Original Research Article

The Effectiveness of Muscle Energy Technique and Mobilization to Improve the Shoulder Range of Motion in Frozen Shoulder

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Abstract

Background: Frozen shoulder is defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of movement in every direction. Prevalence of frozen shoulder was found to be 3.06% in a regional community based study. Frozen shoulder is a discrete clinical diagnosis for painful restriction of shoulder motion that results from capsular fibrosis. It is usually present in age group between 40-60 years. Muscle Energy (MET) technique is very much beneficial in this condition. Muscle energy techniques are class of soft tissue osteopathic manipulation consisting of isometric contraction design to improve musculoskeletal function and reduce pain. MET combined along with scapular Mobilization gives much better effect. So, the aim of the study is to check the effectiveness of muscle energy technique and mobilization to improve shoulder range of motion frozen shoulder.

Materials and methods: 60 patients were included in the study which was divided into two groups; Group A and Group B, 30 patients in each group. Subjects were randomly selected and assigned to each group. Pre-test measurements of the patient were done with the help of two measures VAS, Shoulder pain and disability index (SPADI) and Goniometer was used for assessing range motion of shoulder movements for each group. The Subjects in Group-A were given muscle energy technique. The Subjects in Group-B were given maitland technique. Then the Result analysis was done.

Results: On comparing Group A and Group B for post-treatment VAS and SPADI score, results showed a significant difference (p=0.001). The overall study proved that MET is beneficial in improving Pain and decreasing the disability level.
Conclusion: The analysis obtained indicated that Group A (Muscle energy Technique) showed more significant improvement when compared to Group B (Mobilization).

Key words

Muscle Energy Technique, Mobilization, Frozen Shoulder, SPADI, Goniometer.

Introduction

Frozen shoulder is defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of movement in every direction [1].

The term "frozen shoulder" was first introduced by Codman in 1934. He described frozen shoulder as a painful shoulder condition of insidious onset that was associated with stiffness and difficulty sleeping on the affected side. Codman also identified the marked reduction in forward elevation and external rotation that are the hallmarks of the disease. Long before Codman, in 1872, the same condition had already been labeled "peri-arthritis" by Duplay. In 1945, Naviesar coined the term "adhesive capsulitis". Frozen shoulder is a specific condition that has a natural history of spontaneous resolution and requires a management pathway that is completely different from such distinct shoulder conditions as a rotator cuff tear or osteoarthritis [9].

Frozen shoulder is defined as an idiopathic condition of the shoulder characterized by the spontaneous onset of pain in the shoulder with restriction of movement in every direction [2]. Prevalence of frozen shoulder was found to be 3.06% in a regional community based study [3].

Frozen shoulder is a discrete clinical diagnosis for painful restriction of shoulder motion that results from capsular fibrosis. Its etiology, although unclear, is associated with the interaction of constitutional and extrinsic factors among patients who, notably are between 40 and 60 years of age. Stages of freezing, frozen, and thawing characterize the natural history of Frozen shoulder, and the condition is self-limiting within one to three years. By applying appropriate treatment techniques in a creative and judicious manner, the physical therapist can do much to enhance the speed and degree of recovery from frozen shoulder. More controlled studies, however, are needed comparing the combined effects of different forms of treatment. Adhesive capsulitis is associated with medical conditions such as diabetes, hyperthyroidism, ischemic heart diseases, inflammatory arthritis and cervical spondylosis. The most significant association is with insulin dependent diabetes. Bilateral disease occurs in approximately 10% of patients but can be as high as 40% in with a history of insulin dependent diabetes. It is believed that in patients with diabetes, associated micro vascular disease causes abnormal collagen repair, which predisposes them to adhesive capsulitis [4].

Adhesive capsulitis is classically characterized by three stages. The length of each stage is variable, but typically the first stage lasts for 3 to 6 months, the second stage from 3 to 18 months and the final stage from 3 to 6 months. Passive mobility is also limited in capsular pattern with external rotation being limited most followed by abduction and then internal rotation. The movement of flexion and internal rotation are involved to a lesser extent. No apparent muscular weakness will be present in available range of motion but the over pressure at the end of range will elicit pain [6].

Mobilization in stages of frozen shoulder is useful in improving the range of motion. Cyriax

initially proposed that tightness in a joint capsule would result in a pattern of proportional motion restriction. He used the concept of a capsular pattern to differentiate in diagnosis between loss of motion secondary to bony and/or muscle or joint changes and that caused by the capsule [2, 10].

Frozen shoulder most commonly occur in people above 40 years of age with a higher incidence in females. Hannafind described four stages of frozen shoulder.Stage-1 is painful shoulder. Stage- 2 is "Freezing Stage" with chronic pain and limitation of active and passive range of motion, and the primary goal of the treatment is to interrupt the cycle of inflammatory pain which can be interrupted by maitland's low grade (I and II) mobilization.Stage-3 is "Frozen Stage" with Significant limitation of ROM with rigid "end feel", the primary goal is to increase ROM.Stage-4 is "Thawing Phase" with progressive improvement in ROM [7].

Restriction of Shoulder abduction and external rotation range of motion is usually affected in stage-2 and stage-3 frozen shoulder and the primary goal of the treatment in these stages is to minimize capsular restriction and improve range of motion. These movements are important to perform daily activities. Usual treatment available for frozen shoulder is Codman's exercises, paraffin wax bath, ultrasound, and mobilization [8].

Muscle energy technique helps is increasing shoulder range of motion. An additional tool for the physical therapist's 'manual therapy toolbox', Muscle Energy Techniques (MET) can help to release and relax muscles, and promote the body's own healing mechanisms. MET is unique in its application as the client provides the initial effort while the practitioner facilitates the process. The primary force originates from the contraction of soft tissue, which is then utilized to assist and correct the presenting musculoskeletal dysfunction. MET is generally classified as a direct technique – as opposed to indirect –because the muscular effort is from a controlled position, in a specific direction ,against a distant counter force(usually the practitioner). One of the main uses of this method is to normalize joint range, rather than increase flexibility, and techniques can be used on any joints with restricted range of motion (ROM) identified during the passive assessment [5].

Materials and methods

It was a hospital based comparative study carried out to compare the effects of mobilization techniques and muscle energy technique on two groups of patients of frozen shoulder. The study was conducted from January 2015 to December 2016, applying consecutive sampling technique all the patients attending the OPD of Physiotherapy department of KIMS College and Hospital, Hyderabad, aged 40-60 years suffering from idiopathic frozen shoulder and with minimum of 50% reduction in range of motion (ROM) were included in the study.

A total of 60 patients were enrolled in the study. These patients were then randomly assigned to two groups to receive type of mobilization treatment, using computer generated random numbers.

Inclusion criteria

- Subjects within age group 40-60 years were taken.
- Both male and female were taken.
- Subjects with idiopathic adhesive capsulitis shoulder were taken.
- Subjects with minimum 50% reduction in range of motion were taken
- Reduced Range of Motion (Abduction, external and internal rotation) of 50% compared to the unaffected side.

Exclusion criteria

- Thoracic outlet syndrome
- Peripheral nerve injury
- Previous Manipulation under General Anaesthesia
- Rheumatoid Arthritis, Osteoarthritis, damage of glenohumeral cartilage

- Lesions rotator cuff pathologies, malignancies, etc.
- Injection with corticosteroids in the affected arm in the preceding 4 weeks.
- Recurrent cases of Adhesive Capsulitis.
- Any trauma cases

Strategy

A Total of 2 groups were formed and 30 patients were enrolled in each group, all the participants received written and verbal explanations of the purpose and procedures of the study, if they agreed to participate they signed informed consent.

Group 1: Patients were given treatment using muscle energy technique

Group 2: Patients were treated using maitland mobilization

To minimize bias, an independent trained outcome assessor, was masked to this study, evaluating the patients at baseline and after 4 weeks of therapy. Participants in both the groups received mobilization treatment four days a week for 30 minutes.

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Assessment of patients included evaluation of Range of motion in all the positions i.e. shoulder flexion, abduction, internal rotation and external rotation which was done using goniometer both before and after the treatment and functional assessment for disability was done using Shoulder pain and disability index(SPADI) both pre and post treatment for both the groups [17, 18].

Procedure

Received, Muscle Energy Technique [Post isometric relaxation (PIR)] along with Conventional therapy for the shoulder joint of 3 repetitions per set, 1 session per day, 3 days a week for 4 weeks with each repetition maintained for duration of 7 – 10 seconds. Improve in range of motion and joint function

Muscle Energy Technique: The subject is asked to go for a forceful contraction at the end of the available range against resistance where there will be no movement in the joint. Then the subject is asked to relax the muscle (PIR).This shall be given both to abductor group of muscles to improve abduction range. The same technique will be applied for external rotators to improve range of motion in external rotators [15].

MET for G.H. joint restricted flexion: Therapist stands in front of the patient and places one hand over the top of the patient's shoulder at the superior part of the scapula and cup the G.H. joint to palpate for motion. The other hand and forearm support the patient's flexed elbow and flex the humerus at the G.H .Joint in the sagital plane up to the initial point of resistance. Direct the patient to extend the elbow against your equal counterforce. Maintain the forces for 3-5 seconds allow the patient to relax for 2seconds, take up the slack and then repeat.

MET for G.H. joint restricted extension: Therapist stands in front of the patient and places one hand over the top of the patient's shoulder at the superior part of the scapula and cups the G.H. joint to palpate for motion. Uses the other hand to support patient's flexed elbow and direct the patient to push the elbow anteriorly.

MET for G.H. joint restricted abduction: Therapist stands in front of the patient, places her one hand over the top of patient's shoulder, cups the G.H. joint to palpate for motion. Direct the patient to press the elbow towards the body.

MET for G.H.joint restricted internal rotation: Therapist stands facing the patient. Carefully place the dorsum of the patient's hand against the patients back. Therapist places his hand over the top of shoulder and superior part of the scapula and other palm protecting anterior side of the shoulder capsule. Places her other hand posterior to the patient's flexed elbow. Direct the patient "Press your elbow against my fingers".

MET for G.H. joint restricted external rotation: Therapist stands behind the patient.

Places his hand superior to the patient's GH joint. Places her forearm of the other hand medial to the patient's flexed forearm with her hand supporting the patient's hand and the wrist. Direct the patient to internally rotate the arm by pressing the hand [16].

Mobilization

Received passive mobilization and conversational therapy for the shoulder joint of 3 repetitions per set, 1 session per day, and 3 days for week for 4 weeks with each repetition maintained for duration of 7 – 10 seconds.

Mobilization: For abduction: Subject is made to sit and on a stool and the upper limb is taken to terminal range passively into abduction (available) and then caudal glide will be given. For External rotation: Subject is made to sit on a stool and the upper limb is taken to available terminal range passively external rotation and posterior glide will be given to improve external rotation. For forward flexion initially Antero – posterior for improved rotation and caudal glide to improve range beyond 90 degrees.15-30 glides per/min will be given. Treatment was given for 3 days a week for 4 weeks [13, 14].

Results

Ethical clearance was obtained from the ethics review committee of the institute. Data was analyzed using SPSS 21.0 (SPSS Inc., Chicago, IL, USA), paired t test was used compare within the groups and unpaired t test was applied to compare between the 2 groups. Mann Whitney U test and Wilcoxon's sign rank test was used for non- normally distributed data for inter and intra-group analysis [23, 24].

A total of 60 was the sample size which was further divided into 30 in group A and 30 in group B by convenient sampling.

Most of the subjects were between 40-60 years of age and subjects of both the groups were matched for age and sex (p= 0.4) (**Table – 1**). Shoulder pain and disability index (SPADI) and range of motion of shoulder in all the positions was assessed separately in both the groups, pre and post mobilization treatment therapy. Improvement was observed in both the groups pre and post treatment and these results were statistically significant ($p<0.01$) (**Table – 2**). We also tried to evaluate the effect of 2 different types of techniques i.e. muscle energy technique in group 1 over mobilization alone in group 2 and statistically significant results were observed ($p<0.05$) in group 1 patients for both types of assessment methods (SPADI and Range of motion) (**Table – 3**). Results were observed ($p<0.05$) in group 1 patients for both types of assessment methods (SPADI and Range of motion) (**Table – 3**) [25, 26]. Comparison of post assessment scores in two groups of patients studied as per **Table – 4**. Assessment of study variables pre and post assessment in group A patient was as per **Table – 5**. Assessment of study variables pre and post assessment in group B patients were as per **Table – 6**.

Table - 1: Age distribution of patients studied.

Age in years	Group A		Group B	
	No	%	No	%
41-50	16	53.3	18	66.7
51-60	14	46.7	12	33.3
Total	30	100.0	30	100.0
Mean ± SD	50.07±5.74		50.33±3.98	

Samples were age matched with P=0.883

Table - 2: Gender distribution of patients studied.

Gender	Group A		Group B	
	No	%	No	%
Female	16	53.3	16	53.3
Male	14	46.7	14	46.7
Total	30	100.0	30	100.0

Samples were gender matched with P=1.000

Discussion

The objective of this study was to evaluate the efficacy of muscle energy technique with conventional therapy and passive joint mobilization with conventional therapy in subjects with adhesive capsulitis of shoulder.

Table - 3: Comparison of pre assessment measurements in two groups studied.

Pre Assessment scores	Group A	Group B	P value
SPADI Score	70.87±4.84	69.00±6.32	0.372
Rom in flexion	74.67±9.72	75.67±9.98	0.783
Rom in extension	19.00±5.73	19.00±6.04	1.000
ROM IN ABD	59.00±15.38	59.00±14.42	1.000
Rom in INT rotation	37.67±6.51	37.00±8.19	0.807
Rom in EXT rotation	35.67±5.94	36.67±6.45	0.662
VAS Score	6.60±0.91	6.33±0.90	0.426

Table - 4: Comparison of post assessment scores in two groups of patients studied.

Post Assessment	Group A	Group B	P value
SPADI Score	48.00±8.82	54.67±4.81	0.016*
Rom in flexion	109.00±9.30	101.67±10.29	0.050+
Rom in extension	39.67±4.81	33.33±6.45	0.005**
ROM IN ABD	88.33±14.96	80.00±15.24	0.142
Rom in INT rotation	65.67±8.63	60.33±10.93	0.149
Rom in EXT rotation	63.00±9.02	58.00±8.41	0.128
VAS Score	3.87±1.13	4.00±1.00	0.734

Student t test unpaired

Table - 5: Assessment of study variables @ pre and post assessment in group A patient studied.

Variables	Pre Assessment	Post Assessment	difference	t value	P value
SPADI Score	70.87±4.84	48.00±8.82	22.867	16.060	<0.001**
Rom in flexion	74.67±9.72	109.00±9.30	-34.333	-26.851	<0.001**
Rom in extension	19.00±5.73	39.67±4.81	-20.667	-21.539	<0.001**
ROM IN ABD	59.00±15.38	88.33±14.96	-29.333	-24.819	<0.001**
Rom in INT rotation	37.67±6.51	65.67±8.63	-28.000	-22.005	<0.001**
Rom in EXT rotation	35.67±5.94	63.00±9.02	-27.333	-19.972	<0.001**
VAS Score	6.60±0.91	3.87±1.13	2.733	17.833	<0.001**

Student t test (paired)

Table - 6: Assessment of study variables @ pre and post assessment in group B patients studied.

Variables	Pre Assessment	Post Assessment	difference	t value	P value
SPADI Score	69.00±6.32	54.67±4.81	14.333	14.938	<0.001**
Rom in flexion	75.67±9.98	101.67±10.29	-26.000	-17.567	<0.001**
Rom in extension	19.00±6.04	33.33±6.45	-14.333	-14.938	<0.001**
ROM IN ABD	59.00±14.42	80.00±15.24	-21.000	-13.475	<0.001**
Rom in INT rotation	37.00±8.19	60.33±10.93	-23.333	-16.243	<0.001**
Rom in EXT rotation	36.67±6.45	58.00±8.41	-21.333	-9.664	<0.001**
VAS Score	6.33±0.90	4.00±1.00	2.333	14.642	<0.001**

Student t test (paired)

A sample of 30 was taken and divided into two groups .Each group consisted of 15 individuals who matched the inclusion criteria. They were divided by convenient sampling method into two groups.

Group A received muscle energy technique for a period of 5 weeks and 3 days a week. The outcome measures are VAS for pain, SPADI for disability and Goniometry for range of motion.

Values were taken before and after completion of treatment .They were then assessed statistically.

VAS in group A prior to treatment the score mean was 6.60 prior to treatment 3.87 and after treatment .There was a significant decrease in pain as the mean difference is17.833.

SPADI in group A prior to treatment the score mean was 70 % and decreased to 48 % after treatment. There was a significant improvement in their function by 22.86.

The range of motion was considered in all planes, Flexion, extension, abduction, internal rotation and external rotation ROM were considered.

In flexion pre-treatment mean was 74.67degrees and post treatment it was 109 degrees. There was a significant increase in range of flexion by 34.3degrees.

In extension pre-treatment mean was 19 degrees and post treatment mean score was 39.67. There was a significant increase of 20.66 degrees.

In abduction the pre-treatment score was 59 degrees and post treatment score was 88 degrees. There was a significant increase of 29 degrees.

In internal rotation the pre-treatment score was 37 degrees and post treatment was 65 degrees. There is a significant increase of 28 degrees after the treatment.

In external rotation the pre-treatment scores were 35.67 degrees and post treatment 63.67 degrees. There is a significant increase of 27 degrees after the treatment.

Group B received passive mobilization alone for a period of 4 weeks and 3 days a week. The outcome measures are VAS for pain, SPADI for disability and Goniometry for range of motion.

Values were taken before and after completion of treatment. They were then assessed statistically.

VAS in group B prior to treatment the score mean was 6.33 prior to treatment 4.667 and after treatment. There was a significant decrease in pain as the mean difference is 2.33.

SPADI in group B prior to treatment the score mean was 69% and decreased to 54% after treatment. There was a significant improvement in their function by 14%.

The range of motion was considered in all planes. Flexion, extension, abduction, internal rotation and external rotation ROM were considered.

In flexion pre-treatment mean was 75 degrees and post treatment it was 101.67 degrees. There was a significant increase in range of flexion by 26 degrees.

In extension pre-treatment mean was 19 degrees and post treatments mean score was 33. There was a significant increase of 14.3degrees.
In abduction the pre-treatment score was 59. Degrees and post treatment score is 80 degrees. There was a significant increase of 21 degrees.

In internal rotation the pre-treatment score was 37 degrees and post treatment was 60.3 degrees. There was a significant increase of 23.3 degrees after the treatment.

In external rotation the pre-treatment scores were 36.67degrees and post treatment 58 degrees. There was a significant increase of 21.3 degrees after the treatment.

On comparing group A and group B

Though there was a significant increase in both group A and group B. On comparing the mean scores obtained after treatment the efficacy of the treatment can be evaluated.

In SPADI score mean of group A was 22.86% and mean of group B was 14.3% which indicates that group A had a much better increase of 8.56%.

In VAS scores the mean values were 2.733 for group A and 2.333 for group B. But the mean differences of group A was 2.3 and that of group B was 0.4 Which indicates it was a very minimal difference.

In SPADI the mean values are Group A mean difference was 22.86 and Group B mean was 14 which indicates a greater improvement in group A.

In range of motion

In Flexion the mean difference was 34.33 in group A and 26 in group B which indicates a significant increase in group A by 8.33 degrees.

In Extension the mean difference was 20.6 in group A and 14.33 in group Bethought there was a significant increase in group at the difference was about 6.36 degrees.

In Abduction the mean difference was 29.3 degrees in group A and 21.0 degrees in group B. There was a significant increase in group A with a difference of 8.33 degrees.

In internal rotation the mean difference was 28 degrees in group A and 23.3 degrees in group B. There was a significant increase of 4.67 degrees in group A when compared to group B.

In external rotation the mean difference was 27 degrees in group A and 21.3 degrees in group B. There was a significant increase of 6.33 degrees in group A when compared to group B.

This increase in group A when compared to group B is attributed to" A stiff joint can become a tight muscle and a tight muscle can become a stiff joint'. When used correctly, MET can improve joint mobility, even when you are relaxing the muscles initially. A relaxation period follows the muscle contraction, which then helps to achieve the 'new' ROM [19].

The main effects of MET can be explained by two distinct physiological processes: post isometric relaxation (PIR) and reciprocal inhibition (RI). Certain neurological influences occur during MET, but before considering PIR/RI, it is useful to take into account the two types of receptors involved with the 'stretch reflex'.

Muscle spindles sensitive to change in length and speed of change in muscle fibers.

Golgi tendon organs that detect prolonged change in tension. Stretching a muscle causes an increase in the impulses transmitted from the muscle spindle to the posterior horn cell (PHC) of the spinal cord. In turn, the anterior horn cell (AHC) transmits an increase in motor impulses to the muscle fibres, which creates a protective tension to resist the stretch. But increased tension maintained for a few seconds is sensed within the Golgi tendon organs, which transmit impulses to the PHC and has an inhibitory effect on the increased motor stimulus at the AHC. This inhibitory effect causes a reduction in motor impulses and consequent relaxation. This implies that the prolonged muscle stretch will increase overall stretching capability due to the protective relaxation of the Golgi tendon organs overriding the protective contraction [20]. However, a fast stretch of the muscle spindles will cause immediate muscle contraction and – if not sustained – there will be no inhibitory action. When an isometric contraction is sustained, neurological feedback through the spinal cord to the muscle itself results in post-isometric relaxation (PIR), causing a reduction in tone of the contracted muscle. This lasts for approximately 20 to 25 seconds, during which the tissues can be more easily manipulated to a new resting length*2*), the reduction in tone relies

on the physiological inhibiting effect on antagonists during the contraction of a muscle [21]. When the motor neurons of the contracting agonist muscle receive excitatory impulses from the afferent pathway, the motor neurons of the opposing antagonist muscle receive inhibitory impulses from their afferent pathway. It follows that contraction or an extended stretch of the agonist muscle must elicit relaxation or inhibit the antagonist, and that a fast stretch of the agonist will facilitate a contraction [22]. The refractory period also lasts for approximately 20 seconds but, with RI, it is thought to be less powerful than PIR. In certain circumstances, use of the agonist may be inappropriate due to pain or injury [15].

Conclusion

From the above study results it is concluded that there is a difference among the Group A and Group B when the values obtained were analysed. Though there were no significant changes in VAS scores between the groups. It indicated that Group A (muscle energy technique with conversational) had a significant improvement in Range of Motion in all aspects such as flexion, extension, abduction ,internal rotation and external rotation .Their scores in Shoulder Pain and Disability Index have reduced which indicates decreased level of disability and better functional ability. So, it indicates that Muscle Energy Technique is more effective in improving range and function when compared to Passive Mobilization alone.

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