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EFFICACY OF THORACIC JOINT UNILATERAL VERTEBRAL PRESSURE AS ADJUNCT TO CENTRAL VERTEBRAL PRESSURE ON MIDDLE AND LOWER TRAPEZIUS MUSCLE STRENGTH. A RANDOMIZED CONTROLLED TRIAL.

Physiotherapy

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ABSTRACT

INTRODUCTION: A joint must have normal mobility in order for its corresponding muscles to work efficiently. Weakness of lower trapezius is common clinical finding. Manual therapy has a potential to achieve reflexogenic changes in muscle and enhance the motor activity and strength.
PURPOSE OF THE STUDY: To find out the efficacy of thoracic joint unilateral vertebral pressure on middle and lower trapezius muscle strength.
STUDY DESIGN: A Randomized Controlled Trial.
METHOD: Hundred normal male individuals were included in the sample. The subjects were randomly assigned into two groups. Experimental (EX) group n=50 received Postero-anterior unilateral vertebral pressure along with Postero-anterior central vertebral pressure. Control (CON) group n=50 received Postero-anterior central vertebral pressure.
RESULTS: The mean difference of pre and post of middle and lower trapezius mobilization pressure biofeedback unit was significant < 0.0001 and < 0.0001 in EX and CON group respectively.
The mean value and standard deviation (SD) of middle trapezius mobilization PBU value between EX and CON group was non-significant, post treatment value was 34.54+9.57 and 34.82+9.16 respectively.
The mean value and standard deviation (SD) of lower trapezius mobilization PBU value between EX and CON group was non-significant, post-treatment value was 37.04+10.47 and 36.60+9.91 respectively.
CONCLUSION: The study concluded that both postero-anterior central vertebral pressure and Postero-anterior central vertebral pressure along with postero-anterior unilateral vertebral pressure were effective in increasing strength of middle and lower trapezius. But when compared between experimental (EX) group and control (CON) group there was no difference in strength of middle and lower trapezius muscle. Adding of postero-anterior unilateral vertebral pressure did not gave additional benefit in increasing muscle strength.

KEYWORDS

Pressure Biofeedback Unit (PBU), Arthrokinetic Reflex (AKR), Postero-Anterior Unilateral Pressure (APUP)

INTRODUCTION

A joint must have normal mobility in order for its corresponding muscles to work efficiently.[1] Spinal mobility helps to support the weight of head and trunk, it allows movement of head and trunk, it protect the spinal cord, which transmits the signal all over the nerves to exit each part of the body and provide sites for muscles attachment[2]. Thoracic mobility helps to breathe more deeply, longer more related muscles in spine allows for more movement with the breathe, its lengthen and straighten the thoracic spine and also enable shoulder to roll back without swaying the low back.[3] The upper trapezius does not appear to have a line of action for being a substantive upward rotator in healthy persons, the lower trapezius assists in producing scapulothoracic upward rotation.[4]

Weakness of lower trapezius is common clinical finding. This is associated with upper cross syndrome commonly seen with poor posture. As described by Janda, this pattern is associated with flattened cervical spine, forward head, protracted and elevated shoulder and increase kyphosis, limitation in thoracic extension secondary to localize prolong flexion, leads to muscle tightness and adaptive shortening to the anterior longitudinal ligament and facet capsules.[1]

Further evidence indicates that the lower trapezius acts as a stabilizer at the scapulothoracic joint. Training the activation and strength of selective muscle parts is the most common clinical approach in the management of musculoskeletal disorders. Depending on different stages of rehabilitation various exercise might improve scapular muscle performance because of their preferential trapezius muscle activation.[4] Posterior-Anterior Unilateral Pressure achieve faster pain relief in unilateral neck pain patients.[5]

According to Hurley, a muscle cannot attain its full function unless inhibition is removed. The arthrokinetic reflex (AKR) is responsible for joints reflexogenic effects as it links the central nervous system to skeletal muscles. The muscles within the midback and surrounding scapular region control stability for entire upper kinetic chain i.e. neck, shoulder and elbow. This muscles provide a strong base of support for all movements of the shoulder and arm. They also play direct role in stability of neck and cervical spine without strong base of support condition includes like neck pain, shoulder pain, shoulder impingement, middle and lateral epicondylitis may persist.[5] The scapular muscles plays an important role in upper limb musculoskeletal dysfunction especially trapezius, rhomboids and serratus anterior. Among these major stability is provided by the trapezius muscle.

The trapezius muscle divided into three upper, middle and lower fibers. Middle and lower fibers of trapezius supports in scapular stability. Lack of activity in this muscle group can be directly related to injuries like shoulder pain or shoulder impingement.[4] According Lin et al[22] subjects with various types of shoulder dysfunction found decrease serratus anterior activity and increased upper trapezius activity without change in lower trapezius when compared to normal.[7]

Further evidence indicates that the lower trapezius acts as a stabilizer at the scapulothoracic joint. Training the activation and strength of selective muscle parts is the most common clinical approach in the management of musculoskeletal disorders. Depending on different stages of rehabilitation various exercise might improve scapular muscle performance because of their preferential trapezius muscle activation.[4] Michael Cibula et al concluded that a Manual muscle testing (MMT) assess the whole trapezius in its role as an upward scapular rotator was found to reliable and valid.[8]

The complex scapular motion is controlled by many scapular muscles, which were previously defined as a force couple muscles. Force couple muscles create coordinated and synchronized rotational scapular movements. The three dimensional scapular kinematic properties occur as a result of a balanced force production of upper, middle and lower trapezius muscles as well as serratus anterior. At the same time, this proper scapular orientation enables proper function and optimal performance of the shoulder complex during sports or occupation related activities may researchers have suggested that weakness in one or more scapular muscles may reveal muscular imbalance and altered scapular kinematics. In addition, scapular muscle imbalance has been suggested as a contributing factor to shoulder pain.[9]

Some researcher suggested that by providing visual feedback, the prone test increases motivation to exercise.[10] A Pressure Biofeedback training was more favourable outcome in reducing pain and muscle activation.[11]

According to Carol Oatis, weakness of the middle and lower trapezius results in a significant decrease in strength of scapular adduction. Isolated weakness of middle and lower trapezius is unusual, although

some author suggest that it can occur from prolonged stretch of the muscle as might occur in a posture characterized by scapular abduction. Loss of middle trapezius strength also presents difficulties when contracting the scapulohumeral muscle. Isolated weakness of lower trapezius has been suggested to be the consequences of prolonged stretch resulting from an elevated and downwardly rotated scapular weakness of the lower trapezius may lead to difficulty in stabilizing the scapula during contraction of the other upward rotation.[12]

A study conducted by SI EUN Park et investigated the effect of central and unilateral posteroanterior mobilization on cervical lordosis, muscle stiffness and ROM in patients with ankylosing spondylitis and concluded that central and unilateral PA mobilization was effective in increasing cervical lordosis and range of motion and decreasing muscle stiffness in patients with ankylosing spondylitis.[13] while some researchers demonstrated that significant increase in gluteus maximus in response to PA mobilization performed on asymptomatic thoracic vertebrae.[14] Thoracic mobilization and manipulation was effective in chronic lower back pain.[15] Manual therapy increased the mobility of thoracic spine.[16]

Cervicothoracic mobilization was used to ensure the grip strength in patients with impingement syndrome.[17]

It has been hypothesized that compensation through increased activation of the upper combined with decreased activation and control of the lower trapezius or middle trapezius or serratus anterior contribute to abnormal scapular motion with this in mind many current rehabilitation program which only focus on strengthening these muscles as a whole may be adequate for creating proper scapulohumeral rhythm.[18]

Weakness of muscle as depicted by Janda is due to altered motor regulation from the afferent impulses relayed from tissue surrounding dysfunction joint. This pseudo is decrease in strength which occurs when CNS regulation limits the firing of a muscle. Improvements in strength may be regain through mobilization of restricted joint, thus removing of inhibitory reflexes. The middle and lower trapezius reinforce the thoracic spine extensors, weakness of these fibers of the trapezius increases the tendency towards a kyphosis.[19]

Early strength training a possibility to improve outcomes of clinical importance, given the result of the pre-protocol analysis.[20] According to Lynn Colby, there are various types of resistance exercises static (isometric), dynamic, concentric, eccentric, isokinetic, open-chain and closed-chain exercises as well as manual, mechanical, constant and variable resistance exercise .[21-22] Nicholas manual tester and Magnuson et al, shown that the Nicholas dynamometer has excellent intraday reliability and has shown highly reliable results between trials and days[1]. According to Rucha Choudhari (2012). The stabilizer pressure biofeedback unit was used to assess the strength of upper, middle and lower trapezius which gives valuable information to ensure quality and precision in exercise performance and muscle testing.[23]

Though the research has been proved central pressure improves lower trapezius muscle strength, the purpose of this duty was to find out the effectiveness of unilateral vertebral pressure along with central pressure on middle and lower trapezius muscle strength.

2. METHODS

2.1 Study design

A Randomized Controlled Trial was used to find out the effectiveness of thoracic joint unilateral vertebral pressure as adjunct to central vertebral pressure on middle and lower trapezius muscle strength.

This study was conducted at the Mahatma Gandhi Mission's (MGM's) Hospital Center, Physiotherapy Department (OPD) Aurangabad. Male individuals who were asymptomatic were recruited. Study procedure was initiated after the approval of MGM's Ethics Committee for research on human subjects (MGM-ECRHS/2017/06). Consent was taken in written before the commencement of the protocol.

2.2 Participants and recruitment

The subjects included were 16 to 30 years of asymptomatic male individuals. Students who were easily available and who were willing to participate were invited and the eligibility criterion was evaluated accordingly. Convenient randomized sampling was used to randomly assign them into two groups by the principal investigator who administered the mobilization. The allocation was concealed with an open list of random numbers. The subjects were randomly assigned to one of the two groups.

2.3 Blinding

The subjects were blinded to what intervention they were going to receive.

2.4 Sample size calculation

Sample Size Justification

One study found that prevalence of vertebral pressure was 26.3%. So for this study p=0.263.

Thus the number of patients required for this study was 100.03~ 100 with power 87%.

The formula used for sample size calculation was as follows:-

$n = 4pq / (L^2)$

Where, n= required sample size,
p= 0.263 (as per the study by Groeneveld A et al),
q = 1 – p,
L = Loss % (Loss of information)

Calculation:

Here p= 0.263,
q=1-p = 1-0.263 =0.737,
4pq = 4 x 0.263 x 0.737 = 0.7753
$L^2 = 0.00775$
L= 0.0879
Loss of information percentage = 8.79%
$n = 4pq / (L^2) = 0.7753/0.00775 = 100.03 = 100$

Study group:

100 patients were taken and divided in two groups
1) Experimental (EX) group n=50 subjects
2) Control (CON) group n=50 subjects

2.5 Procedure

The objective of study was established and the permission for research was obtained from the Ethical Committee for Research on Human subjects, MGM Medical College Aurangabad.

The individuals were explained about purpose and nature of study. Informed consent was taken from the subjects before their inclusion in the study. The individuals were allocated to experimental group (EX) and control (CON) group. EX group were given P-A central vertebral pressure along with unilateral pressure and CON group were given P-A central vertebral pressure.

Before and after mobilization strength of middle and lower trapezius was checked by using pressure biofeedback.

2.6 Outcome measure

Pressure Biofeedback unit was used to assess the strength of middle and lower trapezius muscle. Pre-values were noted before the commencement and post-values were noted immediately following it by measuring the amount of force required by the examiner to overcome the participants maximum effort in sequential manner. The maximum force reading was recorded and two trials were taken within 30 second interval between.[23]

2.6.1 Instrumentation

Pressure biofeedback unit (PBU) (Chattanooga Group, Inc, Hixson, TN) consisting of a nonelastic 3-chambered latex pneumatic bag (16.7 × 24cm), a catheter and a manometer gauge ranging from 0 to 200 mmHg with an accuracy of ±3 mm Hg and a stopwatch.[24]

2.6.2 Practice session

The subjects were explained about the Mobilization, Manual muscle testing and Stabilizer pressure biofeedback unit. Strength of middle and lower trapezius muscle by using Stabilizer pressure biofeedback unit was demonstrated before the subjects to help them understand what mistakes they might make and practice session was held to clear all the doubts and queries. [23]

2.6.3 Preparation

The subjects were positioned in prone line with shoulder 90 degree and 110 degree for middle and lower trapezius respectively. A towel roll was placed under the forehead. Then the cuff of pressure biofeedback was kept on dorsal aspect of distal forearm and force was applied by the examiner in downward direction, towards the floor, until the participants maximum effort was overcome.[23]

2.6.4 Testing procedure

Strength of middle and lower trapezius was assessed by using Stabilizer Pressure Biofeedback Unit, by measuring the amount of force required by the examiner to overcome the participants' maximum efforts in sequential manner. Strength of Middle and Lower Trapezius was assessed in standard positions as described by Kendall. Participants were given instructions about the test procedure and positioned in prone, with upper extremity diagonally overhead, in the line of fibers of Lower Trapezius Strength and the upper extremity in 90-degree abducted position for middle and lower trapezius the participants were positioned in sitting with the upper extremity relaxed. A towel role was placed under the head to maintain the cervical spine in neutral position. To avoid the compensation during the test, manual fixation was provided by placing the hand just inferior to opposite scapula. The participants were then instructed to maintain this position while the examiner provided resistance. Then the cuff of pressure biofeedback was kept on dorsal aspect of distal forearm and force was applied by the examiner in downward direction, towards the floor, until the participants maximum effort was overcome. This procedure was done to assess strength of Middle and Lower Trapezius. The maximum force reading was recorded and two trials were taken within 30 sec interval between.[23]

Figure no. 1. Procedure for measuring strength of middle trapezius muscle by using PBU.

Figure no.2. Procedure for measuring strength of lower trapezius muscle by using PBU.

2.7 Interventions

The mobilization was performed taking consideration the pressure changes and the local variations according to methods described by Maitland et. al. EX group received unilateral pressure along with central vertebral pressure and CON group received central vertebral pressure. Central and Unilateral vertebral pressure was implemented from first thoracic vertebra till 12 thoracic vertebra. The therapist who administered mobilization was certified manual therapist and was supervised by cerified manual therapist staff in the Musculoskeletal OPD. The manual therapy table was adjusted according to therapist comfort.[25]

2.7.1 Postero-anterior central vertebral pressure

The subject was positioned in prone lying with his head turned to one side and arm lying by his side The therapist stood at the front side i.e towards the head of subject.

Upper thoracic spine (T1 to T5) was mobilized by placing pads of the thumbs on the spinoud process, pointing transversely across the vertebral column, and the fingers of each hand was spread out over the posterior chest wall to give stability to the thumbs.

Mid-thoracic spine (T5 to T9) was mobilized by investigator from subjects side placing thumbs longitudinally along the vertebral column so that they were pointing to each other. The fingers were spread over the posterior chest wall, to each side of the vertebral column above and below the thumbs.

Lower thoracic spine (T10-T12) was mobilized by investigator using the anteromedial aspect of the fifth metacarpal and there was no direct contact between the pisiform and spinous process for the sake of comfort from the subjects side according to shape of subjects chest.[25]

2.7.2 Postero-anterior unilateral vertebral pressure

The subject was positioned in prone lying with his head turned to left side and his arms was hanging loosely by his side. The thoracic spine (T1 to T12) was mobilized by placing hands on subjects back so that the pad of the thumb was pointing towards each other. The finger of left hand was spread over the chest wall was pointing towads subjects head, while the finger of right hand was was pointing towards his feet and the thumbs were held in opposition. The little pressure was applied through the pads of the thumbs.[25]

2.7.3 Mobilization

The mobilization was carried out by an oscillating pressure on the spinous processes, which was produced by by the body and transmitted through the arms to the thumbs.

The pressure was applied by the body weight over the hands and not by squeezing action with the thumbs.[25]

Figure no.3. P-A Central Vertebral Pressure.

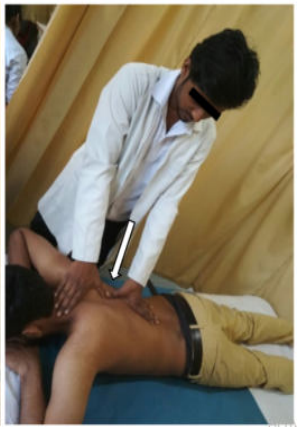

Figure no. 4. P-A Unilateral Vertebral Pressure.

2.8. Stastical Analysis

The data was represented in the form of mean, standard deviation (SD). Both these data was represented on visual such as a bar diagram.

For intra-comparison within group (pre and post values), paired t-test was performed and for inter-comparison between group (post-values) unpaired t-test was performed.

3. RESULTS

3. 1. Participants flow and recruitment

Subjective information

There were two groups Experimental (EX) group (n=50)-central vertebral pressure and unilateral pressure and Control (CON) group (n=50) PA- central vertebral pressure.

The mean age for experimental group was 21.94 with a SD of 2.51 and for control group was 21.08 with a SD of 3.05 (table.1)

Paired t-test

Comparison of mean difference of Pre and Post Pressure biofeedback unit (PBU) value was done by using paired t-test.

A) Middle trapezius

1) The mean difference of Pre and Post (middle trapezius) Pressure Biofeedback Unit (PBU) was 11.12 for EX group.
2) The mean difference of Pre and Post (middle trapezius) Pressure Biofeedback Unit (PBU) was 10.22 for CON group.

B) Lower trapezius

1) The mean difference of Pre and Post (lower trapezius) Pressure Biofeedback Unit (PBU) was 11.36 for EX group.
2) The mean difference of Pre and Post (lower trapezius) Pressure Biofeedback Unit (PBU) was 11.20 for CON group.

Unpaired t-test

A) Middle trapezius

1) Mean value and SD of middle trapezius mobilization PBU value between EX and CON group post-treatment values are 34.52+9.57 and 34.82+9.16

B) Lower trapezius

1) Mean value and SD of middle trapezius mobilization PBU value between EX and CON group post-treatment values are 37.04+10.47 and 36.60+9.91 respectively.

3.2 Activation Score (AS)

The most significant activation for the middle and lower trapezius

occurred at 90º and 125º for Glenohumeral Abduction.[28]

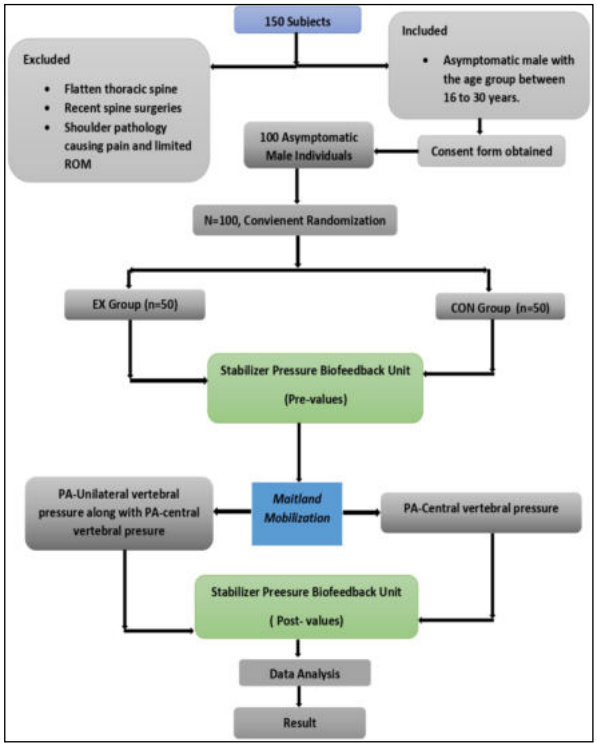

Figure no.5. CONSORT Flow Diagram Of Participants Enrollment, Allocation, Follow-up & Analysis.

Table no.1. Comparison of Mean Age in experimental (EX) and control (CON) group

	Mean±SD	t-value	p-value
EX Group	21.94±2.51	1.58	P=0.128 NS
CON Group	21.08±3.05		

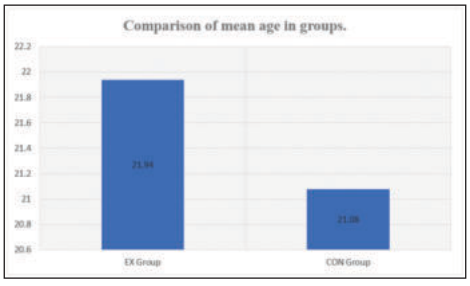

Figure no.6. *Changes of Mean Age in EX and CON group.*

Table no.2. Comparison of Mean Difference in pre and post of Middle Trapezius Mobilization Pressure Biofeedback Unit (PBU) Value in Groups.

	Mean Difference	t-value	p-value
Pre EX Group Vs Post EX Group	11.12	14.22	P<0.0001 S
Pre CON Group Vs Post CON Group	10.22	14.37	P<0.0001 S

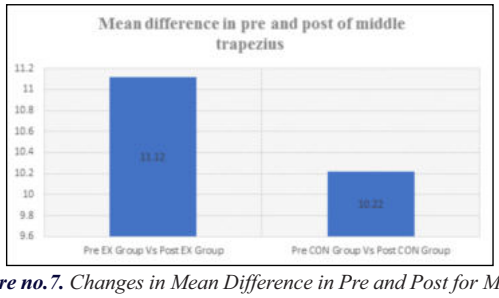

Figure no.7. *Changes in Mean Difference in Pre and Post for Middle Trapezius Mobilization PBU values in EX and CON group (mm Hg).*

Table no.3. Comparison of Mean Difference in pre and post of Lower Trapezius Mobilization Pressure Biofeedback Unit (PBU) Value in Groups.

	Mean Difference	t-value	p-value
Pre EX Group Vs Post EX Group	11.36	13.20	P<0.0001 S
Pre CON Group Vs Post CON Group	11.20	13.65	P<0.0001 S

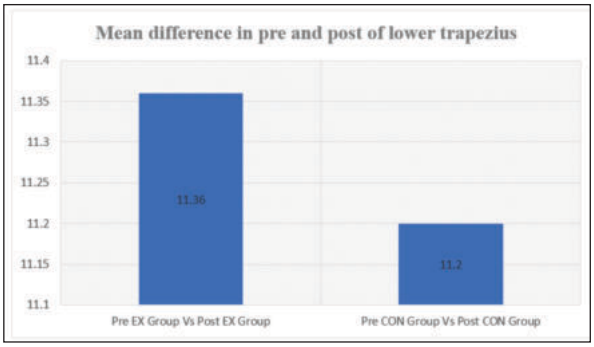

Figure no. 8. *Changes in Mean Difference in Pre and Post for lower Trapezius Mobilization PBU values in EX and CON group (mm Hg).*

Table no.4. Comparison of Mean between experimental (EX) and control (CON) group for post values in middle trapezius.

Particulars	Mean±SD		t-value	p-value
Post	EX Group	34.52±9.57	0.150	P=0.881 NS
	CON Group	34.82±9.16		

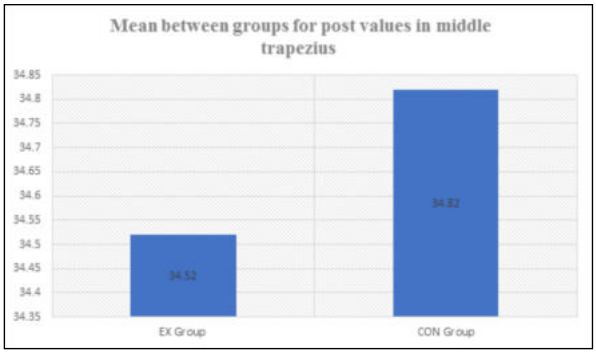

Figure no.9. Changes in Mean between Group A and Group B for post values in middle trapezius (mm Hg).

Table no.5. Comparison of Mean between experimental (EX) and control (CON) group for post values in lower trapezius.

Particular	Mean±SD	t-value		p-value
Post	EX Group	37.04±10.47	0.150	P=0.881 NS
	CON Group	36.60±9.91		

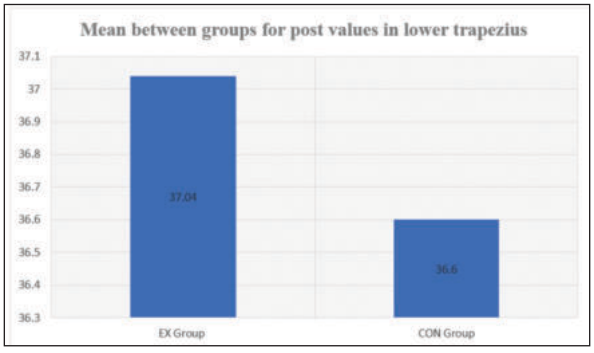

Figure no.10. Changes in Mean between EX and CON group for post values in lower trapezius (mm Hg)

4. DISCUSSION

The study was done to compare the effectiveness of thoracic joint unilateral vertebral pressure as adjunct to central vertebral pressure on

middle and lower trapezius muscle strength. While analyzing the outcome variable of this study it was observed that in both the Groups there was significant improvement in middle trapezius muscle strength.

Based on middle and lower trapezius strength which was measured through Pressure biofeedback value, we found effectiveness of each treatment technique individually.

This is in agreement with previous study done by Ethan John Lieber et al, significant increase in lower trapezius strength testing in response to Grade-IV mobilization performed on asymptomatic thoracic vertebrae T6 to T12.

According to Kristof De Mey et al (2012), The upper trapezius and lower trapezius play different roles around the scapula during dynamic activities. The upper trapezius does not appear to have line of action for being a substantive upward rotation. The lower trapezius acts as a stabilizer at the scapulothoracic joint. Scapular muscle exercise characterized by high lower trapezius and upper trapezius muscle activation are of interest in the rehabilitation of patients with secondary impingement. Training the activation and strength of selective muscle parts in the most common clinical approach in the management of musculoskeletal disorder. Rowing and scapular retraction exercise have been found to enhance scapular muscle performance because of their preferential trapezius muscle activation.[4]

Central vertebral pressure

The group received central vertebral pressure showed significant improvement in middle and lower trapezius muscle strength. Three dimensional scapular kinematics was recorded and concluded that isometrics strength of the upper trapezius muscle affects upward scapular rotation and posterior tilt in asymptomatic shoulder. Therefore, trapezius muscle strength should be assessed and posterior weakness should be addressed in shoulder rehabilitation programs.[23]

The research says that scapulothoracic muscle dysfunction has examined individuals with shoulder pathologies such as impingement, rotator cuff insufficiency and shoulder instability such research has focused on scapulothoracic muscle imbalances which disrupts normal scapular positioning, resulting in impaired biomechanics. For impaired biomechanics upper trapezius, middle trapezius and lower trapezius are the muscles majorly affected and due to muscle imbalances altered kinetics is seen. Bronfort G studied on the efficacy of spinal manipulation and mobilization for low back pain and neck pain and suggest that spinal manipulative therapy or mobilization is effective in short term when compared with placebo and in long term when compared to physical therapy[26]. Rucha Choudhari et al, studied on the comparison of upper, middle and lower trapezius strength in individuals with unilateral neck pain and study supports that assessment and strengthening of upper, middle and lower trapezius is necessary in individuals with unilateral neck pain and demonstrated that no significant difference was found in upper trapezius strength while significant difference was found in middle and lower trapezius strength on the side to ipsilateral to pain and contralateral to pain [23]. Ethan John Lieber conducted study on the effect of thoracic spine mobilization on lower trapezius strength testing, increasing the extensibility of the joint tissues in this region cause an immediate decrease in mechanoreceptors associated inhibition of the lower trapezius muscle.[1] These findings indicate the need for therapist to assess patients weakness and correlate them with possible joint restrictions. This might be the cause of increasing muscle strength in middle and lower trapezius in our study.

Clinican can also use these findings in everyday practice to improve treatment plans by incorporating mobilization.[1] In our study the mobilization was given on asymptomatic vertebrae T1 to T12 and pre and post values were obtained and the result showed significant increase in middle and lower trapezius muscle strength. The grade III and IV mobilization causes plastic deformation of collagen in outermost layer, thereby restoring its normal length. Also evidence says that manual therapy group showed greater improvements than shoulder stabilization exercise in treating muscle dysfunction.

Unilateral Vertebral Pressure

In our study a group received central vertebral pressure along with unilateral pressure also showed significant improvement in middle and lower trapezius muscle strength. This is an agreement with Michael Ogbonnia Egwu et al, compared the relative efficacy of Posterior-Anterior Unilateral Pressure (PAUP), Anterior-Posterior Unilateral Pressure (APUP), Cervical Oscillatory Rotation (COR) and Transverse Oscillatory Pressure (TOP) technique of manual therapy in management of unilateral cervical spondylosis and concluded that APUP and PAUP achieve faster pain relief in more patients with unilateral cervical spondylosis than rotation and transverse pressure should be preferred technique of manual therapy for patients with unilateral neck pain and APUP promise a better outcome. Maitland and Nwuga suggests this technique for unilaterally distributed symptoms of cervical origin. The outcome measures in this study were pain recovery pattern, total TT needed for each technique and rate of relapse within three months post treatment. The result show that not only was significantly less time spent in the use of pressure technique (APUP and PAUP), but significantly more patients were pain-free with use of these technique when compared to COR and TOP. According to result the choice of technique should be APUP and PAUP techniques. Oscillatory pressure techniques of spinal mobilization therapy are known to have both neurophysiologic and mechanical effects. Paris pointed out that mobilization technique stretches tissues by taking them into area of plastic deformation of the stress-strain curve.[27]

This might be the reason for increasing muscle strength in middle and lower trapezius in our study. The joint capsule receptors, type-IV, exert a reflexive effect on muscle tone. Afferent nerve fibers of these receptors project to motor neurons within CNS, thereby contributing to the continuous modulation of activity flowing of muscle spindle. When a stretch reflex on a joint capsule is initiated, the mechanoreceptors exert reciprocally coordinated reflexogenic influences on muscle tone and excitability of stretch reflexes in striated muscles. This reflex inhibits muscles from recruiting the maximal number of motor units and protects the body from overstressing restricted joint structures.[1] Previous researchers have proposed the the arthrokinetic reflex may act through the down regulation on inhibitory inputs on motor unit activity. According to Janda, the altered motor regulation due to afferent inputs from the tissues surrounding a dysfunctional joint may be responsible for muscle weakness. The term functional weakness or "arthrogenous weakness" may be used in the sense and are defined as inhibition of muscle activity by anterior horn cells secondary to joint dysfunction. The increase in muscle strength is theorised to occur when the motor regulation system limits the full firing of a muscle. Based on this theory mobilization of a restricted or dysfunctional joint may improve muscle strength by removing the inhibitory reflexes. As a result, removal of inhibition caused by the arthrokinetic reflex has been proposed as the mechanism responsible for enhanced muscle strength thus by emanating from joint mechanoreceptors.[1]

The result of our study showed that joint mobilization improved muscle strength so may be useful adjunct to the exercise therapy.

Ethan John Liebers et al, study provides evidence to suggest that use of manual therapy to improve muscle strength may be applicable to other synovial joints of the body as well. The study has some limitations. Short term effect of the intervention was studied and as well as no conditioned cases were taken. For the further studies it is recommended that the patients with clinical impairments be compared to an asystomatic.

4.1 Mechanism of action

A joint must have normal mobility in order of its corresponding muscles to work efficiently, muscle cannot attain its full function unless inhibition is removed. The arthrokintic reflex (AKR) is response for these effects as it links central nervous system to skeletal muscles. The regulators of this reflex are the articular mechanoreceptors located within synovial joint capsules. Joint mobilization has been known to return physiologic and accessory motions to hypomobile structures.

As with typical diarthrodial joints, dense, irregular connective tissue comprises the outermost layer of facet capsules. This layer becomes thickened and immediate in joints that have a capsular pattern of hypomobility. Mobilization will cause plastic deformation of collagen in the outermost capsular layer, thereby restoring its normal length.

Weakness of muscle is due to altered motor regulation from afferent impulse relayed from surrounding tissues a dysfunctional joint. This "pseudoparesis" is a decrease in strength, which occurs when the CNS

regulation limits full firing of a muscle. Improvement in strength may be regained through mobilization of restricted joints, thus removing inhibitory reflexes.[1]

4.2 Limitations

Only single session of mobilization technique was given in asymptomatic males with less sample size.

4.3 Future scope

This manual therapy technique can be given in neck pain patients to reduce pain and improve muscle strength. The male individuals can be compared with females for the lonf term effect and duration of the reflexogenic effects can be studied.

4.4 Clinical Significance

Clinicans can utilize these findings to improve the strength of middle and lower trapezius muscle. A Stabilizer Presure Biofeedback unit was used to assess the strength of trapezius muscle because it gives the quantitative information about muscular efforts and reduces manual errors.

5. CONCLUSION

The study concluded that both central vertebral pressure and central vertebral pressure along with unilateral pressure were effective in increasing strength of middle and lower trapezius. But when compared between experimental (EX) and control (CON) group there was no significant difference in middle and lower trapezius muscle strength. Adding of unilateral pressure did not gave additional benefit in increasing muscle strength.

Conflict of Interest

The authors have no conflicts of interest to declare.

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Legal Registration

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