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"THE EFFECTS OF ULTRASOUND AND CRYOTHERAPY ON RANGE OF MOTION AND DISABILITY IN PATIENT WITH FROZEN SHOULDER – A COMPARATIVE STUDY"

Physiotherapy

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ABSTRACT

Background: Frozen shoulder (FS) is signified by pain and stiffness in the shoulder joint; limited range of motion and pain are the most common symptoms. It is also known as adhesive capsulitis or periarthritis (PA). FS has a prevalence of approximately 2 to 5 % in the general population. The incidence among women is 1.6 to 4-fold higher than in men. Functional impairments caused by FS consist of Limited Reaching, particularly during Overhead or to the side activities. **Methodology:** Patients were analyzed pre and post treatment for frozen shoulder by SPADI and range of motion (ROM) of the shoulder joint by using goniometer. Total 40 Patients were taken and divided in two group. Group A received ultrasound with conventional physiotherapy and Group B received cryotherapy ultrasound with conventional physiotherapy for 6 days a week for 4 weeks. **Result:** The research was performed on 100 participants between the age of 20-40. There were 56 patients between the ages of 20 to 30, 44 patients between the age 31to 40. Moderately negative correlation seen in standing duration and pronation of foot. **Conclusions:** In conclusion the treatment program consisting of Ultrasound with Conventional Physiotherapy is more effective in frozen shoulder to reduce Pain, Functional disability and improve Shoulder range of motion.

KEYWORDS

Frozen shoulder, Ultrasound therapy, Cryotherapy, Rang of motion, Shoulder Pain And Disability Index

INTRODUCTION

1.1 Shoulder Complex

The shoulder joint, also known as the glenohumeral joint, is a dynamic articulation between the glenoid of the scapula and the proximal humerus, with functions like abduction, adduction, flexion, extension, and rotation. It is supported by the primary four rotator cuff muscles.[1,2] The shoulder joint is one of the most mobile joints in the human body due to its loose capsule and humeral head size. It is commonly dislocated due to its increased mobility. The upper extremity is connected to the axial skeleton via the sternoclavicular joint. The pectoral girdle consists of three joints.[3,4]

"Frozen shoulder" was first introduced by Codman in 1934, a painful shoulder condition with stiffness, difficulty sleeping, and reduced forward elevation and external rotation. This condition was formerly known as 'periarthritis' by Duplay in 1872, and later redefined as 'adhesive capsulitis' by Julius Naviaser in 1945. The disease is distinct from arthritis and preserves the joint.[5,6,7]

1.2 Frozen Shoulder

"Frozen shoulder" was first introduced by Codman in 1934, a painful shoulder condition with stiffness, difficulty sleeping, and reduced forward elevation and external rotation. This condition was formerly known as 'periarthritis' by Duplay in 1872, and later redefined as 'adhesive capsulitis' by Julius Naviaser in 1945. The disease is distinct from arthritis and preserves the joint.[5,6,7]

1.3 Etiology

Frozen shoulder (FS) is often associated with diabetes mellitus, affecting 10-36% of diabetics. Insulin-dependent diabetics are at the highest risk, and the primary cause is unknown, making them 2-4 times more likely to develop the condition.[8,9]

Frozen shoulder is common in thyroid disorders, Parkinson's disease, and cardiac and pulmonary diseases, often triggered by surgical procedures or shoulder injuries.[10,11]

1.4 Epidemiology:

Frozen Shoulder prevalence in general population is 2-5%, with increased rates in diabetics and thyroid gland pathologies, particularly hypothyroidism, up to 10-38%.[12,13]

Type 1 diabetes significantly increases the risk of developing FS, with a lifetime prevalence of 76%, particularly in patients over 45 years old.[14]

1.5 Pathophysiology:

FS is a condition characterized by synovial inflammation and capsular fibrosis, often resulting from cytokines like TNF-alpha and ILs. The cause is unclear, but potential triggers include chronic inflammation, tendon damage, Tendon Fiber rupture, or inflammatory mediators.[15,16,17] Figure 1 Summarizes the pathological event and pathogenesis of FS.[18]

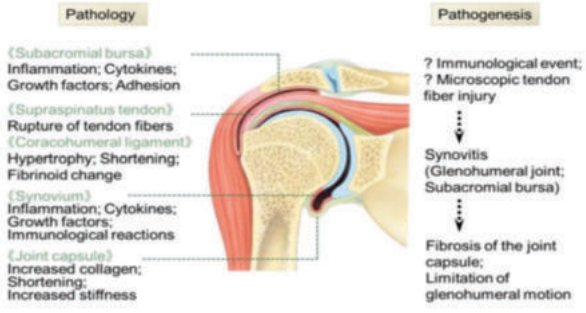


Fig. 1 Pathological event and Pathogenesis of FS

1.6 Stages:

Clinical presentation is typically in three overlapping phases: [19] The clinical presentation of a condition is divided into three phases: Stage 1, which is a gradual onset of pain with movement, Stage 2, which is persistent and intense pain, and Stage 3, which is pain only with movement, significant adhesions, and limited GH motions. Stage 4 of a joint condition, known as Thawing, involves minimal pain, no synovitis, but significant capsular restrictions from adhesions, with gradual motion improvement. The "freezing" stage of treatment for FS should focus on pain control, inflammation reduction, and patient education. Home self-exercise is effective, and daily programs should be given. Other treatments include anesthesia manipulation and surgical procedures.[5,20]

1.7 METHODOLOGY

STUDY DESIGN AND SETTING

Research Design: A COMPARATIVE STUDY

Population: Subjects with Frozen shoulder

Sample Design: Convenient sampling

Sample Size: The study was done on 40 patients. Subjects were divided in to 2 groups.

- Group 1=20 subjects (n=20)
- Group 2= 20 subjects (n=20)

Selection Criteria
Inclusive Criteria:
- Age between 30 to 60 year.
- Painful and limited passive shoulder joint mobility
- FS patients with and without type 2 diabetes mellitus
- More restricted lateral rotation relative to abduction and medial rotation.
- No clear sign (eg. painful arc, positive resistance testing, or loss of power)
- Illness time ranging between 2-15 months
- Stage of frozen shoulder: 1-3 stages

Exclusive Criteria:
- Any previous shoulder surgeries.
- Frozen shoulder Stage 4
- Glenohumeral or Acromioclavicular arthiritis.
- Any condition other than frozen shoulder
- Any Fracture around the shoulder complex
- Patient know to have uncontrolled diabetes mellitus or type 1, orthopedic condition or deformities around shoulder joint and any neuromuscular disorder.

OUTCOME MEASURES:
Shoulder Pain and Disability Index (SPADI) and Shoulder Range of Motion (ROM) Overview

SPADI:
- Self-administered questionnaire with 13 items assessing pain and functional activities.
- Assesses 5 questions on pain severity and 8 questions on difficulty with daily activities.
- High test-retest reliability of 0.92.
- Requires 5-10 minutes of time.

ROM:
- Measured using Universal Goniometer, a highly reliable tool conducted by the same therapist.
- Test-retest reliability of 0.94–0.98.

Patient Positioning and Movement Shoulder Flexibility:
- Patient is supine lying with shoulder and elbow 90º position.
- Axis: Greater tuberosity of the humerus.
- Movable arm placed over the midline of the lateral arm.
- Stable arm placed either perpendicular or parallel to the ground.

Shoulder Extension:
- Patient is prone lying with shoulder and elbow 90º position.
- Axis: One inch below the acromion process of the scapula.
- Movable arm placed over the midline of the anterior arm.
- Stable arm placed perpendicular or parallel to the clavicle.

Shoulder External & Internal Rotation:
- Patient is supine lying with shoulder and elbow 90º position.
- Axis: Olecranon process of the ulna.
- Movable arm placed over the midline of the posterior forearm.

Procedure:
- Approval from Institutional Ethical Committee (IEC) for study.
- Individuals selected based on inclusion/exclusion criteria.
- Informed consent form obtained from willing participants.
- Patients' anamnesis and demographic characteristics recorded.
- SPADI, VAS, and Shoulder joint ROM taken.
- Subjects assigned into two groups:

Group 1(n=20) Ultrasound with Conventional Physiotherapy and Group 2(n=20) Cryotherapy with Conventional Physiotherapy.

Outcome measures taken at baseline, after 2 weeks, and 4 weeks of treatment.

Statistical analysis using SPSS 25.0 software. P value less than 0.05 considered statistically significant.

RESULTS
The study used SPSS 25.0 software for Windows to compare the success of ultrasound and cryotherapy treatment for Frozen shoulder in 40 subjects, with 20 in each group meeting inclusion criteria.

Demographic Data
TABLE 1. Gender distribution

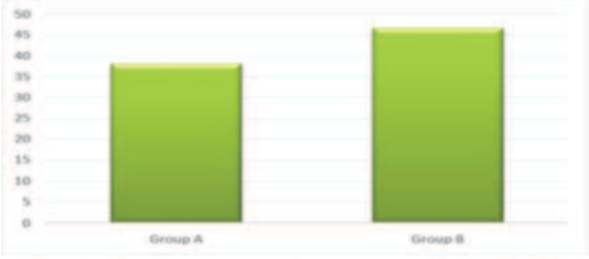
Graph 1: Graph of Gender distribution

Interpretation of Result:
1) Inter Group Analysis:
The table compares shoulder disability in Group A & B using independent T test. At baseline, no significant difference exists, but post-treatment p value of 0.03 suggests significant improvement between groups.

2) Intra Group Analysis:
The table compares shoulder disability in group A and B using paired t-test, showing significant differences in pain scores, indicating effective treatment for both groups.

Graph 2: Intragroup comparison of mean values of SPADI for Group A

Graph 3: Intragroup comparison of mean values of SPADI for Group B

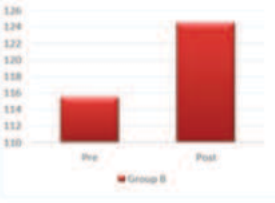


Graph 4: Intergroup comparison of mean values of SPADI

Interpretation of Results:
1) Inter group Analysis:
The study compared shoulder flexion ROM scores between Group A and B using an independent T test, finding no significant difference at baseline but significant improvement post-treatment.

2) Intra group analysis:
The table compares shoulder flexion ROM and pain scores in groups A and B, showing significant differences, indicating effective treatment for both groups.

Graph 5: Intragroup comparison of mean values of Flexion ROM for Group A



Graph 6: Intragroup comparison of mean values of Flexion ROM for Group B

Graph 7: Intergroup comparison of mean values of Flexion ROM

Interpretation of Results:

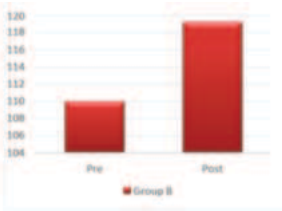
1) Inter group analysis:

The table compares shoulder Abduction ROM scores between Group A and B, showing no significant difference at baseline and a 0.03 post-treatment improvement.

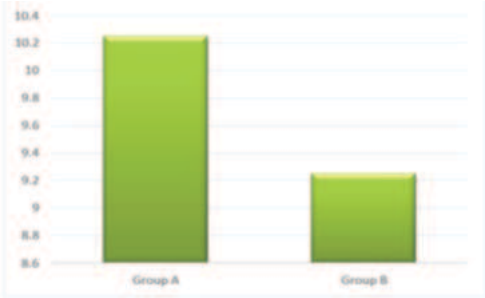
2) Intra group analysis:

The table compares shoulder abduction ROM and pain scores in groups A and B, showing significant differences, indicating effective treatment for both groups.

Graph 8: Intra group comparison of mean values of Abduction ROM for Group A



Graph 9: Intra group comparison of mean values of Abduction ROM for Group B



Graph 10: Intergroup comparison of mean values of Abduction ROM

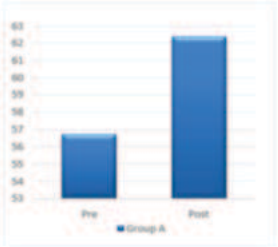
Interpretation of Result:

1) Inter group analysis:

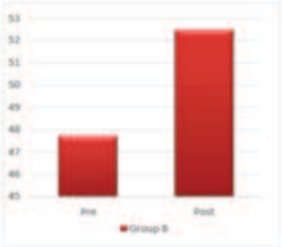
The table compares shoulder External ROM scores between Group A and B, showing no significant difference at baseline and a 0.04 post-treatment improvement.

2) Intra group analysis:

The table compares shoulder external ROM and pain scores in groups A and B, showing significant differences, indicating effective treatment for both groups.



Graph 11: Intragroup comparison of mean values of External rotation ROM for Group A



Graph 12: Intragroup comparison of mean values of External rotation ROM for Group B

Graph 13: Intergroup comparison of mean values of External rotation ROM

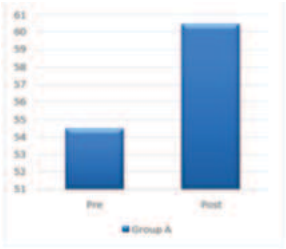
Interpretation of Result:

1) Inter group analysis:

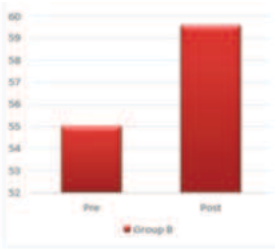
The table compares shoulder Internal ROM scores between Group A and B, showing no significant difference at baseline and a 0.03 post-treatment improvement, suggesting significant improvement between groups.

2) Intra group analysis:

The table compares shoulder Internal ROM and pain scores in group A and B, showing significant differences, indicating effective treatment for both groups.



Graph 14: Intragroup comparison of mean values of Internal Rotation ROM for Group A



Graph 15: Intragroup comparison of mean values of Internal Rotation ROM for Group B

Graph 16: Intergroup comparison of mean values of Internal Rotation ROM

DISCUSSION

The study investigates the effectiveness of ultrasound therapy and cryotherapy in reducing pain, range of motion, and disability in patients with frozen shoulder. Both groups received conventional physiotherapy for 4 weeks. Results showed significant differences in ROM improvement for both groups. However, the group receiving ultrasound therapy showed improvement in flexion extension, internal and external rotation, but not abduction and adduction ROM. The study highlights the self-limiting nature of frozen shoulder symptoms. [21,22] Ultrasound therapy reduces pain, increases blood flow, and aids tissue repair. It's used in rehabilitation for frozen shoulder patients. Connective tissue stretches promote elastic and plastic responses. Crystaltherapy controls pain by altering perception and controlling transmission to higher centers, making it useful for treating shoulder pain. [23] Cold exposure increases norepinephrine, providing calming effects. High-level mobilization improves frozen shoulder treatment in primary patients, while stretching programs relieve symptoms in stage 2 patients. [24,25] The study found that combining cryotherapy with conventional physiotherapy effectively reduced pain, functional disability scores, and improved range of motion in patients with frozen shoulder. Ultrasound therapy, produced using quartz, reduces pain,

increases blood flow, and aids in tissue repair. It's used in rehabilitation for frozen shoulder patients and promotes soft tissue healing. Connective tissue stretches promote elastic and plastic responses.

CONCLUSION

In conclusion the treatment program consisting of Ultrasound with Conventional Physiotherapy is more effective in frozen shoulder to reduce Pain, Functional disability and improve Shoulder range of motion.

Limitations:

✓ Small sample size

✓ No control group was included in the study

Future Recommendation:

✓ The study can be done on a larger number of populations.

✓ The study can be done with control group along with only conventional physiotherapy given in frozen shoulder

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