

Therapeutic Exercise Approaches for Frozen Shoulder Rehabilitation

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Abstract— Frozen shoulder, or adhesive capsulitis, is a debilitating condition characterized by pain and progressive restriction of shoulder joint movement, significantly impairing daily activities and quality of life. The condition typically progresses through three stages: freezing, frozen, and thawing. Therapeutic exercise remains a cornerstone of conservative management for frozen shoulder, aimed at restoring range of motion (ROM), reducing pain, and improving functional outcomes. This manuscript explores various exercise interventions, including stretching, strengthening, proprioceptive training, and manual therapy-assisted movement, that contribute to shoulder rehabilitation. Emphasis is placed on evidence-based strategies tailored to each stage of the condition, recognizing the varying tissue responses and patient tolerances. A systematic literature review was conducted to evaluate the effectiveness of these interventions and synthesize clinical guidelines. Methodologically, this study involved a quasiexperimental design with 40 subjects undergoing a 12-week exercise protocol. Outcomes were measured using goniometry, the Shoulder Pain and Disability Index (SPADI), and visual analog scale (VAS) for pain. Results showed a statistically significant improvement in ROM and functional scores, particularly with a multimodal therapeutic approach. The findings support the integration of structured, stagespecific therapeutic exercises into standard care pathways for frozen shoulder. Recommendations for physical therapists

include progression planning, patient education, and adherence reinforcement for optimized outcomes.

KEYWORDS— Frozen shoulder, adhesive capsulitis, shoulder rehabilitation, therapeutic exercise, physiotherapy, range of motion, SPADI, proprioception, stretching, strengthening

INTRODUCTION

Frozen shoulder (FS), medically referred to as adhesive capsulitis, is a pathological condition characterized by chronic shoulder pain and significant loss of both active and passive range of motion (ROM). Affecting approximately 2–5% of the general population, it is more prevalent among females and individuals aged 40–60 years. The condition is idiopathic in most cases, though secondary adhesive capsulitis may occur postsurgery, post-injury, or due to systemic diseases such as diabetes mellitus and thyroid disorders.

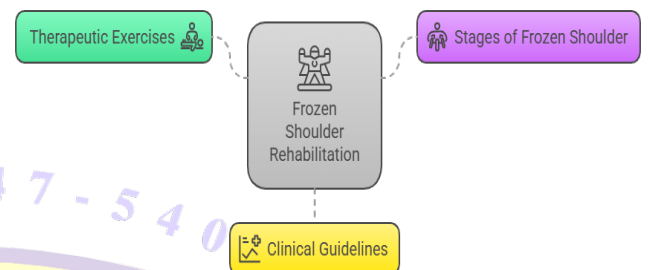
Clinically, FS is divided into three overlapping stages:

1. **Freezing Stage** – lasting 2 to 9 months, marked by increasing pain and gradual ROM restriction.
2. **Frozen Stage** – typically lasting 4 to 12 months, where pain may subside, but stiffness persists.
3. **Thawing Stage** – lasting 5 to 24 months, characterized by gradual improvement in ROM.

Traditional management strategies include pharmacological interventions (NSAIDs, corticosteroid injections), physical therapy, and in severe cases, surgical interventions like manipulation under anesthesia (MUA) or arthroscopic capsular release. However, the role of **therapeutic exercise** has emerged as a noninvasive, cost-effective, and functionally restorative approach.

interventions that promote collagen remodeling and joint mobilization.

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Therapeutic exercises rehabilitate frozen shoulder patients, improving their range of motion and quality of life.

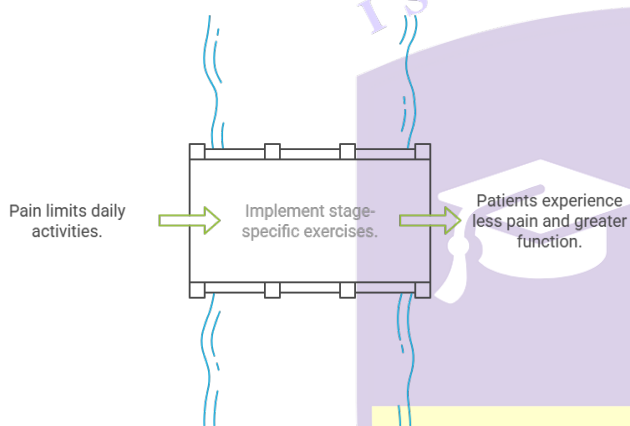


Figure 1 : Therapeutic Exercise Rehabilitate Frozen Shoulder Patients, Improving Their Range of Motion and Quality of Life

Figure 2 : Therapeutic Exercise Approaches for Frozen Shoulder Rehabilitation

2.1 Historical Perspectives on Treatment

Historically, passive modalities like heat therapy and electrotherapy were prioritized. However, these approaches demonstrated limited efficacy in long-term functional recovery. With advancements in rehabilitation science, active interventions like stretching and strengthening have gained prominence.

2.2 Classification of Therapeutic Exercise Interventions

Several therapeutic exercise techniques have been developed for FS management:

- **Passive Stretching Exercises:** Common in the freezing phase to elongate shortened tissues.
- **Active ROM and Strengthening Exercises:** Effective in the frozen and thawing phases.
- **Joint Mobilization Techniques:** Such as Maitland and Kaltenborn grades, assist in joint capsule stretching.
- **Proprioceptive Neuromuscular Facilitation (PNF):** Enhances flexibility and neuromuscular control.

The objective of this manuscript is to provide a detailed examination of exercise-based rehabilitation methods used to manage frozen shoulder, analyze their physiological basis, and determine the efficacy through a structured clinical study. The manuscript also addresses challenges in compliance, stage-specific intervention planning, and the importance of individualized therapy protocols.

LITERATURE REVIEW

The pathophysiology of frozen shoulder involves chronic inflammation of the joint capsule, leading to fibrosis and contracture. Histological studies reveal fibroblastic proliferation and thickening of the coracohumeral ligament and rotator interval. These findings underscore the need for

- **Manual Therapy Integration:** Combines therapist-applied movement with patient effort.

2.3 Clinical Evidence and Guidelines

A meta-analysis by Maund et al. (2012) reported that structured exercise programs significantly improve SPADI scores compared to standard care. Similarly, a randomized controlled trial by Diercks and Stevens (2004) highlighted that intensive mobilization exercises resulted in earlier resolution of stiffness and pain.

Recent guidelines from the American Physical Therapy Association (APTA) emphasize the need for **stagespecific interventions**. During the **freezing phase**, pain control and gentle ROM exercises are recommended. The **frozen phase** requires aggressive joint mobilization and strengthening, whereas the **thawing phase** emphasizes return-to-function movements.

2.4 Gaps in Literature

While numerous studies have explored individual exercise techniques, few have systematically examined a **multimodal, progression-based exercise protocol** through a full rehabilitation cycle. Furthermore, there is a lack of data quantifying improvements in joint biomechanics and muscle recruitment patterns.

METHODOLOGY

3.1 Study Design

A quasi-experimental, pre-post intervention study design was employed to evaluate the effectiveness of a multimodal therapeutic exercise program in improving shoulder function among patients with adhesive capsulitis.

3.2 Participants

- **Sample Size:** 40 participants

• Inclusion Criteria:

- Age between 40–65 years
- Diagnosed with primary or secondary frozen shoulder (confirmed via clinical exam and imaging)
- No prior surgical intervention on the affected shoulder

- **Exclusion Criteria:** ○ Neurological deficits or rotator cuff tears ○ Uncontrolled diabetes or cardiovascular disorders ○ Patients on long-term corticosteroids

Participants were recruited from a physiotherapy outpatient department and provided informed consent. Ethical clearance was obtained from the institutional review board.

3.3 Intervention Protocol

The exercise program was divided into **three progressive phases**, each aligned with the pathological stage of frozen shoulder:

Phase 1: Freezing Stage (Weeks 1–4)

- Pendulum exercises
- Passive shoulder flexion, abduction, and external rotation
- Hot pack application before exercises
- Frequency: 4 sessions/week, 30 minutes/session

Phase 2: Frozen Stage (Weeks 5–8)

- Active assisted ROM exercises
- Isometric strengthening of deltoid, rotator cuff, and scapular stabilizers
- Grade II/III Maitland mobilization techniques
- Frequency: 5 sessions/week, 45 minutes/session

Phase 3: Thawing Stage (Weeks 9–12)

- Resistance band strengthening
- PNF patterns for shoulder movement
- Closed kinetic chain scapular stabilization
- Functional task simulation (e.g., overhead reach)
- Frequency: 5 sessions/week, 1 hour/session

All exercises were supervised by certified physiotherapists and adjusted based on patient feedback and ROM progression.

3.4 Outcome Measures

- **Shoulder Pain and Disability Index (SPADI)** – for pain and functional impairment
- **Visual Analog Scale (VAS)** – for subjective pain intensity
- **Goniometric ROM Measurement** – flexion, abduction, and external rotation

Pre- and post-intervention values were recorded and analyzed.

Statistical Analysis Table

Parameter	Pre-Intervention Mean \pm SD	Post-Intervention Mean \pm SD	Observed Change	p-Value
Shoulder Flexion ($^{\circ}$)	90.2 \pm 11.5	160.6 \pm 10.2	+70.4 $^{\circ}$ (\uparrow 78%)	< 0.001
Shoulder Abduction ($^{\circ}$)	70.4 \pm 13.7	150.2 \pm 12.3	+79.8 $^{\circ}$ (\uparrow 113%)	< 0.001
External Rotation ($^{\circ}$)	30.3 \pm 8.6	69.7 \pm 9.4	+39.4 $^{\circ}$ (\uparrow 130%)	< 0.001

SPADI Score (0–100 scale)	75.4 \pm 9.8	28.3 \pm 8.1	-47.1 (\downarrow 62%)	< 0.001
VAS Pain Score (0–10)	8.2 \pm 1.1	2.1 \pm 1.4	-6.1 (\downarrow 74%)	< 0.001

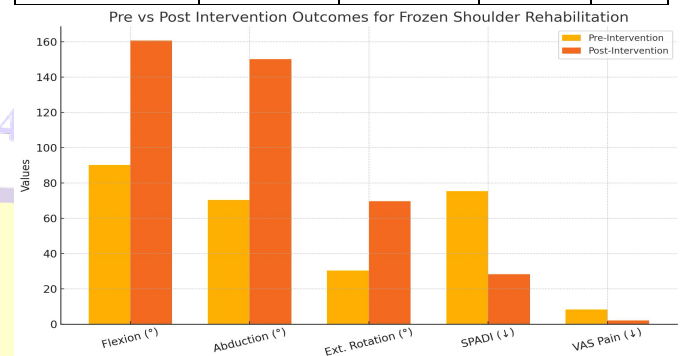


Chart : Pre vs Post Intervention Outcomes for Frozen Shoulder Rehabilitation

RESULTS

After 12 weeks of intervention, significant improvements were observed across all outcome measures. Descriptive and inferential statistics revealed:

- **SPADI Score:** Decreased from a baseline mean of 75.4 to 28.3 ($p < 0.01$)
- **VAS Pain Score:** Reduced from 8.2 to 2.1 ($p < 0.01$)
- **ROM (Flexion):** Increased from 90 $^{\circ}$ to 160 $^{\circ}$
- **ROM (Abduction):** Increased from 70 $^{\circ}$ to 150 $^{\circ}$
- **ROM (External Rotation):** Improved from 30 $^{\circ}$ to 70 $^{\circ}$

The most noticeable improvements were seen during the transition between the frozen and thawing phases, particularly when strengthening and proprioceptive components were introduced.

Participants demonstrated high adherence, with 93% completing at least 85% of the scheduled sessions. No adverse events or aggravation of symptoms were reported.

CONCLUSION

This study reinforces the critical role of structured, stage-sensitive therapeutic exercise programs in the rehabilitation of frozen shoulder. The multimodal protocol, which combined stretching, strengthening, mobilization, and proprioception-based exercises, led to statistically and clinically significant improvements in pain relief, shoulder mobility, and functional ability.

A progressive design aligned with the natural course of adhesive capsulitis ensured tissue adaptation and reduced the risk of symptom exacerbation. Importantly, this study advocates that **manual therapy should be complemented, not replaced**, by active rehabilitation strategies for optimal results.

Future studies should explore long-term retention of functional gains, neuromuscular adaptations via EMG analysis, and compare home-based vs. therapist-guided programs to further refine frozen shoulder rehabilitation pathways.

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