End-range Mobilization (ERM) Versus Mobilization with Movement (MWM) in Treatment of Adhesive Capsulitis

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ABSTRACT

Introduction: The purpose of this study was to determine the efficacy of end-range mobilization (ERM), added to home exercises program versus mobilization with movement (MWM) added to the same home exercises program in treatment of adhesive capsulitis by measuring range of motion of shoulder abduction and external rotation. Forty subjects were randomly assigned into two groups of 20 subjects who received either ERM, MWM three times a week for 6 weeks. Active goniometric range of motion measures by OB goniometer were recorded pre-and post-treatment. Significant improvement was found within groups comparing pre to post treatment scores. No significant difference was found after treatment between the groups concerning active ROM of shoulder abduction but there was a significant difference in active external rotation in favor of the group receiving end-range mobilization (ERM). In conclusion, the results of this study suggest that either ERM or MWM are equally effective interventions for use in patients with shoulder adhesive capsulitis for the range of shoulder abduction, while the range of shoulder external rotation was more significantly improved by the use of shoulder joint ERM.

Key words: *End-range mobilization (ERM); mobilization with movement (MWM); frozen shoulder.*

INTRODUCTION

Shoulder adhesive capsulitis is characterized by a progressive loss of motion[18]. Clinical picture includes pain, limited abduction and external rotation, muscle weakness and loss of function[3,6,19,20]. To regain the normal extensibility of the shoulder capsule, mobilization techniques has been recommended[4,18,19], specially ERM and MWM techniques[10,13,15,16,21].

Joint mobilization was used in rehabilitation of shoulder injuries[14], and can be combined with traditional medical care[1]. Hsu et al.,[8] has recommended mobilization for the treatment of adhesive capsulitis.

This study was done to compare effect of ERM and MWM, on shoulder abduction and external rotation, in cases of adhesive capsulitis.

SUBJECTS AND METHODS

Human samples

This study was conducted in the outpatient clinic of faculty of Physical therapy, Cairo University. The study was conducted on forty patients with unilateral idiopathic chronic frozen shoulder, their ages ranged from 40-55 years. The mean age of group A was (46.9± 5.38 years), while the mean age of group B was (47 ± 4.81 years).

Subjects were divided into two groups. Group (A); consisted of 20 subjects who received end-range mobilization technique combined to a home program of therapeutic exercises, for 18 sessions. Group (B); consisted of 20 subjects who received mobilization with movement technique combined to the same home program of therapeutic exercises used in group (A), for 18 sessions.

Inclusion criteria: (1) painful stiff shoulder for at least 3 months, (2) limited ROM of a shoulder joint (ROM losses of 25% or greater compared with the noninvolved shoulder of each of the following shoulder motions: glenohumeral abduction, and external rotation).

Exclusion criteria: (1) diabetes mellitus, (2) a history of shoulder surgery, (3) rheumatoid arthritis, (4) a painful stiff shoulder after a trauma, (5) fracture of the shoulder complex, (6) rotator cuff rupture, or (7) tendon calcification.

No other physical modalities or intra-articular steroid injection were allowed for the duration of the trial.

Instrumentation

Evaluative instrumentation

OB "MYRIN" Goniometry. The OB goniometer (figure 1) was used for assessing shoulder range of motion (ROM). The OB goniometer consists of a fluid-filled container mounted on a plate. The container has a compass needle that reacts to the earth's magnetic field, and an inclination needle that is influenced by the force of gravity. There is a Velcro strap is applied to the limb segment immediately distal to the joint being assessed.

Methods

Evaluation

After signing a written consent form, instructions about evaluative procedures were explained for each patient before the testing session to make sure that they understood the steps of evaluation and familiar with the evaluative instruments. Evaluation was conducted using the OB "MYRIN" goniometry.

Treatment

End-range mobilization

The techniques were performed as described by Vermeulen et al.,[18] and Maitland[13] as follows; at the start of each session, the physical therapist examined the patient's ROM in all directions to obtain information about the end-range position and the end-feel of the glenohumeral joint. Treatment was started with a few minutes of warm up consisting of rhythmic mid-range mobilizations with the patient in a supine position. The therapist's hands were placed close to the glenohumeral joint, and the humerus was brought into a position of maximal flexion in the sagittal plane. After ten to fifteen repetitions of intensive mobilization techniques in this end-range position, the direction of mobilization was altered by varying the plane of elevation or by varying the degree of rotation. While alternating the direction of mobilization, other movements such as gliding techniques and distraction in joint positions were also varied (ventral, dorsal and inferior). In each direction of mobilization, ten to fifteen repetitions were performed. The duration of prolonged stress varied according to the patient's tolerance.

Mobilization with movement. The MWM technique was performed on the involved shoulder as described by Mulligan[15,16]. With the subject in a relaxed sitting position, a belt was placed around the head of the humerus to glide the humerus head appropriately, as the therapist's hand was used over the appropriate aspect of the head of the humerus. A counter pressure also was applied to the scapula with the therapist's other hand. The glide was sustained during slow active shoulder movements to the end of the pain-free range and released after return to the starting position. Three sets of ten repetitions were applied, with one minute between sets.

Home program. Pendulum swings were repeated 30 times. Wand exercises of shoulder flexion, extension, horizontal abduction, internal and external rotation, were also applied, repeat each exercise ten times.

RESULTS

The dependent variables; active range of motion of shoulder abduction and external rotation were measured at the pre-treatment evaluation (before the first treatment session), and at the post-treatment evaluation.

Sample characteristics (Group A)

Group (A) consists of 13 females and 7 males. The mean age of group (A) was 46.9 years, with a standard deviation of 5.38, the minimum age was 40 years, and the maximum age was 55 years.

Statistical analysis of the measured variables in group (A).

Table (1) shows the mean values of the range of motion (ROM) of active shoulder abduction and external rotation in group (A).

Table (1): Mean and standard deviation of the measured variables, in group (A).

Variables			Mean	Standard deviation
ROM	Abduction	Pre-treatment	51.6	4.79
		Post-treatment	88.1	4.33
	External Rotation	Pre-treatment	37.1	3.64

		Post-treatment	80.84	2.43

Comparison of the pre-treatment with the post-treatment values of group (A).

Paired t-test (Table 2) shows a significant difference between the pre-treatment and post-treatment values of the range of motion of active shoulder abduction and external rotation, in group (A), with P value < 0.0001.

Table (2): Comparison between the pre-treatment and post-treatment results of ROM, in group (A).

Variables	Mean difference	t -Value	Significance
Abduction ROM	36.5	19.523	significant
External rotation ROM	43.79	43.217	significant

Sample characteristics (Group B)

Group (B) consists of 15 females and 5 males. The mean age of group (B) was 47, with a standard deviation of 4.81, the minimum age was 40 years, and the maximum age was 55 years.

Statistical analysis of the measured variables in group (B).

Table (3) shows the mean values of the range of motion (ROM) of active shoulder abduction and external rotation in group (B).

Table (3): Mean and standard deviation of the measured variables, in group (B).

Variables			Mean	Standard deviation
ROM	Abduction	Pre-treatment	52.4	5.64
		Post-treatment	86.6	4.16
	External Rotation	Pre-treatment	37.9	3.01
		Post-treatment	64.8	2.63

Comparison of the pre-treatment with the post-treatment values of group (B)

Paired t-test (Table 4) shows a significant difference between the pre-treatment and post-treatment values of the range of motion of active shoulder abduction and external rotation, in group (B), with P value < 0.0001.

Table (4): Comparison between the pre-treatment and post-treatment results of ROM, in group (B).

Variables	Mean difference	t -Value	Significance
Abduction	34.2	20.68	significant
External rotation	26.9	34.15	significant

Comparison between the pre-treatment values of both groups

Independent t-test. The test has been used to compare between the pre-treatment mean values of the range of motion of active shoulder abduction and external rotation range of motion (ROM) in both groups. Table (5) shows that there was no significant difference between both groups at the pre-treatment evaluation.

Table (5).Comparison between the pre-treatment results of ROM, in both group (A and B).

Variables	Mean difference	P- value	t -value	Significance
Abduction	0.8	0.63	0.484	Non-significant
External rotation	0.8	0.45	0.758	Non-significant

Comparison between the post-treatment values of both groups

Independent t-test. The test has been used to compare between the post-treatment mean values of the range of motion of active shoulder abduction and external rotation of both groups. Table (6) shows no significant difference between both groups concerning the range of motion of active shoulder abduction. There was a significant difference between both groups concerning the shoulder external rotation ROM, in favor of group (A).

Table (6): Comparison between the post treatment results of the ROM, in both group (A and B).

Variables	Mean difference	P-value	t -Value	Significance
Abduction	1.5	0.2709	1.117	Non-significant
External rotation	16.04	< 0.001	20.03	significant

DISCUSSION

Adhesive capsulitis has been researched repeatedly over the years and Patients with adhesive capsulitis have been treated with many different interventions. The purpose of this study was to compare the efficacy of ERM versus MWM in the treatment of frozen shoulder by measuring changes in range of motion of shoulder abduction and external rotation.

The concept of reversing the effects of adhesive capsulitis was supported by the findings of this study. All measures demonstrated an improvement within each group from the data collected at the beginning of the study as compared to the data gathered at the end of the study. Therefore, both techniques of joint mobilization are proved to be effective treatments for patients with adhesive capsulitis.

The results showed that there was an increase in shoulder abduction using ventral, dorsal in addition to inferior gliding, which is supported by the work of Hsu et al.,[8] who stated that both ventral and dorsal mobilization applied at the end range of abduction improved glenohumeral abduction range of motion.

This study was supported by the study of Vermeulen et al.,[19] who investigated the effect of end range joint mobilizations on increasing shoulder motion. The study consisted of 100 participants with adhesive capsulitis of the shoulder, who received interventions of joint mobilization over the course of three months. Forty nine subjects received high grade joint mobilizations and 51 subjects received low grade joint mobilizations. The study defined high grade mobilizations as grades three and four joint mobilizations, and the low grade joint mobilizations as grades one and two joint mobilizations, according to Maitland. The subjects in both groups showed significant improvements regardless of the type of joint mobilizations used. Active external rotation was significantly higher in the group that received high grade mobilizations. The high grade mobilization group also had a greater increase in passive shoulder abduction when compared to the low grade mobilization group.

The combined effects of the techniques compared in the current study were investigated by Yang et al.,[21] who applied different combinations of mid-range mobilizations (MRM), end range joint mobilization (ERM), and mobilization with movement (MWM) for the treatment of frozen shoulder. MRM were defined as mobilization within the available joint play of the joint and was the least effective for the treatment of frozen shoulder. The study showed a significant increase in arm elevation, humeral lateral rotation, and humeral medial rotation, the study concluded that the combination of end range mobilization and mobilization with movement was very effective in increasing shoulder mobility and functional ability.

Results of the current study regarding increase of the range of external rotation were also supported by the results of Johnson et al.,[9] who compared anterior joint mobilizations versus posterior joint mobilizations on increasing shoulder external rotation in patients with adhesive capsulitis, the study looked at 20 patients between the ages of 37 and 66 years, which were assigned to one of two groups that either received anterior joint mobilizations or posterior joint mobilizations. Range of motion was measured using a goniometer. Before the intervention, the capsule was treated with thermal ultrasound, and grade three joint mobilizations were used, according to Kaltenborn[17]. Each participant completed six sessions. After six sessions external rotation was increased significantly in both groups, but external rotation was increased in the anterior mobilization group's less than its increase in the posterior mobilization group's.

The current study implemented the use of passive grade 4 joint mobilization (high

grade mobilization), according to Maitland, which has been used in previous studies and shown to increase range of motion[17,19,21].

Anterior gliding was used in this study for increasing external rotation such as in the study done by Hsu et al.,[8] who used end range dorsal and ventral joint mobilizations to increase shoulder range of motion. The results of the study showed that the two procedures produced increase in shoulder range of motion. Lateral rotation increased to the most after ventral joint mobilizations and medial rotation increased to the most after the dorsal joint mobilizations. The study concluded that the posterior and anterior translation of the humeral head was affected by the length of the posterior capsule in medial rotation and the anterior capsule in lateral rotation, thus according to the convex-concave rule, medial rotation is improved by dorsal joint mobilizations and lateral rotation is improved by ventral rotations.

One of the purposes of mobilization with anterior and inferior gliding is to elongate connective tissue. In the case of adhesive capsulitis, the connective tissue is the joint capsule. Findings cited previously confirm that individuals with adhesive capsulitis have a shortened anterior-inferior joint capsule[7], so that this direction of gliding had been chosen to be applied in this study in addition to the dorsal glide that was also proved to increase abduction and external rotation[8,10].

Exercises were added to the treatment as home program in both groups, as it is an effective strategy to stretch and strengthen the shoulder muscles affected by adhesive capsulitis. Pendulum exercises, as developed by Codman[2], have remained a popular exercise regime as documented in many articles. The pendulum exercise is performed with the patient bent over at the waist or in the prone position with weight in the involved arm that is dangling in a relaxed position. The sway of the body may be used to passively swing the arm or the patient may actively move the arm in a comfortable range of motion. Gravity and the weight of the extremity produce joint distraction, which can be increased by the patient holding a small weight. The motions most commonly used are flexion-extension, horizontal abduction-adduction, and circular pattern.

Exercises that have been used in many researches are such as flexion, extension, and horizontal abduction, internal and external rotation[5,12].The general recommendation for the patient is to perform these exercises in a regular basis, in the form a program of stretching and strengthening exercises. These researches proposed that exercises should be practiced over a minimum of four weeks in effort to monitor improvement in range of motion.

This study is a short term effect study, so the data have been collected only during the period of the study. long term effects has not been studied in the current study and follow up study is recommended to be made as a next experiment to compare the long term effects of ERM and MWM techniques in cases of frozen shoulder.

Conclusion

From the finding of the current study we can conclude that both ERM and MWM techniques are effective interventions to improve shoulder abduction, and external rotation motion. This study has shown that ERM shows more increase of shoulder external rotation range of motion than using MWM.

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الملخص العربي

التحريك لنهاية المدى الحركي مقابل التحريك بالحركة في علاج مفصل الكتف المتجمد

الهدف من هذه الدراسة هو تحديد فاعلية التحريك لنهاية المدى الحركي الذي يتم إضافته إلى برنامج التمرينات التي تتم في المنزل، في مقابل العلاج باستخدام التحريك بالحركة الذي يتم إضافته إلى نفس برنامج التمرينات المنزلية، لعلاج مفصل الكتف المتجمد، من خلال قياس المدى الحركي للفتح الجانبي والالتفاف الخارجي لمفصل الكتف. تم اختيار أربعين مريضاً بشكل عشوائي تم تقسيمهم إلى مجموعتين كلا منهما تضم 20مريضاً، وكلا منهما تلقي أما علاجاً باستخدام التحريك لنهاية المدى الحرك ي أو علاج من خلال التحريك بالحرك ة ثلاث مرات أسبوعياً لمدة ستة أسابيع . وقد تم قياس مدى الزوايا الحركي عن طريق جهاز قياس الزوايا ، حيث تم تسجيل القراءات قبل وبعد العلاج .وقد وجد أن هناك تحسناً ملحوظاً في المجموعات عند مقارنة درجات الاختبار القبلية والبعدية في مدى الحركة . ولم تجد الدراسة أن هناك فروقاً ذات دلالة معنوية بين المجموعتين عند مقارنة النتائج بعد العلاج الخاصة بالفتح الجانبي النشط للكتف ، ولكن كانت هناك فروقا ذات دلالة معنوية في الالتفاف الخارجي النشط للكتف لصالح التحريك لنهاية المدى الحرك ي . والخلاصة هي أن نتائج الدراسة اقترحت أن أ ي من العلاجين سواء باستخدام التحريك لنهاية المدى الحرك ي أو التحريك بالحركة يعتبران تدخلاً فعالاً على قدر المساواة للاستخدام في حالة المرضي الذين يعانون من مفصل الكتف المتجمد، فيما عدا التفاف الكتف الخارجي والتي أظهرت تحسناً أكبر باستخدام العلاج بتحريك الكتف لنهاية المدى الحركي .

الكلمات الدالة : التحريك لنهاية المدى الحركي ، التحريك بالحركة ، مفصل الكتف المتجمد .