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## Effect of muscle energy technique on improving pain and functions in patients with adhesive capsulitis: A narrative review

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### Abstract

**Background:** Around 2%-5% of the general population develops Adhesive capsulitis over their lifetime. Adhesive capsulitis is characterized by painful and gradual loss of ROM leading to contracture of the GH joint. This leads to difficulty in performing ADLs and overhead activities. METs is a unique, non-invasive application known to normalize joint ROM, relieve pain and is found to be very beneficial in this condition. It is an osteopathic manipulation consisting of isometric contractions designed to improve overall musculoskeletal function and reduce pain.

**Objective:** To review the available evidence on the effect of muscle energy technique on improving pain and functions in patients with adhesive capsulitis.

**Methodology:** An electronic search was conducted on PubMed, ScienceDirect, and Google scholar. About 34 Articles were retrieved based on PICO format and appropriate Boolean operators and filters were used to narrow down the search results; considering the inclusion and exclusion criteria 9 studies were selected for the review.

**Conclusion:** Following the intervention, a significant difference in at least one of the outcome measure parameters was seen, hence leading to the conclusion that muscle energy technique can be recommended as an effective treatment intervention for individuals suffering from adhesive capsulitis.

**Keywords:** adhesive capsulitis, frozen shoulder, peri-arthritis, muscle energy techniques, pain, functions, functional disability

### 1. Introduction

Adhesive Capsulitis is also known as Peri-arthritis or frozen shoulder. It is a condition in which there is pain and stiffness or movement loss in the shoulder. This condition most often affects people aged between 40-60years. This condition is commonly seen in women <sup>[1]</sup>. It is characterized by the development of dense adhesions, capsular thickening and capsular restrictions, especially in the dependent folds of the capsule. All the movements of the shoulder joint are severely restricted with progressive loss of both active and passive range of motion <sup>[2]</sup>. Adhesive capsulitis can be the primary [idiopathic] or secondary. The secondary type is usually caused by underlying conditions such as rheumatoid arthritis, osteoarthritis, trauma, or long-term immobilization <sup>[3]</sup>.

A variety of immunological, biochemical, inflammatory, and endocrine abnormalities have been described in patients with adhesive Capsulitis. Many studies have been undertaken to now the pathology, and there are many shreds of evidence of both inflammatory and fibrotic changes <sup>[4]</sup>. The joint capsule is thickened and is loosely adherent to the underlying humeral head, and the normal capsular folds are obliterated. There is synovial cell proliferation, and infiltration of the chronic inflammatory cells leading to pain and stiffness <sup>[5]</sup>.

There are generally three stages in adhesive capsulitis. The first stage is the freezing phase, characterized by the onset of aching pain in the shoulder, the pain is usually more severe at night and may be associated with a sense of discomfort that radiates down the arm this stage lasts up to 3 to 6 months <sup>[6]</sup>. The second stage is the progressive stiffness or the frozen stage. The intensity of the pain decreases and shoulder movements are severely restricted, the patient's complaints of inability to reach into the back of the pocket, comb hair, etc along with this there is atrophy of the muscles around the shoulder joint.

This stage lasts up to 3 to 18 months, the final stage is the resolution or thawing stage [7]. This stage is characterized by a slow recovery of movement. Treatment with aggressive physical therapy and surgical release may accelerate the recovery.

Conservative treatment for Adhesive Capsulitis includes various exercise methods and modalities such as Moist heat, Transcutaneous electrical nerve stimulation (TENS), Ultrasound (US), and LASER (Light Amplification by Stimulated Emission of Radiations). Exercise programs consist of active and passive range of motion exercises, stretching exercises guided by a physiotherapist, self-stretching, Codman's exercises, manipulation, and mobilization techniques, strengthening exercises, patient education, and home

exercises. Muscle energy technique is unique in its application as the patient provides the initial effort while the practitioner facilitates the process [8].

The muscle energy technique was developed by Dr. Fred Mitchell. It is a non-invasive technique that can be used to stretch or lengthen muscle and fascia that lack flexibility [9]. It is defined as a 'manual treatment in which a patient produces a contraction in a precisely controlled position and direction against a counterforce applied by the therapist'. The main effect of MET can be explained by two distinct physiological processes that are; Post Isometric Relaxation (PIR) and Reciprocal Inhibition (RI) [8].

Karel LeWitt *et al.* developed the post isometric relaxation technique [10]. It is caused by a decrease in the muscle tone after a period of submaximal isometric contraction of the same muscle [11]. It is based on the concept of autogenic inhibition. Autogenic inhibition is often seen during static stretchings. The GTO response plays an essential role in the flexibility of the muscle when the GTO inhibits the agonist muscle's contraction and allows the antagonist muscle to contract more readily. 10,11

Muscle spindles are stretch-sensitive mechanoreceptors found in skeletal muscles. When the muscle is lengthened, the

spindles get stretched. It activates the muscle spindles, which causes a reflexive contraction of the agonist muscle, which is known as the stretch reflex when the agonist muscles contract, the antagonist's muscle relaxes. This process is known as reciprocal inhibition [13].

The METs have been found effective on some of the musculoskeletal disorders such as Sacroiliac joint dysfunction, low back pain, pregnancy related pelvic girdle pain etc [14, 15]. This technique is also used to stretch tight muscles, strengthen weak muscles, reduce pain, improve circulation, and mobilize joints. Many athletes use METs as a preventive measure to guard against future injury of muscles and joints [16].

METs are used to improve flexibility, cause relaxation, and improve the range of motion (ROM) of joints. METs can be safely applied to almost any joint in the body. There are many studies evaluating the efficacy of METs on various musculoskeletal disorders. The present literature review is being undertaken with the intention of evaluating the effect of muscle energy techniques in Adhesive Capsulitis to improve the pain, prevent stiffness, and improve the overall functioning of the shoulder joint.

## 2. Methodology

### 2.1 Search strategies

- **Keywords Used:** Medical subject headings {MeSH} were used to find relevant keywords. The keywords from other relevant articles were also used. The following keywords were used Adhesive capsulitis, frozen shoulder, peri-arthritis, Muscle energy techniques, Pain, functions, functional disability.
- **Databases Searched:** PubMed, Science direct, google scholar

### 2.2 Search Techniques

The search techniques used for getting articles for this literature review are:

- The boolean operators 'OR' and 'AND' were used

**Table 1:** Keywords used to search articles

Sr no	Keywords	No. of articles obtained
#1	Adhesive capsulitis OR frozen shoulder OR peri-arthritis AND Muscle energy technique	135
#2	Adhesive capsulitis OR frozen shoulder OR peri-arthritis AND muscle energy technique AND pain	38
#3	Adhesive capsulitis OR frozen shoulder OR peri-arthritis AND muscle energy technique AND pain AND functions OR functional disability	34
	Total	34

## 2.3 Eligibility Criteria

### Inclusion Criteria

- Articles in the English language
- Articles that include pain and functional ability as an outcome measure
- Articles where MET was used as an intervention
- Studies conducted on individuals with adhesive capsulitis only
- Studies published in the last 10 years only

### Exclusion Criteria

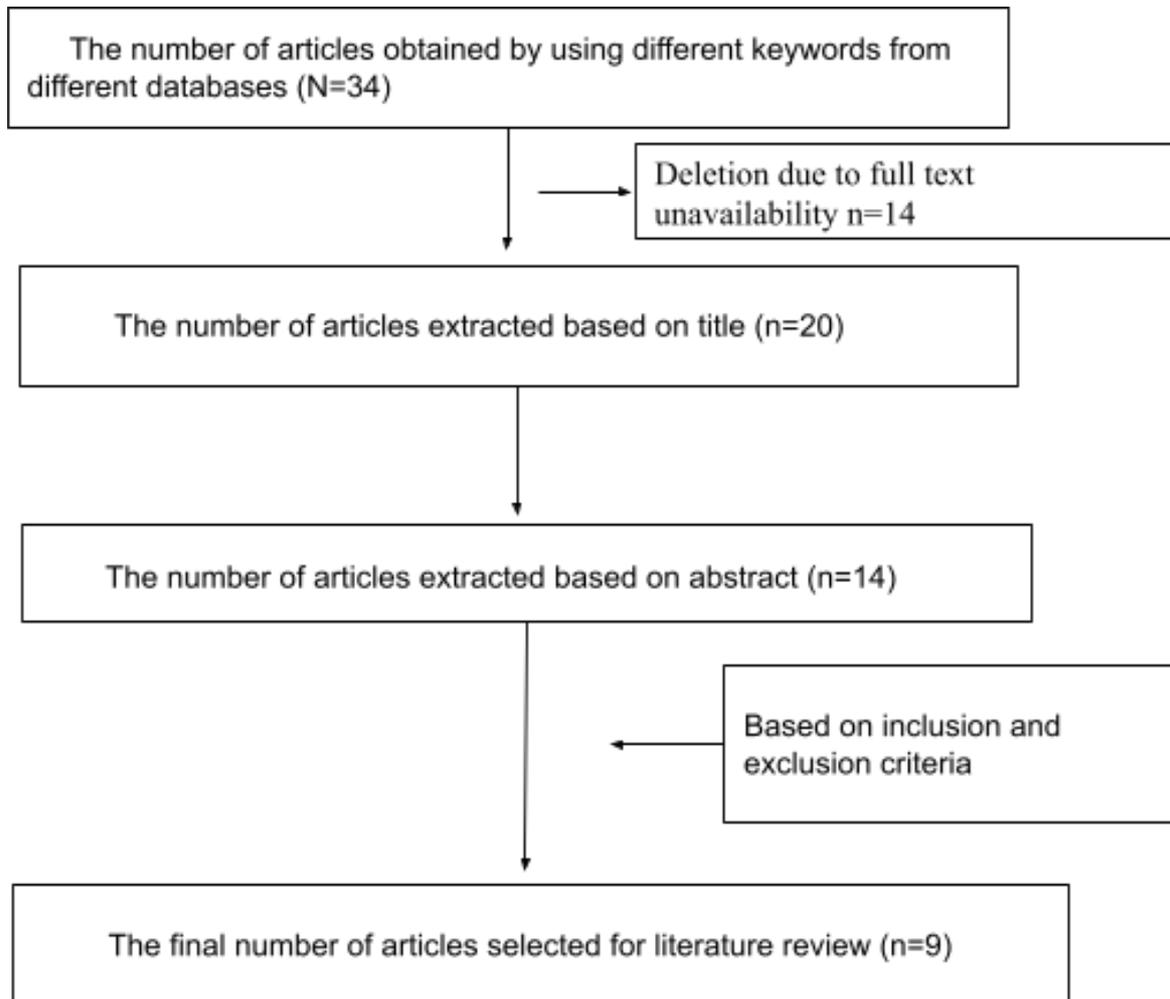
- Article whose full text was not retrieved
- Studies which were done on animals

## 2.4 Data Extraction

The articles were searched using different keywords as mentioned above using different databases accounted for 34. Articles were screened on the basis of a three-stage approach considering the inclusion-exclusion criteria.

- Based on the title the number of articles obtained -20
- Based on the abstract the number of articles obtained -14
- Based on inclusion/exclusion criteria the number of articles obtained -9

So the final number of articles includes in this literature review is 9 which satisfies all the inclusion criteria



**Fig 1:** Flow chart for data extraction

Summary table of studies included

SR No	Title/author / Year of study	Sample size	Intervention	Duration, frequency, intensity of Intervention	Outcome	Outcome Measure	Evaluation Assessment	Result
1	Efficacy of muscle energy technique on functional ability of shoulder in adhesive capsulitis Anupama N <i>et al.</i> 3 2014 Pedro scale 6/10	N= 30	a) Muscle energy technique, with conventional physiotherapy b) Conventional physiotherapy treatment; ultrasound, hot pack, Codman's exercise, pulley exercise and active assisted exercises.	METs; 3 repetitions per set, 1 session per day and thrice a week for 5 weeks	Pain and disability	SPADI	Assessment was taken pre- treatment and post treatment	Both the groups showed improvements in SPADI scores, but the group which was given METs with conventional physiotherapy Showed greater improvement 37.53+/- 11.74 in terms of SPADI score
2	Comparison of Spencer muscle energy technique and Passive stretching in adhesive capsulitis; A single blind randomized control trial Iqbal M <i>et al.</i> 17 2020 Pedro Scale 8/10	N=60	a) METs, hot pack, b) Hot pack, Passive stretching	a. METs- 3-5 repetitions with slight resistance offered by therapist, with rest intervals ,3 sessions per week on alternate days for 4 weeks Hot pack; 7-10 minutes b. hot pack 7- 10minutes Passive stretching ;20 secs with 10secs rest ,10 repetitions over 3 sessions per week for 4 weeks	Pain, disability, range of motion	DASH questionnaire SPADI NPRS Universal Goniometry Index	Assessment was taken pre- treatment and 2nd and 4th week of post treatment	The difference between the groups in terms of pain and disability markers was non-significant, but had significant difference at midway and post- intervention assessment in group which was given METs, (p<0.05) and was with range of motion
3	Efficacy of mulligan technique versus muscle energy technique on functional ability in subjects with adhesive capsulitis Raydu GM <i>et al.</i> 9 2018 Pedro Scale 7/10	N=80	a) Mulligan mobilization b) METs	a) 3 sets of 10 repetitions with 30 secs rest between sets ,3 sessions in a week for 3 weeks b) METs – 5 repetition per set for 3 sets with slight resistance by the therapist, 3 sessions per week for 3 weeks	Pain and disability, range of motion	SPADI, Universal goniometry index	The assessment was done on first day of treatment and last day of treatment [after 3 weeks]	Both techniques were equally effective and there was improvement within group but no statistical and clinical significance was found in between- group comparison
4	Effects of muscle energy technique on pain and function in Adhesive capsulitis-An interventional study Gill M K A <i>et al.</i> 23 2018	N=27	a) Conventional physiotherapy treatments –hot pack Codman's exercise, finger ladder, wand and active exercises, capsular stretching b) METs and conventional physiotherapy treatment	a) Hot pack – 10mins, other exercises- 6 days a week, once a day for 2 weeks. b) 5 repetitions/set ,3 sets/session ,1 session/day for 2 weeks	Pain, shoulder function, and range of motion	Musculoskeletal assessment VAS, SPADI, Goniometry	The assessment was taken pre and post treatment	Both the treatment were individually very effective but the group which received METS along with conventional physiotherapy found to be more effective in terms of outcome measures i.e p value 0.0014 and 0.052
5	Effectiveness of muscle energy technique versus capsular stretching among patients with adhesive capsulitis Sharma H <i>et al.</i> 18 2020	N= 30	a) capsular stretching and conventional therapy b) METs and conventional therapy Conventional therapy included –hot pack, Codman's exercises, pulley rope, finger ladder	a. stretch was maintained for 30 secs ,5 repetition/set, 3sets,5sessions/week once in a day for 3 weeks 5 repetitions b. /3sets against minimal resistance offered by therapist, position was maintained for 7-10secs ,5	Pain, shoulder function, range of motion	SPADI NPRS Goniometry	The assessment was taken pre- treatment and post –treatment [after 3 weeks]	There was significant decrease in pain and improved ROM and functional disability in the patients who received METs along with conventional therapy(p<0.05) when compared to capsular

			exercises	sessions/week/once in a day/3 weeks Conventional therapy –5 Reps, per set ,3 sets per session,3weeks [5days/week] once in a day				stretching with conventional treatment
6	Effects of Spencer Muscle energy technique on pain and functional disability in case of adhesive capsulitis of shoulder joint Saifee E <i>et al.</i> 19 2016	N=30	a) METs and conventional treatment b) Conventional treatment – SWD, Codman’s exercise, rope and pulley, wall and ladder, shoulder wheel and self- stretching exercises	a) METs- 4weeks/3days a week and once a day b) SWD – capacitor field method for 20 mins 4weeks /3 days per week /once a day	Pain, shoulder disability	VAS SPADI	Pre-treatment data was collected before the treatment and 4 weeks post treatment outcome data was collected	Both groups showed significant improvements in terms of VAS and SPADI, but there was more significant improvement in group A in terms of SPADI (p- 0.0001) but not in VAS
7	Effects of muscle energy technique and specific inferior capsular stretching in frozen shoulder Sheikh MK <i>et al.</i> 20 2017	N=30	a) METs, moist heat, ultrasound Inferior capsule stretching, moist heat, ultrasound b) METs, moist heat, ultrasound	a) Inferior capsular stretch was maintained for 30sec 3reps/set,5 sets per session /5days -4 weeks b) METs -7secs hold against slight resistance 3reps/set, 5sets per session/ 5days a week for 4 weeks	Pain, shoulder disability, range of motion	VAS SPADI ROM	Assessment was taken pre- interventional and 4 weeks post-interventional	The outcome measures VAS, SPADI and ROM showed extreme significance in group B(p<0.0001) than group A.
8	A Comparative study on effectiveness of muscle energy technique versus Cyriax’s deep friction technique in adhesive capsulitis Vijayan V <i>et al.</i> 21 2019	N=30	a) METs, b) Cyriax’s deep friction technique,	a) METs- 5 secs hold against slight resistance,5 reps/set 5sets per session/ 5days a week for 3 weeks b) Cyriax’s deep friction- 15 mins per session ,5 times a week, for 3 weeks	Pain and disability, Range of motion	SPADI Goniometry	Evaluation was done on prior to treatment and 21 days after treatment	Both treatment groups showed improvement comparing pre and post treatment while group A(p-0.1117) showed significant difference compared to group B in terms of ROM and functional disability
9	Effects of proprioceptive neuromuscular facilitation stretch and muscle energy technique in the management of adhesive capsulitis of shoulder Ravichandran H <i>et al.</i> 22 2021	N=60	a) PNF b) METs	a) PNF –D2 pnf pattern of Flexion5 and extension 8reps/set ,2 sets per session, 1 session per day,5 days a week, each rep maintained for 5-10 secs b) METs- 5reps/set,5 sets/session,1session/day,5days/week , for 2 weeks, each rep maintained for 7-10 secs	Range of motion, pain and function	Universal goniometer, University of Pennsylvania [1st subset] shoulder score	Evaluation was done prior to studies, at the end of 1st week, and at the end of 2nd week	Group A who received PNF showed greater improvements in pain, ROM, and restoring function than group B(p<0.05)

### 3. Discussion

The purpose of this study was to find the effects of MET on pain and functional ability of the shoulder joint. The data analysis and statistical inference have brought to check the effectiveness of MET and conventional physiotherapy on the variable of the study which are pain, ROM, and functional abilities [3].

This literature review summarizes the effect of the muscle energy technique on improving pain and ROM in patients with adhesive capsulitis [8, 3, 17, 23, 19, 20]. Pain and decrease in range of motion are the main symptoms of adhesive capsulitis leading to difficulty in performing ADLs. The evidence showed the statistically significant improvement in VAS and SPADI score [3] due to the application of MET that relaxes and improves biomechanics and thus results in improved functional ability [3, 8, 17, 19, 20, 21, 22, 23]. Some studies suggested that METs cause post-isometric relaxation which is effective in decreasing pain and range of motion [8, 19]. The possible mechanism for pain relief is that exercises within the pain-free range of motion stimulate mechanoreceptors and decrease pain [19]. During the isometric contraction, activation of mechanoreceptors occurs which leads to sympathoexcitation evoked by somatic efferent and localized activation of PAG that plays a role in descending modulation of pain. The literature supports the observation that MET improves pain by altering circulatory biomarkers of pain and also restores pain-free joint motion by stretching the shoulder capsule and soft tissues around the joint [17, 19].

In the comparative analysis of METs with other conventional physiotherapy techniques like Cyriax deep friction technique [21], Mulligan technique [9], and specific inferior capsular stretching [20], the MET showed greater improvement in terms of outcome measure parameters when it was applied in combination [21, 9, 20]. Almost every study shows a great improvement in ROM followed by the application of MET. The mechanism underlying the improvement in ROM could be because of reflex muscle relaxation and tissue texture change following the application of

MET<sup>9</sup> It was observed that MET improves the extensibility of soft tissues by isometric contraction following immediate muscle relaxation which is claimed to be mediated by the Golgi tendon organ with its inhibitory influence on alpha motor neurons and by reciprocal inhibition from contraction of muscle antagonist [9, 21], these mechanisms bring about a change in muscle physiology and hence lead to increased ROM of the joints.

Functions are considered one of the essential outcome measures for any treatment approach. The current study found a significant difference in Quick dash and SPADI scores between the groups [18, 19, 3, 20, 21]. There was a great improvement in upper limb performance flexibility is considered a valuable component for functional activity. The stretching which is imparted during this technique is the primary mechanism for increasing muscle length [21]. It was observed that MET causes reflex relaxation, viscoelastic or muscle property change, and changes to tolerance to stretching which improves the flexibility of the muscle which crossing the restriction barriers and thus improve the functional disabilities [18, 21].

One of the literature studies supports the use of 7seconds isometric contraction which has found to be effective in improving range [20]. Individuals with diabetes might need long-term treatment for a significant reduction in pain and ROM when compared to the normal individuals with adhesive capsulitis [17, 9, 20, 18, 21]. Also subjects without comorbidities

should be given MET with other physiotherapy treatments like ultrasound, finger ladder, Codman's exercises, range of motion exercises for at least 4-5 weeks to get a significant improvement in ROM, pain, and functional ability [3, 17, 20, 21].

### 4. Limitations

#### 4.1 Limitation of included studies

Following a thorough evaluation of all reviews, certain limitations were discovered, such as small sample size [9, 17], no long-term follow up was taken, short-duration study [9, 17, 18], dropouts before the conclusion of the study [18, 21], techniques were applied for a shorter duration [9, 17], and also further studies are needed to find out the effectiveness of MET alone in adhesive capsulitis. MET requires the subjects to create a force by activating the targeted musculotendinous unit against a precisely directed counterforce by the therapist. The force created by the subject and resistance applied by the therapist might vary from person to person hence there is a lack of accuracy in the treatment protocol [22]. Hence further investigation with a larger sample size, longer duration of treatment, longer follow-up is still necessary to clarify the long-term effects of METs on adhesive capsulitis [9, 17, 21].

#### 4.2 Strength and limitation of the review

This review reveals the primary level of evidence for the effects of MET on improving pain and functions in patients with adhesive capsulitis. The Mesh terms were used as a search strategy to find the relevant keywords. There is a lack of a high level of evidence in this study and review articles were searched in only 3 databases. Some of the articles were not retrieved due to the full-text unavailability and language barrier. Despite all these limitations, findings revealed that pain and function disability were drastically improved after the application of METs. However, further studies are required to generalize the finding. High quality RCTs are required taking in consideration of the limitations mentioned above.

### 5. Conclusion

According to the evidence in these articles, METs can improve the VAS score, NPRS score, SPADI score, Range of motion, and Quick DASH score in patients with adhesive capsulitis. Hence it's an effective non-invasive treatment aimed to improve pain and functions in patients suffering from adhesive capsulitis and can be applied safely to the shoulder joint. In addition, the greater reported effects on METs can be linked to the utilization of active muscle energy. This fact needs exploration in future studies. Additionally, further studies are needed to find out the effectiveness of MET alone in adhesive capsulitis. The severity and stages of adhesive capsulitis also need to be equally considered in future studies to compare the effects of these techniques in chronic adhesive capsulitis as well.

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