Effect of Muscle Energy Technique on Strength and Range of Motion in Young Swimmers with Sick Scapula Syndrome: A Pre-Post Clinical Trial

Ganesh B.R.[1], Pratiksha Patil[2], Anjela Rodrigues[3]

[1]HOD of CVTS Physiotherapy,[2]Bachelors of Physiotherapy, [3]Bachelors of Physiotherapy, KAHER Institute of Physiotherapy, Belagavi, Karnataka, India

Abstract

Background: There are various overhead injuries which mainly affect the shoulder complex in swimmers and one among them is sick scapula syndrome which results in muscular imbalance in such athletes. The abbreviation SICK stands for Scapular malposition, Inferior medial border prominence, Coracoid pain and malposition, Dyskinesia.

Method: In this study 26 subjects with sick scapula syndrome were taken into the study by evaluating through the lateral scapular slide test (LSST), the subjects affected were given muscle energy technique to increase the strength of the scapular muscles the technique was given for 45-60 seconds thrice in a week for three weeks and all the subjects were immediately assessed using MMT.

Results: The t and p value of Pre and Post ROM scale of Extension was 11.523 and 0.001. The t and p value of Pre and Post ROM scale of Internal rotation was 10.490 and 0.001. The t and p value of Pre and Post ROM scale of external rotation was 12.569 and 0.001 which is statistically significant.

The t and p value of Pre and Post MMT scale of serratus anterior was 1.995 and 0.050. The t and p value of Pre and Post MMT scale of Pectoralis Minor was 5.000 and 0.001. The t and p value of Pre and Post MMT scale of Latissimus dorsi was 2.440 and 0.022. The t and p value of Pre and Post MMT scale of Trapezius was 6.325 and 0.001 which is statistically significant.

Conclusion: The present study results demonstrate that of Muscle energy techniques effective in increasing the range of motion and strength in young swimmers within the age group of 8 to 15 years with sick scapular syndrome.

Keywords: *Scapular dyskinesia, Scapular mal-position, Scapular abnormalities.*

Introduction

The shoulder complex is comprised of sternoclavicular joint, glenohumeral joint, scapular and scapulothoracic joint. The scapula is a triangular flat bone that lies on posterolateral aspect of thorax overlying 2nd and 7th ribs stabilizing scapula onto the chest wall by muscle attachments to spinous process and ribs.[1]

There are various overhead injuries which mainly affect the shoulder complex in swimmers and one among them is sick scapula syndrome which results in muscular imbalance in such athletes. Overhead injuries are progressive in nature and therefore could be prevented by strengthening of weak muscles, it is of most importance to prevent and increase the strength and maintain the efficient sports performance. The shoulder complex is of utmost importance in the kinetic chain and

Corresponding Author:
Dr. Ganesh B.R.
HOD of CVTS Physiotherapy, KAHER Institute of Physiotherapy, Belagavi, Karnataka, India
e-mail: drganeshnssofficer@gmail.com

therefore if any component of kinetic chain is affected then performance is also affected.[2]

Muscle energy technique (MET) has been proven effective in increasing the range of motion (ROM) and posture of the upper extremities, the cervical, the thoracic and the lumbar spine in asymptomatic individuals and symptomatic individuals Apart from the usual techniques,muscle energy technique (MET) can be possibly given by altering muscle length at the start, effort of the client or therapist, duration of the contraction, pulsed or single contraction, number of repetitions of the contraction, position change with each repetition, client breathing and eyeball movements in direction of the force.[4]

Scapular dyskinesis can also be classified as: Type 1 or inferior angle prominence, which is associated with excessive anterior tilt; Type 2 or medial border prominence, which is associated with excessive scapular internal rotation; and Type 3 or superior border prominence, which is associated with elevated scapula.[8]

During the clinical examination, clinicians observe the asymmetry in shoulder and scapular posture, such as muscle atrophy, bony contour, excessive scapular winging, inferior angle prominence and presence of a scar.1–6 Postural asymmetries found during the clinical examination may be related to abnormalities.

Alterations inter scapular muscle activation are related to scapular dyskinesis. Serratus anterior activation and strength is decreased in patients with impingement and shoulder pain, contributing to the loss of posterior tilt and upward rotation causing dyskinesis. In addition, the upper trapezius/lower trapezius force couple may be altered, with delayed onset of activation in the lower trapezius, which alters scapular upward rotation and posterior tilt.[13]

Altered scapular motion or position both decrease linear measures of the subacromial space, increase impingement symptoms, decrease rotator cuff strength, increase strain on the anterior glenohumeral ligaments and increase the risk of internal impingement radiculopathy. These protocols have been unable to demonstrate the asymmetry in healthy groups or those with abnormalities.

Hypertrophy of anterior shoulder muscles is often experienced by professional swimmers due to excessive shoulder revolutions. Forward head posture and protracted shoulders are also seen due to tightness of pectoralis minor muscle among professional female swimmers which results in shoulder pain. Therefore, the forward pull on the shoulders and the muscle imbalance lead to increased anterior tilt, internal rotation and downward rotation of the scapula. This, in turn, causes excessive scapular protraction. In many swimmers, it may further give rise to shoulder injuries namely subacromial impingement syndrome, thoracic outlet syndrome, glenohumeral instability.

Muscle energy technique (MET) has been proven effective in increasing the range of motion (ROM) and posture of the upper extremities, the cervical, the thoracic and the lumbar spine in asymptomatic individuals and symptomatic individuals.

Apart from the usual techniques,muscle energy technique (MET) can be possibly given by altering muscle length at the start, effort of the client or therapist, duration of the contraction, pulsed or single contraction, number of repetitions of the contraction, position change with each repetition, client breathing and eyeball movements in direction of the force.

Material and Methodology

Materials Used:

- Consent form
- Data collection sheet
- Pen
- Marker

Apparatus Used:

- Baseline inclinometer (Biotech)
- Goniometer
- Measuring tape
- Marker.

Source of data: Subjects will be recruited from the swimming training center in and around Belagavi, Karnataka, India.

Method of data collection: The present study was conducted on 26 participants,the source of data was taken from the near by swimming centers in and around Belagavi and the study type was a pre-post clinical trial. Subjects were informed about the aims and procedure of the study and a written consent was provided to

them before the intervention and ethical clearance was obtained from the institutional ethical committee. After the subjects were screened for the inclusion and the exclusion criteria, the subjects were given the intervention of muscle energy technique for three weeks for three consecutive months for a time period of 45-60 seconds for each particular muscle which was to be treated.

The strength and range of motion was assesed pre and post after every intervention and the particular record was maintained and it was found that after every intervention the strength was increased, the strength increment and decrement was assessed thorough manual muscle testing(MMT) and the range of motion increment and decrement was assessed using a goniometer and a baseline inclinometer .

Procedure: To perform the muscle energy technique, the subjects were supine positioned for the intervention with the affected side of the patient out of the couch so that it is not in contact with the couch . The therapist will be at the affected side of the patient, the affected arm will be moved into horizontal abduction where the limitation for the range of motion will be felt, that particular angle will be taken as the affected range there in that particular range stretch-contract technique will be conducted foe three seconds in the particular muscles affected and the subject will be asked to take it to the new range, contraction will be performed isometrically. The sequence will be repeated with the arm in horizontally abducted and taken to a new range through stretch contract technique.

Four cycles will be conducted for 45-60 seconds thrice in a week for three consecutive months.

Discussion

According to a study which was done in 2011, evaluated the effects of muscle energy technique in improving Range of motion and he hypothesized that the effects are mainly due to two distinct physiological processes, which are of PIR/RI in which PIR of agonist contraction and RI of antagonist's contraction. They stated that when an isometric contraction is sustained, neurological feedback through the spinal cord to the muscle itself results in PIR. But during IR, the reduction in tone relies on the physiological inhibiting effect on antagonist. this study provides a strong base to our results which show improvement in Shoulder ROM and Increase in muscle strength with p value 0.001.[5]

According to a study done by Gary Fryer MET may influence pain mechanism and promote hypoalgesia. The specific mechanisms are not known, but may involve central and peripheral modulatory mechanisms, such as activation of muscle and joint receptors that involve centrally mediated pathways, like the periaqueductal grey (PAG) in the midbrain, or non-opioid serotonergic and noradrenergic descending inhibitory pathway. Additionally, MET may increase fluid drainage and augment hypoalgesia. He concluded that MET application may reduce pro-inflammatory cytokines and desensitize peripheral nociceptors.[6]

A study was conducted to determine if an MET provides improvements in resting pectoralis minor length (PML), forward scapular position and scapular upward rotation in female collegiate swimmers. total of 40 National Collegiate Athletic women's swimmers from the same swim team volunteered for this study, they were divided into 2 groups. The experimental group received 2 treatment sessions per week for 6 weeks and control group received no intervention during this 6-week period. A total of 4 cycles of MET were continuously applied per treatment session twice per week for 6 weeks. The results indicated that 6 weeks of MET treatments applied to the pectoralis minor of asymptomatic female swimmers provided improvements in PML and forward scapular position compared with a control group with a p value ($p>0.001$) supporting results of our study which shows similar improvement in Pectoralis strength and overall increase in shoulder range of motion.[7]

A study was done to analyses effect of latissimus dorsi and pectoralis minor stretching and shoulder strengthening with an elastic band in subjects with rounded shoulder posture. the groups performed exercises for 40 mins 3 times a week. The results showed that strengthening showed improvement in the strength of latissimus dorsi and pectoralis minor. In our study also MET showed improvement in the MMT of latissimus dorsi and pectoralis minor which was graded using MMT.

A study was done to check effect of exercise at light loads with manipulative resistance on trapezius and deltoid muscle activities in shoulder joint elevation and it showed that exercise helps in improving the strength of deltoid and trapezius. Our study showed improvement in MMT grading of trapezius muscle after 3 weeks of intervention.

A study was done in which muscle energy technique was given on improving Glenohumeral Internal Rotation Deficit and functional outcomes in overhead athletes. 40 patients who had Glenohumeral internal rotation deficit. Group A (n = 20) had received muscle energy technique. Group B (n = 20) underwent stretching program. Both muscle energy technique and the stretching program were found to be significantly effective in increase Glenohumeral internal range of motion and also reduce the disability and improve functional outcomes. In the experimental group the SPADI was reduced which was statistically significant (p value 0.001) the IROM was improved which was statistically significant (p value 0.005) similarly in our study Internal rotation was increased by giving MET with a p value of 0.001.[9]

A clinical trail was done in which elastic resistance bands were used in strengthening of scapular muscles like infraspinatus, supraspinatus and serratus anterior in subjects with frozen shoulder and found that there was an improvement in muscle strength after 1 week of strengthening .in our study there was improvement in serratus anterior, trapezius,pectoralis minor and latissimus dorsi after 3 weeks of MET .the improvement was may be because of realignment of muscle fibers after muscle contraction and relaxation.

A clinical trail studied the differences between the muscle weakness and shoulder Mobility in painful and pain free shoulder in swimmers. The results suggested that prevention and rehabilitation of shoulders in swimmers. Our study also showed reduction of shoulder extension, internal and external rotation which improved after 3 weeks of intervention of MET.[11]

Evidence has shown that MET was effective in reducing pain and improve functional activity and the effect was due to stimulation of joint proprioceptors, via the production of joint movement and the stretching of joint capsule, may be capable of reducing pain by inhibiting the smaller diameter nociceptive neuronal input at the spinal cord leads to alter the perception of pain which leads to decrease in disability . Thus the improvement in ROM and increase in strength of the muscles in our study may be because of the same physiology.[13]

We would recommend MET with other conservative physiotherapy management to patients with SICK scapula and other conditions affecting shoulder complex.

Results

The t and p value of Pre and Post ROM scale of Extension was 11.523 and 0.001. The t and p value of Pre and Post ROM scale of Internal rotation was 10.490 and 0.001. The t and p value of Pre and Post ROM scale of external rotation was 12.569 and 0.001 which is statistically significant.

The t and p value of Pre and Post MMT scale of serratus anterior was 1.995 and 0.050.. The t and p value of Pre and Post MMT scale of Pectoralis Minor was 5.000 and 0.001. The t and p value of Pre and Post MMT scale of Latissimus dorsi was 2.440 and 0.022. The t and p value of Pre and Post MMT scale of Trapezius was 6.325 and 0.001 which is statistically significant.

Descriptive statistical analysis for demographic variables:

Table 1

Particular	Minimum	Maximum	Mean	SD
Age	9.00	15.00	12.42	1.79
Height	130.00	149.00	141.23	4.87
Weight	30.00	50.00	42.23	5.01
BMI	14.27	28.15	21.37	2.49

Table 1 represents the maximum and minimum age, height, weight and BMI of the participants in the study along with the mean and the standard deviation of the same.

Table 2

Variable	Time Frame	Mean	SD	Mean Diff	SD Diff	z-value	p-value
FLEXN	Pre	180	00	NA	NA	NA	NA
	Post W3	180	00				
EXT	Pre	55.65	1.81	4.19	1.85	11.523	0.001*
	Post W3	59.84	0.61				
ABDUCTION	Pre	180	00	NA	NA	NA	NA
	Post W3	180	00				

Variable	Time Frame	Mean	SD	Mean Diff	SD Diff	z-value	p-value
ADDUCTION	Pre	180	00	NA	NA	NA	NA
	Post W3	180	00				
IR	Pre	66.30	1.34	3.65	1.41	13.189	0.001*
	Post W3	69.96	0.19				
ER	Pre	84.80	2.09	4.92	1.93	12.569	0.001*
	Post W3	89.73	1.04				

Table two represents the comparison of pre and post Shoulder ROM with respect to Mean, SD, t value and p value.

Conclusion

The present study results demonstrate that of Muscle energy technique is effective in increasing the range of motion and strength in young swimmers within 8 to 15 years of age with sick scapula.

Conflict of Intrest: None

Source of Funding: Self

Ethical Clearance: Ethical clearance was obtained from institutional ethical review board of KAHER Institute of physiotherapy.

References

1. Pagorek S. Functionally specific shoulder rehabilitation Athl Ther Today. 2006;22(2):43-45
2. Mazoue CG, Andews JR. Injuries to the shoulder in athletes. South Med J. 2004;97(8);748-754
3. Glockness SM. Shoulder pain: a diagnostic dilemma. Am Fam phys. 1995;51(7):1677-1687
4. Tzannes A, Murrell GAC. Clinician examination of the unstable shoulder. Sports Med. 2002:32(7):447-457.
5. Quillan DM, Wuchner M, Hatch RL Acute shoulder injuries. Am Fam phys. 2004;70(10):1947-1954
6. Moore KL, Agur AM. Essential clinical Anatomy 3rd ed. Philadelphia, PA: Lippincott Williams and wilkins,2007:402-442
7. Burkhart SS, Morgan CD, Kibler WB. The disabled throwing shoulder: Spectrum of pathology Part III: The SICK scapula, scapular dyskinesis, the kinetic chain and rehabilitation. Arthroscopy. 2003 Jul 1;19(6):641-61.
8. Preziosi Standoli J, Fratalocchi F, Candela V, Preziosi Standoli T, Giannicola G, Bonifazi M, Gumina S. Scapular Dyskinesis in Young, Asymptomatic Elite Swimmers. Orthopaedic journal of sports medicine. 2018 Jan 23;6(1):2325967117750814.