IMPACT OF MULLIGAN'S MOBILIZATION TECHNIQUE ON CORACOHUMERAL LIGAMENT THICKNESS IN PATIENTS WITH ADHESIVE CAPSULITIS

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Abstract

Background: Mulligan's Mobilization with movement is one of the important physical therapy interventions in the management of adhesive capsulitis of shoulder. Increased coracohumeral thickness is a grave factor in the reduction of shoulder Range of motion and functional limitation in adhesive capsulitis. Very limited literatures are available in this regard. Aim: To identify the effectiveness of Mulligan's Mobilization with movement on coracohumeral thickness in patients with adhesive capsulitis of shoulder. Study Design: Randomized controlled trial. Methods: One hundred and fifty patients with adhesive capsulitis were randomly divided into two groups, viz., group 'A' and group 'B'. In group A, Mulligan's mobilization with movement was administered for three weeks whereas in group 'B'. Conventional physical therapy program was administered for a period of 3 weeks. Outcome measures: Coracohumeral thickness was evaluated by 'B' mode ultrasound scanning before and after therapy. The differences in the CHL thickness between groups was evaluated statistically by independent sample't' test. Results: The mean improvement in the CHL thickness was significantly higher in Mulligan's mobilization, mean diff. = 0.63, t = 50.05, p = 0.001 than in conventional treatment. Conclusion: It is concluded that Mulligan's Mobilization with Movement is effective in reducing coracohumeral ligament thickness in patients with adhesive capsulitis.

Keywords: *Adhesive Capsulitis, Coracohumeral Thickness, Shoulder Abduction and External Rotation ROM, Mulligan's Mobilization with Movement.*

Introduction

Adhesive capsulitis (AC) is an inflammatory condition of the glenohumeral (GH) joint capsule associated with progressive fibrosis of the GH joint structure resulting in restricted Range of Motion (ROM) of the GH joint.[1] The condition is characterized by pain at the beginning followed by active and passive restriction of GH joint movement. It is a disabling condition with marked functional limitation due to reduction of shoulder abduction, external rotation and internal rotation ROM. The condition is classified into three stages depending on the clinical manifestations.[2] The first stage is freezing where pain is the prominent feature and it is severe at night time associated with sense of discomfort. It lasts for 10 to 36 weeks. The next is frozen stage noted with reduction in pain at night but associated with restricted GH ROM in all planes. Activities of daily living (ADL) are limited and there is a sharp acute discomfort at the restriction of tight capsule. This stage lasts for 4 to 12 months. The next phase is called as thawing stage characterized by gradual recovery of ROM. It is lasting for 5 to 26 months. Coracohumeral Ligament (CHL) thickness is the more specific manifestations of the AC noted in Magnetic resonance imaging (MRI) and ultrasonic scanning (USS).[3,4] The CHL is originating from both the base and horizontal limb of the coracoid process. The CHL encompass the GH structures such as subscapularis tendon, the supraspinatus tendon and the infraspinatus tendon. It is well known that thickening of the CHL that covers rotator cuff internal limits external rotation of the shoulder joint.[5] But recent studies have shown that it is also limiting internal rotation of the shoulder.[6] This could have been due to thickening of ligament from the coracoid process to supra medial capsule.

Mulligan's Mobilization with Movement (MWM) is an important rehabilitative joint mobilization technique used to treat AC.[7] Many studies have proved that MWM has successful in treating AC. In MWM, passive gliding movements of GH joint is given by the therapists followed by either active or passive pain free ROM and over pressure at the end range of movement. The principle of MWM is to correct the positional fault of the joint by the physiological glide and to improve ROM.[8] The proposed mechanism for reduction in pain by MWM is by the stimulation of mechano-receptors, which inhibits the nociceptive afferent pathway and causing pre-synaptic inhibition of pain. But its role is causing changes in CHL thickness is not yet studied in detail. It is postulated that MWM corrects the positional fault of the GH joint but its role on the reduction of CHL thickness needs to be critically examined. The need of hour is to examine whether MWM has played significant role in reducing the thickness of CHL. The positive impact of MWM on CHL could be a great boon to patients suffered with AC in general and physiotherapeutic treatment in particular. Therefore, the aim of the present investigation is to evaluate the effectiveness of MWM in reducing CHL thickness in patients with adhesive capsulitis.

Methods

A total of 150 patients with adhesive capsulitis were selected for the study. They were randomly divided into two groups viz group 'A' and group 'B'. The treatment for group 'A' consists of Mulligan's Mobilization with Movement (MWM), therapeutic ultrasound and Codman's pendulum exercise, for group 'B', therapeutic ultrasound and Codman's pendulum exercise was given.

Study design

Randomized Controlled Trial (RCT). Parallel group-single blind study.

Study Setting

Government College of Physiotherapy – Tiruchirappalli – Tamil Nadu, India.

Ethical Clearance

The study was approved by the institutional ethics committee of K.A.P. Viswanathan Govt. Medical College – Tiruchirappalli – Tamil Nadu, India.

Study Procedure

The study methodology and purpose were clearly explained to each patient and written informed consent was obtained. It was based on the declaration of Helsinki. The study patients were chosen based upon the selection criteria. The duration of the treatment was three weeks. The pre and post evaluation of the CHL thickness were compared within groups using paired or related sample 't' test and between groups using independent sample 't' test. The patients were not aware of the study groups.

Sample size estimation:

It was calculated by the following formula applicable to the RCT.

$n = 2 (z\propto + z [1-\beta])^2 \times SD^2 / d^2$ Where

n = number of samples in each group

$z\propto$ = level of significance = 5% = 1.96

z (1-β) = power = 80% = 0.842

SD = standard deviation = 1.0

d = effect size = 0.50

Dropout rate = 20% Estimated sample size = 75 in each group.

Sampling and group allocation

The group allocation was done by block randomization method. The block size used was four and hence through six ways group allocation was carried out. The group allocation was done by a third person a physiotherapist who has not known about the present study methods.

Selection Criteria

Inclusion criteria: age group between 40 to 60 years, both male and female patients were chosen, the patient should have limitation of shoulder abduction and external rotation range of motion actively as well as passively, the duration of the condition between 4 to 12 months and patients with capsular pattern of restriction were only selected.

Exclusion Criteria

Musculoskeletal injuries of glenohumeral joint like fracture and dislocation, and patients associated with cervical radiculopathy were not selected.

Outcome Measures

The CHL thickness was evaluated by bright mode (B mode) ultrasound examination using a frequency of 4 to 15 MHZ transducer. The patient was in a supine lying in the cot. The shoulder was in maximal external notation. Shoulder abduction and flexion was not encouraged. The elbow was positioned in 90° flexion. The transducer was positioned initially on the lateral border of the coracoid process to generate axial oblique plane image of CHL. It was shown as hyperechoic linear band surrounded by a hyper loose fat. The CHL was checked by inclined the probe to see the anisotropic nature of the adjacent tissues. Further, it was confirmed by the dynamic movements of the shoulder. CHL was slacked in internal rotation and taught in external rotation of the shoulder. The examination was carried out on the affected shoulder joint.

Mulligan's Mobilization with Movement (MWM) Technique:

As coracohumeral ligament thickness restricts external and internal rotation of the shoulder, in the current work MWM focusing these two movements were administered.

(i) MWM focusing external rotation of shoulder

The patient was in supine lying with a folded towel under the scapula. The arm was placed close to the chest and elbow in a 90° flexion. The patient was holding a cane in both hands (Fig. 1).

Fig. 1 Shoulder MWM for Painful Restriction of Shoulder External Rotation

The therapist was standing on the opposite side of the affected shoulder. The therapist's hand was made like a cup by a reinforcing hand and reaching across the patient to be positioned on the head of the humerus. The therapist was applied a pain free posterior lateral glide of the humeral head on the glenoidal fossa of scapula. The patient was doing external rotation movement by pushing the affected arm using the cane. This movement is hold for ten seconds and has to be repeated for five to 10 times. It is important to keep the elbow close to the body and also maintain pain free motions. The grade and directions of the glide was adjusted as needed to achieve pain free movement.

(ii) MWM Focusing Internal Rotation of the Shoulder

The patient was in a standing with the top of the towel grasped on the unaffected hand and affected hand grasping the lower end of the towel with the maximum pain free position behind back (Fig. 2).

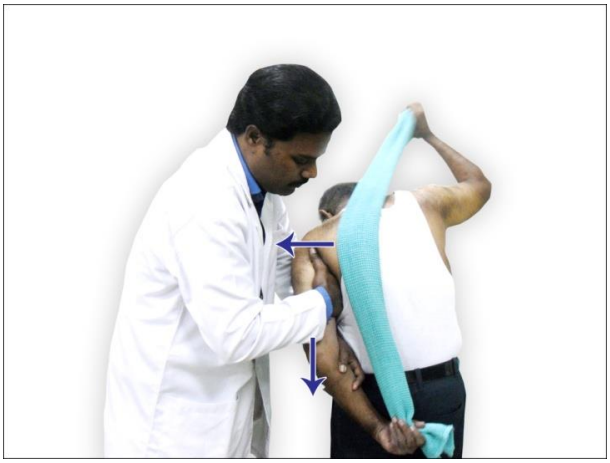

Fig. 2 MWM for Internal Rotation

The therapist was standing towards the affected side of the shoulder. The therapist one had was placed high up in the axilla with palm facing outwards in order to stabilize the scapula by creating upward and inward pressure. The therapist's other hand was positioned in such a way that his thumb was hooked in the cubital fossa and grasps the lower humerus of the patient to generate inferior glide. The therapist's abdomen was close to the patient's elbow to provide an adduction force to the arm. The patient was pulling the towel using unaffected hand to bring the affected hand up the back at the same time mobilization force is being applied in inferior direction by the therapist. It was ascertained that no pain was felt by the patient during the procedure. The direction and force of glide was adjusted to achieve a pain free function.

Therapeutic Ultrasound

A therapeutic ultrasound of frequency of 1MHz was applied in a circular fashion for 10 minutes to the painful site in the anterior joint line of humerus. A continuous mode of ultrasound with the intensity of 1.5 watts/cm^2 was used.

Codman's Pendulum Exercise

The patient's unaffected free arm was supported in a table. The involved arm was hanging straight down in a relaxed position. The affected arm was swinging back and forth then side to side and in circles both clockwise and anticlockwise. Each movement was performed for 15 to 20 times slowly in a pain free range. This has to be done for 3 sets.

Results:

The basic characters of the study patients are shown in Table-1. There was no significant difference in the age and gender between groups. There were no significant differences in the duration of the condition and CHL thickness at the start of the study.

Table – 1: Basic characters of the study patients

Characters		A		B		$t/z/\chi^2$	P
Age (years)							
Mean & S.D.		53.57 ± 6.39		53.00 ± 6.23		0.53	0.593
Gender (N, %)							
	Male	46	65.7	43	61.4	0.52	0.600
	Female	24	34.3	27	38.6		
Side (N, %)							
	Right	39	55.7	44	62.9	0.86	0.391
	Left	31	44.3	26	37.1		
Occupation (N, %)							
	Housewife	18	25.7	16	22.9		
	Agriculture	14	20.0	15	21.4		
	Office Worker	6	8.6	6	8.6	324.11	0.001
	Manual Worker	10	14.3	10	14.3		
	Academic Worker	7	10.0	10	14.3		
	Driver	2	2.9	2	2.9		
	Others	13	18.6	11	15.7		
Duration (Months)							
Mean & S.D.		6.24 ± 4.32		5.79 ± 3.46		0.69	0.491
CHL Pre value							
Mean & S.D.		2.94 ± 0.14		2.90 ± 0.16		1.58	0.116

N – number, $t/z/\chi^2$ – test statistics, p-probability values; * - significant.

Within group analysis (Table-2) shows that there was significant reduction in CH thickness after treatment in both groups. The between group comparison of improvement in CHL thickness is presented in Table-3. The CHL thickness reduction on an average was 0.63 mm higher in group 'A' than in group 'B'. It was further noted that there was significantly higher reduction in CHL thickness in group 'A', compared to group 'B'.

Table – 2: CHL Comparison with in Group

Period of CHL Thickness (mm)	A				B			
	M	S.D.	t	P	M	S.D.	t	P
Pre	2.94	0.14	85.79	0.001*	2.90	0.15	20.65	0.001*
Post	2.14	0.12			2.73	0.16		

M – mean, S.D. – Standard Deviation, 't' – test statistics, P – Probability Value; * - significant.

Table – 3: CHL Comparison Between Groups

CHL Thickness (mm)	Mean Difference	t	P
Between group difference	0.63	50.05	0.001*

Mean diff. – Mean difference, 't' – test statistics, P-probability value, * - significant.

Discussion

The current study results shows that there was significantly higher reduction in the CHL thickness following MWM when compared to conventional physiotherapy in patients with adhesive capsulitis of the shoulder. The present study result is correlating well with the studies done by Jeyakumar S et al.[9] They have found significantly higher improvements in CHL thickness following 4 weeks of MWM. The mean difference in the improvement was 0.4286 ± 0.0653 mm in the above-mentioned study. But in the current study, the mean difference was comparatively higher stands at 0.63 mm when compared to the conventional physiotherapy.

In the present study MWM addressing internal and external rotation range of motion (ROM) was concentrated. It was identified in the previous studies that CHL is thickened in patients with adhesive capsulitis. It was further observed that thickened CHL was the prime reason for reduction in external rotation ROM. More recent works have shown that thickened CHL is not only restricting external rotation but also limiting internal rotation ROM. Hence in the current study MWM techniques addressing these two movements was selected.

Many previous studies have found that MWM was effective in reducing pain, improving ROM and functions in patients with adhesive capsulitis.[10,11] But only very limited literatures are available for influence of MWM on CHL thickness. As CHL thickness is the grave factor in causing restriction of motion and functional abilities in adhesive capsulitis, the present study was undertaken to study the impact of MWM on CHL thickness in these patients. In the present work only CHL thickness was studied. It is suggested to include ROM and functional measures in the future endeavor along with CHL thickness to better evaluate the effectiveness of MWM in adhesive capsulitis. The reduction in the CHL thickness following MWM could have been due to logical reasoning of correcting positional fault of the joint by the physiological glide. Repetition of specific glenohumeral movements continuously during jobs and functional activities put stress on the joint structures. In due course it results in abnormal joint motions and positioning. This needs to be corrected and MWM has specifically addressing this problem. In order to achieve functional ability, these positional fault needs to be reversed. This can be identified by structural improvements in the glenohumeral joint and one of the effective means is studying CHL thickness before and after therapy. This was the missing component in many previous studies. The current study result is an ample proof that MWM is effective in patients with adhesive capsulitis.

Limitation and Suggestions

In the current study only CHL thickness was evaluated and it is suggested to include other functional measures in the future works. The magnitude of CHL thickness reduction needs to be correlated with level of improvements in the range of motion and functional activities.

Conclusion

It is concluded that Mulligan's Mobilization with Movement is effective in reducing coracohumeral ligament thickness in patients with adhesive capsulitis.

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