

EFFICACY OF MUSCLE ENERGY TECHNIQUE ON SHOULDER ADHESIVE CAPSULITIS POST MASTECTOMY

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Abstract:

Background: Shoulder pain, disability and impaired movements are frequently reported complication in post-mastectomy patients. Most individuals who have had a mastectomy suffer from adhesive capsulitis, which causes shoulder pain and impairment.

Aim: The current study was conducted to investigate the effectiveness of Muscle energy technique (MET) on shoulder adhesive capsulitis post mastectomy.

Patients and methods: The present work was carried-out on sixty patients with adhesive capsulitis after mastectomy who participated in this study, they were aged from 40 to 60 years. The individuals were recruited from National Cancer Institute, Cairo University. They were randomized into 2 groups; every group included 30 patients. Group (A) (study group): were given MET 5 days per week for eight weeks as well as their traditional physiotherapy program (Mobilization exercises, stretching of the Posterior capsule, as well as Range of motion (ROM) exercises). Group (B) (control group): received only the conventional physical therapy program, 5 days per week for eight weeks. Visual analogue scale (VAS) was utilized to measure the shoulder pain. Goniometer was utilized to evaluate shoulder ROM. Shoulder pain and disability index (SPADI) was utilized to evaluate shoulder function. All assessments were conducted pretreatment as well as post treatment.

Results: In both Groups A and B, post-treatment VAS as well as SPADI scores were significantly lower than pre-treatment scores ($p < 0.001$). the percentage of change of VAS as well as SPADI in Group A was 68.28% and 71.88% respectively, while it was, 45.76% and 54.4% in group B respectively. In both groups, post-treatment shoulder flexion, abduction, as well as lateral rotation were all significantly higher than pre-treatment values. Shoulder flexion, abduction, as well as external rotation all increased by 128.25, 75.76, and 99.95% in group A, whereas they increased by 97.58, 59.9, and 89.38% in group B, respectively. Pretreatment comparisons showed no statistically significant differences among the groups. Post-treatment comparisons between the two groups showed that VAS and SPADI scores were significantly lower in Group A compared to Group B ($p < 0.001$). Shoulder flexion, abduction, as well as external rotation were significantly improved in group A than in group B after treatment ($p < 0.001$).

Conclusion: adding MET in rehabilitation program can improve the shoulder pain, ROM as well as function in adhesive capsulitis management Postmastectomy.

Keywords: Muscle Energy Technique, Adhesive Capsulitis, Mastectomy.

1. INTRODUCTION

A mastectomy is a surgical removal of the breast in order to address anatomical as well as functional problems. Surgical options for breast cancer range from lumpectomy through mastectomy, either with or without lymph node dissection. Axillary lymphadenectomy (AL) is typically performed for staging purposes. Additionally, there may be employed chemotherapy (CT) manner, radiotherapy (RT), as well as hormone therapy (1).

Restricted shoulder flexion as well as abduction is seen in 60% of patients with breast cancer one month following surgery and persists in 10% of survivors 12 months later. Limitations in early ROM (but not in later ROM) were substantially associated with factors like dissection of the axillary lymph node (2).

The shoulder joint is unaffected by a mastectomy. Shoulder girdle alignment as well as mobility might be affected by pain, protective posture, scar development, and stress of the soft tissues following major surgery (3). Shoulder pain, disability and impaired movements are frequently reported complications in post- mastectomy patients. Adhesive capsulitis, which causes shoulder pain as well as impairment, is common in individuals who had a mastectomy (4). Frozen shoulder, adhesive capsulitis, as well as peri-capsulitis are all popular names for the same condition. The peak age for onset is between 40 as well as 60, and it is quite uncommon before that. Women are partially more likely to be affected than men (5).

Symptoms include a slow-developing pain around the deltoid's insertion, difficulty sleeping on the affected side, and

limitations in active and passive shoulder elevation as well as external rotation despite a normal radiographic appearance. Adhesive capsulitis seems to be the most likely diagnosis in the absence of radiographic evidence of degenerative joint disease. On both active as well as passive motion tests, range of motion has decreased. Moving in this way can be painful since the capsule is being stretched to its limit. Adhesive capsulitis must be diagnosed using a screening radiography of the shoulder. This eliminates osteoarthritis and chronic anterior or posterior dislocation as potential causes of decreased ROM (6)

When treating adhesive Capsulitis, the MET is highly efficient in restoring shoulder function (7, 8). MET are a type of osteopathic soft tissue manipulations that involves carefully guided and controlled isometric as well as isotonic contractions induced by the patient to enhance musculoskeletal function along with alleviate pain. Active muscle relaxation techniques, manual resistive techniques, and so on are only some of the alternate names for the MET. The three most common types of isometric stretching are the contract-relax (CR) method, in which the muscle being stretched is first contracted followed by relaxed, the agonist contract relax (ACR) method, in which contractions of the agonist (instead of than the muscle having stretched) actively moves the joint into enhanced ROM, and a mix of the two methods, contract relax agonist contraction (CRAC). Proprioceptive neuromuscular facilitation (PNF) stretching is a frequent name for these methods (8).

Minimal evidence exists regarding the effectiveness of MET on shoulder adhesive capsulitis after mastectomy. so; this study was carried-out to investigate the effectiveness of MET as alternative physiotherapeutic modality in shoulder adhesive capsulitis management Postmastectomy, in term of enhancing shoulder pain, ROM as well as function. In an effort to prevent invasive modalities as well as oral drugs that cannot be sustained for long periods due to their systemic side effects, this study may offer a safe, efficient, as well as non-invasive therapy method for adhesive capsulitis of the shoulder.

MATERIAL AND METHODS

STUDY DESIGN:

The Physical Therapy Ethics Committee at Cairo University approved this study. Clinical Trial Registry registration number: **NCT05274698**. This trial was registered in retrospectively. Informed consent was gained when all study details were shared with participants. The patients were divided into two groups at random using the envelope method. Following informed consent from patients, randomized assignment to the MET or traditional exercise group was determined by having a blinded physical therapist randomly select an envelope containing one of two cards. Thirty patients were divided into two groups: group A were given MET as well as exercise therapy, whereas group B were given exercise therapy alone. The allocated therapy was started at a predetermined date following the initial week of randomization. The examining physiotherapist was not a part of the randomization process and did not know who would be receiving therapy. During the evaluation with the physiotherapist, patients were instructed to keep their therapy assignment a secret. During the course of treatment, participants were instructed to report any adverse effects they experienced.

SAMPLE SIZE DETERMINATION

Utilizing G*POWER statistical software (*version 3.1.9.2; Franz Faul, Universitat Kiel, Germany*), the minimum number of participants per group was determined to be 30. Allocation ratio $N_2/N_1 = 1$ was used in the calculations with a significance level of 0.05, power of 80%, and effect size of 0.74.

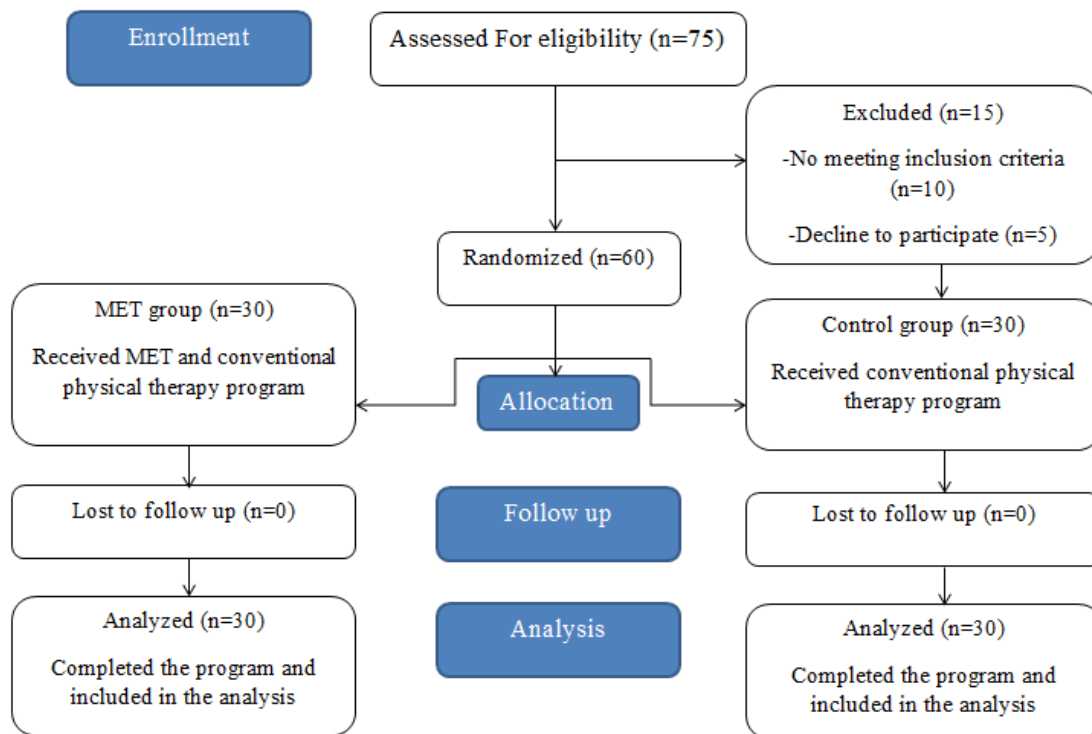


Figure 1: Consort Flow chart of the study

SUBJECTS:

Sixty female patients diagnosed with unilateral Postmastectomy Adhesive Capsulitis took-part in this study. A qualified orthopedist made the initial diagnosis for each patient. and recruited from the National Cancer Institute at Faculty of Medicine, Cairo University. The patients were randomized into 2 groups (study as well as control groups) of the same number, 30 patients within each group. Patients were included in the trial if they fulfilled the subsequent criteria: (1) aged from 40 to 60 years old. (2) Patients with 2nd stage adhesive capsulitis. (3) Patients had shoulder pain as well as stiffness for at minimum three months. (4) Patients with mild lymphedema. (5) Patients with limitation in shoulder flexion, abduction, medial and lateral rotation ROM fewer than 50% in comparison with the other shoulder. (6) Patients clinically and medically stable. (7) All patients were assessed and referred by a physician with MRI before starting the study. (8) All patients don't have from any pathological conditions that might disturb the findings. Patients who had met one of the subsequent criteria were excluded from the study :(1)shoulder or acromio-clavicular joint osteoarthritis. (2) Diseases such as rheumatoid arthritis, Diabetes mellitus. (3) Bone disease. (4) Infection. (5) Severe osteoporosis. (6) Tumors or metastasis. (7) Injury or trauma to the shoulder (whether traumatic or accidental) in the past. (8) Neurological dysfunction (stroke, Parkinson's disease, radiculopathy). (9) Shoulder dislocation or surgery in the past. In addition to (10) supraspinatus tendinitis and impingement, any additional shoulder problems (11) Recent shoulder fracture or wound. (12) Severe psychiatrist illness.

OUTCOME MEASURES:

Methods of Assessment:

Pain intensity was measured by a VAS, ROM by Goniometer while shoulder pain and disability were measured by SPADI.

The visual analog scale (VAS): is a valid and subjective tool of assessment of both acute as well as chronic pain. Marks are made by hand on a 10-cm line that reflects a scale from "no pain" to "worst pain."(9).

It has been widely accepted as the 'gold standard' method for evaluating pain. Using standardized language ('no pain' on one side of the line as well as 'worst pain imaginable' on the other side), a 100 mm blank line is used, and the patient then makes a mark on the line matching to their severity of pain (10).

Goniometer:

Utilizing a goniometer to measure the joint's ROM is a frequent assessment technique. This approach has been employed for nearly nine decades. Joint ROM measurements performed with a goniometer have been the subject of extensive research, all of which have demonstrated their great reliability (11).

Shoulder Pain and Disability Index (SPADI):

Is a self-administered questionnaire developed to evaluate pain and impairment caused by shoulder diseases (12). The SPADI was created to assess present shoulder pain as well as disability in an out-patient context. There are a total of 13 questions in the SPADI, split between a pain scale of 5 questions and a disability scale of 8 questions. A final score, from 0 (best) to 100 (worst), is calculated by averaging the means of each of the subscales (13, 14).

Shoulder pain as well as disability were evaluated using the Arabic SPADI before and after treatment for adhesive capsulitis following mastectomy.

There was a high degree of internal consistency, test-retest reliability, as well as construct validity in the Arabic version of SPADI. Patients with shoulder problems should be evaluated using the SPADI(15)

INTERVENTION:

Patients in both groups participated in passive mobilization exercises for the shoulder joint as well as the scapulothoracic articulation as part of a standard physical therapy program consisting of a single session per day, five days per week, for a total of eight weeks. Mobilizations of the GH joints (gliding posterior to enhance flexion as well as medial rotation, gliding inferior to enhance abduction, and gliding anterior to enhance external rotation). Mobilization of the scapulo-thoracic joint to enhance scapular protraction, retraction, elevation, depression, as well as rotation. Patient was given active ROM as well as pendulum exercises and was told to bend forward and rest their uninjured hand on a table. Exercises include wall climbs (hold for 15 to 30 seconds at the highest point for ten repetitions), the shoulder wheel exercise (circumduction of the glenohumeral joint clockwise as well as anticlockwise utilizing a shoulder wheel), and gentle forward as well as backward, side-to-side, along with circular arm swings while maintaining a straight back as well as relaxed shoulder, and posterior capsular stretching exercises hold 20 s for each 10 repetitions, 30-s of rest was given among each stretching. Total duration of treatment for both groups was approximately 30-40 minutes. (16-18)

The experimental group (MET group) additionally received MET (MET was performed for shoulder flexors, abductors, lateral as well as medial rotators). Patient position: supine lying position. The following are the steps involved in application MET: Patients were asked to (1) stretch the muscle to a felt 'barrier' or to their tolerance of stretching, and (2) create a voluntary contraction that is isometric of the muscle being stretched while being resisted with equal and regulated counterforce by the physiotherapist for 7-10 seconds. (3) a stretch is held for a set amount of time after the muscle relaxes, (4) the physiotherapist "takes up the slack" once the muscle relaxes, thereby lengthening it to a new barrier, and (5) this process is done multiple times. Duration of treatment was approximately 15-20 minutes. (19).

STATISTICAL ANALYSIS

The age of participants in each group was compared using an unpaired t test. The Shapiro-Wilk test was used to ensure that the data followed a normal distribution. The homogeneity of the groups was tested using Levene's test for homogeneity of variances. To analyze the differences in VAS, SPADI, as well as shoulder ROM among the groups, an unpaired t-test was performed. The pre- as well as post-treatment characteristics of each group were compared using a paired t-test. All statistical tests were performed at the $p < 0.05$ level of significance. IBM SPSS Statistics Version 25 for Windows (Chicago, Illinois, USA) was used for all statistical analysis.

- RESULTS

- SUBJECT CHARACTERISTICS:

Sixty females with shoulder adhesive capsulitis post mastectomy participated in this study. Group A had a mean SD age of 50.13 ± 6.67 years, while group B had a mean SD age of 51.8 ± 5.68 years. no significant differences have been detected in age among groups ($p > 0.05$).

Impact of treatment on VAS, SPADI as well as shoulder ROM:

- Within group comparison:

There was a significant decline in VAS as well as SPADI after treatment in comparison with that before treatment in group A and B ($p < 0.001$). the percentage of change of VAS as well as SPADI in Group A was 68.28% and 71.88% respectively, while in group B it was, 45.76% and 54.4% respectively. (table1).

There was a significant improvement in shoulder flexion, abduction as well as lateral rotation after treatment in comparison with that before treatment in both groups ($p > 0.001$). The percentage of change in shoulder flexion, abduction as well as external rotation in group A was 128.25, 75.76 as well as 99.95% respectively where as that in group B was 97.58, 59.9 as well as 89.38% respectively. (Table2).

- Between groups comparison:

at baseline, comparisons showed no statistically significant differences among the groups. Post-treatment comparisons between the two groups showed that VAS as well as SPADI scores were significantly lower in Group A compared to Group B ($p < 0.001$). Shoulder flexion, abduction, as well as lateral rotation were significantly higher in

group A than in group B after treatment ($p < 0.001$). (Table 1-2).

Table 1. Mean VAS and SPADI pre and post treatment of group A and B:

	Group A	Group B	MD	t- value	p value
	Mean ± SD	Mean ± SD			
VAS					
Pre treatment	7.66 ± 0.84	7.43 ± 0.81	0.23	1.08	0.28
Post treatment	2.43 ± 0.81	4.03 ± 0.76	-1.6	-7.82	0.001
MD	5.23	3.4			
% of change	68.28	45.76			
t- value	33.39	22.88			
	p = 0.001	p = 0.001			
SPADI (%)					
Pre treatment	81.66 ± 11.94	79.46 ± 12.59	2.2	0.69	0.49
Post treatment	22.96 ± 6.08	36.23 ± 5.72	-13.27	-8.7	0.001
MD	58.7	43.23			
% of change	71.88	54.40			
t- value	24.02	16.63			
	p = 0.001	p = 0.001			

SD, standard deviation; MD, mean difference; p-value, probability value

Table 2. Mean shoulder ROM pre and post treatment of group A and B:

ROM (degrees)	Group A	Group B	MD	t- value	p value
	Mean ± SD	Mean ± SD			
Flexion					
Pre treatment	70.17 ± 9.95	68.66 ± 9.82	1.51	0.58	0.55
Post treatment	160.16 ± 8.35	135.66 ± 11.35	24.5	9.52	0.001
MD	-90	-67			
% of change	128.25	97.58			
t- value	-41.97	-26.45			
	p = 0.001	p = 0.001			
Abduction					
Pre treatment	72.16 ± 7.73	69.83 ± 6.08	2.33	1.29	0.19
Post treatment	126.83 ± 8.04	111.66 ± 8.93	15.17	6.91	0.001
MD	-54.67	-41.83			
% of change	75.76	59.90			
t- value	-31.95	-20.08			
	p = 0.001	p = 0.001			
External rotation					
Pre treatment	36.66 ± 7.35	35.5 ± 7.11	1.16	0.62	0.53
Post treatment	73.3 ± 5.08	67.23 ± 6.94	6.07	3.85	0.001
MD	-36.64	-31.73			
% of change	99.95	89.38			
t- value	-21.45	-16.65			
	p = 0.001	p = 0.001			

SD, standard deviation; MD, mean difference; p-value, probability value

ETHICAL APPROVAL

This trial has been approved by the Ethical Committee of the Faculty of Physical Therapy at Cairo University, and every aspect of human subject's research has been conducted in accordance with all applicable national rules and institutional standards. Clinical Trial Registry registration number: NCT05274698. This trial was registered in retrospect.

INFORMED CONSENT

All participants gave their informed consent before being included in the study.

DISCUSSION:

Shoulder pain, disability and impaired movements are frequently reported complication in post- mastectomy patients. Adhesive capsulitis, which causes shoulder pain and impairment, is common in individuals who had a mastectomy (4). Both asymptomatic individuals as well as those with symptoms have reported improvements in pain, disability, as well as joint ROM after performing MET (20, 21).

The purpose of this study was to examine the effectiveness of MET for post-mastectomy adhesive capsulitis of the shoulder. Because of the neurophysiologic effects of mobilization upon peripheral mechanoreceptor activation as well as nociceptors inhibition, mobilization has been shown to reduce pain, and the influence of mobilization on shoulder adduction as well as abduction explains why all patients in this trial experienced an increase in ROM along with a decrease in pain. Postero-anterior as well as inferior glides of the glenohumeral joint may have increased capsular extensibility and extended soft tissues, hence releasing restricted joint motion. The shoulder joint may have had higher range of motion because of the increased capsular extensibility. The proprioceptive as well as kinesthetic sensations inside the joint are expected to improve with these therapies, allowing patients to accomplish tasks within their increased ROM. Stretching exercises may also have an effect, since they have been proven to increase ROM by improving the extensibility of soft tissue via the creep reaction, hence altering viscoelastic properties. To keep their joints mobile, individuals need to engage in activities that fall within their expanded ROM. This result confirms the findings of previous research showing that mobilization as well as stretching activities can aid AC (22-25).

When the two groups were examined after treatment, the study group's VAS and SPADI scores were significantly lower than the control group's ($p < 0.001$). the percentage of change of VAS as well as SPADI in Group A was 68.28% and 71.88% respectively, while in group B it was, 45.76% and 54.4% respectively. Changes in the viscoelastic characteristics of the soft tissue after application of the method account for the analgesic and mobilizing effects; an improvement in stretch tolerance is thought to be the mechanism through which mobility is improved(26, 27).Activation of low threshold mechanical receptors on a centrally mediated pain inhibiting mechanism as well as on populations of neurons in the dorsal horn with a putative gating impact are two potential mechanisms for this reduction in pain. The periaqueductal grey in the midbrain receives projections from low threshold mechanical receptors in the joints as well as muscles. Muscle and joint mechanoreceptors are stimulated throughout isometric contraction. This causes localized activation of PAG, which participates in descending modulation of pain, as well as sympatho-excitation triggered by somatic efferents. Mechanoreceptor stimulation leads to nociceptive inhibition at the dorsal horn located in the spinal cord, where nociceptive impulses are gated simultaneously (28). These findings corroborate and agree with those of previous research (29-32) to further highlight the crucial function of MET in AC recovery.

In addition, the findings of the present study showed that the experimental group improved much more in terms of shoulder flexion, abduction, as well as lateral rotation than the control group did after treatment ($p < 0.001$). Shoulder flexion, abduction, as well as lateral rotation all increased by 128.25, 75.76, as well as 99.95% in group A, whereas they increased by 97.58, 59.9, as well as 89.38% in group B, respectively. The Golgi tendon organ is activated when a muscle contracts against an equivalent counterforce, which is how MET increases ROM. Golgi tendon organ afferent nerve impulse travels down the spinal cord's dorsal root to interact with an inhibitory motor neurone. This inhibits the efferent motor neurones from sending out their impulses, lowering muscle tone and allowing the agonist to relax and lengthen for a gain in ROM (33).In addition to increasing the ROM in your joints, MET also lengthens your muscles through a process described as a "raised tolerance to stretch" (26). Consistent with previous research (31-36), this study found that MET is crucial to the recovery of AC patients.

The study showed that MET is important for managing AC without causing any negative side effects. It also gives preliminary evidence for making MET an important part of AC rehabilitation. However, there are some factors to keep in mind when interpreting these results; The primary drawback with the study was that it was lacking of long-term effect of the patients after the trial was finished. This made it hard for researchers to look at the long-term effects of the treatment, so additional studies should include patient follow-up. To reduce human suffering as well as financial costs, it is important to raise awareness about the protection, early diagnosis, as well as prompt treatment of shoulder problems in post-mastectomy patients, so experiments should be done to evaluate early detection.

CONCLUSION:

Muscle energy technique can improve the shoulder pain, range of motion as well as function in AC Postmastectomy significantly more than traditional physical therapy exercise program only.

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Disclosure statement

No author has any financial interest or received any financial benefit from this research.

Conflict of interest

The authors state no conflict of interest.

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