Eklem Hastalıkları ve Cerrahisi
*Joint Diseases and Related Surgery*

Original Article / *Çalışma - Araştırma*

*Eklem Hastalık Cerrahisi*
*2012;23(2):94-99*

# Manual therapy is an effective treatment for frozen shoulder in diabetics: An observational study

## Manuel terapi diyabetli hastalarda donmuş omuz için etkili bir tedavidir: Gözlemsel bir çalışma

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**Objectives:** This study aims to compare the efficacy of manual therapy in the frozen shoulder patients with or without diabetes mellitus.

**Patients and methods:** Between May 2006 and January 2008, 50 patients (10 males, 40 females; mean age 52±10 years; range 40 to 65 years) orthopedic surgeons referred to the Sports Physiotherapy Unit were included in the study. The patients were divided into two groups, including patients with primary frozen shoulder with type II diabetes mellitus (n=12) and non diabetics (n=38). All patients underwent a rehabilitation program including cold application, manual therapy and exercises twice a week. A total of 16 treatment sessions were performed. The most important part of the manual therapy included scapular mobilization and posterior capsule stretching. The range of motion was measured by goniometry. Functional activity status was assessed by Constant's score. The pain level was evaluated by visual analog scale, while muscle strength was evaluated by hand-held dynamometer. Student t-test was used to compare between the parameters of groups, while Paired sample t-test was used to compare pre- and post-treatment parameters of the patients.

**Results:** The range of motion, functional activity status and muscular strength were improved and the pain level was reduced after rehabilitation in all of the patients in both groups ($p<0.05$). There was no difference in duration of the treatment between the groups ($p>0.05$). There were no differences in range of motion, functional activity status, pain level, and muscle strength before and after rehabilitation between the groups ($p>0.05$).

**Conclusion:** Manual therapy approaches may be safely applied in diabetic patients with frozen shoulder.

*Key words:* Diabetes mellitus; frozen shoulder; musculoskeletal manipulations.

**Amaç:** Bu çalışmada diabetes mellitusu olan ve olmayan donuk omuz hastalarında manuel terapinin etkinliği karşılaştırıldı.

**Hastalar ve yöntemler:** Mayıs 2006 - Ocak 2008 tarihleri arasında ortopedik cerrahlar tarafından Sporcu Sağlığı Ünitesi'ne sevk edilen 50 hasta (10 erkek, 40 kadın; ort. yaş 52±10 yıl; aralık 40-65 yıl) çalışmaya dahil edildi. Hastalar iki gruba ayrıldı: tip II diabetes mellitusu olan (n=12) ve olmayan (n=38) primer donuk omuzlu hastalar. Tüm hastalar haftada iki kez soğuk uygulama, manuel terapi ve egzersiz içeren rehabilitasyon programına alındı. Hastalara ortalama 16 tedavi seansı uygulandı. Manuel terapinin en önemli kısmını skapular mobilizasyon ve posteriyor kapsül germe egzersizi oluşturmaktaydı. Eklem hareket açıklığı, gonyometre ile ölçüldü. Fonksiyonel aktivite düzeyi Constant skoruna göre değerlendirildi. Ağrı düzeyi görsel analog ölçeği ile ve kas kuvveti el dinamometresi kullanılarak değerlendirildi. Grupların parametrelerinin karşılaştırılmasında Student t-testi; hastaların tedavi öncesi ve sonrası değerlerinin karşılaştırılmasında ise, iki grup t-testi kullanıldı.

**Bulgular:** İki gruptaki hastaların tümünde eklem hareketi açıklığı, fonksiyonel aktivite düzeyi ve kas kuvveti rehabilitasyon sonrasında gelişti ve ağrı düzeyi azaldı ($p<0.05$). Grupların tedavi süresi arasında bir farklılık bulunmadı ($p>0.05$). Rehabilitasyon öncesi ve sonrasında grupların eklem hareketi açıklığı, fonksiyonel aktivite seviyesi, ağrı düzeyi ve kas kuvveti arasında farklılık bulunmadı ($p>0.05$).

**Sonuç:** Manuel terapi yaklaşımları, donuk omzu olan diyabetli hastalarda güvenle uygulanabilir.

*Anahtar sözcükler:* Diabetes mellitus; donuk omuz; muskuloskeletal manipülasyonlar.

- *Received: January 01, 2011 Accepted: April 15, 2011*
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Primary frozen shoulder refers to the idiopathic form of a painful, stiff shoulder.[1,2] Possible causes include immunologic, inflammatory, biochemical, and endocrine alterations.[3]

The frozen shoulder in patients with diabetes mellitus (DM) is reported to be more persistent than an idiopathic frozen shoulder and is difficult to treat. Multiple interventions have been studied in rehabilitation including corticosteroid injections,[4] exercise[5-9] and joint mobilization.[7,10,11]

Joint mobilization techniques are assumed to induce various beneficial effects including neurophysiological, biomechanical and mechanical effects.[1,12,13] Some researchers have suggested manual therapy techniques for shoulder problems.[14]

The published literature has shown mobilization to have a positive effect on treatment of frozen shoulder[8,10] but is unclear if there are any differences in patients with or without DM. The aim of this study was to compare the effects of manual therapy and exercise on frozen shoulder in patients with or without DM.

## PATIENTS AND METHODS

Fifty patients with frozen shoulder between the ages of 40-65 were included in the study. Patients were referred for rehabilitation by a single orthopedic surgeon to the sports physiotherapy unit at Hacettepe University between May 2006 and January 2008 were enrolled in this study.

They were not admitted to the study if any of the following criteria were present: *(i)* a painful stiff shoulder after a trauma, *(ii)* the presence of osteoarthritis or signs of bony damage due to trauma on the radiographs of the affected shoulder, *(iii)* any local or systemic disease aside from DM. Inclusion criteria were *(i)* must be in frozen stage (stage III),[15] *(ii)* having a painful stiff shoulder for at least three months, *(iii)* having restriction of passive and active shoulder abduction and external rotation in comparison with the opposite side, *(iv)* DM when present, was diagnosed by a general practitioner at least two years prior to this study. All patients read and gave written informed consent on a University approved consent form.

Patients were classified into two groups: group 1 included those who had primary frozen shoulder with type 2 DM (n=12) and group 2 included those who had primary frozen shoulder alone (n=38) (Table I). All evaluations were performed by a single physiotherapist with 23 years experience. A single physiotherapist who had 10 years experience and was blinded to the patients' DM status did all treatments.

Before treatment, the following information was obtained: age, height, weight, gender and DM status (Table I). The number of treatments was recorded.

The rehabilitation program was given as in table II. We did not permit resistive activities (such as cleaning and vacuuming) for their shoulder.

Patients were evaluated before and after treatment protocol average in eight weeks. Pain experienced at rest, at night and during activity was indicated by a vertical mark on visual analog scale (VAS).[16] Functional activity level was determined using the Constant-Murley score system.[17] Shoulder flexion, abduction, external rotation, and internal rotation range of motion were determined by goniometry.[18] Muscle strength of shoulder flexion, abduction, external rotation and internal rotation[19] and supraspinatus muscle strength during full can testing position were determined with a hand-held dynamometer (JTECH Medical, Salt Lake City, Utah, USA).[20] All tests were determined with manual muscle test positions.

### Statistical analysis

Statistical analysis was performed using SPSS-PC+ (SPSS, Inc., Chicago, IL, USA) 15.0 version software. Student t-test was used to test the significance of the difference of changing between the parameters of groups in the study. In addition, paired sample test was used to determine between pre and post treatment parameters values of patients. The level of significance for all statistical analysis was set at a $p$ value of $<0.05$.

## RESULTS

Based on Student t-test there was no significant difference in descriptive characteristics between the two groups of patients volunteering for this study (Table I).

There were no complications for patients in either group and no adverse responses reported by patients throughout the duration of the rehabilitation protocol for the period of study. There were no significant differences between groups pain levels, range of motion, muscle strength, and functional status on

**TABLE I**

Physical characteristics of subjects

| | Diabetes mellitus (n=12) Mean±SD | Non-diabetes mellitus (n=38) Mean±SD | *p* |
|---|---|---|---|
| Age (years) | 54±9 | 52±9 | 0.545 |
| Height (m) | 1.6±0.1 | 1.6±0.1 | 0.512 |
| Weight (kg) | 69±9 | 73±10 | 0.328 |

SD: Standard deviation.

**TABLE II**

Rehabilitation program

| Weeks | Exercises protocol | Frequency |
|---|---|---|
| First | | |
| | Scapular mobilization | By physiotherapist |
| | Manual posterior capsule stretching | By physiotherapist |
| | Posterior capsule stretching exercise | 20 seconds/hour |
| | Cold application | 20 min/4 times/day |
| Second | | |
| | Continue 1st week | |
| | Glenohumeral joint mobilization | |
| | Scapular retraction with elbow flexed | 10 rep/4 times/day |
| | Scapular retraction with elbow extension | 10 rep/4 times/day |
| | Shoulder flexion and abduction stretching near the table | 10 rep/4 times/day |
| | Shoulder flexion and abduction stretching on the wall | 10 rep/4 times/day |
| | Wand exercises | 10 rep/4 times/day |
| Third | | |
| | Continue 2nd week | |
| | Shoulder external rotation stretching on the wall | 10 rep/4 times/day |
| | Shoulder internal rotation stretching near the table | 10 rep/4 times/day |
| Fourth | | |
| | Continue 3rd week | |
| | Shoulder flexion with theraband | 10 rep/4 times/day |
| | Shoulder abduction with theraband | 10 rep/4 times/day |
| | Shoulder external and internal rotation with theraband | 10 rep/4 times/day |
| | Supraspinatus strengthening during full can with theraband | 10 rep/4 times/day |

pre-treatment ($p>0.05$). Muscle strength, functional activity level and duration of treatment results are shown in table III. Range of motion results are shown in figure 1 and pain results in figure 2.

## DISCUSSION

This study showed that manual therapy is an effective approach of physiotherapy for rehabilitation in diabetic and non-diabetic patients with frozen shoulder. We did not find any adverse effect on progression of rehabilitation in diabetic patients.

This study also showed no difference in range of motion, functional activity level, pain and muscular strength between diabetic and non-diabetic patients before treatment. It could be because our patients' diabetic levels were under control with medication by general practitioner.

**TABLE III**

Muscle strength, functional activity level and duration of treatment

| | Diabetes mellitus | | Non-diabetes mellitus | |
|---|---|---|---|---|
| | Before | After* | Before | After* |
| | Mean±SD | Mean±SD | Mean±SD | Mean±SD |
| Muscle strength (kg) | | | | |
| Flexor | 82.4±48.3 | 103.3±47.0 | 78.2±48.3 | 111.3±48.0 |
| Abductor | 56.5±47.1 | 91.5±54.0 | 72.0±48.5 | 106.9±50.4 |
| External rotator | 49.5±27.6 | 71.3±27.0 | 61.7±31.0 | 79.6±24.0 |
| Internal rotator | 84.8±47.2 | 123.7±38.0 | 101.4±47.0 | 128.4±40.8 |
| Supraspinatus | 68.3±52.8 | 89.7±52.4 | 65.6±49.3 | 88.6±49.9 |
| Constant score | 42±11 | 68±11 | 41±11 | 73±12 |
| Number of session | 17±7 | | 16±7 | |

SD: Standard deviation; * $p<0.05$.

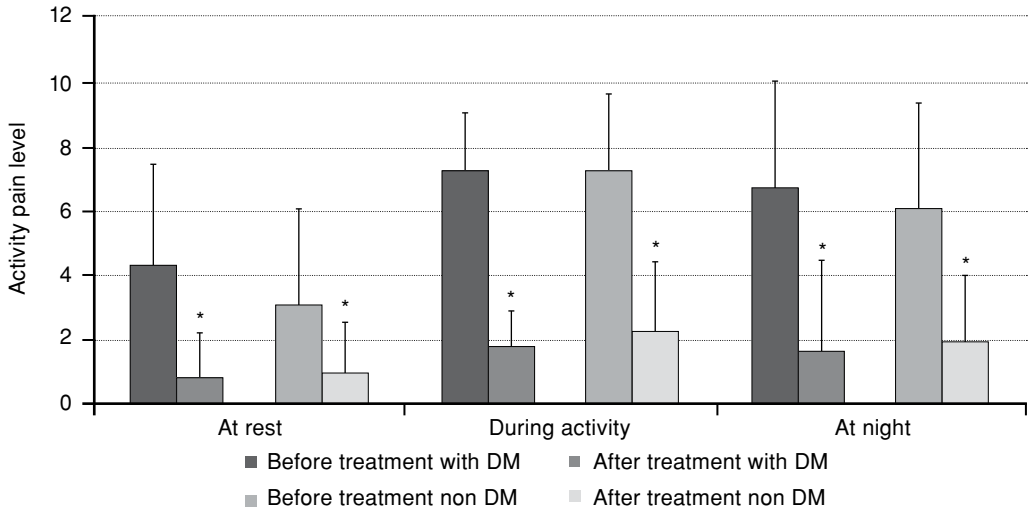


**Figure 1.** At rest and night, and during activity pain level of patients. DM: Diabetes mellitus; * p<0.05.

In our rehabilitation protocol we preferred cold application, which is indicated for the inflammatory response of soft tissue around the shoulder. Most of the patients had night pain, and some manual therapy techniques could be painful. Hence, cold application was aimed to decrease the pain and inflammatory response.[21]

Shoulder movement in most planes involves scapulothoracic mobility (not affected by adhesive capsulitis) to a highly variable degree.[22] Some studies have shown that abnormal scapular movement patterns need to be normalized to restore glenohumeral range of motion.[22-26] In this study we used scapular mobilization techniques for the improvement of range of motion. It is known scapular movement is based on upper extremity movement.[23] When the physiotherapist is applying some mobilization techniques on the glenohumeral joint before scapula mobilization in rehabilitation protocol, this can be very painful for patients and range of motion could not improve so much because of scapula restriction.

Physiotherapists should follow increasing scapular movement with scapula stabilization exercises for the middle and lower trapezius and serratus anterior muscles. Celik[6] showed better results for pain and range of motion (ROM) with scapula stabilization exercises in frozen shoulder patients than with glenohumeral exercises alone.

Other signs in patients with frozen shoulder were thickness and lack of flexibility of the posterior

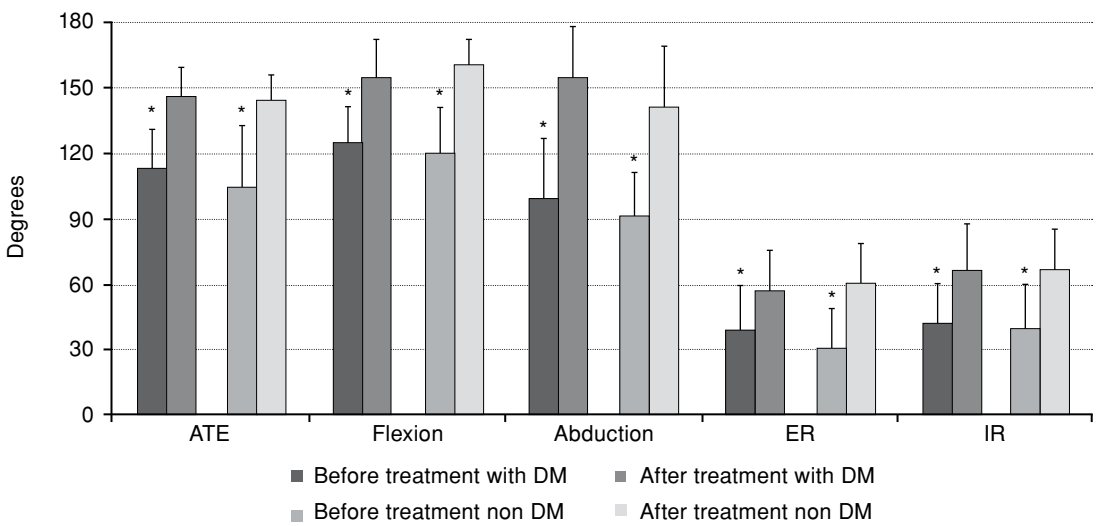


**Figure 2.** Active total elevation, flexion, abduction, external and internal rotation range of motion of subjects before and after treatment. DM: Diabetes mellitus; ATE: Active total elevation; ER: External rotation; IR: Internal rotation; * p<0.05.

capsule. Increasing posterior capsule flexibility supported normal scapula-humeral rhythm and increased range of shoulder motion especially internal rotation.[7,25] This tightness could be solved by the application of manual therapy techniques for the posterior capsule. Vermeulen et al.[10] concluded that in subjects with adhesive capsulitis of the shoulder, high-grade mobilization techniques (HGMT) appear to be effective in improving glenohumeral joint mobility and reducing disability. We also found the same positive effects on pain and activity level by using the HGMT techniques including manual posterior capsule stretching. Our clinical experience showed that stretching of the posterior capsule in most shoulder problems would be an important step of rehabilitation. Although the number of therapy sessions in our study (17 sessions in approximately 2 months) was shorter than in Vermeulen's study[27] (3 months), our results were better than the results of Vermeulen's study in ROM. These could be related to the positive effect of manual posterior capsule stretching.

On the other hand Tanaka et al.[8] defended that there were no differences between joint mobilization techniques and self-exercise programs. They suggested early intervention and a self-exercise program in the home setting are more important factors than session frequency of joint mobilization. However, their group was in early stage in frozen shoulder. Other studies found improvement in functional level by using a shoulder stretching exercise program for adhesive capsulitis.[5,9] Our patients were in the frozen phase of frozen shoulder and needed joint mobilization techniques. Our study added stretching and strengthening exercises to the exercise program as an important part of treatment to protect the gained range of motion. We recommend that mobilization techniques could be supported with exercises.

Ogilvie-Harris et al.[28] explained that patients with diabetes did worse initially, but the outcome was similar to patients without diabetes. We found no difference between diabetic and non-diabetic shoulder parameters both before and after treatment. The cause of this might be related to good control of diabetes by the endocrinology department in our diabetic patients.

Among the limitations of this study was the difference in subject numbers of our two groups. Further, we did not determine the relationship between the effect of management and the glucose level of all patients.

In conclusion, manual therapy has a positive effect on pain, range of motion, muscular strength and level of the functional activity on frozen shoulders following intervention by physiotherapist to a similar extent on patients with and without diabetes.

**Declaration of conflicting interests**

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

**Funding**

The authors received no financial support for the research and/or authorship of this article.

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