place but neural adaptations have been shown to take place in initial 2 weeks of the strengthening program followed by the muscular adaptations. (Richard Lieber Skeletal muscle structure, function and plasticity).[9]

The reason for a more significant improvement in group A *i.e.* cervicothoracic mobilization group over group B *i.e.* hand grip exercise group can be due to the direct concentration of the muscle inhibiting mechanism at the spinal level rather than its peripheral component. The correction of the hypo mobility or the biomechanical alterations in the cervical and thoracic spine caused by the impingement syndrome at the shoulder might be responsible for the increased mobility of the originating nerve roots from the specific spinal levels, thereby increasing the nerve conduction velocity and further improving the muscle unit recruitment of the hand gripping muscles.[10,11]

More significant effects of mobilization can also be explained with the support of studies inferring the physiological and biomechanical changes brought by manipulation of the spinal segments. In a literature review on updates on manipulation and exercise by Malik in 2009 it is stated that from a purely logical perspective, it makes sense that spinal manipulation will add a substantial benefit to exercise. Manipulation by improving range of motion, overcoming abnormal restrictive barriers, increasing and normalizing mechanoreceptive input from articular and periarticular structures, and restoring normal motor programs may allow a joint to derive more benefit from exercise training while minimizing the risk of injury. The study also proposes that spinal manipulation is a superior treatment over the exercises alone but best results are seen when both are used as a synergistic treatment.[12,13]

Clinical relevance

Although hand grip strengthening exercises are known to increase the grip strength, the effectiveness of an intervention concentrating on the spinal control of the grip strength was questionable. The following study demonstrated the effectiveness of cervicothoracic mobilization in increasing the hand grip strength in impingement syndrome subjects and so should be included in the therapy regimen.

Future research & Limitations

The study was done on a small sample size. Mobility of the specific spinal segments was not checked before administering the mobilization and resistance of the springs used in hand grip exerciser was not evaluated.Future research is necessary with a comparatively large sample size to determine the carryover of the improvement after the treatment session terminates. The influence of age, sex and dominance on hand grip strength may also be evaluated along with specific grip style testing. The variation in grip strength after each week of intervention can also be recorded for further evaluation.

Conflict of interest & Ethical approval

There was no conflict of interest was reported among all authors. This research

work is approved by ethical committee of HIPMS, HIHT University (UK) India.

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