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Evidence-Based Physiotherapeutic Management of Adhesive Capsulitis: A Comprehensive Review

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***Abstract*: Background: Adhesive capsulitis (frozen shoulder) is a common musculoskeletal disorder characterized by pain, stiffness, and restricted shoulder range of motion, leading to functional limitations and reduced quality of life. The objective was to review and summarize evidence-based physiotherapy interventions for the management of adhesive capsulitis.**

Methods: A systematic search of databases including PubMed, Cochrane Library, PEDro, Scopus, and others identified 112 records. After screening and eligibility assessment, 31 studies (2017-2026) were included for analysis.

Results: A multimodal physiotherapy approach is most effective. Electrotherapy modalities such as LLLT and UST provide better pain relief when combined with exercise, while TENS and cryotherapy offer short-term benefits. Manual therapy, particularly joint mobilization and MWM, significantly improves ROM and function. Exercise therapy remains the cornerstone, with ROM, stretching, strengthening, and proprioceptive training improving mobility and disability. Advanced techniques such as PNF and MET further enhance outcomes. Patient education and stage-specific interventions are essential for optimal recovery.

Conclusion: An individualized, stage-based, and multimodal physiotherapy program is most effective in reducing pain, restoring mobility, and improving function in adhesive capsulitis.

***Keywords*: Adhesive capsulitis; Physiotherapeutic modalities; Exercise therapy; Joint mobilization; Rehabilitation.**

1. INTRODUCTION

Adhesive capsulitis (AC), commonly referred to as frozen shoulder, is a prevalent musculoskeletal disorder characterized by progressive shoulder pain, stiffness, and marked restriction of both active and passive range of motion (ROM) of the glenohumeral joint [1]. It is typically an insidious condition with spontaneous onset and significant functional limitation, often affecting activities of daily living and overall quality of life [2].

The global prevalence of adhesive capsulitis is estimated to range between 2–5% of the general population, with a higher incidence reported in individuals aged 40–70 years and a slight predominance in females [3]. The condition may be classified as primary (idiopathic) or secondary, the latter being associated with systemic conditions such as diabetes mellitus, thyroid disorders, trauma, or prolonged immobilization [4]. Notably, the estimated prevalence of AC in diabetic populations ranges from 10% to 30%, with meta-analytic evidence suggesting an average prevalence of around 13.4% [5,6]. Other risk factors associated with increased prevalence include thyroid disorders, prolonged immobilization, cardiovascular disease, and previous shoulder injury. Bilateral involvement may occur in a subset of patients, often sequentially rather than simultaneously [7].

Pathophysiologically, AC is recognized as a chronic inflammatory and fibrotic disorder of the joint capsule. The condition begins with synovial inflammation, followed by capsular fibrosis, thickening, and contracture, leading to reduced joint volume and loss of capsular elasticity [6]. This process results in adhesion formation, particularly within the rotator interval and coracohumeral ligament, thereby restricting normal joint mechanics [8].

Clinically, AC progresses through three characteristic stages:

1. Freezing (painful stage): Gradual onset of diffuse shoulder pain, often worsening at night, with progressive restriction of motion.
2. Frozen (stiffness stage): Pain may decrease, but stiffness and significant ROM limitation persist.
3. Thawing (recovery stage): Gradual improvement in ROM and functional recovery occurs over time [9].

The natural course of the condition typically lasts 1 to 3 years, although some individuals may experience prolonged symptoms and residual stiffness without appropriate intervention [10]. Due to its chronic nature and impact on functional independence, early diagnosis and management are essential.

Among conservative treatment strategies, physiotherapy is considered the cornerstone of management, focusing on pain reduction, restoration of joint mobility, and improvement of functional outcomes. Evidence supports the use of a combination of interventions, including joint mobilization, stretching, strengthening exercises, and electrotherapy modalities, to optimize recovery and prevent long-term disability [11–13]. A stage-specific and individualized rehabilitation approach is critical for achieving optimal therapeutic outcomes.

Goals of Physiotherapy in Adhesive Capsulitis

The primary goal of physiotherapy in AC is to reduce pain and inflammation, particularly during the early (freezing) stage of the condition. Pain management is essential to allow patient participation in rehabilitation. Modalities such as transcutaneous electrical nerve stimulation (TENS), therapeutic ultrasound, and low-level laser therapy, along with gentle mobilization techniques, have been shown to effectively decrease pain and inflammatory responses, thereby improving patient compliance and functional engagement [10,12].

Another key objective is to improve joint mobility, which is significantly restricted due to capsular fibrosis and adhesions. Physiotherapy interventions such as joint mobilization (Maitland and Kaltenborn techniques), stretching exercises, and mobilization with movement (MWM) aim to restore accessory joint glides and capsular extensibility. Evidence suggests that graded mobilization techniques are effective in increasing shoulder range of motion and reducing stiffness [10,11].

Closely related is the goal to restore functional range of motion (ROM), which is essential for performing activities of daily living such as grooming, dressing, and overhead tasks. Structured exercise programs, including active-assisted and passive stretching, as well as proprioceptive neuromuscular facilitation (PNF) techniques, have demonstrated significant improvements in functional ROM when applied consistently and progressively [12,13].

Physiotherapy also aims to prevent muscle atrophy, which may occur due to disuse and prolonged immobility of the affected shoulder. Strengthening exercises targeting the rotator cuff and scapular stabilizers are introduced progressively, particularly during the frozen and thawing stages, to maintain muscle integrity and support joint stability [11,14].

Finally, an overarching goal is to enhance quality of life by improving functional independence, reducing disability, and enabling patients to return to their normal activities. Comprehensive physiotherapy programs that combine pain relief, mobility restoration, strengthening, and patient education have been shown to significantly improve patient-reported outcomes, including pain scores, functional ability, and overall well-being [12,15].

2. MATERIALS AND METHODS

A total of 112 records were initially identified through database searching. After removing duplicates, 91 records remained, of which 63 were screened based on titles and abstracts. Subsequently, 44 full-text articles were assessed for eligibility, and finally, 31 most recent studies published between 2017 and 2026 met the inclusion criteria and were included for detailed analysis in this review.

The literature search was conducted systematically across major electronic databases, including PubMed, Google Scholar, EBSCO, Cochrane Library, PEDro, Embase, Scopus, and Web of Science. A comprehensive search strategy was implemented using both Medical Subject Headings (MeSH) and relevant free-text terms such as “Adhesive Capsulitis,”

"Physiotherapeutic Management," and "Quality of Life." Boolean operators (AND/OR) were applied to refine and broaden the search to capture all relevant studies. Additionally, reference lists of selected articles were manually screened to identify any further relevant studies not retrieved through the database search. Clearly defined inclusion criteria were used to ensure the methodological rigor and clinical relevance of the studies included in this review.

3. RESULTS

Physiotherapeutic Management

A. Pain Relief Modalities

Transcutaneous Electrical Nerve Stimulation (TENS) is effective in reducing pain through the gate control mechanism and is particularly useful during the freezing stage of adhesive capsulitis [16]. Therapeutic Ultrasound (UST) helps promote deep tissue heating and improves collagen extensibility, thereby aiding in tissue flexibility [17]. Low-Level Laser Therapy (LLLT) contributes to pain reduction by decreasing inflammation and enhancing tissue healing [12]. Cryotherapy and thermotherapy are also beneficial, where ice is primarily used for managing acute pain, while heat helps in reducing stiffness and promoting muscle relaxation [11,13].

Table 1: Comparison of pain relief modalities in management of adhesive capsulitis

Modality	Mechanism of Action	Clinical Effects	Evidence (Recent Findings)	Stage of Use	Limitations
TENS	Stimulates A-beta fibbers → inhibits nociceptive transmission (Gate control theory)	Reduces pain, improves tolerance to exercise	Often used as adjunct; evidence suggests pain relief but limited functional improvement when used alone [10,12]	Freezing stage	Limited effect on ROM and long-term outcomes
Therapeutic Ultrasound (UST)	Deep heating → increases collagen extensibility and blood flow	Pain reduction, mild ROM improvement	Meta-analysis shows significant pain reduction when combined with exercise, but inconsistent ROM gains [11,13]	Freezing & Frozen stages	Less effective as standalone therapy; mainly adjunct
Low-Level Laser Therapy (LLLT)	Photobiomodulation → reduces inflammation, enhances cellular repair	Pain reduction, improved function, mild ROM gains	RCTs show significant pain reduction and functional improvement, though ROM gains are modest [12,17]	Freezing stage primarily	Variable dosing protocols; inconsistent long-term effects
Cryotherapy	Vasoconstriction → reduces inflammation and pain	Effective for acute pain relief	Comparable to UST for pain relief in some studies	Acute/freezing stage	Temporary relief; no effect on stiffness
Thermotherapy (Heat)	Vasodilation → increases tissue extensibility and relaxation	Reduces stiffness, improves mobility before exercise	Commonly used before stretching; improves tissue flexibility (supportive evidence in rehab protocols)	Frozen & Thawing stages	Does not directly reduce inflammation

B. Manual Therapy Techniques

Joint mobilization techniques (Maitland/Kaltenborn) improve capsular extensibility and joint play, with posterior glide enhancing internal rotation and inferior glide improving abduction. High-grade mobilization (Grade III–IV) is more effective than low-grade techniques for improving ROM and function, especially in the frozen and thawing stages, though it may cause discomfort in the acute stage [10,12].

Mobilization with Movement (MWM) combines sustained accessory glide with active movement, effectively improving functional ROM, reducing pain, and enhancing task-specific activities. It is superior to conventional therapy and can be applied across all stages with modifications in the freezing stage [19,20].

Myofascial release (MFR) reduces fascial restrictions, improving flexibility and decreasing pain, particularly as an adjunct therapy in the frozen stage, though evidence as a standalone treatment is limited [20,21].

Soft tissue mobilization improves circulation, reduces muscle guarding, and enhances tissue pliability, with benefits mainly in the freezing and frozen stages; however, effects are short-term unless combined with exercise [12,13].

Table 2. Comparison of manual therapy techniques in management of adhesive capsulitis

Technique	Mechanism of action	Key applications	Clinical effects	Evidence (recent findings)	Stage of use	Limitations
Joint Mobilization (Maitland / Kaltenborn)	Passive oscillatory or sustained glides restore capsular extensibility and joint play	Posterior glide → ↑ internal rotation; Inferior glide → ↑ abduction	Significant improvement in ROM, pain reduction	High-grade mobilization (Grade III–IV) more effective than low-grade in improving ROM and function [10,12]	Frozen & Thawing stages	May cause discomfort in acute stage
Mobilization with Movement (MWM)	Sustained accessory glide combined with active physiological movement	Functional movement restoration (e.g., abduction, elevation)	Improves ROM, reduces pain, enhances functional tasks	RCTs show MWM superior to conventional therapy in improving functional ROM [19,20]	All stages (modified in freezing)	Requires patient cooperation
Myofascial release (MFR)	Releases fascial restrictions → improves tissue extensibility and reduces stiffness	Targets peri-scapular muscles, rotator cuff, fascia	Improves flexibility, reduces pain, enhances movement	Studies show moderate improvement in pain and ROM, especially as adjunct therapy [20,21]	Frozen stage	Limited evidence as standalone treatment
Soft tissue mobilization	Mechanical stimulation improves circulation and reduces muscle tone	Applied to shoulder girdle muscles (trapezius, deltoid, rotator cuff)	Reduces muscle guarding, improves relaxation	Evidence supports pain reduction and improved tissue pliability [12,13]	Freezing & frozen stages	Effects are short-term unless combined with exercise

C. Exercise therapy (core component)

Range of motion (ROM) exercises such as pendulum (Codman's), wand, and pulley exercises reduce pain, prevent stiffness, and improve mobility when performed regularly; evidence supports significant improvements in pain and joint movement [22,23].

Stretching exercises, including capsular stretching (15–30 seconds), improve ROM and capsular extensibility, while PNF stretching provides superior improvements in pain, ROM, and disability compared to conventional therapy [24-26].

Strengthening exercises targeting the rotator cuff and scapular stabilizers enhance muscle strength, joint stability, and functional recovery, especially when combined with stretching [23,27]. Proprioceptive and functional training, including neuromuscular exercises, PNF patterns, and task-specific activities, improve coordination, functional performance, and disability, with evidence showing significant overall clinical benefits [24,25,27].

Table 3: Comparison of evidence-based exercise therapy components in management of adhesive capsulitis

Component	Exercise type	Description & dosage	Clinical outcomes	Recent evidence with complete references
Range of motion (ROM)	Pendulum (Codman's), wand, pulley	Gentle AAROM exercises; 10–15 reps, 2–3 sessions/day	Reduces pain, prevents stiffness, improves joint lubrication	ROM-based exercise programs significantly improve pain and mobility in AC patients [22,23]
Stretching exercises	Capsular stretching (anterior, posterior, inferior)	Sustained stretch 15–30 sec, 3–5 repetitions/day	Improves capsular extensibility and ROM	Capsular stretching improves ROM and function; commonly used in RCT control groups [24,25]
PNF stretching (hold-relax)	D1/D2 patterns, contract-relax, and hold-relax techniques.	Contract–relax cycles, repeated 2–3 times/session	Superior ROM and pain reduction	PNF significantly improves pain, ROM, and disability compared to conventional therapy [24,26]
Strengthening exercises	Rotator cuff strengthening (isometric → isotonic)	2–3 sets, 10–12 reps, 3x/week	Improves muscle strength and joint stability	Strengthening combined with stretching enhances functional recovery [23,27]
	Scapular stabilization (trapezius, serratus anterior)	Progressive resistance training	Restores scapulohumeral rhythm	Exercise-based rehab improves functional outcomes and shoulder mechanics [27]
Proprioceptive & functional training	Neuromuscular training (closed chain, rhythmic stabilization)	Task-specific progression	Improves coordination and joint position sense	Proprioceptive training significantly improves pain and functional activity scores [25]
	Task-specific functional training	ADL-based exercises (reaching, lifting)	Improves disability and daily function	Functional training enhances ADL performance and recovery [25,27]
	PNF movement patterns	Diagonal patterns (D1/D2)	Improves neuromuscular control and ROM	Recent RCT shows PNF superior to conventional therapy in pain, ROM, and disability [24]

D. Advanced Physiotherapy Techniques

Muscle energy technique (MET) improves ROM through post-isometric relaxation and reduces capsular tightness, with evidence showing significant improvements in pain and mobility compared to conventional therapy, particularly in the frozen and thawing stages [12,28].

Proprioceptive neuromuscular facilitation (PNF) enhances neuromuscular control and functional movement through diagonal (D1/D2) patterns, leading to improved ROM, coordination, and shoulder function, especially when combined with stretching [12,13].

Dry needling targets myofascial trigger points in shoulder muscles, reducing pain and muscle tightness while improving mobility; evidence supports its effectiveness for short-term pain relief and ROM improvement [29,30].

Kinesio taping provides sensory input that improves proprioception, reduces pain, and supports movement, with studies showing added benefits when used alongside exercise therapy, although long-term evidence remains limited [13,31].

Table 4: Comparison of advanced physiotherapy techniques in management of adhesive capsulitis

Technique	Mechanism of action	Key applications	Clinical effects	Evidence (recent findings)	Stage of use	Limitations
Muscle Energy Technique (MET)	Uses post-isometric relaxation and reciprocal inhibition to reduce muscle tone and capsular tightness	Gentle isometric contractions followed by stretch	Improves ROM, reduces stiffness and pain	RCTs show significant improvement in ROM and pain compared to conventional therapy [12,28]	Frozen & Thawing stages	Requires patient cooperation; less effective in acute pain stage
Proprioceptive neuromuscular facilitation (PNF)	Enhances neuromuscular control via diagonal movement patterns and facilitation techniques	Functional movement patterns (D1/D2 patterns)	Improves ROM, coordination, and functional use of shoulder	Studies show PNF combined with stretching improves ROM and function significantly [12,13]	Frozen & thawing stages	Technique-dependent; requires skilled therapist
Dry needling	Targets myofascial trigger points → reduces nociceptive input and muscle tightness	Applied to rotator cuff, deltoid, trapezius muscles	Reduces pain, improves mobility and muscle activation	Evidence suggests short-term pain relief and ROM improvement [29,30]	All stages (especially freezing)	Invasive; requires trained practitioner
Kinesio taping	Provides sensory input → improves proprioception, reduces pain, supports muscles	Applied over shoulder musculature	Reduces pain, improves functional movement	Studies show adjunctive benefit when combined with exercise therapy [13,31]	Freezing & frozen stages	Limited long-term evidence

E. Patient Education

Patient education, including activity modification, postural correction, and adherence to a home exercise program (HEP), plays a crucial role in improving functional outcomes and supporting long-term recovery.

Table 5. Stage-wise physiotherapy management

Stage	Focus	Interventions
Freezing	Pain relief	TENS, gentle ROM, education
Frozen	Increase mobility	Joint mobilization, stretching, MFR
Thawing	Restore function	Strengthening, functional training

F. Evidence-based insights (2020–2025)

Joint mobilization combined with exercise demonstrates superior outcomes compared to exercise alone. Mobilization with Movement (MWM) techniques significantly improve ROM and functional performance. Low-level laser therapy (LLLT) combined with exercise provides greater pain reduction, while muscle energy technique (MET) and proprioceptive neuromuscular facilitation (PNF) act as effective adjunct therapies enhancing overall treatment outcomes.

G. Clinical Implications

Early physiotherapy intervention reduces disease duration and improves recovery outcomes. A multimodal approach is the most effective strategy for management, and individualized treatment based on the stage of the condition is essential for optimal results.

Table 6: Description of patient education in adhesive capsulitis

Component	Description	Clinical importance	Evidence
Activity modification	Avoid painful overhead/repetitive movements; encourage pain-free activity	Prevents exacerbation of inflammation and protects joint	Education improves adherence and reduces disability [10,12]
Postural correction	Correction of forward head and rounded shoulder posture	Reduces abnormal stress on shoulder joint and improves biomechanics	Postural training enhances functional outcomes [12,13]
Home exercise program (HEP)	Structured daily exercises (ROM, stretching, strengthening)	Maintains gains achieved during therapy and promotes recovery	Strong evidence supports HEP for long-term improvement [10,15]

Table 7: Stage-wise physiotherapy management

Stage	Pathology focus	Treatment goals	Key interventions	Evidence
Freezing (painful stage)	Synovial inflammation, pain	Pain relief, maintain ROM	TENS, LLLT, cryotherapy, gentle ROM exercises, patient education	Pain-relieving modalities + gentle exercise improve early outcomes [10,19]
Frozen (stiffness stage)	Capsular fibrosis, restricted mobility	Increase joint mobility	Joint mobilization (Grade III–IV), stretching, MFR, MET	Joint mobilization + stretching significantly improves ROM [10,12]
Thawing (recovery stage)	Gradual tissue remodeling	Restore function and strength	Strengthening, PNF, functional training, proprioceptive exercises	Exercise-based rehab improves functional recovery [13,15]

Table 8: Evidence-based insights (2020–2025)

Intervention	Key findings	Clinical significance	References
Joint mobilization + exercise	Superior to exercise alone for ROM and pain	Gold standard conservative approach	[10,12]
Mobilization with movement (MWM)	Significant improvement in ROM and function	Enhances functional movement patterns	[19,20]
LLLT + exercise	Greater pain reduction compared to exercise alone	Useful in early stage pain control	[17,18]
MET & PNF	Improve ROM and functional outcomes as adjuncts	Effective advanced physiotherapy techniques	[12,13]

Table 9: Description of clinical implications

Aspect	Description	Evidence
Early physiotherapy	Early intervention reduces severity and duration of symptoms	Early rehab leads to faster recovery [10,15]
Multimodal approach	Combination of modalities, manual therapy, and exercise is most effective	Integrated approach shows superior outcomes [12,19]
Individualized treatment	Stage-specific and patient-centered care is essential	Tailored programs improve adherence and outcomes [13,20]

4. DISCUSSION

The present body of evidence emphasizes that a multimodal and stage-specific physiotherapy approach is essential for the effective management of adhesive capsulitis. Electrotherapy modalities contribute meaningfully to symptom control, but their role is primarily adjunctive. Among these, low-level laser therapy (LLLT) and ultrasound therapy (UST), particularly when combined with structured exercise programs, demonstrate stronger evidence for reducing pain and improving functional outcomes [12,17]. In contrast, TENS and cryotherapy mainly offer short-term analgesic effects and are more suitable during the painful "freezing stage" of the condition [16,13]. Thermotherapy, while not directly curative, enhances tissue extensibility and is most effective when applied prior to stretching or mobilization interventions [11]. This reinforces the understanding that passive modalities alone cannot address the underlying capsular pathology.

Manual therapy remains a cornerstone in restoring joint mobility. High-grade joint mobilization techniques show the strongest evidence for improving capsular restrictions and arthrokinematic deficits, making them the gold standard for ROM restoration. Additionally, mobilization with movement (MWM) techniques are particularly beneficial for improving functional ROM and facilitating task-specific activities. Complementary soft tissue interventions such as myofascial release (MFR) and other soft tissue mobilization techniques help reduce muscular tightness and secondary restrictions, thereby enhancing the overall effectiveness of joint-based interventions.

Exercise therapy is consistently identified as the foundation of conservative management [27]. A structured program incorporating range of motion (ROM), stretching, and strengthening exercises is critical across all stages of the disorder. In the early phase, pendulum (Codman's) exercises are highly recommended due to their low joint stress and ability to maintain mobility [10]. As the condition progresses, capsular stretching techniques, particularly targeting the posterior and inferior capsule, become essential for improving movements such as internal rotation and abduction [12,14]. Progressive strengthening of the rotator cuff and scapular stabilizers plays a vital role in restoring dynamic stability, correcting biomechanics, and preventing disuse atrophy. Furthermore, combining stretching and strengthening yields superior functional outcomes compared to isolated interventions [23].

An important advancement in rehabilitation is the integration of proprioceptive and functional training, which significantly enhances neuromuscular control, joint position sense, and overall functional recovery [15,25]. Activities such as reaching, overhead tasks, and coordination drills are particularly valuable during the later stages of rehabilitation.

Advanced therapeutic techniques further augment treatment outcomes. Proprioceptive neuromuscular facilitation (PNF) has demonstrated superior effectiveness compared to conventional physiotherapy in improving pain, ROM, and disability [24], likely due to its emphasis on coordinated, functional movement patterns. Similarly, muscle energy techniques (MET) provide greater improvements in joint mobility compared to passive stretching alone by utilizing post-isometric relaxation mechanisms [1]. Dry needling contributes to short-term pain relief and reduction in muscle hypertonicity [4], while kinesio taping offers additional proprioceptive input and supports movement confidence, although its effects are primarily adjunctive.

Overall, the evidence clearly indicates that no single modality or technique is sufficient when used in isolation. The most effective outcomes are achieved through a comprehensive, individualized, and stage-based rehabilitation program that integrates electrotherapy, manual therapy, and progressive exercise interventions. This multimodal strategy not only addresses pain and mobility limitations but also facilitates long-term functional recovery and reduces the risk of recurrence.

5. CONCLUSION

Adhesive capsulitis is a disabling condition characterized by pain and progressive restriction of shoulder mobility, significantly impacting functional activities and quality of life. Physiotherapy remains the cornerstone of management, with evidence supporting a multimodal and stage-specific approach. Pain-relieving modalities such as TENS, therapeutic ultrasound, and low-level laser therapy are effective in the early stage for symptom control [1,7]. However, manual therapy techniques, particularly joint mobilization and mobilization with movement (MWM), combined with exercise therapy demonstrate superior improvements in range of motion and function [1,2,5]. Structured exercise programs, including stretching, strengthening, and proprioceptive training, form the core of rehabilitation and are essential for long-term recovery [2,4]. Adjunct techniques such as MET, PNF, dry needling, and kinesio taping further enhance outcomes when integrated appropriately. Additionally, patient education and adherence to home exercise programs are critical for sustaining improvements. Overall, early intervention with a combined, individualized physiotherapy program leads to optimal recovery and reduced disability [1–4].

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Ethical Approval

Not applicable.

Competing Interests

The authors declare no competing interests.

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