The efficacy of designed physical therapy program on frozen shoulder syndrome

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Abstract: Frozen shoulder is one of the most causes of shoulder pain that results in pain and limitation of range of motion which causes a serious limitation in function which need early and progressive physical therapy intervention. This study was conducted to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome. One hundred patients who have frozen shoulder participated in this study. Their age ranged from 40–60. They were divided randomly into two equal groups; study group and control group. All patients were evaluated for intensity of pain, range of motion of shoulder flexion, shoulder abduction and shoulder external rotation and muscle testing for shoulder flexors, shoulder abductors and shoulder external rotators. The results of this study showed significant improvement in both groups in favour of study group. It can be concluded that, the combined effect of LASER, ultrasound, stretching and mobilization have more efficacy in the treatment of frozen shoulder.


Keywords: Frozen shoulder, Shoulder pain, Adhesive capsulitis, LASER.

1. Introduction

Frozen shoulder is a condition where the shoulder joint (glenohumeral joint) gradually becomes stiff, resulting in loss of movement. It may involve other restrictions in motion in the surrounding muscles and shoulder blade (scapula) movements.1 It is an insidious condition that begins with pain, then gradual restriction of movement in the shoulder in all planes. Frozen shoulder is the main cause of shoulder pain and dysfunction in the middle age and elderly population.2 It is a commonly encountered clinical complaint. It is encountered by clinicians, Rheumatologists, Orthopaedic surgeons and physical therapists. Defining ‘frozen shoulder’ is not straightforward.3 It has been used incorrectly as a general diagnosis for shoulder pain and stiffness. The definition, aetiology, pathophysiology and treatment of this condition are subjects of debate.4

The non-dominant arm is more likely to be involved, although about 12% of people are affected bilaterally.5 Frozen shoulder syndrome is common affecting 2-5% of the general population, whilst in diabetics the incidence is between 10-20%.6 Other factors such as depression, immunologic factors, posture and occupation have been implicated in the aetiology.7

The natural history of this condition is well documented.4 Frozen shoulder passes through the three phases of freezing, frozen and thawing. The freezing (painful) phase lasts between 2.5 and 8 months. This phase is a reactive phase. Night pain is a common feature of this phase. This is followed by the frozen (stiff) phase, which lasts between 4 and 12 months. There may still be night pain but this usually diminishes as gleno-humeral mobility decreases. Stretching may be effective in this phase. Spontaneous recovery of mobility (thawing) follows over the next 4 to 12 months although full recovery is commonly protracted. After the thawing phase, an objective restriction of mobility may often persist for several years.8

The most commonly affected movements are external rotation and abduction of the glenohumeral joint. Patients commonly complain of sharp pain reaching for the back pocket, combing the hair, or doing up the bra.9 The arm does not swing when walking. At rest the arm is often held in adduction and internal rotation, and the scapula of the affected side is usually elevated, laterally rotated and abducted. Depending on the longevity of symptoms, the body may develop a compensatory mechanical adaptation.8 Frozen shoulder is a challenging condition for both the physical therapist and patient.10

The definitive treatment for frozen shoulder remains unclear even though multiple interventions have been studied including oral medications,1 corticosteroid injections,2,12 exercise,12-14 joint mobilization,15-17 acupuncture,18 manipulation,19-21 nerve blocks22 and surgery.23-25 Unfortunately, varied inclusion criteria, different treatment protocols, and various outcome assessments render study comparison difficult. Management of this disorder focuses on restoring joint movement and reducing shoulder pain, involving medications, physical therapy, and/or surgical intervention. Treatment may continue for months, there is no strong evidence to
favor any particular approach. Medications frequently used include NSAIDs; corticosteroids are used in some cases either through local injection or systemically. Physiotherapy may include massage therapy and daily extensive stretching. Patients may have more than a dozen physical therapy sessions during this time including ultrasound, mobilization and exercise regimens. Transcutaneous electrical nerve stimulation (TENS) are commonly used to alleviate pain. Ultrasound (US) is used as a therapeutic modality for many conditions and for soft tissue disorders. US can exert effects on the cells and tissues via thermal and nonthermal mechanisms. Nonthermal effects are claimed to promote healing, although this has not been proven with in vivo studies.

The aim of the current study was to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome.

2. Subjects, Materials and Methods

Subject selection:
This study was carried out on 100 patient who are complaining from frozen shoulder. They were selected from a general governmental hospital. An experimental study of a new designed physical therapy program performed on 100 patients with frozen shoulder. All patients fulfilled the inclusion criteria:

Inclusion criteria:
- Their age ranged from 40 – 60 years old.
- History of shoulder pain and stiffness of the shoulder for more than one month.
- Flexion < 120°, abduction < 100° and external rotation < 40°.

Exclusion criteria:
Patients were excluded if they:
- had previous surgery in the shoulder joint.
- had rotator cuff tear.
- history of recent severe trauma.
- had disorders in the cervical spine and neurological pathologies.

Patients were randomly divided into 2 equal groups; study group (Group A) and control group (Group B).

Procedures:
A. Assessment procedures:
Full history taking and full examination for those patients were conducted before participation in this study to ensure that those patient fulfilled the inclusion criteria.

Full examination should include:
- Assessment of pain by using visual analogue scale. Patients were asked to fill in a linear 10cm visual analogue pain scale.
- Range of motion (ROM) of all movements of the shoulder joint including, shoulder flexion, shoulder abduction and shoulder external rotation. This was conducted by using goniometer. Flexion and abduction of the shoulder joint were measured from sitting position, while external rotation of the shoulder joint was measured from prone lying position.
- Assessment of active and passive ROM were conducted. Passive motions were assessed from...
supine lying position to appreciate the quality of the resistance to motion at the end of passive movement (end feel).
- Manual muscle testing of the muscles around the shoulder joint including shoulder flexors, shoulder abductors and shoulder external rotators.
- Assessment procedures repeated three times; before treatment (pre-treatment), after 2 months and at the end of the treatment (post-treatment).
- A full examination for the upper-quarter of the body was performed before participation in the study to rule out pathology of the cervical spine and other neurological pathologies.

B. Treatment procedures:
The study group (Group A) received a designed physical therapy program in the form of:
- TENS to decrease pain.
- Laser to decrease pain and alter pathology that occurs in case of frozen shoulder.
- Ultrasound therapy to improve the extensibility of soft tissues around the shoulder.
- Stretching of the tight structures.
- Strengthening exercises: strengthening exercises conducted for all muscles around the shoulder specially shoulder flexors, shoulder abductors and shoulder external rotators as follows:
  - Open-chain isometric strengthening.
  - Light isotonic dumbbell exercises.
  * Mobilization exercises for the shoulder joint and the scapula-costal articulation.

The control group (Group B) received the traditional physical therapy program which consists of just mobilization and TENS application.

The treatment continued for four months for control group and study group.

Data analysis
Statistical analyses were performed using the software package SPSS for Windows, version 16. A repeated measures analysis of variance was performed to examine the change in each outcome measure among the study groups and across treatment sessions. The analysis of variance was followed by Tukey’s post hoc multiple comparisons. The level of significance (alpha) was set at 0.05 and the least significant difference test was used to adjust the inflation of alpha due to multiple comparisons.

3. Results
This study was conducted to evaluate the efficacy of a designed physical therapy program on the treatment of frozen shoulder syndrome. This study was carried out on 100 patients who were divided randomly into two equal groups; study group (n=50) and control group (n=50). The results of this study showed the following:

1- Concerning general characteristics of subjects:
The results showed no significant differences between both groups as shown in table 1.

Table 1: General characteristic of the patients

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group A (n=50)</th>
<th>Group B (n=50)</th>
<th>t-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (year)</td>
<td>50.76±5.15</td>
<td>49.74±5.43</td>
<td>0.964</td>
<td>0.544</td>
</tr>
<tr>
<td>Weight (Kg)</td>
<td>75.5±4.36</td>
<td>74.7±4.65</td>
<td>0.865</td>
<td>0.758</td>
</tr>
<tr>
<td>Height (cm.)</td>
<td>176.4±5.72</td>
<td>175.4±5.74</td>
<td>0.89</td>
<td>0.87</td>
</tr>
<tr>
<td>Duration of illness (month)</td>
<td>4.04±1.27</td>
<td>3.94±1.3</td>
<td>0.388</td>
<td>0.889</td>
</tr>
</tbody>
</table>

2- Concerning assessment of pain by using visual analogue scale (VAS):
The results showed significant decrease in intensity of pain in both group in favour of the study group (Group A) at pre-treatment, after two months and at post-treatment as shown in table 2. Independent t-test proved that there was no significant difference between the two groups for pain level at pre-treatment (p= 0.359). On the other hand, the pain level of study group was significantly lower than that of control group at after 2 months (p= 0.02) and at post-treatment (p= 0.001).

Table 2: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of pain intensity according to VAS

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-treatment</th>
<th>After 2 months</th>
<th>Post-treatment</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group A</td>
<td>5.24±1.60</td>
<td>3.70±1.37</td>
<td>2.48±1.15</td>
<td>18.43</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>5.54±1.66</td>
<td>4.34±1.33</td>
<td>3.30±1.30</td>
<td>15.968</td>
<td>0.000</td>
</tr>
</tbody>
</table>
3- Concerning measurement of ROM of the shoulder joint:

The results showed significant improvement in ROM of shoulder flexion, shoulder abduction and shoulder external rotation in both group at pre-treatment, after 2 months and at post-treatment in favour of the study group as shown in table 3. Regarding shoulder flexion, independent t-test proved that there was no significant difference between the two groups at pre-treatment mean values of shoulder flexion ROM ($p= 0.433$) while, the mean values of shoulder flexion was significantly higher in study group at after 2 months ($p= 0.033$) and at post-treatment ($p= 0.006$).

As well, the analysis of the results of shoulder abduction showed that, there was no significant difference between the two groups at pre-treatment ($p= 0.751$) while, the value of study group was significantly higher at after 2 months ($p= 0.005$) and at post-treatment ($p= 0.000$). For shoulder external rotation; independent t-test proved that there was no significant difference between the two groups for pre-treatment mean values ($p= 0.530$). On the other hand, the mean values of study group was significantly higher at after 2 months ($p= 0.015$) and at post-treatment ($p= 0.001$).

### Table 3: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of ROM of shoulder flexion, shoulder abduction and shoulder external rotation:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-treatment</th>
<th>After 2 months</th>
<th>Post-treatment</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder flexion</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>118.56±17.40</td>
<td>129.22±20.03</td>
<td>137.48±19.29</td>
<td>560.638</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>115.48±16.27</td>
<td>121.7±14.22</td>
<td>128.16±13.56</td>
<td>134.81</td>
<td>0.000</td>
</tr>
<tr>
<td>Shoulder abduction</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>75.32±15.89</td>
<td>97.60±18.67</td>
<td>117.48±17.30</td>
<td>505.279</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>76.58±16.10</td>
<td>88.04±14.02</td>
<td>94.26±12.68</td>
<td>207.746</td>
<td>0.000</td>
</tr>
<tr>
<td>Shoulder external rotation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>22.36±11.81</td>
<td>35.56±12.44</td>
<td>40.62±12.34</td>
<td>338.654</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>25.82±12.62</td>
<td>29.64±11.44</td>
<td>32.82±10.92</td>
<td>289.542</td>
<td>0.000</td>
</tr>
</tbody>
</table>

4- Concerning manual muscle testing:

The results showed significant improvement in the muscle power of shoulder flexors, shoulder abductors, and shoulder external rotators in both group at pre-treatment, after 2 months and at post-treatment in favour of the study group as shown in table 4.

### Table 4: Comparison between both groups at pre-treatment, after 2 months and post-treatment mean values of muscle power of shoulder flexors, shoulder abductors and shoulder external rotators:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre-treatment</th>
<th>After 2 months</th>
<th>Post-treatment</th>
<th>F-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shoulder flexors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>2.96±0.832</td>
<td>3.48±0.707</td>
<td>4.2±0.756</td>
<td>32.984</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>3.08±0.804</td>
<td>3.32±0.741</td>
<td>4±0.756</td>
<td>19.337</td>
<td>0.000</td>
</tr>
<tr>
<td>Shoulder abductors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>2.58±0.575</td>
<td>3.22±0.582</td>
<td>3.88±0.521</td>
<td>67.455</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>2.6±0.571</td>
<td>3±0.495</td>
<td>3.48±0.505</td>
<td>35.249</td>
<td>0.000</td>
</tr>
<tr>
<td>Shoulder external rotators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group A</td>
<td>2.56±0.705</td>
<td>3.2±0.639</td>
<td>3.88±0.659</td>
<td>48.821</td>
<td>0.000</td>
</tr>
<tr>
<td>Group B</td>
<td>2.66±0.658</td>
<td>2.94±0.586</td>
<td>3.5±0.505</td>
<td>26.604</td>
<td>0.000</td>
</tr>
</tbody>
</table>

4. Discussion

This study was conducted to evaluate the effectiveness of a designed physical therapy program on the treatment of frozen shoulder syndrome. The main findings of this study revealed significant differences among pre-treatment, after 2 months and post-treatment as regarding to intensity of pain, shoulder flexion, shoulder abduction, shoulder...
external rotation, muscle power of shoulder flexors, shoulder abductors and shoulder external rotators in both groups (in favour of the study group).

Concerning the significant improvement in the control group, this appears to be attributable to the effect of traditional physical therapy treatment.

It can be justified as follows TENS alleviated pain in patient in the control group, as it blocks pain through both peripheral and central mechanisms.\(^{32}\) This opinion is supported by the opinions of Indeck & Printy,\(^ {33}\) Kaada,\(^ {34}\) who concluded that TENS is often used to treat pain in variety of acute and chronic musculoskeletal conditions.

The use of TENS alleviated pain in addition to the added effect of mobilization were suggested to be the cause for pain relief and increasing ROM\(^ {15,16}\) and give a chance for patients to move the shoulder joint in all directions and so increased muscle power of shoulder flexors, shoulder abductors and shoulder external rotators. This findings are supported by the findings of Dewan & Sharma.\(^ {35}\) This is in consistent with the opinion of Rizk et al.,\(^ {36}\) who found that TENS has been shown to significantly increase range of motion more than heat combined with exercise and manipulation.

Concerning the study group, there was a significant improvement more than that in the control group it can be explained by the added effect of LASER can explain the better results of pain relieve for the study group. This opinion is in agreement with the opinion of Stergioulas.\(^ {37}\) who stated that, low-power laser therapy is more effective for treatment of patients with adhesive capsulitis. This is also, supported by the opinion of Treles et al.,\(^ {38}\) who found that LASER therapy elicited the following types of effects: biostimulatory, analgesic, anti-exudative, antihaemorrhagic, anti-inflammatory, antineuralgic, anti-oedematous, anti-spasmodic and vasodilatory.

Additionally, the use of ultrasound and stretching were suggested to decrease pain and inflammation and increased ROM through improving microcirculation and increase of collagen and tendon extensibility. This is supported by the opinion of Mao et al.,\(^ {39}\) Basford,\(^ {40}\) and Leung & Cheing.\(^ {41}\)

As well, the significant improvement in the study group more than that in the control group might be explained by the added effect of mobilization and exercises. This is supported by the opinion of Jewell et al.\(^ {42,43}\) They suggested that joint mobilization and exercise were the most effective interventions.

**Conclusion and Recommendations**

The combined effect of LASER, ultrasound, stretching and mobilization have more efficacy in the treatment of frozen shoulder as they can relieve pain, improve range of motion and improve functional activities.

**References**

16. Vermeulen HM, Roizing PM, Obermann WR, le Cessie S, Vliet Vlieland TP. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder: