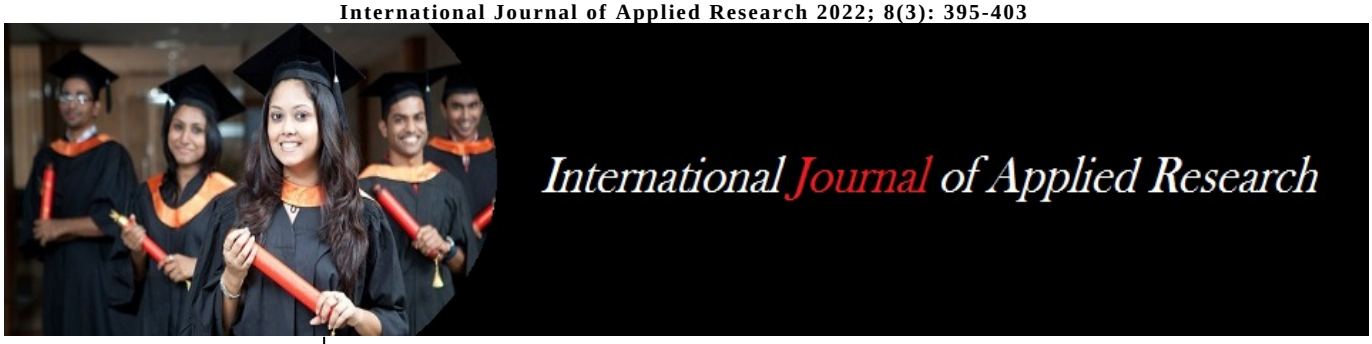

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Effectiveness of muscle energy technique and movement with mobilization in adhesive capsulitis of shoulder

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Abstract
Background: Adhesive capsulitis is a clinical diagnosis made from the history of the gradual onset of severe shoulder pain with the progressive limitation of active and passive Glenohumeral movements. Muscles energy techniques helps to mobilize restricted joints by stretching hypertonic muscles, capsules, ligaments and fascia. Mobilization with Movement technique combines technique, with a sustained application of a manual technique "gliding" force to a joint with concurrent physiologic (osteo-kinematic) motion of the joint, either actively performed by the subject or passively performed by the therapist.
Aim: To compare the effectiveness of Muscle energy technique versus Mulligan's technique on improvement of pain, mobility and functional ability for subjects with ACS
Methodology: 42 individuals with ACS were included and allocated to two groups (n=21). Groups were administrated with Muscle energy technique along with conventional therapy, Mobilization with Movement along with Conventional therapy and for 4 weeks (5 days per week). ROM, SPADI and NPRS were used to assess changes between baseline and post intervention.
Result and Conclusion: The MWM (Group B) was associated with statistically significant greater change in ROM and SPADI score than MET (Group A) and. There was statistically significant change observed NPRS in both the groups: MWM along with Conventional therapy improves ROM of shoulder and functional disability in patients with Adhesive capsulitis.

Keywords: Adhesive capsulitis of shoulder, muscle energy technique, mobilization with movement

Introduction
Adhesive capsulitis of shoulder (ACS) is a condition of the shoulder of unknown aetiology. It is characterized by pain and restriction of both passive and active range of motion (ROM) [1]. Primary adhesive capsulitis is a term used to describe an insidious onset of pain and movement restriction in the glenohumeral joint. The shoulder is a complex anatomical structure that allows movement in many planes and is crucial for activities of daily living.

Decreased shoulder mobility is a serious clinical finding. The various synonyms for Adhesive Capsulitis are frozen shoulder, pericapsulitis, scapula-humeral periarthritis, humeroscapular fibrositis, periarthritis stiff and painful shoulder [2]. The term "Periarthritis" first described by a French doctor ES Duplay in 1872. The term "ACS" was first introduced by Codman in 1934 [3]. Prevalence of Adhesive capsulitis Adhesive capsulitis usually affects patients aged 40-70, with females affected more than males, and no predilection for race. There is a higher incidence of ACS among patients with diabetes (10-20%), compared with the general population (2-5%). There is an even greater incidence among patients with insulin dependent diabetes (36%), with increased frequency of bilateral shoulder involvement. ACS typically last 12 to 18 months with a cycle of 3 clinical stages [2].
Adhesive capsulitis is a disorder in which the shoulder capsule, the connective tissue surrounding the glenohumeral joint of the shoulder, becomes inflamed and stiff, greatly restricting motion and causing chronic pain" [4].
Pain associated with adhesive capsulitis can cause a limitation or selective immobilization of the painful shoulder. Prolonged immobilization of a joint has been shown to cause several detrimental patho-physiologic findings including: decreased collagen length, fibro-fatty

infiltration into the capsular recess, ligament atrophy resulting in decreased stress absorption, collagen band bridging across recesses, random collagen production, and altered sarcomere number in muscle tissue [5].

Clinical features

Adhesive capsulitis is a clinical diagnosis made from a history of the gradual onset of severe shoulder pain with the progressive limitation of active and passive Glenohumeral movements [6, 7] Primarily, There are 3 phases in Adhesive capsulitis:

Phase One: (Stage of Pain or Freezing)

The freezing stage is also known as the painful inflammatory phase. The freezing phase is characterized by acute constant shoulder pain and range of motion (ROM) limitations in all direction particularly in capsular pattern external rotation (ER) > abduction (ABD) > flexion (FLX) > and internal rotation (IR). The onset is gradual and is experienced as diffuse shoulder pain, which the patient has difficulty in localizing anatomically. Patient often describe a progressive onset of pain lasting for weeks and months. Pain is usually worse at night and is exacerbated when the patient lies on affected side. Duration is from 2 to 9months [3, 5, 8].

Phase Two: (Stage of Stiffness or Frozen)

The frozen phase is characterized by subsiding pain and progressive loss of shoulder movement in capsular pattern that is external rotation, abduction, followed by internal rotation. In this stage, pain during rest subsides, and discomfort in the form of a dull ache occurs during movement. Functional restriction increases as immobility sets in, and they often seek out the clinician at this stage because they are alarmed by their inability, for example; to reaching out for a telephone, remove wallet from a back pocket. The duration of this may last anywhere from 4 to 12 months [3].

Phase Three: (Stage of Recovery or Thawing)

The thawing phase is characterized by gradual regaining of shoulder movements, as the shrunken and adherent capsules become separated from the humeral head. As motion slowly increases, there is a progressive lessening of discomfort, which comes as a great relief for the patient. The duration is from 6 to 2 years [9].

Etiologies of adhesive capsulitis

While the aetiology of ACS remains unclear, several studies have found that patients with ACS had both chronic inflammatory cells and fibroblast cells, indicating the presence of both an inflammatory process and fibroblasts [10].

Muscle Energy Technique

Muscle Energy Techniques (MET) are a class of soft tissue osteopathic manipulation methods that incorporate precisely directed and controlled, patient initiated, isometric contractions, designed to improve musculoskeletal function and reduce pain [9]. METs have a wide application. They can be applied to muscle hyper tonicity and muscle tightness, but can be equally effectively applied to joint dysfunction and joint capsule adhesions [11]. It is used to help mobilize restricted joints by stretching hypertonic muscles, capsules, ligaments, and fascia. This leads to improved postural alignment and the restoration of proper joint biomechanics and functional movement [12].

Mobilization with Movement

The use of MWM for peripheral joints was developed by Mulligan. This technique combines a sustained application of a manual technique “gliding” force to a joint with concurrent physiologic (Osteo-kinematic) motion of the joint, either actively performed by the subject or passively performed by the therapist. The manual force, or mobilization, is theoretically intended to cause repositioning of bone positional faults. The intent of MWM is to restore pain-free motion at joints that have painful limitation of range of movement [13]. Studies have shown that both the MET technique and MWM are used effectively in the treatment of ACS. However there are no studies found in the literature which compare the effects of these two methods of manual therapy. The present study is a research question whether there is any difference between met technique versus MWM on improving pain, mobility and functional disability in subjects with ACS.

Aims and Objectives: To determine the effectiveness of the MET and MWM along with conventional therapy on range of motion, on pain and on functionality in ACS patient, to compare the effectiveness of MET to MWM.

Methodology

Study Design: Experimental pre-test – post-test study design

Sample Size: Sample size is calculated on G* power software on the basis of mean abduction range of motion of the shoulder previously reported study [31] from a similar population of patients with adhesive capsulitis effect size 0.956 and significance level of 0.05 and 0.80 power was selected. These criteria led to an estimated sample size of 19 participants in each group and to take into account a probable 10% drop out, the sample size is enhanced to 21 in each group so total 42 patients were included in this study.

Sampling Method: Purposive sampling

Inclusion Criteria

- All the patients (both males and females) with AROM approximately equal to 90 (±20) degrees between ages 40 to 60 years.
- All the subjects must have ACS for at least last three months with average shoulder pain >4 on 11-point scale [NPRS] (0 =no pain; 10 = maximal pain).
- Subjects must be diagnosed with stage-2 adhesive capsulitis by an orthopaedic surgeon.

Exclusion Criteria

- All the patients having any cervical pathology.
- Patients with DM.
- Previous surgeries to affected shoulder; neck and elbow.
- Shoulder girdle motor deficit associ5ated with neurological disorders (Stroke, Parkinson’s disease).
- History of fracture around shoulder complex.
- Osteoporosis.
- Subjects with Rotator cuff tears and other shoulder ligament injuries.
- Malignancy

Procedure
Approval by the institutional ethical committee of The Sarvajanik College of Physiotherapy, Surat was obtained before commencing this study. The purpose of this study was explained and a written informed consent was obtained from all the subjects. The study procedure was conducted through assessing ACS patients, initial recording, treatment and final recording. Forty two participants volunteered to be a part of this study based on the inclusion and exclusion criteria. Demographic data was collected along with initial assessment of shoulder range of motion (flexion, shoulder abduction, and shoulder external rotation) using the universal goniometry, functional disability using SPADI and NPRS for pain. Subjects were allocated into two groups, group A (MET) and group B (MWM) by using quasi-randomization procedure as follows. First subject with ACS was allocated to Group A, second visiting subject to Group B once they fulfilled the inclusion and exclusion criteria. The same sequence of procedure was followed throughout for consecutive subjects.

Descriptions of groups were as follows
Group A (M *Et al.* ong with Conventional therapy): patients were administered MET technique along with conventional therapy.

Group B (MWM along with Conventional therapy): patients were administered MWM along with conventional therapy.

All the patients completed demographic details and physical examination performed by the researcher. On the first day of the study all subjects underwent a baseline assessment prior to any intervention using ROM, SPADI and NPRS. All the measurements were taken by the researcher of the study.

Sequence of muscle energy technique for Group A (MET group)
All the 21 patients had received M*Et al.*ong with conventional physiotherapy for 5 days a week, up to 4 weeks *et al.* [32, 33].

MET for Glenohumeral Joint Restricted Flexion
All the patients with restricted Glenohumeral joint flexion were positioned in Side lying position

Fig 1: MET for Glenohumeral Joint Restricted Flexion

Procedure
Therapist stands in side of the patient and one hand of therapist cups the shoulder of the side lying subjects firmly compressing the scapula and clavicle to the thorax, with the other hand the therapist's slowly introduces shoulder flexion in the horizontal plane as range of motion to 180º is assessed. At the position of very first indication of restriction in movement, the patients were instructed to push further towards the direction of flexion, this effort firmly resisted utilizing not more than 20% of their strength, and after 7 to 10 seconds, the patients were instructed to slowly cease the efforts simultaneously with the therapist. After 3 to 4 seconds of relaxation, the therapist moved the arm to take the shoulder in to further flexion to next restriction barrier, and three sets of ten repetitions in each direction was been given to the patient [9, 11].

MET for Glenohumeral Joint Restricted Abduction
All the patients with restricted Glenohumeral joint abduction were positioned in Side lying position

Fig 2: MET for Glenohumeral Joint Restricted Abduction

Procedure
Therapist stands in side of the patient and one hand of therapist cups the shoulder of the side lying patient firmly compressing the scapula and clavicle to the thorax, with the other hand the therapist slowly abducts the shoulder towards the patients head. At the position of very first indication of resistance to movement, the patient was instructed to push further towards the direction of abduction, utilizing not more than 20% of their strength, after 7 to 10 seconds, the patient were instructed to slowly cease the efforts simultaneously with the therapist. After 3 to 4 seconds of relaxation, the therapist moved the arm to take the shoulder in to further flexion to next restriction barrier, building up force slowly. Three sets of ten repetitions in each direction was been given [9, 11].

MET for Glenohumeral Joint Restricted External Rotation
All the patients with restricted Glenohumeral joint abduction were positioned in Side lying position

Fig 3: MET for Glenohumeral Joint Restricted External Rotation

Procedure
Therapist stands in side of the patient and one hand of therapist cups the shoulder of the supine lying patient

firmly, and ensures that his/her shoulder remained in contact with the table throughout the procedure. The patient shoulder and elbows slowly introduce the external rotation of the shoulder. At the position of very first indication of resistance to movement, patient was instructed to push further towards the direction of examiner at the distal forearm. After 7 to 10 seconds of contraction, the patient was instructed to slowly cease the efforts simultaneously with the therapist. After 3 to 4 seconds further flexion to the next restriction barrier, and three sets of ten repetitions in each direction was been given [9, 11].

Sequence of movement with mobilization technique for Group B (MWM group)

All the 21 subjects had received MWM along with conventional physiotherapy for 5 days per week, up to 4 weeks *et al*. [32, 33]. Researcher had practiced enough before doing it on the subjects.

MWM Glenohumeral Joint Restricted flexion

All the patients with restricted glenohumeral joint flexion were positioned in sitting position

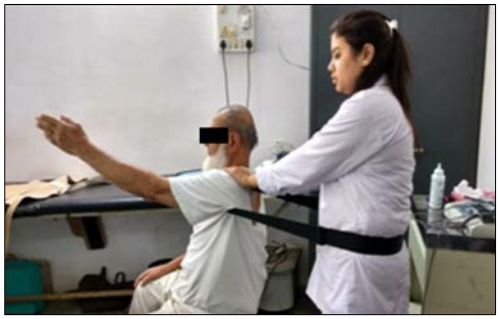

Fig 4: MWM for Glenohumeral Joint Restricted flexion

Procedure

Mulligan belt placed around the head of the humerus to glide the humerus head appropriately (posterior glide) with one hand the therapist held the belt in place sustaining the glide. A counter pressure was been applied to the scapula with therapist's other hand. The patient was asked to perform slow active shoulder movement (flexion) to the end of pain free range. The glide was been sustained during the movement and released after returning to the starting position. The same procedure was been performed. The procedure was been performed with three sets of ten repetitions, with 1 minute rest between sets [15].

MWM for Glenohumeral Joint Restricted Abduction

All the patients with restricted glenohumeral joint flexion were positioned in sitting position

Fig 5: MWM for Glenohumeral Joint Restricted Abduction

Patient's position: Sitting position. Mulligan belt was placed around the head of the humerus to glide the humerus head appropriately (Inferior glide) with one hand the therapist held the belt in place sustaining the glide. A counter pressure was been applied to the scapula with therapist's other hand. The patient was asked to perform slow active shoulder movement (abduction) to the end of pain free range. The glide was sustained during the movement and released after returning to the starting position. The same procedure will be performed. The procedure was been performed with three sets of ten repetitions, with 1 minute rest between sets (15).

MWM Glenohumeral joint restricted external rotation

All the patients with restricted Glenohumeral joint flexion were positioned in sitting position

Fig 6: MET for Glenohumeral Joint External Rotation

Patient's position: Sitting. Mulligan belt placed was around the head of the humerus to glide the humerus head appropriately (Posterolateral glide). With one hand the therapist held the belt in place sustaining the glide. A counter pressure was been applied to the scapula with the therapist's other hand. The patient will be asked to perform slow active shoulder movements (external rotation) to the end of pain free range. The glide was been sustained during the movement and released after returning to the starting position. The procedure was been performed three sets of 10 repetitions, with 1 minute rest between sets [15].

Conventional therapy for both groups (group A, group B)

Conventional therapy (moist heat therapy, Codman's exercise, finger walk on walk exercise, wand exercise and) for both the group were given, Moist heat therapy:

Moist heat therapy using hot packs were given to the patients' prior to MET technique and MWM technique in both the groups.

Moist heat therapy

Fig 7: Application of hot pack

Moist heat therapy

All the patients receiving moist heat therapy were laied in supine position.

Procedure: Hot pack wrapped in several layers of towel was given on shoulder joint for approximately 10mins.Codman's exercises:
Codman's exercise, Wand exercises, finger ladder, ROM exercises were given to the patients after the application of hot packs and MET technique and MWM technique in both the groups.

Codman's exercise

Fig 8: Codman's exercise

Position of patient: patients was asked to lean over at the waist about 90 degree (or as close to 90 as you can), holding on a sturdy surface for support and with the unaffected arm

Procedure: Patients were instructed to let the affected arm hang down, patients were instructed to keep the muscle around your shoulder, arm and back relaxed. Patients were asked to move their arm side to side (adduction, abduction). Patients were asked to move their arm forward and backward (flexion and extension). Patient was asked to move their hand in circumduction. All the exercises were repeated 10 times.

Finger ladder Exercises

Fig 9(a): Finger ladder exercise for flexion

Fig 9(b): Finger ladder exercise for Abduction

(a) Finger ladder exercise for flexion
position of patients: patients were asked to stand facing towards the wall with straight elbow Procedure: patient were asked to slowly walk their finger up the wall (ladder) as high as they can by moving closer to the wall and hold for few seconds and then walk finger back down. Patients was asked to repeat the same exercise 10 times

(b) Finger ladder exercise for Abduction
Position of patients: patients were asked to stand facing lateral side of affected shoulder.
Procedure: patient was asked to slowly walk his finger up the wall (ladder) as high as he can by moving closer to the wall and then hold for few seconds hold for few seconds and then walk finger down. Patient was asked to repeat the same exercise 10 times.

Wand Exercises

Fig 9(c): Wand exercise for flexion

Fig 9(d): Wand exercise for abduction

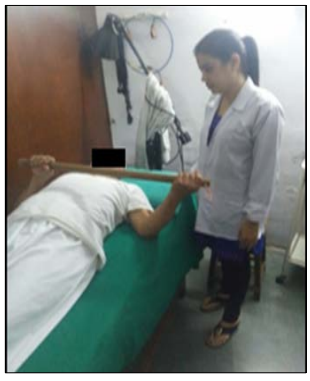

Fig 9(e): Wand exercise for External Rotation

(C) Wand exercise for flexion: Patients were asked to stand in upright position and hold a stick in both hands, palm down. Patients were instructed to stretch their arms by

lifting them over head, keeping their arm straight hold for 5 seconds and return to the starting position. Repeat 10 times

(D) Wand exercise for abduction: Patients were asked to stand in upright position and hold a stick in both hands palm facing away from the body, use the unaffected side to push the affected side out to the side and up as high as possible. Keep arm straight. Hold for 5 seconds. Relax and return to starting position. Repeat 10 times.

(E) Wand exercise for External Rotation: patients were instructed to lie on the back and hold the stick in both hands, palms up while his upper arm was resting on the floor with his elbow at his side and was bend up to 90 degree. Patients were asked to use the unaffected arm to push his affected arm out away from the body. Hold it the stretch for 5 seconds. Repeat 10 times.

Active range of motion exercises of shoulder flexion, abduction, adduction and external rotation [23]. Patient were instructed to stand in upright position and perform all active exercises of range of motion of shoulder flexion, abduction and external rotation

Reassessment of the all the patients including Group A and Group B were taken post treatment at the end of 4th week. Reassessment was taken for outcome ROM, SPADI AND NPRS.

Results and Discussion

Table 1: Demographic Data

Variable	MET Group	MWM Group
Subjects	21	21
Age	52.52	54.38

Table 1 shows the demographic data of the both groups including number of patients in Group and Mean age

Table 2: Normality of data

Outcome	Shapiro-Wilk test		
	Statistic	Df	Sig.
Flexion rom	0.85	42	0.000
Abduction rom	0.899	42	0.001
External Rotation rom	0.917	42	0.005
SPADI	0.895	42	0.001
NPRS	0.779	42	0.000

Table-2 Shows test of Normality of 42 subjects from both the m MET group and MWM group which were included in present study. In this Shapiro-Wilk test are used and according to that data were not normally distributed so Non-parametric test were used for further analysis.

Table 3: Wilcoxon Signed Rank test for within group comparison ROM (Flexion, Abduction, External rotation, SPADI, NPRS) in Group A (n=22)

Variables	Level	Mean± SD	Z Value	P Value
Shoulder Flexion ROM	Baseline	94.24 ± 5.52	-4.017	0.00
	4TH Week	140.90 ± 7.83		
Shoulder Abduction ROM	Baseline	90.90 ± 5.62	-4.017	0.00
	4TH Week	138.43 ± 8.46		
	4TH Week	59.90 ± 4.95		
SPADI	Baseline	70.67 ± 4.71	-4.022	0.00
	4th week	46.33 ± 5.04		
NPRS	Baseline	3.05 ± 1.28	-4.006	0.00
	4TH Week	5.14 ± 0.85		

Table 3 shows there is a significant difference between pre-post treatment in Group A

Table 4: Wilcoxon Signed Rank test for within group comparison ROM (Flexion) in Group B (n=21)

Variables	Level	Mean± SD	Z Value	P Value
Shoulder Flexion ROM	Baseline	93.67 ± 5.19	-4.016	0.00
	4TH Week	161.43 ± 10.47		
Abduction	Baseline	90.62 ± 4.76	-4.017	0.00
	4TH Week	152.00 ± 8.56		
External Rotation	Baseline	37.86 ± 5.45	-4.047	0.00
	4th week	72.76 ±7.449		
SPADI	Baseline	68.29 ± 5.041	-4.016	0.00
	4th week	29.76 ± 5.62		
NPRS	Baseline	4.95 0.86	-4.020	0.00
	4th week	2.29 1.14		

Table 4 shows there is an significant difference between pre-post treatment in Group B

Table 5: Independent sample t test for between group comparison of ROM and SPADI in Group A (n=21) and Group B (n=21)

Variables	MET Group	MWM Group	t value	P value
Improvement Flexion	Mean ±S SD	Mean ± SD		
	46.66 ± 8.87	67.76 ± 11.92	-6.502	0.00
Improvement Abduction	47.52 ± 10.83	61.38 ± 9.83	-4.339	0.00
SPADI	-24.33 ± 5.62	-38 ± 7.92	6.693	0.00

Table 5 shows there is a significant difference between pre-post treatment in Group B Group A and Group B for (Flexion, Abduction and SPADI)

Table 6: Non parametric (independent sample t-test) for between group comparison of ROM and NPRS in Group A (n=21) and Group B (n=21)

Variable	MET Group	MWM Group	Z Value	P Value
	Mean ± SD	Mean ± SD		
Improvement External Rotation	21.76 ± 3.63	34.90 ± 7.68	-4.917	0.00
Improvement NPRS	-2.09 ± 0.88	-2.66 ± 1.11	-1.631	0.103

Table 6 shows there is a significant difference between pre-post treatment in Group A and Group B for (External Rotation), but there was no significance difference seen in NPRS score in both the groups.

Discussion

The study attempted to find out the effectiveness of Muscle Energy Technique with conventional therapy and Movement with Mobilization with conventional physiotherapy on ACS. In the present study it was found that there is a statistically significant improvement in pain, shoulder mobility and functional disability within MET and MWM. Between the groups analysis found that there is no statistically significant difference between MWM group and MET group in improvement of pain, but there is statistically significant

difference in improvement of shoulder mobility, functional disability for subjects with adhesive capsulitis of shoulder.

Khyati p *et al*. [34] conducted a study on comparative effect of Spencer technique versus mulligan's technique for subjects with ACS. 20 subjects each in mulligan and Spencer group included subjects in Mulligan group received mulligan technique while subject in Spencer technique received Spencer technique. Assessment for pain by visual analog scale, functional disability using SPADI and shoulder abduction and external Rotation using Goniometer was done, The result improvement in SPADI score, abduction and external rotation range of motion in mulligan group compared to Spencer group there was no significance difference in reduction of pain present between both groups, assessment was taken before and after five days of intervention. In present study said that there was 4 week intervention, in that significant improvement was showed in rom of flexion, abduction and external rotation, the present study has taken flexion range of motion in consideration and intervention and its assessment was taken for the same while range of motion of flexion and intervention and assessment was not performed in this study as it is equally important because Glenohumeral joint gets restricted in capsular pattern. The present study also shows improvement in range of motion of abduction and external rotation, improvement in SPADI score which was more significant in mulligan group, there was no significant improvement in reduction of pain between the MET and MWM group. Hence both the study shows similar results.

Jing-Ian Yang *et al*. [23] studied to compare the use of three mobilization techniques – end range mobilization, mid-range mobilization and MWM in the management of subjects with frozen shoulder syndrome and found that end range mobilization and MWM were more effective in increasing mobility and functional ability [23]. Therefore in present study the mechanisms behind the effectiveness of MWM are based on the neurophysiologic effect on pain reduction, correction of mechanical dysfunction and positional fault. Thus, promoting alleviation of pain, restoring ROM and earlier return to function.

Wayne Hing [22] conducted a systematic literature review on Mulligan's Mobilization with Movement to critically evaluate the literature regarding MWM at peripheral joints and determine the overall efficacy related to MWM prescription they concluded that the efficacy of MWM at peripheral joints is well established for various joints and pathologies with 24 out of 25 studies (96%) demonstrating positive effects [22]. The present study supports this literature as the presence study also shows the improvement in range of motion, functional disability and pain in ACS.

Hariharasudhan Ravichandran, Janakiraman Balamurugan [35] conducted an experimental study on 60 patients of ACS and they were divided into 2 groups, outcome measures used were range of motion of flexion, abduction and external rotation and Pennsylvania shoulder score(1st subset) to determine the efficacy of Proprioceptive neuromuscular facilitation (PNF) technique and muscle energy technique (MET) in limiting pain and disability among subjects with adhesive capsulitis of shoulder and they concluded that Proprioceptive neuromuscular facilitation technique was effective technique in relieving pain, restoring ROM and restoring function among subjects with adhesive capsulitis and MET technique was least significant. Diabetic patients were also included in study and the prognosis is poor in diabetic patient. Conventional therapy was not given along with this techniques. Diabetic patients were excluded in this study also conventional therapy were added along with MET and MWM techniques that might have been the reason for improvement in ROM, SPADI and NPRS within the MET group The present study shows that MWM is more effective in improving ROM (Flexion, Abduction and External Rotation) and functional ability then MET but MET may be less effective than MWM technique but it shows significant improvement in ROM, SPADI and NPRS within the MET group

In Mulligan's group, the improvement in pain, shoulder mobility and functional disability could be because of Mulligan's mobilization with movement which is a combination of an active movement with simultaneous passive accessory mobilization which helps in rapid restoration of movement. MWM technique is found to be effective by neurophysiologic mechanism of production of initial hypoalgesia based on stimulation of peripheral mechanoreceptors and the inhibition of nociceptors and altering sympathetic nervous system, and biomechanical concept of positional fault correction. This treatment technique produces a total and immediate pain relief during the treatment application. It corrects the positional fault and there is an immediate change in the bony position during application of MWM. One mechanism underlying this manipulative therapy induced pain modulation is the activation of the descending pain inhibitory system within the central nervous system [35] The active movement in this technique stimulates the proprioceptive tissues, such as the Golgi tendon organ by tendon stretch MWM repositions the joint, causing it to track normally [36]. MWM passively stretches the tightened soft tissues and shoulder capsule in adhesive capsulitis and thereby restores the normal extensibility of the shoulder capsule and tight soft tissues. This initial effect is sufficient to stimulate the long term changes in nociceptive and motor system dysfunction that are reflected in pain relief and improved function.

MET increases pain free ROM by stretching the shoulder capsule and tight soft tissues, thus restoring specific joint motion. This technique when applied increases the lymphatic flow from the treatment area. With this technique the joint regains its normal ROM and resets neural reflexes. In MET group the improvement in pain, shoulder mobility and functional disability could be because MET technique is aimed to decrease pain by altering the circulatory pain biomarkers. Its passive rhythmic movement re-establishes the arthrokinematic gliding and rolling thereby restoring shoulder mobility. MET technique increases pain free ROM by stretching the shoulder capsule and tight soft tissues, thus restoring specific joint motion. This technique when applied increases the lymphatic flow from the treatment area. With this technique the joint regains its normal ROM and resets neural reflexes [37]. Osteokinematic rotation and enable the restoration of shoulder mobility. MET technique also reduces or nullifies the physical signs of somatic dysfunction, tissue changes, asymmetry, restriction of motion and tenderness. The mechanism of this manipulative technique in reduction of pain is that this technique influences the levels of circulatory pain biomarkers. Pain is associated with the production and release of multiple nociceptive, inflammatory mediators, circulatory neurochemical biomarkers. After treatment concentration of several circulatory biomarkers were altered. Changes from

baseline levels of these biomarkers occurred immediately after, as well as 24 hours after the treatment [38]. These mechanisms of MET technique in the present study might have shown reduction in pain levels. When the improvement in pain in MWM group was compared with MET subjects there, was no significant difference, however MWM group subjects showed greater improvement score in shoulder ROM (Flexion Abduction and External Rotation) and functional disability. This could be due to added effect of active movement along with simultaneous passive accessory mobilization in MWM technique which is lacking in Spencer technique. MWM technique was better in improving function as it may be beneficial due to additional proprioceptive tissues, such as the Golgi tendon organs got activated by tendon stretch and it restored the normal Glenohumeral arthrokinematic which resulted in capsular stretching. Both the groups received conventional exercises. These exercises also might have shown the added effect in the both groups. Therefore this study is lacking in finding out the effect of conventional therapy as there was absence of control group. Also this study was carried out for one session per day for five days, therefore long term effects of both the techniques are not evaluated. Based on the analysis and findings, the present study found that with one week of MWM and Spencer technique, there is no statistically significant difference in pain levels between the groups and pain was measured as a subjective outcome measure. There is a statistically significant difference in objective measures such as shoulder mobility and functional disability.

Limitations

It is a short duration study, long term effects were not known. Randomized controlled trial is needed to find long term effects of both mobilization techniques. There is lack of control group. Future research is required.

Conclusion

Thus from this study, it can be concluded that all the three groups showed significant difference within the group, but there was no statistical significant difference between the group. Hence all the three groups were equally effective in reducing tenderness of upper trapezius.

Future Recommendation: Further study can be carried out to find the effect of MWM and MET technique comparing with control group. Further study can be done measuring effect of these techniques on other outcome measures.

Ethical Clearance: Approval by the institutional ethical committee of The Sarvajanik College of Physiotherapy, Surat was obtained.

Conflict of interest: None

Source of funding: Self

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