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Effect of McKenzie method of Mechanical Diagnosis and Therapy (MDT) on pain, range of motion and shoulder functions using Penn shoulder score in individuals with stage ii adhesive capsulitis: A pre-post experimental study

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Abstract

Adhesive capsulitis is one of the commonest musculoskeletal disorder that has a disabling capacity and is characterized by pain and restriction of range of motion in shoulder joint. McKenzie Therapy is well-known and commonly applied in the management of spinal disorders and more recently the principles and mechanical syndromes have been applied to extremities. The purpose of the study is to assess the effectiveness of McKenzie therapy on pain, range of motion and shoulder functions using Penn shoulder score in individuals with stage II adhesive capsulitis. It is a pre-post experimental study design which was conducted on 20 individuals both male and females aged between 40-60years and clinically diagnosed with stage II adhesive capsulitis. The participants received MDT therapy for 5 consecutive sessions and the baseline and post 5th day intervention outcome measure were assessed using Numerical pain rating scale, ROM shoulder and Penn Shoulder Score. The results in the study showed highly statistical significant changes (p value 0.0001) on pain, shoulder range of motion and shoulder functions. The study concluded that McKenzie Method of Mechanical Diagnosis and Therapy (MDT) treatment was highly effective in improving the range of motion, reducing pain at the shoulder joint and furthermore improving the shoulder functions using Penn shoulder score in individuals with stage II adhesive capsulitis.

Keywords: Adhesive Capsulitis, MDT, Pain, Penn shoulder score.

Introduction

Adhesive capsulitis is also termed as frozen shoulder is the most common condition which involves pain in the glenohumeral joint followed by loss of motion. According to American Shoulder and Elbow Surgeons "A condition of uncertain etiology characterized by significant restriction of both active and passive shoulder motion that occur in the absence of a known intrinsic shoulder disorder" [1]. Over 40 years of age, individuals affecting the shoulder joint in general population were slightly greater than 2%. Hazelman B L and Wright reported that the age group between 40 to 70 years were at a higher rate of incidence of adhesive capsulitis and females are at greater risk than males where non dominated shoulder was slightly more affected than the dominant [2].

Adhesive capsulitis is classically described having 3 stages. Stage I (freezing) involves pain and acute synovitis in the joint lasts for 0-3 months. Stage II (frozen) involves pain, restricted ROM lasts for 3-9months and Stage III (Thawing) involves painless restriction which lasts for 9-15months [3]. Research suggests the process is started with inflammation in the lining of the joint within the shoulder, which gradually thickens resulting in painful and stiff shoulder. In adhesive capsulitis, fibrous adhesions are formed at the glenohumeral capsule, especially in the inferior fold and decreased joint excursion, because of which the capsule is unable to unfold to allow full flexion or abduction movements.

Numerous physiotherapeutic techniques have been used to treat adhesive capsulitis including mobilization, manipulation, taping, electrotherapy, home exercise programs and steroids injections if necessary.

McKenzie method of mechanical diagnosis and therapy (MDT) is a comprehensive, evidence-based system of assessment, diagnosis, treatment and prevention strategies aimed at subjects education and independence [4]. The system utilized a mechanical evaluation that involves single and repeated active, passive and or resisted movements that are performed at the end range while evaluating symptomatic and mechanical responses. Ania and May documented the first evidence of application of MDT on shoulder derangement syndrome which proved to be effective [5]. There is dearth of literature to assess the effectiveness of MDT in relieving the symptoms in stage II adhesive capsulitis and to the best of our knowledge no studies have been undertaken to evaluate the effectiveness of MDT in stage II adhesive capsulitis patients. Hence the purpose of the study was to assess whether McKenzie therapy have an effect on pain, ROM and function of the shoulder in individuals with stage II adhesive capsulitis.

Materials and Methods

A pre-post experimental study was conducted in 20 subjects both male and females aged between 40-60 years who were clinically diagnosed with stage II adhesive capsulitis. Exclusion criteria were A) History of fractures, dislocations less than 6 months. B) Polyarthritis. C) Shoulder ligament injuries < 6mths. D) Patients with cardiac conditions, infections and coagulation disorders. An approval for the study was obtained from the Institutional Ethical Committee. Subjects were recruited from a Tertiary Health Care Set-up, Belagavi, Karnataka. A brief history was taken about the musculoskeletal assessment for educational profile and as per the inclusion criteria. Physical therapy protocol included MDT and conventional therapy for 5 consecutive sessions. Outcomes measures were numerical pain rating scale, range of motion of shoulder using universal Goniometer and shoulder functions using the Penn Shoulder Score. The outcomes were assessed on the 1st day and 5th day of intervention.

Outcome Measures: NPRS: 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. Reliability $r = 0.96$ and 0.95 respectively. MCID is 2.17 [6]. Shoulder ROM: Measured using Universal Goniometer. The intertester ICC ranged from 0.31 to 0.95 and intratester ICC ranged from 0.91 to 0.99 respectively [7].

Penn Shoulder score: 100 point scale with 3 subscales including pain (at rest, normal and strenuous activities), level of satisfaction and shoulder functions. Maximum score 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, $0.89-0.97$) [8].

Conventional Therapy: Hot Moist Packs (HMP) was given for 15 minutes around the shoulder region with the subject is in chair sitting positing and the temperature of the pack should be atleast $40^{\circ}\text{C} - 45^{\circ}\text{C}$ [9].

Conventional TENS was given around the shoulder joint with the subject in sitting position. The frequency adjusted was 100Hz, pulse width $200\mu\text{s}$ and duration of the treatment was 15 minutes [10].

Exercises: [11]

1. Cross Body Reach: Subject was asked to sit or stand. Instructions were given to the subject to use the unaffected arm to support the affected arm at the elbow

and to get the arm towards the body exerting gentle pressure on shoulder to hold it for 15-20 seconds.

Dosage: 10 to 20 repetitions with 10 sec hold each day.

2. Finger Ladder: Subject was asked to be in standing position. Subject was instructed to reach out and touch the wall at waist level with fingertips of the affected arm with elbow bent slightly, subject was then instructed to walk the fingers up the wall and hold for 10 seconds. Then slowly lower down.

Duration: 10 to 20 repetitions with 10 sec hold each day.

3. Pendulum stretch: Subject was asked to be in standing position. The subject was instructed to relax the shoulders and slightly lean forward with the affected arm hanging down. Small circular movements were advised in clockwise and anticlockwise direction. 10 revolutions in each direction.

Dosage: 10 repetitions with 10 sec hold

4. Armpit Stretch: Subject was asked to be in standing position. Gently affected arm was lifted and placed onto the shelf about breast-high. The subject was asked to bend knee joint, which will gently stretch the armpit.

Dosage: 10-20 repetitions per day.

5. Towel Stretch: Subject was asked to be in standing position and hold one end of the towel behind the back and grasp the other end with opposite hand. Hold the towel in horizontal position. Subject was instructed to use the good hand to pull the affected hand upward and stretch.

Dosage: 10-20 repetitions per day.

6. Strengthening Exercise for inward and outward rotation: Subject was advised to be in standing position and instructed to hold a rubber exercise band between the hands with the elbows at 90-degree angle close to the body. Later the subject was asked to rotate the lower part of the affected arm outward two or three inches and hold for five seconds.

Dosage: 10-15 repetitions with 5 sec hold each day.

Subject was then instructed to be in standing position next to the door and hook one end of rubber exercise band around the door knob, then instructed to hold the elbow at 90-degree and pull the band towards the body. Hold it for 5 seconds.

Dosage: 10-15 repetition with 5 second hold each day.

McKenzie Method of Mechanical Diagnosis and Therapy (MDT): [5]

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

Repeated shoulder extension with overpressure: Subject is 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 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 applies overpressure at the end range. Dosage: minimum of 10-12 repetitions.

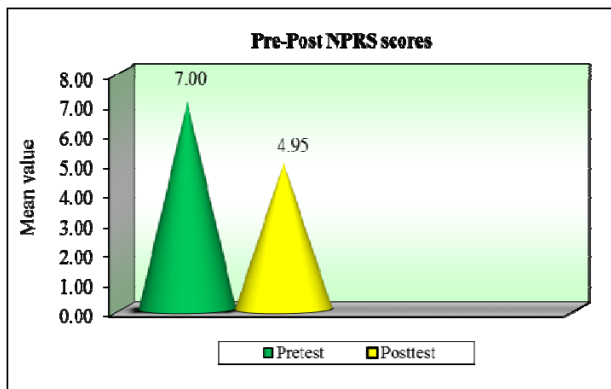


Results

Table 1

Characteristics of demographic data	
Gender (M,F)	(10,10)
Side affected (Rt, Lt)	(12,8)
Mean Age group	53.95 ± 5.82
Diabetic, Non Diabetic	(10,10)

The age group was between 40-60 years and with a mean age of 53.95 ± 5.82. Males and females in the study were equally affected. The demographic data showed homogeneity.



The pre-intervention average scores for NPRS was 7.00±0.86 and post intervention 4.95±0.94 respectively. The percentage of change (29.29%) in the NPRS revealed high statistical significance. (p value 0.0001).

Table 2: The ROM pre post scores.

	Pre	Post	% change
Flexion	97.00°±10.31°	140.95°±12.68°	45.31% #, p=0.0001*
Abduction	75.25°±16.66°	122.60° ± 13.06°	62.92% #, p=0.0001*
Extension	22.70° ± 6.04°	33.00 ± 4.87	45.37% #, p=0.0001*
IR	24.80° ± 7.78°	33.55° ± 6.71°	35.28% #, p=0.0001*
ER	42.85° ± 3.80°	60.10° ± 4.99°	40.26% #, p=0.0001*

*p<0.05, # applied dependent t test

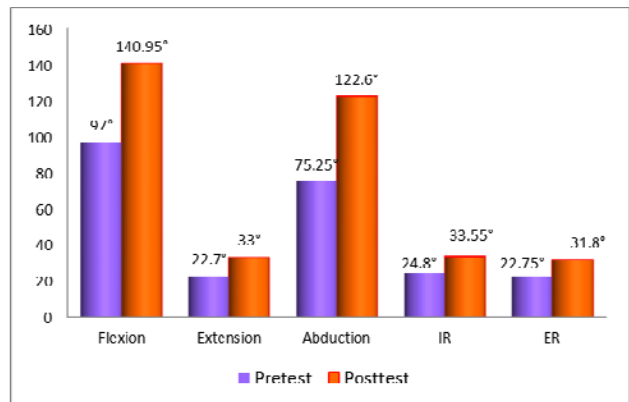


Fig 2: Shoulder ROM scores.

The mean increase for flexion was 43.95°±11.26°, abduction was 47.35°±14.74°, for extension was 10.30°±4.05°, for IR was 8.75°±4.20° and for ER was 9.05°±5.22° respectively. The shoulder ROM for all the movements was found to be highly significant with a p value of 0.0001.

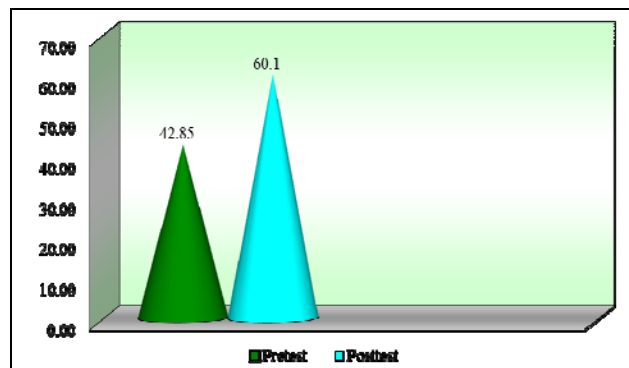


Fig 3: Pre-Post Penn Shoulder Scores

The mean pre-session Penn shoulder score was 42.82±3.80 and was increased to a mean of 60.10±4.99 respectively. The mean change in Penn shoulder score value was 17.25±4.41 and the change in percentage was 40.26%. (p=0.0001). The p value by dependent t-test was found to be <0.05 which is highly significant.

Discussion

The results from the study provided immediate improvement

in shoulder pain, range of motion and the functions in 5 consecutive sessions. Adding both the conventional therapy and MDT have reduced manifestations of adhesive capsulitis, mainly in improving Pain, ROM and functions.

In the study, gender distribution was found to be equal with males (n=10) and females (n=10). Literature does not support these findings as it is predicted that females are more commonly affected than men.¹² In a study conducted by Watson and colleagues, the prevalence of men and women were nearly equal (males 43% and females 57%)^[13]. Hence the present study correlates with the above study where equal gender distribution are affected with adhesive capsulitis.

The mean age in the study was 53.95 ±5.82 for the age group ranging 40-60 years. According to a systematic review in which nine randomized control trials were identified on shoulder adhesive capsulitis were mean affected age group of the participants showed little variations with a maximum of 57 age and minimum of 47 age group^[14]. Hence the present study correlates with the systematic review.

In the present study, subjects affected with right shoulder were 12 and left were 8 respectively. In 1965 Pasila conducted a study in which it was found that right shoulder is more often involved in cases of adhesive capsulitis^[15]. hence the present study correlates and suggests that right shoulder joint is more affected than the left.

NPRS scores were highly significant (29.29% change) in reducing pain at the shoulder joint. Littlewoods suggested that pain will be persistent until and unless the tissues are remodelled, which is usually done by loading the impairment with active and resisted training or movements. He also suggested that loading must be sufficient enough to produce a degree of pain that settles once the repeated movements are ceased^[16].

According to literature, the conventional exercises in patients with adhesive capsulitis proved effective in reduction of pain and increasing the range of motion in the shoulder joint. It is noted that exercises within the pain free range of motion stimulate the mechanoreceptors and hence reduces the pain in the joint and also help in movement of the synovial fluid and thus decreases the inflammation and decreases the pain. These exercises use the effects of gravity to distract the humerus from the glenoid fossa which helps to relieve pain by gentle traction and oscillations. The pain reduction is also noted through the mechanical and neurophysiological effect. Hence proved that conventional exercises help in improving ROM and pain reduction. In the present study conventional exercise therapy have helped in improving ROM, pain reduction and better shoulder functions^[17].

The present study qualified that Penn Shoulder Score used as an outcome measure showed improved results in posterior stabilization of shoulder joint^[8]. In the present study Penn shoulder score also showed statistical significance (40.26% change) with a p value 0.0001.

All the ranges showed statistical difference in the present study. The present study correlates with the study conducted by Aina and May^[5], where repeated movements were able to abolish symptoms and restore full pain free range of motion in the shoulder joint. MDT technique applied to shoulder derangement syndrome and improvement was noted which can be because of repeated end range loading in appropriate direction, termed directional preference in pain reduction and improving range.

The limitations in the study were that follow up in the study was not monitored. The overpressure applied during the MDT was not measured and the examiner was not blinded. Future

scope of the study: Longer follow up periods are recommended and comparison with other techniques can be done.

Conclusion

The study concluded that McKenzie method of mechanical diagnosis and therapy was effective in improving the range of motion, reducing pain at the shoulder joint and furthermore improving the shoulder functions in individuals with stage II adhesive capsulitis.

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