

A comparative study on effectiveness of muscle energy technique versus Cyriax's deep friction technique in adhesive capsulitis

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ABSTRACT

Introduction and Aim: Adhesive capsulitis occurs commonly among middle aged and elderly populations which is typically consist of stiffness in both active and passive range of motions, pain and difficulty in performing normal activities of living. The aim of the study was to compare the efficacy between muscle energy technique and Cyriax technique coupled with mobilisation technique in reduction of pain and in improving the range of motion and functional ability in subjects with adhesive capsulitis.

Materials and Methods: 30 subjects were randomly assigned for the experimental study by the selection criteria and separated into two groups: group A –Mobilisation technique with muscle energy technique and group B – Mobilisation technique with Cyriax's deep friction technique. The period of intervention was 5 sessions per week for three weeks. The therapy progression was evaluated by goniometry and SPADI Scores day prior to treatment and 21 days after treatment.

Results: The analysis showed that the both treatment groups showed improvement comparing pre and post treatment, while group A showed significant difference compared to group B in pain relief, range of motion and functional disability. Statistically comparing the mean values of all the outcome scores of the two treatment groups has showed group A as more efficient than group B at p- value less than 0.001.

Conclusion: The current study concluded that the muscle energy technique with mobilisation technique shows more improvement than the Cyriax's deep friction technique with mobilisation technique. It shows a better combination therapy for the treatment of Adhesive Capsulitis.

Keywords: Cyriax's deep friction technique; muscle energy technique; adhesive capsulitis.

INTRODUCTION

Adhesive capsulitis occurs commonly among middle aged and elderly populations which is typically consist of stiffness in both active and passive range of motions, pain and difficulty in performing normal activities of living (1, 2). Adhesive capsulitis is a chronic painful condition with restricted movement in all planes particularly more restrictions on abduction and external rotation of shoulder joint. It affects more commonly middle aged and elderly populations. The condition was explained and differentiated from glenohumeral arthritis in 1872 by Duplay (3, 4). The term "frozen shoulder" was first introduced by Codman in the year 1934. The common symptoms of frozen shoulder are pain and stiffness in the capsular pattern.

The term "adhesive capsulitis" means that this condition sequenced from thickening and eventual contracture of the joint capsule (5). More than 4 % of adult population between 40 and 65 years suffered from adhesive capsulitis with more sufferers are women. The exact cause is not known. There had been so many theories proposed, but conclusive and confirmatory results have not been found yet. However, there exists a greater link between adhesive capsulitis, hyperthyroidism, cerebrovascular disease, coronary artery disease,

autoimmune disease and diabetes mellitus (6, 7). The main effects of MET can be explained (8) by two distinct physiological processes: Post Isometric Relaxation (PIR) and Reciprocal Inhibition (RI). Deep transverse friction is also known as cross-fiber friction massage, popularized by James Cyriax (9) DTF is a crucial type of soft tissue massage applied especially to the structure such as joint capsules, tendons, muscle bellies, musculotendinous junction, ligaments. The finger directly to the lesion and transverse to the direction of the fibres apply massage.

Deep transverse friction:

Place the thumb or fingertip on the shoulder joint line, supraspinatus, subscapularis and pectoralis major and compress. Moving the client's skin back and forth over the treated fibers at right angles or perpendicular to the tissue fibers. Pressure should be moderate between a 5 and 7 on a 10 point scale (10, 11).

The aim of the study was to compare the efficacy between muscle energy technique and Cyriax's technique coupled with mobilisation technique in reduction of pain and in improving the range of motion and functional ability in subjects with adhesive capsulitis.

MATERIALS AND METHODS

Thirty patients were selected based on simple random sampling technique. After getting approval from ethical committee, the patients were selected depending upon the various inclusion and exclusion criteria. All samples included were diagnosed as adhesive capsulitis by orthopedicians and they all showed a capsular pattern of restriction was participated in this study.

Inclusion criteria: Clinically diagnosed adhesive capsulitis (stage II), Age group (40-60 years), Minimum 2 months' duration and marked loss of passive and active ROM.

Exclusion criteria: Age group below 40 years, History of any trauma or surgery, Patients under steroid therapy, un-controlled diabetes, skin infections, polyarthritis, neurological disorder, Medical conditions such as cardiac disease, infection, coagulation disorder were excluded.

Procedure

60 patients with clinically diagnosed adhesive capsulitis reporting to the Physical Therapy Department of ACS Medical College and Hospital. Then tested for the above said inclusion and exclusion criteria and 30 patients who were diagnosed with adhesive capsulitis by orthopaedicians and showed a capsular pattern of restriction included in this study.

After getting approval from ethical committee, aim and technique were explained to the patients and get an informed consent from them. The baseline assessment was recorded. The study was conducted for a period of three weeks. Group A received MET with maitland mobilisation technique and while group B received Cyriax deep friction technique with maitland mobilisation technique. Both groups were given moist heat therapy for 15 minutes before the initiation of treatment and were instructed to do home exercise program. Home exercise program consist of shoulder mobilisation exercises and capsular self-stretching exercises. Post intervention assessment was measured. An experimental design was followed with outcome measures of range of motion and shoulder pain and disability score (SPADI) were collected with pre and post treatment scores.

Prior to the manual therapy, moist heat was given for two groups. Then, maitland graded oscillation technique grade 2 and 3 (for improving range of motion, stretching (3) and to reduce pain (2). shoulder mobilisation exercises consist of pendular exercises, wall ladder exercises, towel exercises, wand exercises and capsular stretching exercises.

Group A

MET for glenohumeral joint restricted flexion

Therapist stood in front of the subject and placed one hand over the top of the patient's involved shoulder

at the superior part of the scapula and hold the glenohumeral joint to palpate for motion. The other hand and forearm supported the subject's flexed elbow and flexed the humerus at the glenohumeral joint in the sagittal plane up to the initial point of resistance. The subjects were instructed to extend the elbow against equal opposite force applied by the therapist. Hold it for 3-5 seconds, and then the patients were allowed to relax for 2 seconds, take up the slack and then repeat the procedure for 5 times.

MET for glenohumeral joint restricted abduction

Therapist stood in front of the patient, placed one hand over the top of patient's involved shoulder, cups the glenohumeral joint to palpate for motion and instructed the patients to press the elbow towards their body against equal opposite force applied by the therapist. Hold it for 3-5 seconds, and then the patients were allowed to relax for 2 seconds, take up the slack and then repeat the procedure for 5 times.

MET for glenohumeral joint restricted external rotation

Therapist stood behind the patient and placed his hand superior to the patient's involved glenohumeral joint. Placed his forearm of the other hand medial to the patient's flexed forearm with his hand supporting the patient's hand and the wrist and then instructed the patient to internally rotate the arm by pressing the hand. Against equal opposite force applied by the therapist. Hold it for 3-5 seconds, and then the patients were allowed to relax for 2 seconds, take up the slack and then repeat the procedure for 5 times.

Muscle energy technique was applied for 5 repetitions per set, 5 sets per session, 1 session per day, and 5 days a week for 2 weeks with each repetition maintained for the duration of 7-10 sseconds.

Group B

Deep transverse friction was applied to 15 patients in the group. Constant transverse friction were applied around the shoulder joint line, more to be concentrated at the anterior and posterior aspect, at the bicipital groove, serratus anterior, subscapularis and supraspinatus muscle. Deep friction was given 15 minutes per session, five times a week for three week. DTF at bicipital groove for the release of anterior capsule: patient in supine lying, affected side on the edge of the couch with elbow flexed 90°. Therapist stands to the side of affected shoulder. Patient's thenar eminence of one hand on the anterior aspect of the affected shoulder and the other hand should hold the forearm in order to produce internal and external rotation. Therapist apply constant transverse friction force using his weight for pressure application while doing internal rotation of the shoulder by the other hand and pressure is released while doing external rotation. DTF for serratus

anterior muscle: patient is positioned in side lying with affected side facing upwards. Therapist stood at the head end of the table. The patients one hand passive retract the patients affected shoulder to approximate the medial border of scapula, creating a space between medial border and thoracic cage and with the other hand therapist apply DTF in the space between the scapula and the thoracic cavity. DTF for supraspinatus muscle: patient positioned in sitting with arm fixed in adduction and medial rotation. Therapist stood at the head end of the table and

applied DFR using thumb or tip of the index finger reinforced by middle finger.

Statistical analysis

All the parameters were assessed using statistical package for social science (SPSS) version 24.0. The outcome scores were measured by using goniometry for range of motion (of external rotation, abduction and flexion) and shoulder pain and disability index (SPADI). Intergroup comparison were analysed using independent ‘t’ test and intragroup comparison were analysed using paired ‘t’ test.

RESULTS

Table 1: Comparison of ROM within group A between pre and post-test

Range of motion	Pre-test		Post-test		‘t’ test	P value
	Mean (in degrees)	SD	Mean (in degrees)	SD		
Abduction	44.33	15.45	86.07	19.73	9.6357	0.00
External rotation	12.33	5.94	33.57	8.42	8.2663	0.00
Flexion	97.33	18.98	118.21	15.14	13.3027	0.00

Group A: MET GROUP (p<0.001)

Table 1 denotes that there is a highly significant difference between the means of pre-test and post test of ROM values within group A (MET) (p<0.001). There is a marked improvement in the post-test means ROM values. Mean values of abduction

range increased markedly compared to flexion and external rotation in group A. Abduction range increased from 44.33° to 86.07°, flexion range increased from 97.33° to 118.21° and external rotation range increased from 12.33° to 33.57°.

Table 2: Comparison of SPADI within group A between pre and post-test

	Pre-test (%)		Post-test (%)		‘t’ test	P value
	Mean	SD	Mean	SD		
Total pain score	54.13	10.97	43.71	10.78	6.6384	0.00
Total disability score	69.73	9.68	58.57	8.35	9.8844	0.00
Total SPADI score	61.93	8.34	51.14	7.28	11.5798	0.00

Group A: MET technique; P value < 0.001)

SPADI: Shoulder pain and disability index; SD = Standard deviation

Interpretation:

The above (Table 2) revealed that there is a highly significant difference between the means of pre-test and post-test of total pain score, total disability score and total SPADI values within group A (MET)

(p<0.001). There is a marked improvement in the post-test means of SPADI scores. Total pain score decreased from 54.13 to 43.71, total disability score diminished from 69.73 to 58.57. The overall SPADI value decreased from 61.93 to 51.14.

Table 3: Comparison of pre-test and post-test ROM in group B

Range of motion	Pre-test		Post-test		t’ test	P value
	Mean (in degrees)	SD	Mean (in degrees)	SD		
Abduction	50.33	13.16	73.21	14.09	6.3804	0.000
External rotation	15.67	7.53	23.93	8.59	8.0385	0.000
Flexion	98.33	19.97	111.79	21.89	8.3096	0.001

SD = Standard deviation

Interpretation:

The above (table 3) denotes that there is highly significant difference between the means of pre and post-test range of motion of shoulder abduction, external rotation and flexion in group B (CYRIAX) (p<0.001) There is a marked improvement in the post

test abduction ROM values than that of external rotation and flexion values. Abduction range increased from 50.33° to 73.21° degrees, flexion range increased from 98.33° to 111.79° and external rotation range increased from 15.67° to 23.93°.

Table 4: Comparison of pre and post-test SPADI score within group b (Cyriax)

	Pre-test (%)		Post-test (%)		't' test	P value
	Mean	SD	Mean	SD		
Total pain score	58.67	11.68	48.71	10.28	6.2216	0.000
Total disability score	69.60	6.73	65.86	5.95	10.3612	0.000
Total SPADI score	64.13	7.50	57.64	7.39	8.5498	0.000

SD = Standard deviation

Interpretation: The above (Table 4) indicated that there is highly significant improvement in mean values of post-test SPADI scores compared to pre-test SPADI scores within group B (CYRIAX)

($p < 0.05$). The total pain score decreased from 58.67 to 48.71, total disability score reduced from 69.60 to 65.86 and total SPADI score reduced from 64.13 to 57.64

Table 5: Post-test comparison of mean range of motion in group A and B

	Group	Mean(in degrees)	SD	Mean diff	't' test	P value
Abduction	A	89.67	20.66	26.10	3.9706	0.0005
	B	63.57	13.79			
External rotation	A	33.67	7.90	9.74	3.1811	0.0037
	B	23.93	8.59			
Flexion	A	123.67	16.31	14.74	2.1624	0.0396
	B	108.93	20.30			

SD = Standard deviation.

Interpretation: All the data shown in Table 5 reveals that there was no significant difference in mean, standard deviation (SD), 't'-test and p-value of the ROM between group A and group B. but the data proves that there is highly significant difference

in mean of post-test's range of motion of shoulder abduction, external rotation and flexion than pre test scores in group A (MET) than group B (Cyriax; $p < 0.05$).

Graph 5: Post-test comparison of mean rom between group A and group B

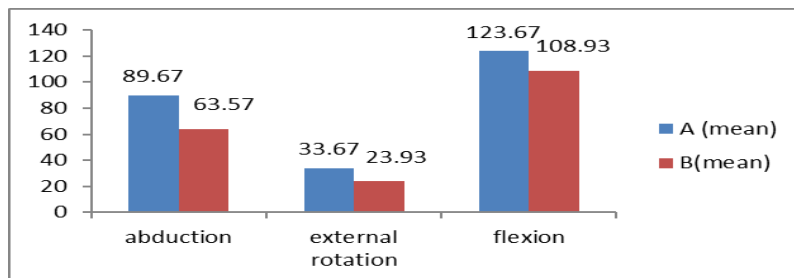


Table 6: Post-test analysis of mean SPADI scores of group A and group B

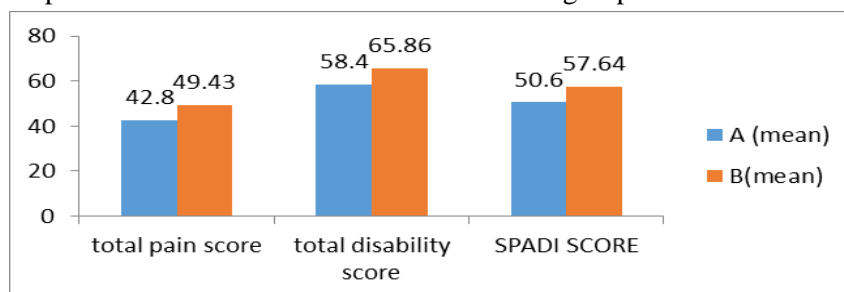
	Group	Mean	SD	Mean diff	't' test	P value
Total pain score	A	42.8	10.98	-6.63	1.6442	0.1117
	B	49.43	10.71			
Total disability score	A	58.4	8.08	-7.46	2.8137	0.009
	B	65.86	5.95			
SPADI SCORE	A	50.6	7.33	-7.04	2.5766	0.0158
	B	57.64	7.39			

SD = Standard deviation

Interpretation: Table 6 denotes that there is highly significant difference between the means of post disability score and means of post SPADI scores of

group A(MET) and group B(Cyriax) ($p < 0.05$). There is no significant difference exists between mean of post total pain score between two groups.

Graph 6: Post- test comparison of means of SPADI scores between group A and B



From the paired 't' test results, it is observed that $p=0.000$ ($P<0.05$) thereby significant difference between pre-test and post-test value is seen statistically in both the groups. We observed mean values of abduction, external rotation and flexion of 89.67, 33.67 and 123.67 in group A compared to mean values of 63.57, 23.93 and 103.93 in group B respectively. Mean pain score, disability score and SPADI score of pre and post-test values of group A reduced from 54.13, 69.73, 61.93 to 43.71, 58.57, and 51.14. Mean total disability score has decreased markedly compared to mean total pain score and mean total SPADI score. The comparison of mean values of pain score, disability score and SPADI score between group A and group B shows that MET group achieved a greater improvement in total disability and SPADI score. The total pain score is relatively same between two groups. There is no significant difference in mean pain score between two groups with a p-value of 0.1117 (<0.05).

DISCUSSION

Adhesive capsulitis is a more and more usual disorder of the shoulder joint constantly requiring physiotherapy for its treatment. This study helps to know which very effective adjunct for adhesive capsulitis is. Usman *et al.*, compared the Maitland mobilisation technique with conventional physical therapy methods and shows that Maitland technique is far better than other treatments in treating this condition (12). There are so many researches suggesting the effectiveness Maitland's mobilisation technique. However, in our current study, we compared which combinations worked well with Maitland's mobilisation technique.

Uysal *et al.*, prove that Cyriax technique has a remarkable response in pain and stiffness. The results showed that there is a significant difference exists between pre and post-test values of Cyriax group (13). Vaishali *et al.*, have reported application of Cyriax deep friction technique for the treatment of adhesive capsulitis and its effect in relieving adhesion and pain earlier (14). It shows greater improvement than any other physical therapy modalities.

Redda *et al.*, compared the positional release with muscle energy technique and there is a marked improvement with muscle energy technique (15). Physiological effect of MET is by reciprocal inhibition of the antagonist when the agonist contracts, resulting in improving the stretch tolerance of muscle spindle and increasing the range of motion. Therefore, the application of MET is found to be more effective in improving the range of motion of glenohumeral joint when compared to Cyriax technique in adhesive capsulitis. The comparison between mean post-test values between MET and Cyriax group showed that significant

difference exist for total disability score and total SPADI score with MET proven to be more beneficial. There is no significant difference exist for total pain scores. Muscle energy technique has also been widely used in the treatment of adhesive capsulitis along with mobilisation technique combination. We can observe that MET can be used to reduce the pain and increase the range of motion and flexibility effectively in combination with Maitland and mulligan mobilisation technique. So far, there is no comparison between METS with Maitland's mobilisation technique and Cyriax's DFT with Maitland's mobilisation technique.

There is a comparison of immediate effects of Cyriax's DFT to the conventional physical therapy in 2004. Cyriax technique does detach fibrils from their proper formation at the healing breach, and prevent continued adherence at abnormal sites. Thereby it supports the mechanism of relieving capsular adhesions and improving the range of motion of shoulder joints (16). There are also previous studies supporting the result of the study in improving the range of motion as well as pain reduction. Chamberlain reviewed the existing articles related to Cyriax deep friction technique, in which, he referred that traumatic hyperaemia results in enhancement of blood supply to the area. The hyperaemia appears to diminish pain by increasing the speed of destruction of Lewis P substance, probably due to the release of histamine. Lewis p factor is an irritative metabolite, which produces ischaemia when it accumulates (16).

Gehlsen *et al.*, studied the effect of soft tissue mobilisation pressure on fibroblast response and it is found that there is significant increase in healing process and number of fibroblast after soft tissue mobilisation (17).

There are several studies comparing the MET with different techniques. Not a single study compared the efficacy of Cyriax's DFT to the MET in the combination of mobilisation technique. Both are so effective in combination with other manual therapy treatments. This study compared these two techniques as a means of combination therapy along with Maitland's technique and found out which works best for adhesive capsulitis.

There are so many articles supporting the effects of extensibility of tissues by MET. MET has shown to reduce pain, stiffness and to achieve the greater functional improvements. It was observed that MET relaxes the muscles thereby improves the extensibility of muscles while crossing the restriction barriers (18, 19).

This also coincides with the results of previous study done by Moore *et al.*, who examines the immediate effects of muscle energy technique, which shows a marked improvement in internal rotation and horizontal adduction range of motion (20).

Limitation of the study includes sample size which is small and also further studies are needed to find out the effectiveness of Cyriax's DFT and METs alone in adhesive capsulitis subjects. The result of this study demonstrated that both MET group and Cyriax group experienced significant improvement in pain and functional status. The study also reveals MET group experienced greater outcomes for all variables in comparison to those receiving Cyriax group.

CONCLUSION

From the result of this study, it is concluded that the MET is more effective than Cyriax deep friction technique in phase II adhesive capsulitis. The result of the study also showed that there is a marked statistical improvement in Muscle Energy Technique as compared to Cyriax technique for adhesive capsulitis patients.

CONFLICT OF INTEREST: None

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