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Divya Sajjana Chary
Intern, P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Dr. Sanket Nagrale
Associate Professor, P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Dr. Sucheeta Golhar
(Principal), P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Corresponding Author:
Divya Sajjana Chary
Intern, P.E.S Modern College of Physiotherapy, Pune, Maharashtra, India

Immediate effects of muscle energy technique on pain and posterior shoulder tightness in badminton players: An experimental study

Divya Sajjana Chary, Dr. Sanket Nagrale and Dr. Sucheeta Golhar

Abstract

Study Design: Experimental study.
Objective: To see the efficacy of muscle energy technique on pain and posterior shoulder tightness of dominant arm in badminton players.
Background: Badminton is the second most sport played in India [13]. It is an individual non-contact sport played using a racket to hit a shuttlecock across a net. Measurable posterior shoulder tightness in dominant arm of badminton players along with associated internal rotation deficit present. Prevalence of shoulder pain on dominant side is 52%.
Method: Forty badminton players were selected, MET was given to shoulder horizontal abductors. Pain and Shoulder horizontal adduction and internal rotation ranges were noted pre and post MET. Data analysis was done using primer app and significant results were found (p<0.001).
Results: Paired t test was used to see the effectiveness. Pre and Post Mean values for shoulder horizontal adduction range using baseline bubble inclinometer is 115.8 ±5.523 and 128.9±1.317 respectively ('t' value obtained was-17.845 and p value was <0.0001, which is considered highly significant). Pre and Post Mean values for shoulder internal rotation range using Baseline Bubble Inclinometer are 77.82 ± 5.104 and 87.28± 3.856 respectively ('t' value obtained was-27.984 and p value was <0.0001, which is considered highly significant). Pre and Post Mean values for pain using Numerical pain rating scale (NPRS) scale are 3.375±1.48 and 0.925±0.9971 respectively ('t' value obtained was 17.133 and p value was <0.001, which is considered highly significant).
Conclusion: It concluded application of MET was effective immediately on reducing pain and posterior shoulder tightness in professional badminton players.

Keywords: Muscle energy technique, posterior shoulder tightness, badminton, baseline bubble inclinometer

1. Introduction

Badminton is the second most sport played in India [13]. It is an individual non-contact sport played using a racket to hit a shuttlecock across a net. There is 6% prevalence of shoulder injury [3]. Prevalence of shoulder pain on dominant side is 52%.

Posterior shoulder tightness is a common impairment implicated in etiology of shoulder pain. Posterior shoulder tightness is defined as limited glenohumeral horizontal adduction and internal rotation. Hypothesis states that substantial speeds and forces occurring at the posterior shoulder result in altered glenohumeral joint range of motion and posterior shoulder tightness in throwing athlete [4]. Phadke Shweta S Devare, Dixit Stuti, Yardi Sujata *et al* 2015 studied Assessment of Posterior Shoulder Tightness in Badminton and Lawn Tennis Players. 80 healthy badminton and lawn tennis players above age 18years. This study concluded measurable posterior shoulder tightness in dominant arm of both badminton and lawn tennis players along with associated internal rotation deficit.

Posterior shoulder tightness affects glenohumeral joint and associated with impaired mobility of posterior glenohumeral capsule, posterior inferior glenohumeral ligament, stiffness of infraspinatus, teres minor, and teres major, posterior deltoid musculature [4]. Eccentric resistive forces during deceleration phase of throwing places stress on posterior shoulder capsule and Rotator cuff musculature leading to posterior shoulder tightness.

Muscle energy techniques are a class of soft tissue osteopathic (originally), manipulation methods that incorporate precisely directed and controlled, patient initiated, isometric and/or isotonic contraction designed to improve musculoskeletal function and reduce pain. It is used to: lengthen a shortened, contracted muscle; strengthen physiologically weakened muscle; Reduce pain; Stretch tight fascia; Mobilize joint restrictions [9].

Post-isometric relaxation technique is a type of muscle energy technique in which the hypertonic muscle is taken, without force or bounce, to a length just short of pain, or at a point where resistance to movement is first noted. The patient gently contracts the affected muscle away from the barrier (i.e. the agonist is contracted) for between 5-10 seconds, while an effort is resisted with an exactly equal counterforce. After the effort the patient is asked to "let go" completely and only when this is achieved, the muscle is taken to a new barrier with all slack removed. Starting from this new barrier, the procedure is repeated two to three times [9].

Throwing appears as one of the main gestures which involves shoulder joint being present in many sports including badminton [10]. Throwing athletes in particular have predilection for Posterior shoulder tightness owing to repetitive micro trauma at the posterior capsule during follow through phase [6]. Thus, shoulder is vulnerable to injury. [1]. Posterior Shoulder Tightness is a common impairment implicated in the etiology of shoulder pain. Thus, the pain should be reduced [4]. Muscle energy technique provides wide range of uses and hence it can be used for getting immediate effects on pain and tightness [9].

As physiotherapist deals with such sports injury problem. Use of muscle energy technique to get immediate effects on pain and posterior shoulder tightness in badminton players would be beneficial.

2. Materials and Tools

1. Pen and paper
2. Consent form
3. Plinth
4. Velcro strap
5. Baseline Bubble Inclinometer: It is a gravity dependent goniometer. It has a fluid filled circular chamber containing an air bubble. It is used to measure the joint range of motion [8]. Interrater and Intrarater reliability is 0.92 [6].
6. Numerical Pain Rating Scale: It is a self-reported or clinician administered measurement tool consisting of a numerical point scale typically set up on a horizontal or vertical line ranges from 1-10 and can be administered in written or verbal form. Reliability ranging from 0.67-0.96 and validity ranging from 0.790.95 [12].

3. Methodology

3.1 Participants

Forty subjects including 23 Males and 17 Females between age group 18-30 years were included according to inclusion and exclusion criteria i.e. subjects playing badminton at professional level (playing more than or equal to 5 years) having pain and posterior shoulder tightness in dominant arm. All the subjects received MET for 3 repetitions.

Glenohumeral horizontal adduction and internal rotation range of motion and pain was noted as outcome measure before and after the application of MET.

3.2 Procedure

Measurement of Pain: All subjects were asked to rate their pain on the scale of 0-10 using NPRS. Pre and Post MET pain was noted using NPRS.

Measurement of Shoulder Horizontal Adduction: First the non-dominant arm ranges were taken and compared to dominant side range of motion.

Subjects were positioned side lying on the non-tested arm with non-tested extremity under their head to support a neutral position and tested side ½ the length of humerus from the edge of a plinth to allow clearance of forearm past the plinth during horizontal adduction. The trunk was positioned perpendicular to the plinth with hip and knee flexed to 45 degrees. Therapist standing at the level of subject's shoulder facing the subject.

Baseline bubble inclinometer anchored to mid-humerus with a Velcro strap and the bubble set to zero relative to the vertical plane. Therapist passively abducts the humerus to 90 degrees while maintaining 0 degrees of rotation at the humerus and approximately 90 degrees of elbow flexion with one hand and other hand manually placing the lateral scapular border in a fully adducted (retracted) position. This retracted postion was maintained throughout the measurement [7].

Prior to passively lowering the humerus, a verbal cue was given to relax the arm. The therapist then passively lowers the humerus into horizontal adduction towards the plinth in transverse plane maintaining neutral humeral rotation and scapular stabilization in retraction.

The movement is ceased once the therapist determined that the scapular or humerus was unable to be further stabilized and/or movement stopped. Once the end point is reached, the degrees were noted using bubble inclinometer.

Measurement of Shoulder Internal Rotation range of motion: First ranges were taken of the non-dominant arm and then dominant arm. Subject positioned in prone lying, with tested arm supported on plinth with 90 degrees of abduction, elbow flexed to 90 degrees and wrist in neutral. A towel roll placed under the arm to ensure neutral position of humerus in coronal plane without migration into the transverse plane and provide stabilization. Inclinometer was anchored to the mid forearm. Bubble set to 0 degrees. Therapist passively takes the arm back into internal rotation. Once the end point is reached, degrees were noted [7])

Application of Muscle Energy Technique (MET): Subjects were positioned supine on plinth. The therapist stabilized scapula at the lateral border and with the elbow flexed, subject's shoulder was horizontally adducted to the first barrier of motion.

The subject gently contracts the agonist away from the barrier for 10 seconds, while an effort is resisted with an equal counterforce. After the effort the patient is asked to" let go" completely and the muscle is taken to new barrier with all slack removed starting from the new barrier, the procedure is repeated 2 more times. Post MET pain and shoulder horizontal adduction and internal rotation ranges of dominant arm were noted using NPRS and inclinometer respectively [9].

3.3 Data Analysis

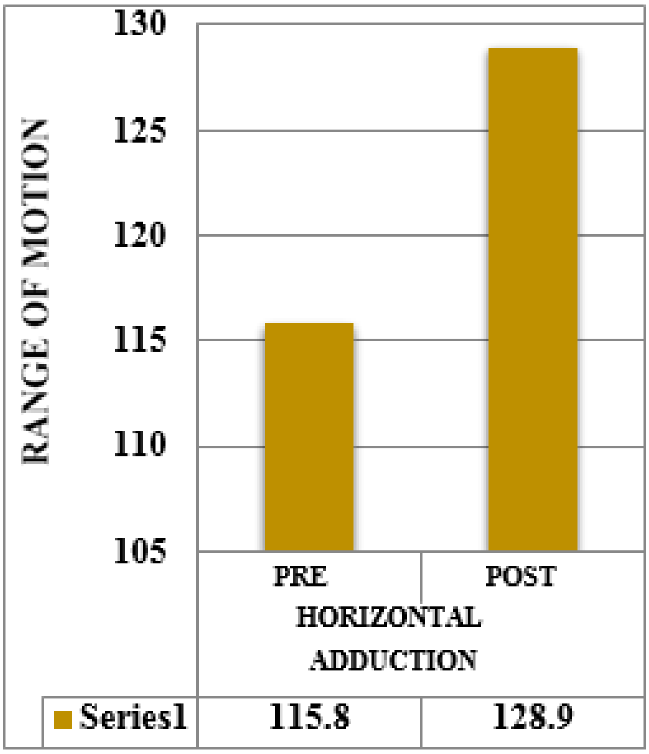
In this study 40 subjects were taken. Improvement in the shoulder horizontal adduction and internal rotation range of motion and reduction in pain were analysed using Baseline Bubble Inclinometer and NPRS respectively. The data was entered in excel spreadsheet and analyzed using Primer app. The data passed the normality test when the demographic data was analysed.

4. Result

- Paired t test was used to see the effectiveness.
- Pre and Post Mean values for Shoulder Horizontal Adduction range using baseline bubble inclinometer is 115.8±5.523 and 128.9±1.317 respectively ('t' value obtained was -17.845and p value was <0.0001 which is considered highly significant).
- Pre and Post Mean values for Shoulder Internal Rotation range using Baseline Bubble Inclinometer are 77.82±5.104 and 87.28±3.856 respectively('t' value obtained was-27.984 and p value was <0.0001 which is considered highly significant).
- Pre and Post Mean values for pain using NPRS scale are 3.375±1.48 and 0.925±0.9971 respectively ('t' value obtained was 17.133 and p value was <0.001 which is considered highly significant).

Table 1 and Graph 1: Shows the difference in pre and post MET shoulder horizontal adduction range of motion

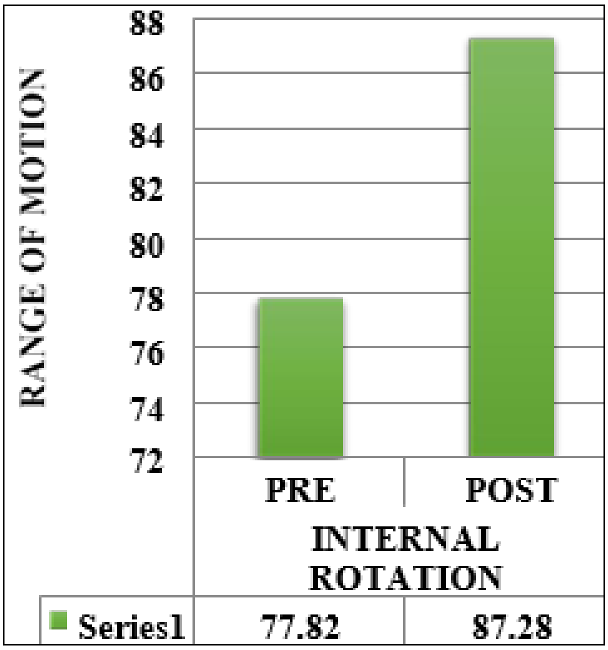
Shoulder horizontal adduction Rom	Pre-met	Post-met
Mean	115.8	128.9
SD	5.523	1.317
p value	*p*<0.0001 (considered extremely significant)	
t value	t = -17.845	



Graph 1

Table 2 and Graph 2: Shows the difference in pre and post MET shoulder internal rotation range of motion

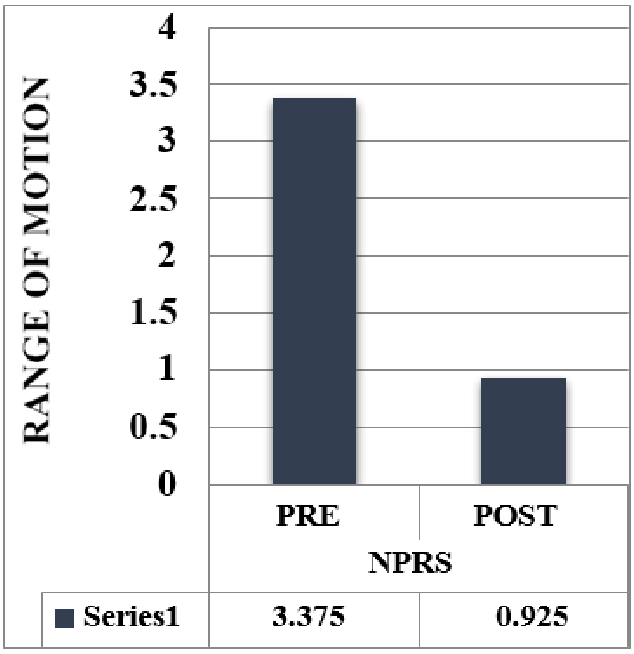
Shoulder internal rotation Rom	Pre-met	Post-met
Mean	77.82	87.28
SD	5.104	3.856
p value	*p*<0.0001 (considered extremely significant)	
t value	t = -27.984	



Graph 2

Table 3 and Graph 3: Shows the difference in pre and post MET shoulder pain

Pain (NPRS)	Pre-met	Post-met
Mean	3.375	0.925
SD	1.48	0.9971
p value	*p*<0.0001 (considered extremely significant)	
t value	t = 17.133	



Graph 3

5. Discussion

Past research has consistently demonstrated that throwing athletes in particular have predilection for Posterior shoulder tightness owing to repetitive micro trauma at the posterior capsule during follow through phase [6]. Posterior shoulder tightness in dominant arm of badminton player along with associated internal rotation deficit is present. Thus, shoulder is vulnerable to injury [1].

The aim of our study was to see the immediate effects of muscle energy technique on pain and posterior shoulder tightness in badminton players. We observed improvement of GHJ horizontal adduction and internal rotation range of motion following MET to GHJ horizontal abductors. Pre and Post Mean values for shoulder horizontal adduction range are 115.8±5.523 and 128.9±1.317 respectively ('t' value = -17.845; p value <0.001 which is highly significant); shoulder internal rotation range are 77.82 ±5.104 and 87.28±3.856 respectively ('t' value = -27.984; p value<0.0001 which is highly significant) Current study shows: significant improvement in flexibility of posterior shoulder.

Similiar study was done by Stephanie *et al.* in asymptomatic collegiate baseball players, aim of the study was to compare a muscle energy technique (MET) for the glenohumeral joint (GHJ) horizontal abductors and an MET for the GHJ external rotators to improve GHJ motion (ROM) in baseball players. This study concluded that a single application of an MET for the GHJ horizontal abductors provides immediate improvements in both GHJ horizontal adduction and internal rotation ROM in asymptomatic collegiate baseball players.

Our study showing similar finding, that improvement of GHJ horizontal adduction and internal rotation range of motion following MET to GHJ horizontal abductors. The probable mechanism by which it improves flexibility is Reflex Inhibition (which is the principle of POST-ISOMETRIC RELAXATION). The Golgi tendon organ (GTO) located between the muscle belly and its tendon senses increased tension when the muscle contracts or stretches. When muscle contracts, the GTO is activated and responds by inhibiting this contraction (REFLEX INHIBITION) and contracting the opposing (antagonist) muscle group. GTO response plays an important role in flexibility. When GTO inhibits agonist muscle contraction, it allows antagonist muscle to relax more readily and so, the muscles can be stretched further and easier. Also, Roberts indicated the effects of MET as decreased pain and increased range of motion, decreased muscle tension and spasm and increased strength. Another study by Greenman (1989) depicts that MET helps to regain the mobility of the hypomobile joints by restoring normal length tension relationships which are shortened. One of the experimental study also concluded that MET produced a change a ROM was possibly due to an increased tolerance to stretch, as there is no evidence of viscoelastic change (B. Chandradhar Reddy, Santosh Metgud, 2014) [2].

Posterior Shoulder Tightness is a common impairment implicated in the etiology of shoulder pain [4]. Our study results shows a significant reduction in pain. Pre and post Mean values using NPRS scale are 3.375±1.48 and 0.925±0.9971 respectively ('t' value obtained was 17.133; p value was <0.001 which is considered highly significant)

Karel lewitt (1999) states that there is close connection between Tension and Pain, and between Relaxation and Analgesia. Hence, as MET works on tension and relaxation component of these shoulder structures; this could be the probable mechanism for pain reduction. Lewitt also suggest, that trigger points and fibrositic changes in the muscle will often disappear after MET contraction methods.

Eccentric resistive forces during deceleration phase of throwing places stress on posterior capsule and posterior rotator cuff musculature leading to tightness. PST has been identified in literature as an impairment that is both predictive of and associated with shoulder disorders. To maintain optimal sports performance there has to be a delicate balance between shoulder mobility and stability. As shoulder injury is a career ending problem for professional badminton players. So, our study hypothesized at immediate reduction in pain and posterior shoulder tightness in badminton players

To minimize bias in the study, measurement of ROM and application of MET was applied by a single examiner. Finally, immediate effects of MET was observed to be effective on pain and PST. Future investigations should study the effects of MET over multiple session applications to further validate its use and examine the duration of increased flexibility following both single and multiple sessions of treatment with MET. Also, can compare results between different types of MET.

6. Conclusion

Muscle energy technique for badminton players with pain and posterior shoulder tightness is effective immediately in reducing pain and improving flexibility of posterior shoulder. It could be incorporated in daily routine.

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