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## Effect of McKenzie method of mechanical diagnosis and therapy (MDT) versus Maitland mobilization in individuals with stage II adhesive capsulitis: A randomized clinical trial

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### Abstract

**Background:** Adhesive capsulitis is a musculoskeletal condition with insidious onset that is associated with pain, stiffness and difficulty sleeping on the affected side. Maitland concept is a process of examination, assessment and treatment of neuromusculoskeletal disorders. McKenzie is a comprehensive, evidence-based system of assessment, diagnosis, treatment and prevention strategies and utilizes a mechanical evaluation that involves single and repeated active, passive and resisted movements that are performed at the available end range. There is paucity of literature regarding the comparison of these two techniques. Hence the purpose of the study was to evaluate and compare McKenzie technique and Maitland mobilization in individuals with stage II adhesive capsulitis.

**Methods:** The present randomized clinical trial was conducted among 40 individuals both males and females aged 40-60 years and clinically diagnosed with stage II adhesive capsulitis. Participants were assigned using envelope method into two groups of 20 each. Physical therapy protocol included McKenzie and Maitland mobilization along with conventional therapy given for 5 consecutive sessions. The outcome measures recorded were pre and post 5<sup>th</sup> day of intervention using numerical pain rating scale, shoulder range of motion using Universal Goniometer and functional evaluation by Penn Shoulder Score. Mean, standard deviation, dependent t test and Kolmogorov Smirnov Test were used to analyze the data.

**Result:** In the present study the within group analysis showed statistical significant difference in both the group A and B (<0.0001) reduction in pain, improvement in shoulder range of motion and shoulder functions. Between group analysis revealed no statistical significant difference.

**Conclusion:** MDT and Maitland mobilization were equally effective in reducing pain, improving the range of motion and also the functional scores in individuals with stage II adhesive capsulitis.

**Keywords:** McKenzie method of mechanical diagnosis and therapy, Maitland mobilization, stage ii adhesive capsulitis

### Introduction

Shoulder joint is one of the largest and complex joint in human body [1]. Shoulder problems are considered to be third most common musculoskeletal problems in general clinical practice [2]. Estimated proportion of subjects seeking treatment for shoulder conditions is between 20% and 50% [3]. Adhesive capsulitis is a musculoskeletal condition that has a disabling capability affect somewhere between 2% to 5% of the people in their lifetime [4]. The term frozen shoulder was first introduced by Codman in the year 1934 [5]. Frozen shoulder (FS) is insidious painful condition with gradual restriction of the shoulder movements in all the planes and is said to be the main cause of shoulder pain and dysfunction in the middle aged and elderly individuals. It can be due to idiopathic, post-operative trauma to the shoulder joint or secondary to other pathological conditions [6]. Primary risk factors of frozen shoulder are diabetes, thyroid disorder, cervical radiculopathy, and shoulder surgery and post-operative immobilization [4].

Conventional therapy includes electrotherapeutic modalities such as superficial and deep heating and various other manual therapy techniques. Literature suggests, application of hot moist pack causes relaxation of the muscles and indirectly causes reduction in resistance in the muscles which stretches in and around and helps in improving the range [7].

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TENS application also helps in stimulation of the mechanoreceptors and thus leads to reduction of pain. Doner *et al.* conducted a study on subjects with adhesive capsulitis using TENS and HMP and found that both these electrotherapeutic modalities do have an effect in reducing pain and improving the ROM at the shoulder joint [8].

Mobilization are skilled manual therapy techniques applied passively to the joint and related soft tissues at varying speed and amplitude using physiological or accessory motions for therapeutic purpose [9]. Evidences state that joint mobilization procedures can lessen the associated glenohumeral rotational deficits characteristics of the condition. Maitland grades I and II are given primarily for pain reduction followed by grade III and IV are stretching maneuvers. The oscillations may have an inhibitory effect on the perception of painful stimuli by repetitively stimulating the mechanoreceptors that block nociceptive pathways at the spinal cord. A study conducted by Abhay Kumar *et al* [10] in which idiopathic adhesive capsulitis was treated with Maitland mobilization using the caudal glide, caudal glide progression and antero-posterior glide and found Maitland mobilization technique to be effective in reduction of pain, increasing the ROM and the functions in the joint.

McKenzie Method of Mechanical Diagnosis and Therapy (MDT) is a well-known and commonly applied technique in management of spinal disorders. MDT is comprehensive, evidence based system of assessment, diagnosis, treatment and prevention strategies. Recent literature reports its reliability and effectiveness with specific regards to extremities. Joshua Kidd [11] in his case report on shoulder pain demonstrated that treatment based on MDT sub-classification principles may be an effective way to manage shoulder pain as it is in the spine. Another study by Aina and May on shoulder derangement syndrome using MDT showed that there was significant reduction in symptoms and the study acclaimed to be the first documented evidence of the application of these principles to extremity problems [12].

There is paucity of literature that assesses the effectiveness of MDT and Maitland mobilization in stage II adhesive capsulitis. Hence the present study is undertaken to compare and evaluate the effectiveness of these two techniques in individuals with stage II adhesive capsulitis on pain, range of motion and shoulder functions.

### Materials and Methodology

An approval for the study was obtained from the Institutional Ethical committee and informed consent was signed by the participants to participate in the study. A randomized clinical trial was conducted in tertiary health care centre, Belagavi, Karnataka, India where 40 participants clinically diagnosed with stage II adhesive capsulitis aged between 40-60 years were recruited in the study. Participants were randomly allocated in 2 groups using envelope method with 20 participants in each group. The exclusion criteria were A) History of fractures, dislocations less than 6months. B) Rheumatoid arthritis, Polyarthritis. C) Shoulder ligament injuries <6months. D) Participants with cardiac conditions, infections, coagulation disorders. Group A received McKenzie along with conventional therapy and Group B received Maitland mobilization along with conventional therapy for 5 consecutive sessions.

### Outcome Measures

- 1. Numerical Pain Rating Scale (NPRS)** [13] is a unidimensional measure of pain intensity in adults. NPRS can be administered verbally or graphically for self-completion. The NPRS is an 11 point numerical scale ranges from 0-10 points where "0"= no pain and "10"= worst possible pain. A high score indicates greater pain intensity. The pain intensity can be categorized as none (0), mild (1, 2, 3), moderate (4, 5, 6) severe (7, 8, 9, 10). The MCID for average NPRS patients is 2.17. Reliability  $r = 0.96$  and  $0.95$  respectively. Validity is from  $0.86$  to  $0.95$ .
- 2. The Shoulder Range of Motion** [14] was measured using Universal Goniometer. The universal Goniometer is capable of measuring range upto  $180^\circ$ . It consists of a movable arm and a stationary arm. The body resembles a protractor. The intratester ICC ranged from  $0.91$  to  $0.99$  and the limits of agreement (LOA) ranged from  $3^\circ$  to  $9^\circ$  made with Goniometer and the intertester ICC ranged from  $0.31$  to  $0.95$  and the LOA ranged from  $6^\circ$  to  $25^\circ$ . Goniometer is a reliable and valid tool.
- 3. Penn Shoulder Score:** [15] Developed in the year 1990. It is a patient outcome-reporting tool for shoulder problems to evaluate pain, current satisfaction level of the shoulder and the functions. It's a 100 point scale with 3 subscales to evaluate pain, satisfaction level and shoulder functions. The items are based on 10 point numeric scale with end point "no pain" or "worst possible pain" for pain component, "not satisfied" or "very satisfied" for satisfaction level. Functional subsections based on 20 items using 4 point scale. The response options include 0 (can't do at all), 1 (much difficulty), 2 (with some difficulty), and 3 (no difficulty). The total PSS maximum score of 100 indicates high function, low pain, and high satisfaction with the shoulder function. The lower the score the lesser the function, more the pain and reduced satisfaction: Reliability  $0.94$  (95% CI,  $0.89-0.97$ ) PSS is said to be a reliable and valid tool of measurement.

### Intervention

#### Conventional Therapy

- HMP was given around the shoulder region for 15minutes with the subject in chair sitting position.
- TENS was given to the subject in sitting position at the shoulder joint for 15 minutes with a frequency of 100Hz and pulse width of  $200\mu s$  [16].

Exercises included– cross body reach, finger ladder, pendulum stretch, armpit stretch, strengthening exercise for inward and outward rotation with a dosage of 10-20 repetitions with 10sec hold each day.

#### MDT Technique

**Hand behind the back with overpressure:** The subject was in standing position. The subject was instructed to take the affected shoulder at the back and then the therapist applied over pressure in an upward direction in the available end range. Dosage: minimum of 10 -12 repetitions.

**Repeated shoulder extension with overpressure:** Subject was instructed to be in standing position. Subject was asked to do repeated shoulder extension movements till the end range and then overpressure was applied by the therapist at the end ranges. Dosage: minimum of 10-12 repetitions.

**Shoulder flexion overpressure:** Subject was in standing or sitting position. Subject was asked to do flexion till the end range repeatedly until it is a pain free movement, at the end range therapist applied overpressure. Dosage: minimum of 10-12 repetitions.

**Maitland mobilization** [17]

**Caudal glide:** Subject was in supine position to arm abducted at the end of available range with humerus externally rotated. The therapist stands facing the subject, one hand was placed at the patients arm and web space of other hand was placed just distal to acromion process of the proximal humerus and the mobilization was applied in inferior direction. Dosage: 3sets×30sec.

**Anterior glide:** Subject was in prone position with the arms rested on the table. The therapist stands facing the top of the table with the legs closer to the table in forward stride position. The therapist then placed the ulna border of hand just distal to the posterior angle of the acromion process and gave mobilizing forces in anterior and slightly medial direction. Dosage: 3sets×30sec

**Posterior glide:** Subject was in supine position. The therapist was standing facing back to the subject between the subjects trunk and arm. Arm was supported with the therapist’s trunk while other hand will be placed just distal to the joint with fingers pointing superiorly and mobilization was given. Dosage: 3sets×30sec.

Statistical analysis was done manually as well as using SPSS software version 20 so as to verify the results. Mean, standard deviation, dependent t test were used to verify the data. Kolmogorov Smirnov test was done to assess the normality of the pre and post data. Probability value <0.05 were considered statistically significant and probability value <0.0001 were considered highly significant.

**Results**

Results were analyzed in the study in terms of pain relief using numerical pain rating scale, ROM of the shoulder (flexion, abduction, extension, internal and external rotation) using Universal Goniometer and functional disability of the shoulder using Penn shoulder score (PSS).

**Table 1:** Baseline Characteristics

Characteristics	Group A	Group B	P value
Gender (M,F)	(10,10)	(10,10)	
Side affected (Rt, Lt)	(12,8)	(11,9)	0.7492
Mean Age group	53.95 ± 5.82	53.00 ± 6.36	0.7449
Diabetic, Non Diabetic	(10,10)	(8,12)	0.5252

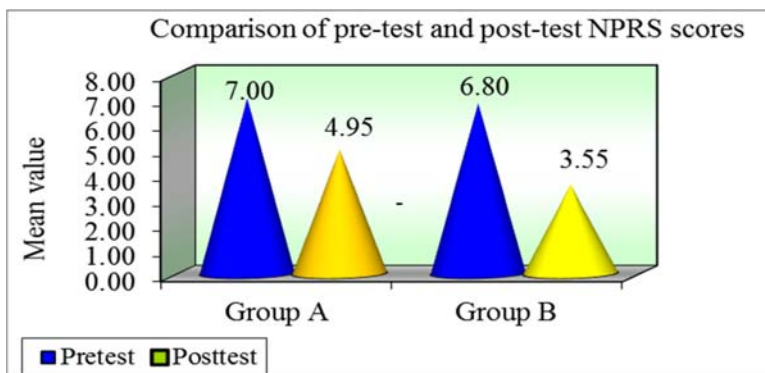
The demographic details in the study showed homogeneity at the baseline with no statistical significant difference. Gender distributions were equally affected. Right handed individuals were more affected than the left handed. Mean age of the individuals was 53.95 ± 5.82 in group A and 53.00 ± 6.36 in group B.

**Table 2:** Within Group Comparison of NPRS scores

	Group A (NPRS)	Group B (NPRS)	P-value
	Mean ±SD	Mean ±SD	
Pre-test	7.00 ± 0.86	6.80 ± 0.95	0.4894
Post-test	4.95 ± 0.94	3.55 ± 1.15	0.0001*
Changes	2.05 ± 0.51	3.25 ± 0.91	0.0001*
% of Change	29.29% p=0.0001*	47.79% p=0.0001*	

In NPRS there was a statistical significant change observed in both the groups A and B with a % change of 29.29% in group A and 47.79% in group B respectively. The

probability value was 0.0001 which suggested highly significant change in pain reduction post therapy treatment.



**Table 3:** Within group comparison of Penn Shoulder Scores (PSS)

	Group A (PSS)	Group B (PSS)	P-value
	Mean ±SD	Mean ±SD	
Pre-test	42.85° ± 3.80°	41.00° ± 6.43°	0.2751
Post-test	60.10° ± 4.99°	56.70° ± 5.72°	0.0525
Changes	17.25° ± 4.41°	15.70° ± 5.67°	0.3405
% of change	40.26% p=0.0001*	38.29% p=0.0001*	

\*p<0.05, # applied dependent t test

PSS showed statistical difference in both group A and B with an p value 0.0001 which suggests highly statistical significance. The increase in the score suggests, more the

score better is the shoulder function and lesser is the disability. Group A showed slightly higher significant values as compared to group B.

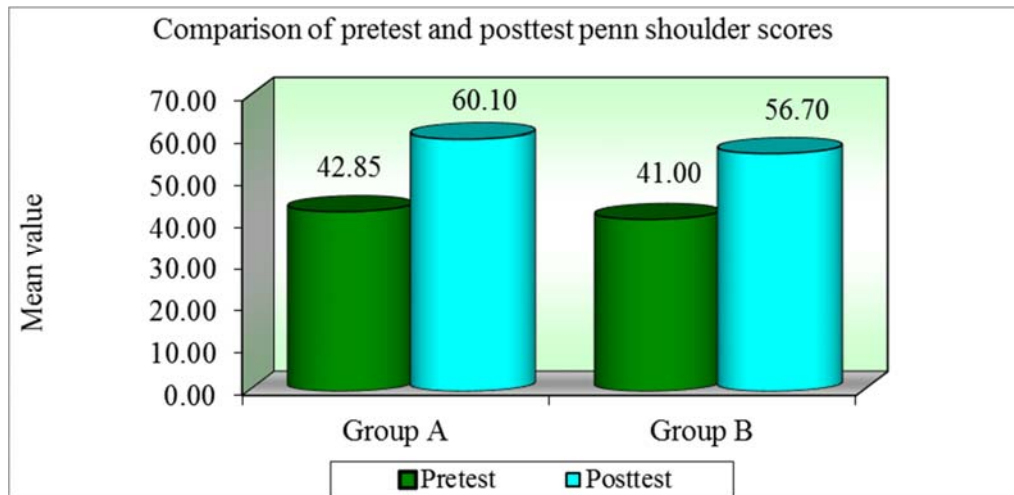


Table 4: Within group comparison of Shoulder ROM.

	Group A (MDT)			Group B (Maitland)		
	Pre	Post	% change	Pre	Post	% change
<b>Flexion</b>	97.00°±10.31°	140.95°±12.68°	45.31%#, p=0.0001*	97.00°±10.31°	138.60°±18.16°	42.89%#, p=0.0001*
<b>Abduction</b>	75.25°±16.66°	122.60° ± 13.06°	62.92%#, p=0.0001*	80.75° ± 19.75°	118.85° ± 15.36°	47.18%#, p=0.0001*
<b>Extension</b>	22.70° ± 6.04°	33.00 ± 4.87	45.37%#, p=0.0001*	21.95° ± 7.24°	35.10° ± 9.64°	59.91%#, p=0.0001*
<b>IR</b>	24.80° ± 7.78°	33.55° ± 6.71°	35.28%#, p=0.0001*	27.60° ± 10.63°	36.25° ± 13.22°	31.34%#, p=0.0001*
<b>ER</b>	42.85° ± 3.80°	60.10° ± 4.99°	40.26%#, p=0.0001*	41.00° ± 6.43°	56.70° ± 5.72°	38.29%#, p=0.0001*

\*p<0.05, # applied dependent t test

Shoulder ROM for flexion, abduction and external rotation was highly significant in group A (MDT) as compared to group B (Maitland). Shoulder extension and internal rotation ROM was highly significant in group B as compared to group A.

**Discussion**

The present study conducted was a randomized clinical trial to compare the effect of McKenzie Method of Mechanical Diagnosis and Therapy and Maitland mobilization in individuals with stage II adhesive capsulitis.

In the present study the total number of males and females were equally affected, however according to literature the prevalence of adhesive capsulitis were nearly equal with men (43%) and women (57%).<sup>18</sup> In the present study the age group ranged from 40-60years and the subjects were in the age group between 47 to 58 years. According to a systematic review in which nine randomized clinical trials were identified on adhesive capsulitis and the affected mean age of the subjects showed little variation with a maximum of 57 years and a minimum of 47 years which in term correlates with the present study.<sup>19</sup> In a study conducted by Pasila<sup>20</sup> in which it was found that right shoulder joint is most commonly involved. Hence the present study correlates with the above study where right shoulder was more affected than the left. Various literature suggests that non dominant hand is usually affected and hence the present study contradicts this statement and states that right hand can be affected because of overuse.

In the present study conventional therapy was used along with the MDT and Maitland techniques and helped in reduction of pain and improving the ROM and functions of

the shoulder. Studies suggest that conventional therapy in adhesive capsulitis conditions is proved to be effective in pain reduction, improving range and shoulder functions. It is stated that exercises within the pain free range stimulate the mechanoreceptors and movement in the synovial fluid which leads to decrease in inflammation and reduction in pain intensity.

NPRS showed statistical significance on post 5<sup>th</sup> day of treatment in both the groups. The present study correlates with the study conducted by Abhay, Suraj, Anoop, Ratnesh and Pooja where 40 subjects with adhesive capsulitis were compared with Maitland mobilization and the results showed effective reduction in pain and hence favors Maitland mobilization.<sup>10</sup> According to Littlewoods and May,<sup>[21]</sup> during MDT treatment pain will be persistent until the tissues are remodeled, which is done usually by loading the impairment with active and resisted movements. Loading must be sufficient enough to produce a degree of pain that settles once the repeated movements are ceased. In the present study the % change in NPRS was significant with a score of 29.29% reduction. Penn shoulder score showed statistically significance in both group A and B with p=0.0001. MDT group (40.26%) showed better improvement in shoulder functions as compared to Maitland group (38.29%). The scores are interpreted as higher the score better the shoulder function, lower the pain intensity and better the satisfaction level.

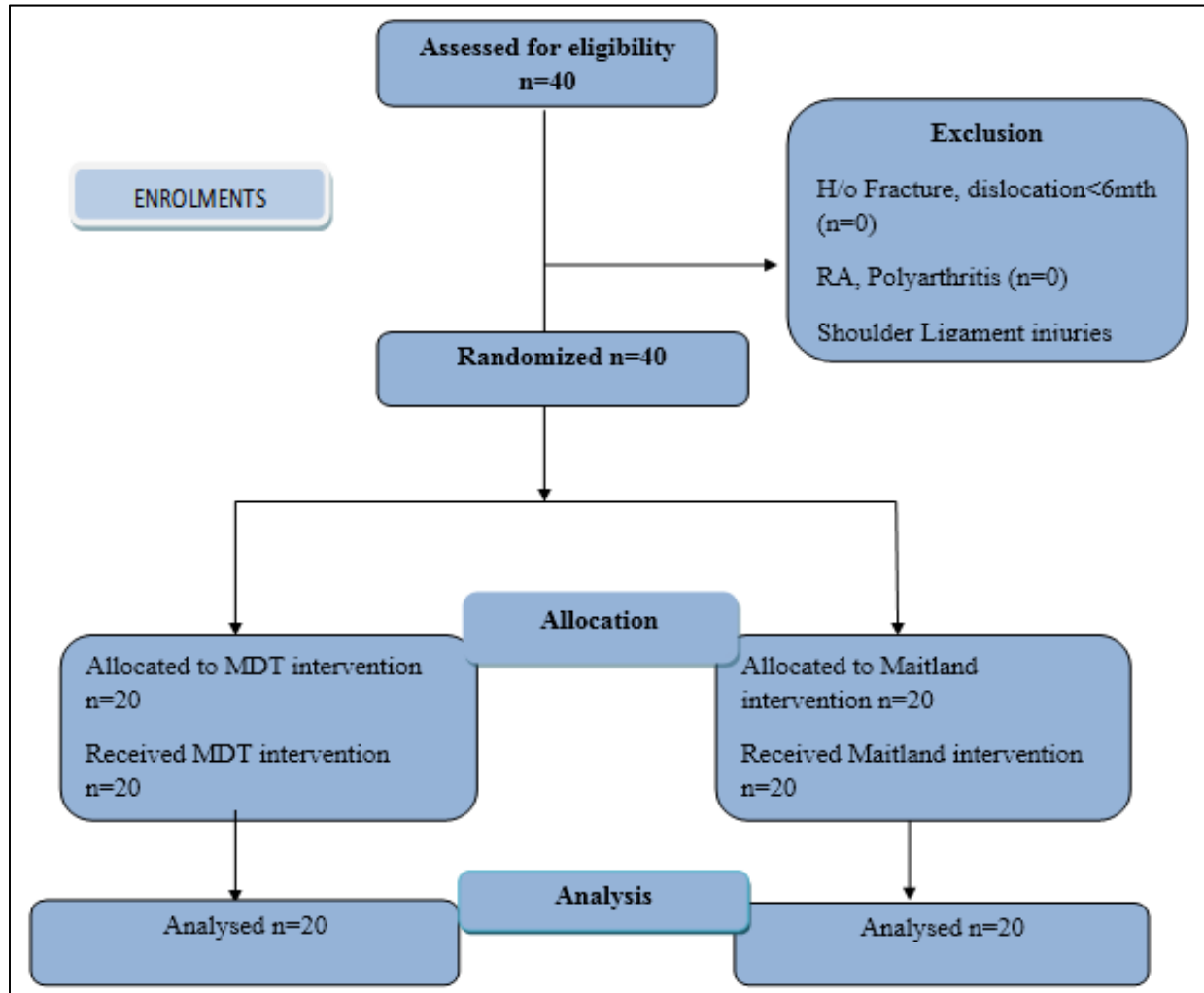
Both the group showed higher statistical difference in subjects with stage II adhesive capsulitis. MDT showed higher significance in flexion, abduction and external rotation ROM as compared to Maitland, whereas Maitland showed higher significance in extension and internal

rotation ROM as compared to MDT. According to Aina and May<sup>12</sup> repeated movements during MDT technique causes stimulation of the mechanoreceptors and hence abolishes pain and improves ROM because of overpressure applied at the available end range. On the other hand while performing Maitland mobilization, the oscillatory glides help in pain reduction as in turn it also stimulates the mechanoreceptors. On overall comparison, statistically each group has different

standard deviation values, but the subjects compared for pre and post (5 consecutive sessions) findings showed a good prognosis.

#### Limitations of the study

The examiner was not blinded. Overpressure given during MDT was not quantified and long term follow up sessions were not evaluated.



#### Conclusion

The present randomized clinical trial provide evidence to support the use of intervention in the form of Conventional therapy, MDT and Maitland are useful in reducing pain, improving range of motion and functional ability in terms of Penn shoulder score in individuals with stage II adhesive capsulitis. Hence it can be concluded that both the techniques are equally effective in treatment of adhesive capsulitis.

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