Soft Tissue Mobilization and PNF Improve Range of Motion and Minimize Pain Level in Shoulder Impingement

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Abstract. [Purpose] The aim of this study was to evaluate the effects of soft tissue mobilization and PNF on pain level, and shoulder ROM in patients with shoulder impingement syndrome. [Subjects and Methods] Thirty patients with painful and limited glenohumeral ROM activities were selected. The subjects were randomly assigned to an experimental group (n=15), which received treatment consisting of soft tissues mobilization and the PNF technique. The control group received an ultrasound treatment. Pain level, glenohumeral external rotation and overhead reach were measured before and after the intervention in groups. [Results] The experimental group showed a significant reduction in pain level in comparison with the control group. The values for Shoulder external rotation showed a significant improvement. The mean value for overhead reach in the experimental group significantly increased. [Conclusion] The combination of soft tissue mobilization for the subscapularis for 7 minutes and 5 repetitions of the contract-relax PNF technique for the shoulder internal rotator muscles followed by 5 repetitions of a PNF facilitated abduction and external rotation diagonal pattern was found to be effective in reducing pain and improving glenohumeral external rotation and overhead reach during a single intervention session.

Key words: Shoulder pain, PNF, Soft tissue mobilization

INTRODUCTION

Shoulder impingement syndrome is the most frequent cause of pain and overhead reach limitation in the shoulder area. It represents the third most frequent disease of the musculoskeletal system5). Normal shoulder functions are dependent on the scapular humeral rhythm and rotator cuff muscles control3). Disruption of the scapular humeral rhythm synergistic relationship may occur because imbalance in the shoulder muscles3, 4). The subscapularis muscle is the most powerful of the rotator cuff muscles. It has an important role in shoulder movement and stability5, 6). Restriction of shoulder movement in most cases results from muscle spasm, which also restricts the flow of blood, lymph, and nerve signals in the area4–6).

Many treatment methods are practiced clinically of management of shoulder impingement syndrome. Some studies have shown that manual therapy and soft tissue mobilization may promote restoration of joint functions after an injury through elongation of shortened structures, which helps the restoration of range of motion6, 7). Manual therapy may promote proper restoration of joint function after an injury. As a treatment for shoulder impingement syndrome, physical therapists often used subscapularis trigger release (STR) combined with proprioceptive neural facilitation (PNF) procedures, both of which are used to induce changes in myofascial length. Contract-relax PNF (CRPNF) procedures have been shown to be effective in increasing shoulder range of motion (ROM)8–10). The hold-relax technique is also called the contract-relax technique and is a technique in which the muscle is stretched isometrically, contracted for 7–15 seconds, briefly relaxed for 2–3 seconds, and then immediately subjected to a passive stretch that stretches the muscle even further than the initial passive stretch. This final passive stretch is held for 10–15 seconds. The muscle is then relaxed for 20 seconds before the PNF technique is performed11–13). Few studies on glenohumeral external rotation and overhead, reach exist that prove which treatments are best for immediately minimizing pain in patients with shoulder impingement syndrome5, 6). The aim of this study was to evaluate the effects of subscapularis soft tissues and contract-relax PNF techniques on minimization of pain and improving of glenohumeral external rotation at 45° of abduction and overhead reach activity in patient with shoulder impingement syndrome.

SUBJECTS AND METHODS

The study consisted of experimental randomized controlled trials. The sample size was 30. The subjects were assigned randomly into two groups by lot method: Group A
The study was carried out with subjects from a physiotherapy outpatient department. The inclusion criteria included a clear diagnosis of shoulder impingement syndrome and age between 40 and 60 years. In addition, the criteria negative results in the capsule stretch test, visual analog scale (VAS ≥ 5), External rotation = 35° ± 5°, overhead reach of 155 ±10 cm, no use of analgesics, and anti-inflammatory drugs and muscle relaxants within 24 hours before the participation in the study, and positive results in the Neer impingement test. The subjects with following problems were excluded; open wounds, infection, acute injuries or fractures, recent surgeries, swelling, rheumatoid arthritis, reflex sympathetic syndrome, or adhesive capsulitis. All subjects signed informed consent form designed by the IRB at Majmaah University.

Subjects were assessed for pain with VAS, range of motion with a Goniometer, and overhead reach with an inch tape. Measurements of pain, external rotation and overhead reach were made for all subjects before and after receiving either the experimental or control intervention. Pain was measured using (VAS). Glenohumeral external rotation was measured with the subjects lying supine on a treatment table with a pillow under their knees. Stabilization of the scapula was achieved by depressing the shoulder girdle. Reference lines for abduction were drawn on the skin over the midline of the sternum and the anterior aspect of the scapula was palpated in the axilla to identify areas of myofascial mobility restrictions, taut bands, or trigger points. Identified restrictions were treated with STM utilizing a combination of sustained manual pressure, and slow deep strokes to the subscapularis myofascia for 7 minutes. The STM was followed by contract-relax PNF for the subscapularis and other glenohumeral medial rotators, beginning in the same position used for the STM. The patients were instructed to perform maximal glenohumeral internal rotation against an opposing, isometric, manual resistance applied by the treating physical therapist for 7 seconds. Afterwards, the patient actively moved the humerus into full available external rotation. This position was maintained for 15 seconds. This 7-second internal rotation contraction against resistance followed by full active external rotation was repeated 5 times. Subjects were then instructed to actively move through the PNF flexion-abduction-external-rotation diagonal pattern for 5 repetitions with manual facilitation. The total time for the described intervention was approximately 10 minutes.

The subjects were then made to sit in a comfortable position with back support. The arm was abducted to 45 and the forearm was rested on the pillow for support. Ultrasound (US) therapy was given to the subscapularis muscle insertion at the shoulder region. The intensity used was 0.5 watt/ Cmsq, frequency used is 3 MHz and the time of the treatment was 10 minutes.

Immediately after the treatment post reading for pain, external rotation of shoulder and overhead reach were recorded.

**RESULTS**

The data are expressed as Mean± SD. The probability value less than 0.05 (p value ≤ 0.05) was considered significant by using SPSS software (V.16.0). Paired t test and Independent t test was used for those variables that are normally distributed (Table 1).

There is significant difference in VAS between groups. The mean value of pre-test VAS score in Group A is 6.20 and the mean value of post-test VAS score in Group A is 3.80. The mean value of pre-test VAS score in Group B is 6.07 and the mean value of post-test VAS score in Group B is 5.33.

There is significant difference between groups in external rotation range of motion at glenohumeral external rotation of 45° of shoulder abduction. In Group A pre-test was 36.60 and the mean value of post-test was 52.4. The mean

| Parameter          | Groups | Mean After | Mean Before | SD |
|--------------------|--------|------------|-------------|----|
| VAS                | Group A | 6.2        | 3.8         | 0.79* |
|                    | Group B | 6.07       | 5.23        | 0.72 |
| External rotation  | Group A | 36.6       | 52.4        | 4.9* |
|                    | Group B | 36.47      | 40.33       | 5.6  |
| Overhead reach     | Group A | 162.5      | 173.1       | 9.07* |
|                    | Group B | 163.6      | 165.3       | 8.4  |

(n=15) and Group B (n = 15).
value of pre-test in Group B was 36.47 and the mean value of post-test in Group B was 40.33.

There is significant difference between groups in overhead reach at p ≤0.028. The mean value of pre-test overhead reach in Group A is 162.5 and the mean value of post-test overhead reach in Group A is 172.1. The mean value of pre-test overhead reach in Group B is 163.63 and the mean value of post-test overhead reach in Group B is 165.3.

DISCUSSION

The purpose of the study was to determine whether soft tissue mobilization (STM) with proprioceptive neuromuscular facilitations (PNF) are effective in producing an immediate improvement in glenohumeral external rotation, at 45° of shoulder abduction and overhead reach in patients with shoulder impingement syndrome.

The results of this study proved that the STM with PNF is more effective in improving the glenohumeral external rotation and overhead reach. The subjects of Group A, who underwent the treatment of STM with PNF were assessed for immediate changes in pain, glenohumeral external rotation and overhead reach. The study shows significant improvement in pain with 2.8 levels in the VAS and overhead reach up to 12 cm in average. When compared with Group B, who underwent the treatment of ultrasound therapy.

The results of this study was in agreement with the results was obtained by the research work done by Joseph J. Godges, et al.13. The main reason for the increase in the range of motion and the overhead reach is that the STM helps in reducing the tightness and it promotes changes in myofascia allowing the elongation of the shortened structures.

PNF is effective in increasing the range of motion and its reciprocal activation of agonist and antagonist provides the greatest potential for muscle tendon as it lengthens the Golgi tendon organ which stimulates relaxing the antagonist muscles. When PNF is applied and the patient is told to contract the muscle in internal rotation against the resistance and the muscle tension develops, the GTO fibers inhibits alpha motor neurons activity and decreases tension in the muscle tendon, so for the neuromuscular system, inhibition is the state of decreased neuronal activity and altered synaptic potential which reflexively diminishes the capacity of a muscle to contract. As the capacity of muscle to contract decreases the arm is moved to external rotation, the antagonists are contracted and antagonist muscles are relaxed and again tension is developed in the agonist muscles. This GTO monitors the excessive tension during muscle contraction and thus inhibits the excessive contractions6-7.

The shoulder rotation at the position of 45° of abduction was adopted for soft tissue mobilization and proprioceptive neuromuscular facilitation because at this position subscapularis muscle flexibility deficit is major cause than any capsular restrictions which is mainly the cause of restriction at 90° of glenohumeral external rotation3, 4. While performing the STM, the subscapularis was palpated at the axilla to identify the areas of myofascial mobility restrictions, taut bands or trigger points identified restrictions were treated with STM utilizing a combination of sustained manual pressure and slow deep strokes to the subscapularis myofascia for 7 minutes.

In Group B (control group) also there was decrease in the pain level, increase in the range of motion and overhead reach but it is comparatively less than that of Group A.

Our results is in agreement with Yildirim MA, et al. where their results have indicated that ultrasound therapy reduces pain and increases the mobility and functional status if used for many sessions on painful area. The results shows US is statistically less significance in pain reduction when used for one session on glenohumeral external reduction and overhead reach.

Our study confirmed the immediate effect of STM with PNF and significant values for reduction in pain, increased glenohumeral external rotation and overhead reach were obtained.

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