Mobilization Techniques Versus A Selected Exercise Program in Treatment of post Traumatic Frozen Shoulder

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ABSTRACT

Purpose: *The purpose of this study was to compare between the effect of mobilization techniques and therapeutic exercises on range of motion of the glenohnmeral joint and pain intensity in patients with post-traumatic frozen shoulder.* ***Subjects:*** *Thirty patients diagnosed as post traumatic frozen shoulder secondary to fractures around the shoulder region participated in this study.* ***Methods:*** *Patients were divided randomly into two groups: group (A) consisted of 15 patients with mean age of 51.00 (± 6.82) years treated by mobilization techniques; and group (B) consisted of 15 patients with mean age of 48.40 (± 6.77) years treated by the therapeutic exercises. Each patient in both groups received 15 treatment sessions, 3 sessions per week for 5 weeks. Patients were evaluated just before the study, before the 8th session, and after the end of the study by pain intensity scale and the universal standard goniometer.* ***Results:*** *Regarding within groups differences in mobilization techniques group and in therapeutic exercise groups, there was significant increase of shoulder flexion, abduction and external rotation with significant reduction of pain intensity. Comparison between groups in midtreatment assessment and post treatment assessment revealed no significant difference between the mean shoulder flexion, abduction and external rotation of both groups. Concerning shoulder pain intensity, there was no significant difference between groups in the midtreatment assessment and post-treatment assessment.* ***Conclusion:*** *Both the mobilization techniques and the selected exercise program used in this study proved efficiency in the treatment of patients with post-traumatic frozen shoulder and each may be used in the treatment of these patients.*

Key words: *Frozen shoulder, adhesive capsulitis, range of motion, pain, mobilization techniques, therapeutic exercises.*

INTRODUCTION

The shoulder is a very complex joint that allows movement in many planes. It is crucial to many activities of daily living[51]. Adhesive capsulitis is a syndrome defined as idiopathic gradual progressive restriction of active and passive glenohumeral joint movements, that is usually painful at onset[4,40,51,53].

Adhesive capsulitis subdivided into primary and secondary syndromes, which have similar clinical presentations[52]. The term "adhesive capsulitis" should be used to refer to the primary idiopathic condition which is not associated with a specific underlying condition, and the term "secondary adhesive capsulitis" should be applied to the condition that is associated or results from other pathologic states. Secondary causes include alteration of the supporting structures of and around the shoulder[51] as tendonitis, bursitis, or cervical dysfunction[22,24], autoimmune disorders, endocrine diseases as hyperthyroidism or other systemic diseases such as diabetes, stroke, post-myocardial

infarction and rheumatoid arthritis[17,22,24,44,51]. Immobility following to trauma, avascular necrosis and osteoarthritis may predispose a patient to secondary adhesive capsulitis[7,22,24,27,51]. Trauma may be fractures of the shoulder region, fractures any where in the upper limb, missed diagnosis of posterior shoulder dislocation, and hemoarthrosis of the shoulder secondary to trauma[49].

The term "Frozen shoulder" has been loosely applied to conditions when the shoulder is working at less than its optimal range[57]. According to Sandor[47] the terms of adhesive capsulitis and frozen shoulder could be used interchangeably. Adhesive capsulitis results from thickening and contraction of the capsule around the glenohumeral joint which causes progressive loss of motion and pain[1,20,59]. Post traumatic transient inflammatory state with granualation tissue and eventual fibrous adhesions and thickening of the capsule may cause adhesive capsulitis[16,43]. Adhesive capsulitis tends to occur in females older than 40 years, and it has been reported in children. Fifteen percent of patients develop bilateral disease[34].

Functional inferior axillary fold is necessary for full abduction to occur at the glenohumeral joint[45]. The change in scapulohumeral rhythm may be attributed to decreased inferior glide at the glenohumeral joint[45]. Capsular adhesions of the axillary recess hinder normal expansion during abduction resulting in diminished active and passive mobility of the shoulder[56].

The clinical stages of the disease have been described as freezing, frozen, and thawing. The freezing stage lasts from onset to between 2.5 and 9 months and is characterized by the most severe pain and a gradual diminution of movement and daily living activity[3,37,47]. The frozen stage lasts between 4 and 12 months. Pain decreases gradually but without appreciable improvement in motion[47], which limit the patient in personal care, activities of daily living and occupational activities[3,37]. The thawing phase is marked by gradual return of motion and may be as short as 12 months but may last for years. Full or almost full recovery can be achieved during this phase[39,42,47].

Patients with chronic shoulder pain and loss of range of motion should be evaluated for frozen shoulder[58]. Clinical evaluation of patients with adhesive capsulitis reveals the following: 1) decreased active and passive range of motion at the glenohumeral joint mainly in abduction and external rotation with subsequent decrease in functional use of the upper extremity, 2) pain diffusely located around the shoulder, 3) decreased joint play, and 4) altered scapulohumeral rhythm with compensatory increase in movement of the scapulothoracic joint[36,45].

A carefully designed treatment plan for patients with frozen shoulder may include rest, physical therapy, pain medications such as NSAIDs, oral corticosteroid, intra-articular corticosteroid injection and capsular distension arthrography. Closed manipulation under anesthesia and surgical intervention such as open or arthroscopic capsular release may be indicated after conservative treatment has failed[33,47,59]. Non-operative treatment, the gold standard for initial management, affords satisfactory results in most patients[15]. The main goals of physical therapy are reduction of discomfort and pain, preservation of shoulder mobility, resolution of the significant abnormal scapulohumeral rhythm, promotion of muscle relaxation, improvement of tissue extensibility and improvement of function[9,49,51,53,57]. Physical therapy usually include heat, cryotherapy and other modalities as ultrasound that decrease pain, and inflammation and relax the muscles[15,26,41,51].

Strengthening exercises as well as stretching exercises with or without mobilization techniques are of great importance in the treatment of patients with frozen shoulder[26,30,45].

To restore joint mobility and normal muscles performance, soft tissues extensibility of the joint capsule should be regained[11]. To regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion by means of mobilization techniques has been recommended[31,57]. Manual therapy techniques are skilled hand movements intended to improve tissue extensibility; increase range of motion; induce relaxation; mobilize or manipulate soft tissue and joints; modulate pain; and reduce soft tissues swelling, inflammation, or restriction[48].

Ryans et al.,[46] reported improvement of the range of motion of external rotation after 6 weeks of standardized physical therapy. Statistically significant improvement has been reported in glenohumeral active range of motion and reappearance of axillary recess in patients managed by moist heat, ultrasound, passive joint mobilization, flexibility and strengthening exercises[32]. In another study, pain and passive range of motion showed statistically significant improvement in patients with frozen shoulder who were treated by passive joint mobilization and traditional active exercises than those treated by traditional active exercises alone[38].

In another study shoulder function in patients with frozen shoulder was evaluated after 4 weeks of combining mobilization exercises with electrical therapy and massage, there was improvement of shoulder flexion, extension, abduction and adduction active range of motion. A significant increase in shoulder muscles isometric strength and endurance and decrease in shoulder pain were also observed[17].

Comparative study of deep friction massage combined with mobilization and stretching exercises versus hot packs combined with shortwave diathermy and stretching exercises was conducted for patients with adhesive capsulitis[25]. 95% of patients in the first group and 13% of patients in the second group reached sufficient range of motion at the end of the second week of the study. The improvement in shoulder flexion, internal and external rotation and decrease in pain were significantly better in the first group of patients[25].

Mobilization techniques such as dorsal, ventral or inferior glides of the glenohumeral joint are frequently used as an intervention for joints with limited range of motion[27]. Hsu et al.,[23] studied the effect of dorsal and ventral translational mobilization of the glenohumeral joint on cadaver models with specimens from elderly subjects. Their findings suggest that both dorsal and ventral translational mobilization of the glenohumeral joint are effective in improving range of motion of abduction if they are applied at the end range of glenohumeral abduction rather than at the resting position.

Ventral and dorsal accessory glides are used to increase lateral and medial rotation, and lateral distraction to increase movement in general. By assessing the patient's pain response and movement after each technique, the therapist can determine results and plan subsequent treatment[57].

Schneider and Prentice[49] reported the efficiency of using different types of exercises for the shoulder in the rehabilitation program of adhesive capsulitis as Codman's exercises, hold relax techniques, rhythmic stabilization techniques, wall climbing exercises, wall corner stretches, and isometric exercises. Cane

exercises are used for improving internal and external rotation, and elevation[26].

Pendulum (Codman's) exercises are techniques that use the effects of gravity to distract the humerus from the glenoid fossa. They help relieve of pain through gentle traction and oscillating movements (grade II) and provide early motion of joint structures and synovial fluid[28].

To the investigators knowledge based on the literature reviewed, there is no study that compared directly between mobilization techniques and the commonly used therapeutic exercises in treatment of frozen shoulder. Therefore, this current study was conducted in order to detect any difference between the effects of both treatments.

MATERIALS AND METHODS

Subjects

Thirty patients between the ages of 40-60 years old diagnosed as post traumatic frozen shoulder secondary to fractures around the shoulder region participated in this study. Patients were divided randomly into 2 groups: group (A) which consisted of 15 patients (6 males and 9 females) with mean age of 51.00 (± 6.82) years. This group was treated by mobilization techniques and group (B) which consisted of 15 patients (7 males and 8 females) with mean age of 48.40 (± 6.77) years. This group was treated by the traditional exercises. All patients had painful stiff shoulder which ranged in duration between 3 to 6 months from the onset of illness in order to be included in the study.

Patients were excluded from the study if they were receiving physical therapy to the affected shoulder prior to participation in the study to eliminate the possible effect of previous treatment. Patients with systemic diseases such as diabetes, hyperthyroidism or rheumatoid arthritis, referred shoulder pain from the heart, neck, diaphragm, liver or spleen, cardiovascular accident and chronic pulmonary diseases were also excluded[18].

This study was conducted in the orthopaedic outpatient clinic of the faculty of physical therapy, Cairo University.

Patient assessment

Patients were evaluated just before the study (pretreatment assessment), before the 8th session (mid-treatment assessment) and 2 days after the end of the study (post-treatment assessment).

Assessment included the following

1) Assessment of shoulder pain intensity

Shoulder pain intensity was assessed by using the pain intensity scale. This scale is 10 cm horizontal line which is graded from 0 to 10, where 0 = no pain and 10 = killing pain. The patient was instructed to choose a number on that line that best describes his pain intensity[21,41,54].

2) Assessment of shoulder motions

Assessment of physiological movements of the shoulder was conducted[57] for active flexion, abduction and external rotation by using the universal standard goniometer[18,56], while the patient was in supine lying position. Measurements were repeated 3 times for each movement and the mean of the three trials of each motion was calculated to be used later for the purpose of data analysis.

Treatment Procedures

Each patient in both groups received 15 treatment sessions, 3 sessions per week "each other day" for 5 weeks. All patients were received infrared radiation in sitting position as a local heat for warming up, to decrease pain and to increase tissue extensibility just

before exercises[26]. Infrared was applied for 20 minutes for the affected shoulder.

(1) Mobilization techniques for group (A)

The passive mobilization technique of the glenohumeral joint was applied to restore normal joint glide and separation[26] in a comfortable position[57], with the affected shoulder supported in a pain-free position[28]. In this study, the therapist's hands were placed on the humeral head close to the glenohumeral joint just below the acromion. The patient's arm was placed rested to the end of maximal available range of flexion, abduction, and then external rotation. Advanced progressions in the shoulder range of motions beyond 90 degrees include progression of the humerus at the end of the gained range, externally rotating the humerus then a grade III distraction or grade III glide was applied to stretch the restrictive capsular tissue or adhesions[28].

Distraction of the glenohumeral joint was performed to improve general mobility. The patient was in supine, the proximal hand was in the patient's axilla, while the other hand supported the humerus from the lateral surface. With the hand in the axilla the humerus was moved laterally.

Gliding of the humeral head posteriorly was performed to improve range of flexion. The patient was in supine and his arm in resting position supported with the lateral hand. The other hand was placed just distal to the anterior joint margin giving the mobilizing force and gliding the humeral head posteriorly.

Gliding of the humeral head anteriorly was performed to improve external rotation. The patient was in prone with his arm rested over the edge of the table. The arm was supported by the outer hand, and the ulnar border of the other hand was placed just distal to the posterior angle of the acromion to give the mobilizing force gliding the humeral head in an anterior and slightly medial direction.

Gliding of the humeral head caudally was performed to improve abduction of the glenohumeral joint. With the patient in supine, one hand was placed in the patient's axilla to provide grade I distraction. The web space of the other hand was placed just distal to the acromion process, to perform glide of the humerus in an inferior direction. With the hand placement as in distraction, the patient's arm was pulled caudally in long axis traction. Gliding and distraction were performed in each position for 15 repetitions.

(2) Therapeutic exercises for group (B)

Therapeutic exercise program for group (B) was applied for 30 minutes, 3 times / week for 15 sessions. The following exercises was applied up to the point of pain:

1- Codman's pendulum exercises

They were used as warming up exercises, using the effects of gravity on the arm to distract the humerus from the glenoid fossa[28], for 3-5 minutes in the start of treatment. The patient's trunk was flexed with the hips approximately 90º in a horizontal position, and the knees were slightly bent to allow greater hip flexion and minimize stress to the low back. The patient placed the hand of the normal side on a firm surface to permit relaxed movement and concentration on the indicated movement of the involved shoulder. The affected arm was hung loosely downward like a pendulum. The patient was asked to swing his arm freely back and forth like a pendulum, stimulating the motion of flexion and extension. This was followed by asking the patient to swing his arm freely upward and laterally and downward and medially to increase horizontal abduction and adduction. The patient was also instructed to move his arm in circles. Each of these exercises was

repeated 15 times with rest periods in between. In addition to that, light weight was held in the hand as a graduation of these exercises according to the patient's tolerance. During these exercises, the scapula was manually stabilized by the therapist[19,28].

2- Pulley system exercises

They were started after Codman's pendulum exercises as they give effective assistance and are easy to be applied. Patient was in sitting position, grasping one end of the pulley system by the sound hand, while the other hand was grasping the other end. As the patient pulled down with the sound hand, the affected shoulder went up into flexion. From the same position, while the affected arm beside the patient, he was asked to pull down with the sound hand, by this the affected shoulder was drawn up gradually into abduction[19]. Each of these exercises was repeated 15 times, with 5 minutes rest in between to avoid fatigue.

1- Shoulder wheel exercises

Shoulder wheel exercises were used to assist in increasing shoulder flexion and extension. The patient was in standing position with his affected shoulder parallel to the shoulder wheel, and rotate the wheel up and down as much as he could. The exercise was repeated 15 times.

2- Autopassive exercises (self assisted exercises)

Autopassive exercises were applied by using the wall bars. Each exercise was repeated 15 times. For shoulder flexion, the patient was in standing position facing the wall bars and grasping the bar at the level of the shoulder. He was instructed to sit down as much as he could flexing his shoulder. For shoulder abduction, the patient was in standing position with his affected shoulder beside the wall bars grasping the bar at the level of the shoulder. He was instructed to sit down as much as he could moving his affected shoulder into abduction. For shoulder external rotation, the patient was in standing position beside the wall bars making full flexion at his elbow and grasping the wall bar. He was instructed to rotate his body outside as much as he could moving his shoulder in external rotation.

RESULTS

1- General characteristic of subjects

There was no significant difference between the two treatment groups regarding age, duration of illness, and range of motion. In group (A) treated with mobilization techniques the mean age was 51 (± 6.82) years, and the mean duration of illness was 5.30 (±2.64) months (Table 1). The pretreatment means of the studied shoulder motions were 64.40 (±18.08) degrees for flexion, 41.60 (±23,09) degrees for abduction, 22.20 (±12.05) degrees for external rotation, and the mean of pain intensity was 6.20 (±1.64) as shown in (Table2).

In group (B) treated with the therapeutic exercises, the mean age was 48.40 (±6.77) years, and the mean duration of illness was 5.20 (±3.21) months (Table 1). The pretreatment means of the studied shoulder motions were 68 (±23.89) degrees for flexion, 50.40 (±18.91) degrees for abduction, 28.40 (±14.08) degrees for external rotation, and the mean of pain intensity was 6.20 (±1.92) (Table 2).

Using unpaired t-test, it was found that there were no significant difference between groups before treatment regarding age and duration of illness (Table 1). In addition to that unpaired t-test showed that there was no significant differences between pretreatment shoulder motions, and pain intensity of both groups as showed in table (2).

Table (1): General characteristics of the patients

Variable	Mobilization techniques group	Therapeutic exercises group	t- value	P- value
Age (year)	51 (± 6.82)	48.40 (± 6.77)	0.60	P > 0.05
Duration of illness (month)	5.30 (± 2.64)	5.20 (± 3.21)	0.50	P > 0.05

Table (2): Comparison between groups before treatment

Variable	Mobilization techniques group	Therapeutic exercises group	t- value	P- value
Shoulder flexion	62.40 (±18.08)	68.00 (±23.89)	0.42	P > 0.05
Shoulder abduction	35.60 (±11.06)	50.40 (18.91)	0.66	P > 0.05
Shoulder ext. rot.	22.20 (±12.05)	28.40 (±19.08)	0.75	P > 0.05
Pain intensity	6.20 (±1.64)	6.20 (±1.92)	0.01	P > 0.05

2- Within groups differences

Paired t-test was used to find out within groups differences in both the mobilization techniques group, and the exercise group.

a) Comparison between pretreatment and midtreatment assessment in the mobilization techniques group

In the mobilization techniques group, there was significant increase of shoulder flexion, the pretreatment mean was 62.40 (±18.08) degrees and the midtreatment mean was 98.00 (±28.31) degrees. There was also significant increase of shoulder abduction, the pretreatment mean was 35.60 (±11.06) degrees, and the midtreatment mean was 63.40 (±25.60) degrees. In addition to that there was significant increase of shoulder external rotation, the pretreatment mean was 22.20 (±12.05) degrees, while the midtreatment mean was 41.20 (±12.15) degrees (Table 3).

Regarding shoulder pain intensity, there was significant reduction, between the pretreatment mean of 6.20 (±1.64) and the midtreatment mean of 4.80 (±2.17) as shown in table (3).

Table (3): Pretreatment and midtreatment assessment within the mobilization techniques group.

Variable	Pretreatment	Mid-treatment	t- value	P- value
Shoulder flexion	62.40 (±18.08)	98.00 (±28.31)	6.12	P < 0.01
Shoulder abduction	35.60 (±11.06)	63.40 (±25.60)	4.11	P < 0.01
Shoulder ext. rot.	22.20 (±12.05)	41.20 (±12.15)	9.62	P < 0.01
Pain intensity	6.20 (±1.64)	4.80 (±2.17)	5.72	P < 0.01

b) Comparison between pretreatment and post-treatment assessment in the mobilization techniques group

In the mobilization techniques group, there was significant increase of shoulder flexion, the pretreatment mean was 62.40 (±18.08) degrees and the post-treatment mean was 129.00 (±24.89) degrees. There was also significant increase of shoulder abduction, the pretreatment mean was 35.60 (±11.06) degrees, and the post-treatment mean was 97.40 (±22.75) degrees. In addition to that there was significant increase of the shoulder external rotation, the pretreatment mean was 22.20 (±12.05) degrees, and the post-treatment mean was 64.20 (± 21.72) degrees (Table 4).

Regarding shoulder pain intensity, there was significant reduction between the pretreatment mean of 6.20 (±1.64) degrees, and the post-treatment mean of 2.60 (±2.07), as shown in table (4).

Table (4): Pretreatment and post-treatment assessment within the mobilization techniques group.

Variable	Pretreatment	Post-treatment	t- value	P- value
Shoulder flexion	62.40 (±18.08)	129.00 (±24.89)	14.44	P < 0.01
Shoulder abduction	35.60 (±11.06)	97.40 (±22.75)	10.85	P < 0.01
Shoulder ext. rot.	22.20 (±12.05)	64.20 (±21.72)	4.16	P < 0.01
Pain intensity	6.20 (±1.64)	2.60 (±2.07)	9.00	P < 0.01

c) Comparison between pretreatment and midtreatment assessment in the therapeutic exercises group

In the therapeutic exercises group, there was significant increase of shoulder flexion, the pretreatment mean was 68.00 (±23.89) degrees and midtreatment mean was 92.20 (±26.30) degrees. There was also significant increase of shoulder abduction, the pretreatment mean was 50.40 (±18.92) degrees, and the midtreatment mean was 69 (±21.12) degrees. In addition to that there was significant increase of shoulder external rotation, the pretreatment mean was 28.40 (±14.08) degrees, and the midtreatment mean was 44.20 (±15.19) degrees (Table 5).

Regarding shoulder pain intensity, there was significant reduction between the pretreatment mean of 6.20 (±1.92) degrees, and midtreatment mean of 4.80 (±2.28) degrees, as shown in table (5).

Table (5): Pretreatment and midtreatment assessment within the therapeutic exercises group.

Variable	Pretreatment assessment	Midtreatment assessment	t- value	P- value
Shoulder flexion	68 (±23.89)	92.20 (±26.30)	11.36	P< 0.001
Shoulder abduction	50.40 (±18.92)	69 (±21.12)	6.43	P< 0.001
Shoulder ext. rot	28.40 (±14.08)	44.20 (±15.19)	16.30	P< 0.001
Pain intensity	6.20 (±1.92)	4.80 (±2.28)	5.72	P< 0.001

d) Comparison between pretreatment and posttreatment assessment in the therapeutic exercises group

In the therapeutic exercises group, there was significant increase of the shoulder flexion, the pretreatment mean was 68 (±23.90) degrees and post-treatment mean was 113.60 (±18.55) degrees. There was also significant increase of shoulder abduction, the pretreatment mean was 50.40 (±18.92) degrees, and the post- treatment mean was 89.80 (±17.37) degree. In addition to that there was significant increase of shoulder external rotation, the pretreatment mean was 28.40 (±14.08) degrees, and the post- treatment mean was 57 (±17.39) degrees (Table 6).

Regarding shoulder pain intensity, there was significant reduction between the pretreatment mean of 6.20 (±1.92) degrees, and the post-treatment mean of 2.40 (±1.67) degrees, as shown in table (6).

Table (6): Pretreatment and post-treatment assessment within the therapeutic exercises group.

Variable	Pretreatment assessment	Post-treatment assessment	t- value	P- value
Shoulder flexion	68 (±23.89)	113.60 (±18.55)	14.44	P < 0.001
Shoulder abduction	50.40 (±18.92)	89.80 (±17.37)	36.58	P < 0.01
Shoulder ext. rot.	28.40 (±14.08)	57.00 (±17.39)	11.62	P < 0.01
Pain intensity	6.20 (±1.92)	2.40 (±1.67)	6.52	P < 0.01

3- Comparison between groups in the midtreatment assessment

Unpaired t-test showed that there was no significant difference between the mean shoulder flexion of the mobilization techniques group and that of the therapeutic exercises group. It also showed that there was no significant difference between the means of the shoulder abduction in both groups. Regarding shoulder external rotation, no significant difference was found between the midtreatment mean of the mobilization group and the midtreatment mean of the exercise therapy group. These findings are clarified in table (7).

Concerning shoulder pain intensity in the midtreatment assessment, there was no significant difference between groups as shown in table (7).

Table (7): Comparison between groups in the midtreatment assessment.

Variable	Mobilization techniques group	Therapeutic exercises group	t- value	P- value
Shoulder flexion	98 (±28.31)	92.20 (±26.30)	0.34	P > 0.05
Shoulder abduction	63.40 (±25.60)	69 (±21.12)	0.38	P > 0.05
Shoulder ext. rot.	41.20 (±12.15)	44.20 (±15.19)	0.35	P > 0.05
Pain intensity	4.80 (±2.17)	4.80 (±2.28)	0.21	P > 0.05

4- Comparison between groups in the posttreatment assessment

Unpaired t-test showed that there was no significant difference between the mean shoulder flexion of the mobilization techniques group and that of the therapeutic exercises group. It also showed that there was no significant difference between the means of the shoulder abduction in both groups. Regarding shoulder external rotation, no significant difference was found between the post-treatment mean of the mobilization group and the post-treatment mean of the exercise therapy group. These findings are clarified in table (8).

Concerning shoulder pain intensity in the post-treatment assessment, there was no significant difference between groups as shown in table (8).

Table (8): comparison between groups in the posttreatment assessment

Variable	Mobilization techniques group	Therapeutic exercises group	t-value	P- value
Shoulder flexion	`129 (±24.89)	113.60(±18.55)	1.11	P > 0.05
Shoulder abduction	97.40 (±22.75)	89.80 (±17.37)	0.59	P > 0.05
Shoulder ext. rot.	64.20 (±21.72)	57 (±17.39)	0.34	P > 0.05
Pain intensity	2.60 (±2.07)	2.40 (±1.67)	0.21	P > 0.05

DISCUSSION

Substantial disability may result from shoulder disorders. Moving the shoulder allows placement of the hand, hence compromised shoulder mobility impacts substantially on the performance of tasks essential for daily living (e.g. dressing, personal hygiene, eating and work). In addition impaired ability to sleep, so affecting mood and concentration. People with shoulder pain have been shown to score substantially less than normal values for physical, social, emotional function and pain[5,12]. Some studies

demonstrated persisting pain and disability in shoulder disorders which vary from 12 months to 18 months in up to 50% of cases[8,14,55].

Hypomobility can occur as a result of immobilization. This immobilization may be due to pain, fear, or a deconditioned state. Immobilization should never be prolonged because of the tendency to develop myofascial shortening, loss of capsular extensibility, muscular atrophy, and disturbed motor control[19]. In addition to that, inflammation and pain can cause reflex inhibition of shoulder muscles. Disuse of the arm results in loss of shoulder mobility. It is difficult to perform activities of daily living that require overhead movement of the involved arm, reaching outside or rotation of the humerus causing functional limitation and profound disability[20]. These changes in range of motion are clinically meaningful for the patient suffering from a restricted glenohumeral joint[19].

Therapeutic exercise regimens are associated with both increased motion and decreased pain in the treatment of frozen shoulder syndrome[16]. A supervised exercise regime has been demonstrated to be of a significant benefit in the treatment of adhesive capsulitis in both the short and long term. A previous study reported significant pain reduction and significant improvement of shoulder motions, and function after one month of treatment[13]. In another study, which lasted two and a half year, follow up confirmed the same findings[6].

Furthermore, three trials compared mobilization plus exercises versus exercises alone in treatment of adhesive capsulitis[2,10,38]. They found that there was no significant difference between the use of mobilization techniques plus exercises and exercises alone on reduction of shoulder pain and increasing shoulder motions in spite of decreasing pain and increasing mobility within groups. These findings support, to some extent, the results of our current study in which we found that there was no significant difference between therapeutic exercises versus mobilization techniques in treatment of adhesive capsulitis. On the contrary to that two previous studies demonstrated the benefit of adding mobilization techniques to exercises when compared to exercises alone on increasing motions, strength, and functional activity, in addition to significant reduction of pain after 4 weeks of treatment[2,10].

The goal of passive joint mobilizations is to stretch the capsule sufficiently to allow restoration of normal glenohumeral biomechanics[20]. Joint glides are important for increasing capsular mobility and prevention of joint compression and periarticular soft tissue injury that may occur with long lever angular mobilizations[20].

In the early phases of healing, a traditional gravity-lessened exercises in which glenohumeral motion is achieved are the Codman's exercises. These exercises add traction to the glenohumeral joint, stretch the capsule, avoid active abduction, and minimize the common faulty pattern of scapular elevation during exercise against gravity. The rhythmic pendulum movements can modulate pain[19]. The weight adds traction to the glenohumeral joint and widens the pendulum arc. This explains the improvement of the patients in the therapeutic exercise group in our study.

Pendulum exercises are done passively, no muscular action of the glenohumeral joint is required. Instead, muscular effort of the trunk and hips allows the body to sway and the arm to swing in sagittal, frontal and transverse planes of motion. These exercises can be progressed to active exercise by actively swinging the arm in the same planes and arcs of motion[19]. This may had similar effect as

passive mobilization techniques so both treatments used in the current study increased range of motion of the glenohumeral joint.

On the other hand, Moritz[35] stated that, from a biomechanical viewpoint, passive mobilization techniques of the shoulder are preferred over conventional passive range of motion exercises, especially in conditions of reduced load tolerance of the joint structures. Because of the leverage effect of the conventional passive exercises, a compression force is produced on the articular surfaces and a stretching of the periarticular structures occurs which is much greater than the external force applied. Significant degree of osteoporosis was found associated with frozen shoulder which indicates that leverage or compression should be minimized during treatment.

The perception of pain produced by a joint lesion is influenced not only by the intensity of the nociceptive stimulation from the lesion but also by the activity of the type I and type II articular mechanoreceptors[60]. Any movement of the joint would activate the mechanical receptors, so considering the biomechanical advantage suggested by Moritz[35].

Passive mobilization may result in less concurrent stimulation of the nociceptors than active or passive exercises in the anatomical planes that cause more joint stress. The sequence of events in the cycle of pain and inflammation indicates that form of motion should be initiated as soon as it is tolerable to influence the fibrous reaction from the inflammatory process[38].

Lee et al.,[29] found no significant difference in patients treated with steroid injections and exercises compared to those received superficial heat and exercises. The exercises used in the study done by Lee et al.,[29] consisted of a graduated program including proprioceptive neuromuscular facilitation techniques. They believed that it is valuable adjunct to passive mobilization techniques and would suggest their combined use.

Miller et al.,[33] reported on 50 patients during a 10 years period, and found that the majority of the patients regained motion with minimal pain after home therapy, moist heat, anti-inflammatory medications, and physician-directed rehabilitation. In contrast, Shaffer et al.,[50] reported that 50% of patients had pain or residual stiffness at 7 years follow up. These findings cleared the importance of the use of joint mobilization and therapeutic exercises. The results of our current study proved the clinical efficacy of joint mobilization techniques and therapeutic exercises in the treatment of painfully stiff shoulder.

There is a clear need for trials of physical therapy interventions, including trials of combinations of modalities, in the treatment of shoulder disorders[14]. There is a need for validation studies of the inclusion and exclusion criteria used to define specific conditions which result in painful shoulder and trials should aim to use properly defined interventions[14].

As a conclusion, we believe that the stage of adhesive capsulitis is critical in determining the appropriate treatment and can dramatically affect the outcome of treatment. In our current study we investigated the efficacy of therapeutic exercises versus mobilization techniques in the frozen stage, both treatments were equally effective. We recommend replication of this study on a larger sample in both the frozen and thawing stages in the future research. It is recommended to prevent immobilization of the shoulder, during painful periods or during the "rest" phase of healing. Carefully prescribed

range of motion exercises can be initiated during this period.

REFERENCES

1. Anton, H.A.: Frozen shoulder: Can Fam Physician.39: 1773-1778, 1993.
2. Bang, M.D. and Deyle, G.D.: Comparison of supervised exercise with and without manual physical therapy for patients with shoulder impingement syndrome. JOSPT: 30(3): 126-137, 2000.
3. Banker, T.D. and Anthony, P.P.: The pathology of Frozen Shoulder: "Dupuytren – Like disease". J Bone Joint Surg. 77-B: 677-683, 1995.
4. Baslund, B., Thomsen, B.S. and Jensen, E.M.: Frozen shoulder: Current concepts. Scand J Rheumatol. 19 (5): 321-325, 1990.
5. Beaton, D. and Richards, L.: Measuring function of the shoulder. J Bone Joint Surg. 78-A: 882- 890, 1996.
6. Brox, J., Bohmer A. and Staff, P.: Supervised exercises in relation to rotator cuff disease (impingement syndrome, stages I and II): A treatment regimen and its rational. Physiotherapy Theory & Practice. 14: 93-105, 1998.
7. Bulgen, D.Y., Binder, A., Hazleman, B.L. and Park, J.R.: Immunological studies in Frozen shoulder. J Rheumatol. 9: 893-898, 1982.
8. Chard, M.D., Hazleman, R., Hazleman, B.L., King, R.H. and Reiss, B.B.: Shoulder disorders in elderly: A community survey. Arthritis and Rhmatism. 34(6): 766-769, 1991.
9. Cleland, J. and Durall, C.J., Physical therapy for adhesive capsulitis: A systematic review. Physiotherapy. 88(8): 450-457, 2002.
10. Conroy, D.E., Hayes, K.W. The effect of joint mobilization as a component of comprehensive treatment for primary shoulder impingement syndrome. JOSPT. 28(1): 3-14, 1998.
11. Donatelli, R.: Case study, Rehabilitation of stiff and painful shoulder: A biomechanical approach. JOSPT. 9: 118-126, 1987.
12. Gartsman, G.M., Brinker, M.R., Khan, M. and Karahan, M.: Self assessment of general health status in patients with five common shoulder conditions. J Shoulder and Elbow Surg. 7(3): 228-237, 1998.
13. Ginn, K.A., Herbert, R.D., Khouw, W. and Lee, R.: A randomized, controlled trial of a treatment of shoulder pain. Phys Ther. 77(8): 802-811, 1997.
14. Green, S., Buchbinder, R. and Hetrick: Physiotherapy interventions for shoulder pain. The Cochrane Database of Systematic Reviews. The Cochrane Library. 1: 2005.
15. Griggs, S.M., Ahn, A. and Green A.: Idiopathic adhesive capsulitis: A prospective functional outcome study of non operative treatment. J. Bone Joint Surg., 82-A: 1398-1407, 2000.
16. Grubbs, N.: Frozen shoulder syndrome: A review of literature. JOSPT. 18(3): 479- 487, 1993.
17. Guler-Uysal, F. and Kozanoglu E.: Comparison of the early response to two methods of rehabilitation in adhesive capsulitis. Swiss Med. Wkly. 134: 353- 358, 2004.
18. Gursel, Y.K., Ulus, Y., Bilgic, A., Dincer, G. and Van der Heijden: Adding ultrasound in the management of soft tissue disorders of the shoulder: A randomized placebo-controlled trial. Phys Ther. 84(4): 336- 343, 2004.
19. Hall, C.M.: The shoulder girdle: In Hall C.M., Brody, L.T.: Therapeutic exercises: Moving toward function. Lippincott Williams & Wilkins. 575- 617, 1999.
20. Hannafin, J.A. And Chiaia TA.: Adhesive capsulitis: A treatment approach. Clin Orthop Rel Res. 372: 94-109, 2000.
21. Harms-Ringdahlk, C.A.M. and Ekholm, J.O.: Pain assessment with different intensity scales in response to loading to joint structures. Pain. 27: 401-411, 1986.

22. Hill, J.J. and Bogumill, H.: Manipulation in the treatment of frozen shoulder. Orthopedics 11(9): 1255-1260, 1988.
23. Hsu, A.T., Hedman, T., Chang, J.H., Vo, C.., Ho, L., Ho, S. and Chang, G.: Changes in abduction and rotation range of motion in response to simulated dorsal and ventral translational mobilization of the glenohumeral joint. Phys Ther. 82(6): 544-556, 2002.
24. Jeracitano, D. and Copper R.G.: Abnormal temperature control suggesting sympathetic dysfunction in the shoulder skin of patients with frozen shoulder. Br J Rheumatol 31(8): 542-559, 1992.
25. Jurgel, J., Rannama, L., Gapeyeva, H., Ereline, J., Kolts, I. and Paasuke, M.: Shoulder function in patients with frozen shoulder before and after 4 week rehabilitation. Medicina (Kaunas). 41(1): 30-38, 2005 [English Abstract].
26. Kaltenborn, F.: Manual mobilization of the joints: The Kaltenborn Method of joint examination and treatment. Vol. 1: The extremities. 5th Edition. Olaf Norlis Bokhandel, Oslo, Norway, 1999.
27. Kamkar, A., Irraang, J.J. and Whitney SL.: Non operative management of secondary shoulder impingement syndrome. JOSPT. 17: 212-224, 1994.
28. Kinser, C. and Colby, L.A.: The shoulder and shoulder girdle. In Therapeutic Exercise Foundations and Techniques. FA Davis, USA, 4th Edition. 319-391, 2002.
29. Lee, M., Haq, A., wright, V. and Longton, E.B.: Periarthritis of the shoulder: A controlled trial of physiotherapy. Physiotherapy: 59: 313-315, 1973.
30. Lin, S., Jarmain, S.J., Krabak, B.J. and McFarland, E.G.: Shoulder disorders: Diagnosis, treatment, and pain control. J Musculoskel Med. 21: 39-46, 2004.
31. Maitland, G.D.: Treatment of the glenohumeral joint by passive movement. Phys. Ther. 69: 3-7, 1983.
32. Mao, C.V., Jaw, W.C. and Cheng, H.C.: Frozen shoulder: Correlation between response to physical therapy and follow-up shoulder arthrography. Arch. Phys. Med. Rehabil. 78: 857-859, 1997.
33. Miller, M.D., Wirth, M.A. and Rockwood, C.A. Jr.: Thawing the frozen shoulder: the 'patient' patient. Orthopaedics 19(10): 849-853, 1996.
34. Modesto, C., Creopo, E., Villas, C. and Aquerreta, D.: Adhesive capsulitis. Is it possible in children?. Scand J Rheumatol. 24: 255-256, 1995.
35. Moritz, U.: Evaluation of manipulation and other manual therapy. Scand J Rehabil Med. 11: 173-179, 1979.
36. Neviaser, R.J. and Neviaser, T.J.: The frozen shoulder, diagnosis and management. Clin. Orthop. 223(12): 59-64, 1987.
37. Neviaser, T.J.: Intra-articular inflammatory diseases of the shoulder. Instructional Course Lecture. 38: 199-204, 1989.
38. Nicholson, G.: The effects of passive joint mobilization on pain and hypomobility associated with adhesive capsulitis of the shoulder. JOSPT. 6(4): 238-246, 1985.
39. Ogilvie-Harris, D.J., Biggs, D.J., Fitsialos D.P. and McKay, M.: The resistant frozen shoulder: Manipulation versus arthroscopic release. Clin. Orthop. 319: 238-248, 1995.
40. Pearsal, A.W., Speer, K.P: Frozen shoulder syndrome: diagnostic and treatment strategies in the primary care setting: Medicine and science in sports and exercises, 30: 33-39, 1998.
41. Placzek, J.D., Roubal, P.J., Freeman, D.C., Kulig, K., Nasser, S. and Pagett, B.T.: Long-Term effectiveness of translational manipulation for adhesive capsulitis: Clin. Orthop. 356: 181-191, 1998.
42. Reeves, B.: The natural history of the frozen shoulder syndrome: Scand J Rheumatol. 4(4): 193-196, 1975.
43. Rizk, T.E. and Pinals, RS.: Frozen Shoulder: Semin Arthritis Rheum. 11(4): 440-451, 1982.
44. Rizk, T.E. and Pinals, R.S.: Histocompatibility type and radical incidence of frozen

shoulder: Arch. Phys. Med. Rehabil. 65: 33-34, 1984.
45. Roubal, P., Dobitt, D. and Placzed, J.D.: Glenohumeral gliding manipulation following interscalene brachial plexus block in patients with adhesive capsulitis: JOSPT. 24(2): 66-77, 1996.
46. Ryans, I., Montogomery, A., Galway, R., Kernohan, W.G. and Mc Kane, R: A randomized controlled trial of intra-articular triamcinolone and /or physiotherapy in shoulder capsulitis Rheumatology (Oxford). 44(4): 529-535, 2005.
47. Sandor, R.: Adhesive capsulitis: Optimal treatment of frozen shoulder: Physician Sports Med. 28(9): 2000.
48. Saunders, D.G., Walker, J.R. and Levine, D.: Joint mobilization. Vet Clin North Am. Small Anim Pract. 35(6): 1287-1316, 2005.
49. Schneider, R. and Prentice, W.E.: Rehabilitation of the shoulder. In Prentice WE., Voight ML.: Techniques in musculoskeletal rehabilitation. First Edition. McGraw Hill Medical Publishing Division. 428-429, 2001.
50. Shaffer, B., Tibone, J.E. and Kerlan, P.K: Frozen Shoulder. A long- term follow-up study. J Bone Joint Surg. 74(A): 738-746, 1992.
51. Siegel, L.B, Cohen, N.J. and Gall, E.P.: Adhesive capsulitis: A sticky issue. Am Fam Physician, 59(7): 1843-1851, 1999.
52. Stam, H.: Frozen Shoulder: A review of current concepts. Physiotherapy. 80(9): 588-599, 1994.
53. Vad, V.B. and Hannafin, J.A.: Frozen shoulder in women: Evaluation and management. J. musculoskel. Med. 17: 13-28, 2000.
54. Valley, M.A.: Pain measurement. In: Ray PP.: Pain Medicine: A comprehensive review. Mosby Company. 35, 1996.
55. Van, der, Windt, D.A., Van, der. Heijden, G.J., Scholten, R.J., Koes, B.W. and Bouter, L.M.: The efficacy of non-steroidal anti-inflammatory drugs for shoulder complaints: A systematic review. J of Clin Epidemiology. 48(5): 691-704, 1995.
56. Vermeulen, H.M., Obermann, W.R., Burger, B.J., Kok, G.J. and Rozing, P.M.: End range mobilization techniques in adhesive capsulitis of the shoulder joint: A multiple subject case report. Phy. Ther. 80(12): 1204-1213, 2000.
57. Wadsworth, C.T.: Frozen Shoulder: Phys. Ther. 66(12): 1878-1883, 1986.
58. Woodward, T.W. and Best, T.M.: The painful shoulder. Part I. Clinical evaluation. Am Fam Phys. 61: 3079-3088, 2000.
59. Woodward, T.W. and Best, T.M.: The painful shoulder: Part II. Acute and chronic disorders. Am Fam Phys. 61(11): 3291-3300, 2000.
60. Wyke, B.K.: Neurology of the Cervical Spinal Joints Physiotherapy. 65: 72-76, 1979.

الملخص العربي

وسائل المرونة مقابل برنامج مختار من التمرينات في علاج الكتف المتجمد بعد الإصابات

الهدف من هذه الدراسة هو مقارنة تأثير وسائل المرونة والتمرينات العلاجية على مدى حركة مفصل الكتف وشدة الألم في مرضى الكتف المتجمد بعد الإصابات. اشترك في هذه الدراسة ثلاثون مريضا تم تشخيصهم كمرضى الكتف المتجمد بعد كسور حول منطقة الكتف. تم تقسيم المرضى عشوائيا إلى مجموعتين، مجموعة (أ) وقد تكونت من 15 مريضا متوسط أعمارهم 51 (± 6.82) عاما تم علاجهم بوسائل مرونة المفصل، مجموعة (ب) تكونت من 15 مريضا متوسط أعمارهم 48.4 (± 6.77) عاما تم علاجهم بالتمرينات العلاجية. هذا وقد تم علاج كل مريض لمدة 15 جلسة بمعدل ثلاثة جلسات أسبوعيا لمدة خمسة أسابيع. تم تقييم المرضى قبل بدء تلقي العلاج مباشرة وقبل الجلسة الثامنة في وسط المدة العلاجية، وكذلك بعد نهاية التجربة بعد الجلسة الخامسة عشر وذلك باستخدام قياس المدى الحركي ومقياس شدة الألم. مقارنة النتائج في المجموعتين، بالنسبة للتقييم في وسط العلاج وفى نهاية العلاج.أثبتت النتائج زيادة واضحة فى مدى حركات مفصل الكتف للأمام وللجانب وكذلك حركة دوران الكتف للخارج مع نقص واضح فى شدة الألم فى كلتا المجموعتين وذلك فى منتصف العلاج وبعد نهايته. كذلك أثبتت النتائج عدم وجود فروق واضحه بين المجموعتين فى زيادة مدى حركات مفصل الكتف وفى تخفيف شدة الألم . **الخلاصة :** يستخلص من نتائج البحث أن كلا من وسائل مرونة المفصل وبرنامج التمرينات العلاجية المستخدمين في هذه التجربة اثبتا كفاءة في علاج حالات تجمد مفصل الكتف الناتج عن كسور حول الكتف وأن كلا من الطريقتين يمكن استخدامهما لعلاج هؤلاء المرضى بكفاءة .

الكلمات المستخدمة: تيبس مفصل الكتف - التهاب حافظة الكتف - مدى الحركة - الألم - وسائل مرونة المفصل- التمرينات العلاجية.