

Comparison of Outcome of Passive Joint Mobilization Techniques with Active Assisted Pulley Exercises in Patients with Frozen Shoulder in Improving Range of Motion

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Abstract: Frozen shoulder is a multi-factorial glenohumeral joint dysfunction that develops due to many causes and it involves a large number of world populations irrespective of gender and race. Its prevalence is 2 to 5 percent of world population is a major public health problem resulting in serious social and physical limitations and psychological problems due to physical and emotional stresses. Objective was to measure and compare the outcomes of passive joint mobilizations with active assisted pulley exercises in improving ROM at shoulder joint. This was a multicenter quasi experimental study of 100 patients (both M/F) which were randomly assigned to two different interventional groups. Group A patients received U/S, TENS and active assisted pulley exercises (twice/week) + home plan for exercises and Group B patients received U/S, TENS and manual joint mobilizations (twice/week) + home plan for exercises. ROM and VAS pain score was taken before the interventions and then after 2 months for both groups and then outcomes were compared by using paired sample t test. The study proved that the interventions used in both groups had same efficacy and statistically there was no significant difference in outcomes of both groups.

Keywords: Frozen shoulder, joint mobilizations and frozen shoulder, pulley exercises in frozen shoulder, mobilization Vs pulley exercises, active assisted exercises Vs passive joint mobilizations

1. Overview

Frozen shoulder/adhesive capsulitis has been defined as a disorder of varying severity which is characterized by the slow but progressive development of limitation of active and passive shoulder range of motion in which radiographic findings other than osteopenia may not be present. (Frontera et al., 2008). It is also characterized by severe shoulder pain which aggravates at night and also during work. The patients ADL's become limited and they are unable to participate in all those activities which involve frequent movements at glenohumeral joint.

The prevalence of frozen shoulder is approximately 2 to 5 percent (143 million to 360 million approximately) of the general world population (Moren-Hybbinette et al., 1987, Reeves, 1975), (Reeves, 1975). The primary frozen shoulder is idiopathic having no known cause and insidious onset while secondary frozen shoulder is with a known cause. The frozen shoulder is much common in the fifties and sixties years of life, and the peak age of onset is in the mid-50s. Also the non-dominant shoulder is more prone to get affected (Siegel et al., 1999).

Adhesive capsulitis/Frozen shoulder occurs mostly unilateral and it is mostly self limited condition, and automatically resolves within two to three years (Grey, 1978). However, according to some researchers it is said that up to 40 percent of cases have symptoms and limitation of range of motion that persist even after 3 years (Robinson et

al., 2012), and 15 percent have long-term or permanent disability if not treated (Iannotti and Williams, 2007).

Frozen shoulder/adhesive capsulitis can be primary (with not known cause) but is mostly associated with other conditions. Patients who are diabetic are at high risk of development of frozen shoulder (Huang et al., 2013). It has also been associated with thyroid dysfunction (Wohlgethan, 1987), prolonged immobility, CVA, autoimmune disease, and with Parkinson disease (Tison and Ghorayeb, 2005) and antiretroviral therapy for HIV infection (Zabraniecki et al., 1998). The main objective of physiotherapy is to stretch the shoulder joint. Most of the frozen shoulder exercises are aim to stretch the joint capsule. For this, mobilization techniques are given by which patient improves very well for gaining full range of movement by specially designed simple and specific frozen shoulder exercise regimes which ensure graduated stretching of the contracted joint capsule. Also Frozen shoulder exercises also play an important part to lessen pain, and to increase flexibility of the thickened and contracted joint capsule at the anteroinferior part and at the attachment of the joint capsule to the anatomical neck of humerus, to improve ROM of the shoulder.

2. Objectives

The main objective of the study was to measure and compare the outcomes of passive manual joint mobilizations with active assisted exercises done by a simple pulley in patients with frozen shoulder for improving

ROM. In both groups standard physical therapy treatment was given along with these two interventions.

3. Operational Definitions

3.1 ROM

The range of motion /ROM is the movement at shoulder joint that is available at a specific time and it is taken in sitting or standing position. AROM/ active range of motion done by patients themselves while PROM/ passive range of motion done partially by patient and then completing the range by physical therapist.

3.2 VAS

Visual analog scale/VAS is the scale which describes the pain nature and its intensity at a specific time during, before or after the treatment.

3.3 Goniometry

This is a procedure which involves the use of a conventional goniometer for recording available ROM in any plane of motion and it always records the reading in units of angle i.e. degrees. The reading were taken by goniometer at the start and then at the end of treatment by specially trained Physical therapists.

3.4 Pulley Exercises

Pulley exercises are a set of multiple repetitions, usually more than 50 at a time, in flexion and abduction by using a simply designed pulley. This was done by the patients at physiotherapy clinic and at home as well.

3.5 Joint Mobilizations

Joint mobilization techniques which are used to gain ROM are Maitland grade 3 and 4 movements and for pain reduction usually use grade 1 and 2 only.

4. Materials and Methods

Study Design

The present study is a Quasi experimental study

4.1 Setting

RASHEED HOSPITAL DHA LAHORE
RASHEED HOSPITAL GARDEN TOWN LAHORE
CANADA ORTHOPEDIC & REHABILITATION CENTRE
(Lahore)

4.1.1 Hypothesis

H₀ There is no difference in outcomes of passive joint mobilizations and active assisted pulley exercises in patients with frozen shoulder.

H₁ There is difference in outcomes of passive joint mobilizations and active assisted pulley exercises in patients with frozen shoulder

4.2 Materials/ Tools Used

Goniometer and patient questionnaires are required to have patients data and to screen the patients and also for re-evaluation of the patients.

- Visual analogue scale/VAS scale
- Patient consent form
- Goniometer
- Patient evaluation form

4.3 Duration of Study

The study took 5 months from November 2013 to February 2014 after approval from advance research committee.

4.4 Sample size

The sample size was calculated by the following formula keeping the power of study equal to 90% and level of significance equal to 5%. The sample size should be 30 in each group.

$$n = \frac{(Z_{1-\beta} + Z_{1-\alpha/2})^2 + (\delta_1^2 + \delta_2^2)}{(\mu_1 - \mu_2)^2}$$

Desired Power of the study = $\beta = 90\%$

Desired Level of Significance = $\alpha = 5\%$

Mean ROM in abduction Difference = 151 - 159 = -30 = 310
(Vermeulen et al., 2000)

Proposed Standard Deviation of Group A = $\delta_1 = 22$

Proposed Standard Deviation of Group B = $\delta_2 = 24$

Sample size in each group = $n = 50$

4.5 Eligibility

Inclusion Criteria

- All the patients (both males and females) with AROM/PROM less than or equal to 90 degrees between ages 50 to 70 years.
- Diabetic and hypertensive patients are included in this study if they meet the criteria of limited ranges and specified age.
- All the subjects must have frozen shoulder for at least last three months.
- Affected shoulder must have not more than 90 degrees of abduction and 50 % decreased external rotation as compared to normal side/normal ROM values.

Exclusion Criteria

- All the objects must not have any intra articular injection in the glenohumeral joint during last three months.
- Patients with fractured scapula were not included.
- Any history of surgery on that shoulder and patients with tendon calcification are not included.
- Patients with cervical rib are not included.
- Rotator cuff complete tear patients are not included in this study.
- All the patients with cervical and thoracic spine dysfunctions are first ruled out.
- All the patients (M/F) between ages 50 and 70 years with no other serious pathology/red (as tumor, infection and any fracture or tear) flags are to be included in the study.

4.6 Data collection

All the subjects interviewed and evaluated for inclusion and if they signed the consent form then they were asked to pick up a card for entitlement randomly in each of two groups.i.e either group A or B and included in the study. Data was collected by convenience sampling and then all

The objects were divided into 2 groups i.e. group A and group B.

Group A subjects were treated by U/S, TENS and active assisted pulley exercises (twice/week) + home plan for exercises

Group B received U/S, TENS and manual joint mobilizations (twice/week) + home plan for exercises

Data was collected prospectively by using specially designed questionnaires

4.7 Ethical consideration

This study had no barriers and it was ethical to do as the outcomes were expected to become positive and did no harm to the subjects/patients and results of this study were intended to be used for the betterment of patients suffering from this global problem. Furthermore both treatments are non invasive and have no side effects so being already used for the management of frozen shoulder and have their own identity and efficacy so there were no barrier or ethical issue regarding implementation and generalizability of results.

4.8 Statistical Procedure

SPSS was used for analysis of data using paired t test. Data entry done by using Microsoft excel and SPSS and data analysis done using SPSS. Firstly we measured the outcomes of Group A and Group B, and then we compared the outcomes of both groups to find the most effective choice of treatment by using paired sample t test.

5. Results

5.1 Paired Samples Statistics (Group A)

ROM OF GROUP A

| | | Mean | N | Standard. Deviation | Standard. Error Mean |
|--------|-------------------|--------|----|---------------------|----------------------|
| Pair 1 | FLEXION | 50.80 | 50 | 19.082 | 2.699 |
| | flex after2months | 152.92 | 50 | 13.659 | 1.932 |
| Pair 2 | EXT | 10.78 | 50 | 4.700 | .665 |
| | EXT after2months | 22.06 | 50 | 5.105 | .722 |
| Pair 3 | ABDD | 42.88 | 50 | 12.818 | 1.813 |
| | ABDD after2months | 153.50 | 50 | 15.884 | 2.246 |
| Pair 4 | In-Rot | 10.82 | 50 | 3.963 | .560 |

| | | | | | |
|--------|------------------|-------|----|--------|-------|
| | I/R after2months | 56.44 | 50 | 8.399 | 1.188 |
| Pair 5 | Ext-Rot | 11.18 | 50 | 3.932 | .556 |
| | E/R after2months | 50.80 | 50 | 11.220 | 1.587 |

Table showing MEAN shoulder ranges of 50 patients measured by goniometer in degrees, before and after treatment in Group A

5.2 Paired Samples Statistics (Group B)

ROM OF GROUP B

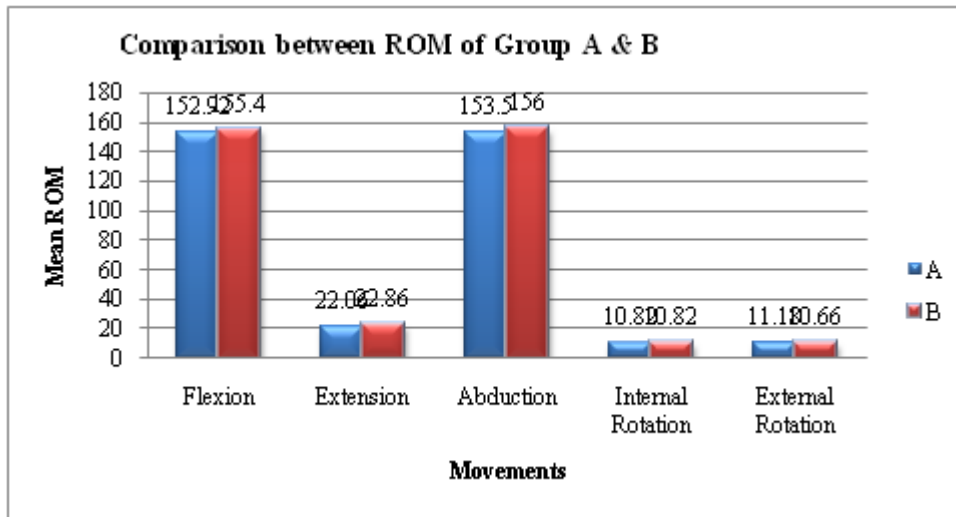
| | | Mean | N | Standard. Deviation | Standard. Error Mean |
|--------|-------------------|--------|----|---------------------|----------------------|
| Pair 1 | FLEXION | 49.82 | 50 | 17.388 | 2.459 |
| | FLEX after2months | 155.50 | 50 | | 1.791 |
| Pair 2 | EXT | 10.72 | 50 | 4.730 | .669 |
| | EXT after2months | 22.66 | 50 | 4.369 | .618 |
| Pair 3 | ABDD | 43.70 | 50 | 38.489 | 5.443 |
| | ABDafter2months | 155.40 | 50 | 11.377 | 1.609 |
| Pair 4 | In-Rot | 10.72 | 50 | 4.046 | .572 |
| | I/R after2months | 58.94 | 50 | 8.522 | 1.205 |
| Pair 5 | Ext-Rot | 10.56 | 50 | 3.775 | .534 |
| | E/R after2months | 54.40 | 50 | 8.785 | 1.242 |

5.3 Comparison of ROM after treatment in degrees

| | Group | N | Mean | Std. Deviation | t-test | p-value |
|--------------|-------|----|--------|----------------|--------|---------|
| Flexion | A | 50 | 152.92 | 13.659 | 0.943 | 0.348 |
| | B | 50 | 155.40 | 12.610 | | |
| Extension | A | 50 | 22.06 | 5.105 | 0.834 | 0.407 |
| | B | 50 | 22.86 | 4.472 | | |
| Abduction | A | 50 | 153.50 | 15.884 | 0.906 | 0.367 |
| | B | 50 | 156.00 | 11.339 | | |
| In-Rotation | A | 50 | 10.82 | 3.963 | 0.000 | 1.000 |
| | B | 50 | 10.82 | 3.963 | | |
| Ext-Rotation | A | 50 | 11.18 | 3.932 | 0.682 | 0.497 |
| | B | 50 | 10.66 | 3.690 | | |

Table showing MEAN shoulder ranges of 50 patients measured by goniometer in degrees, before and after treatment in Group B

In both comparative groups ROM regarding flexion and abduction were greater in group but the difference was not statistically significant (p-value 0.348 and 0.367 respectively). Whereas, ROM in Group A regarding extension and external rotation were greater but difference was not statistically significant (p-value 0.407 and 0.497 respectively). According to internal rotation mean ROM was same in both groups.



Comparison of Group A and Group B

| ROM Component | Group A (mean increase in ROM) | Group B (mean increase in ROM) |
|-------------------|--------------------------------|--------------------------------|
| FLEXION | 102 | 105 |
| Extension | 11 | 11 |
| Abduction | 110 | 111 |
| Internal-Rotation | 45 | 48 |
| External-Rotation | 39 | 43 |

Comparison between both groups according to VAS at baseline and after treatment

Table showing Independent sample t test

| | Group | N | Mean | t-test | p-value |
|------------------------------|-------|----|------------|--------|---------|
| Pain on VAS Before Treatment | A | 50 | 7.26±0.803 | 0.000 | 1.00 |
| | B | 50 | 7.26±0.803 | | |
| Pain on VAS after Treatment | A | 50 | 2.44±0.760 | 0.129 | 0.897 |
| | B | 50 | 2.42±0.785 | | |

Mean Visual analogue scale score was not statistically significantly different among both groups at the time of base line and after 2 months of treatment

Table showing Paired sample t-test

| Group | | N | Mean ± S.D | t-test | p-value |
|-------|------------------------------|----|------------|--------|---------|
| A | Pain on VAS after Treatment | 50 | 2.44±0.760 | 40.11 | <0.001 |
| | Pain on VAS Before Treatment | 50 | 7.26±0.803 | | |
| B | Pain on VAS after Treatment | 50 | 2.42±0.785 | 37.543 | <0.001 |
| | Pain on VAS Before Treatment | 50 | 7.26±0.803 | | |

Mean Visual analogue scale score was statistically significantly different within both groups at the time of base line and after 2 months of treatment

6. Conclusion

This study proved that passive joint mobilizations and active assisted pulley exercises are equally effective used for increasing ROM in frozen shoulder patients.

This study also proved and quantified the efficacy of active assisted pulley exercises in improving ROM and reducing

Pain scores which is indicative that these techniques have their own efficacy and validity in the management of frozen shoulder. And it can be used to improve public health and quality of life of all the patients in under developed countries who can't afford/do not have access to physical therapists.

Although Joint mobilizations are more effective in gaining ROM, reducing pain and improving of functional outcomes. But statistically the difference in outcomes of both treatments is insignificant so we can say there is no statistical difference in both treatment outcomes.

On the Basis of the outcomes we accept H_0 , H_1 is rejected

H_0 There is no difference in outcomes of passive joint mobilizations and active assisted pulley exercises in patients with frozen shoulder.

H_1 There is difference in outcomes of passive joint mobilizations and active assisted pulley exercises in patients with frozen shoulder.

Also its obvious that both the treatments significantly decreased the VAS scores within each group but when we compared two groups for decreasing VAS score then there was no significant difference and both treatments were equally effective for reducing pain.

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