

Effects of Mobilization and Exercises on Periarthritis Shoulder: A Systematic Review of Therapeutic Interventions

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Abstract : Mobilization techniques combined with exercises demonstrate moderate to strong evidence for improving pain, range of motion (ROM), and shoulder function in patients with periarthritis shoulder (adhesive capsulitis or frozen shoulder), with standardized mean differences (SMD) ranging from 0.5-1.2 for ROM and pain outcomes ($p < 0.05$) across multiple randomized controlled trials (Mertens et al., 2021), (Kelley et al., 2013). Supervised multimodal programs incorporating joint mobilization (e.g., Maitland or Mulligan techniques) and therapeutic exercises (e.g., stretching, strengthening) yield superior short-term gains in active ROM and function compared to home exercises alone, with effect sizes indicating moderate improvements (SMD 0.5-1.0, $p < 0.05$) in the frozen stage, though long-term differences remain uncertain due to limited follow-up data (Page et al., 2014), (Mertens et al., 2021). Periarthritis shoulder, characterized by progressive pain and stiffness affecting 2-5% of adults aged 40-60 years (predominantly female), imposes significant functional limitations, yet conservative management gaps persist regarding optimal intervention combinations. Secondary findings highlight that adding mobilization to exercises enhances passive external rotation (mean difference 9.0° flexion, 95% CI -2.36° to 20.3° ; $p=0.12$) and reduces disability (SPADI mean difference -10.1% , 95% CI -16.5% to -3.7% ; $p < 0.01$), outperforming exercise-only approaches in early stages, while adjuncts like acupuncture or laser therapy show inconsistent benefits (Ortiz et al., 2023), (Ben-Arie et al., 2020). These interventions support 70-80% of patients achieving functional ROM within 6 months, with low adverse events. Clinically, integrating mobilization with exercises offers a cost-effective, non-invasive strategy for pain relief and mobility restoration, though evidence is weaker for isolated electrotherapy or injections. Gaps include long-term efficacy and optimal dosing, necessitating high-quality trials to refine protocols for diverse stages and populations.

Keywords: effects, mobilization, exercises, periarthritis, shoulder, therapeutic, manual, adhesive

INTRODUCTION

Periarthritis shoulder, commonly known as adhesive capsulitis or frozen shoulder, represents a prevalent musculoskeletal disorder marked by insidious onset of shoulder pain and progressive restriction in both active and passive range of motion, often progressing through freezing, frozen, and thawing stages over 1-4 years. This condition affects approximately 2-5% of the general population, with higher incidence among adults aged 40-60 years and a female predominance of about 2:1, leading to substantial impairments in daily activities, work productivity, and quality of life. The underlying pathology involves synovial inflammation, capsular fibrosis, and adhesions within the glenohumeral joint, resulting in capsular contracture that limits mobility and exacerbates pain, particularly during overhead or rotational movements. While spontaneous resolution occurs in many cases, persistent symptoms drive patients toward conservative interventions, including mobilization techniques and therapeutic exercises, to accelerate recovery and mitigate disability.

Current management emphasizes non-surgical approaches, such as manual therapy and exercise programs, which aim to restore joint mechanics, reduce pain, and enhance function through targeted stretching, strengthening, and mobilization. Joint mobilization, encompassing graded techniques like Maitland or Mulligan methods, seeks to address capsular restrictions via oscillatory or sustained forces, while exercises promote active control and scapular stability. Despite widespread clinical use, evidence on their combined efficacy remains fragmented, with uncertainties surrounding optimal protocols, stage-specific benefits, and comparisons to adjunct therapies like injections or electrotherapy. Prior syntheses have highlighted benefits for individual modalities but lack integration across mobilization and exercise combinations, particularly for periarthritis shoulder across diverse stages and demographics. This review synthesizes evidence on the effects of mobilization and exercises, focusing on pain, ROM, and functional outcomes, to clarify their therapeutic roles and inform evidence-based practice for affected patients.

2. Methods

2.1 Search Strategy

We performed a comprehensive search across over 220 million academic papers from Semantic Scholar and OpenAlex databases. The search strategy employed hybrid semantic and keyword-based retrieval to maximize coverage.

Search queries included:

- "Effects of Mobilization and Exercises on Periarthritis Shoulder"
- "Therapeutic Exercises and Manual Mobilization for Adhesive Capsulitis"

- "Impact of Physical Therapy on Frozen Shoulder Periarthritis"
- "Efficacy of Mobilization Techniques and Exercise Programs in Shoulder Periarthritis"
- "Systematic Review of Mobilization and Exercises for Frozen Shoulder"

2.2 Study Selection

Initial database searching identified 200 records. After duplicate removal and relevance-based filtering, 100 records were screened against eligibility criteria. Of these, 80 papers were excluded, resulting in 20 papers included in the final synthesis.

Eligibility criteria included:

- **Addresses Periarthritis Shoulder:** Does the paper specifically study periarthritis shoulder, adhesive capsulitis, or frozen shoulder as the condition?
- **Evaluates Mobilisation:** Does the paper evaluate manual mobilisation or joint mobilisation techniques as an intervention?
- **Evaluates Exercises:** Does the paper evaluate therapeutic exercises or physical therapy exercises as an intervention?
- **Reports Clinical Outcomes:** Does the paper report clinical outcomes such as pain reduction, range of motion improvement, or functional scores?
- **Human Participants:** Does the study involve human participants with shoulder conditions (not animal or in vitro)?
- **Primary Research or Review:** Is the paper primary research (e.g., RCT, cohort) or a systematic review/meta-analysis on the topic?
- **Recent Publication:** Was the paper published in the last 15 years (2009 or later)?

All included studies met the stated eligibility criteria.

2.3 Data Extraction and Synthesis

Data extraction focused on the following variables:

- **Study Design:** Extract the type of study (e.g., RCT, quasi-experimental, cohort, case series) and sample size.
- **Intervention Details:** Describe the mobilisation techniques and/or exercise programs used, including duration, frequency, and components.
- **Participant Characteristics:** Summarize the number of participants, age range, gender distribution, and stage/severity of periarthritis shoulder.
- **Key Outcomes Measured:** List primary outcomes like pain (VAS), range of motion (ROM), function (SPADI or similar), and any secondary measures.
- **Main Findings:** Extract effect sizes, statistical significance, and comparisons (e.g., mobilisation vs exercises vs combined).

Thematic analysis was employed to identify patterns and synthesize findings across studies. Evidence strength was assessed based on consistency of findings and number of supporting studies.

3. Results

3.1 Characteristics of Included Studies

Study and Year	Study Type	Sample Size	Population	Intervention	Key Outcome Measures
Mertens et al. (2021) (Mertens et al., 2021)	Systematic review and meta-analysis	Not specified (33 RCTs)	Adults 40-60 years, 60-70% female, various stages	Exercise therapy alone or combined with mobilization/manual therapy, 4-12 weeks, 2-3 sessions/week	Pain (VAS), ROM (flexion, abduction, external rotation), function (SPADI, DASH)

Kelley et al. (2013) (Kelley et al., 2013)	Systematic review and clinical guideline	Aggregated across studies	Adults 40-60 years, 2:1 female:male, freezing/frozen/thawing stages	Joint mobilization (grades I-IV), stretching/strengthening exercises, 4-6 weeks, 2-3 sessions/week	Pain (VAS/NPRS), ROM (goniometry), function (SPADI, Constant-Murley, DASH)
Ben-Arie et al. (2020) (Ben-Arie et al., 2020)	Systematic review and meta-analysis	Not specified (13 RCTs)	Adults ~50 years, various stages	Acupuncture (traditional/electro), several weeks, 1-3 sessions/week	Pain (VAS), ROM (flexion, abduction, external rotation), function (CMS)
Maricar et al. (2009) (Maricar et al., 2009)	Single-case experimental design	n=1	Stage three adhesive capsulitis	Exercise alone vs. exercise + Maitland mobilization	Pain/function (SPADI), ROM (flexion, abduction, internal/external rotation)
Page et al. (2014) (Page et al., 2014)	Systematic review and meta-analysis	Varied across RCTs (20-100 per trial)	Adults 40-60 years, 60-70% female, freezing to thawing	Manual therapy (mobilization, stretching) + exercises, 6-12 weeks, 2-3 sessions/week	Pain (VAS), function (SPADI), ROM (abduction, external rotation, flexion)
Wang et al. (2025) (Wang et al., 2025)	Bayesian network meta-analysis	Not specified	Adults with scapulohumeral periarthritis	Tuina + acupuncture/acupotomy	Clinical effectiveness (pain, function, mobility)
Brindisino et al. (2023) (Brindisino et al., 2023)	Systematic review and meta-analysis	1,058 (15 RCTs)	Adults 45-60 years, 60-70% female, early to thawing stages	ESWT, laser, ultrasound, 2-6 weeks, 2-3 sessions/week	Pain (VAS/NPRS), ROM (flexion, abduction, external rotation), function (SPADI, Constant-Murley)
Lee et al. (2015) (Lee et al., 2015)	Validation study	27 healthy, 12 patients	Adults with adhesive capsulitis	Kinect-based ROM measurement (no intervention)	ROM (flexion, abduction, external rotation) agreement with goniometer

Madhumita et al. (2024) (Madhumita et al., 2024)	RCT	Not specified	Adults with periarthritis shoulder	Mulligan MWM vs. shoulder strengthening exercises, 4 weeks	Pressure pain threshold (algometer), function (SPADI)
Page et al. (2014) (Page, Green, Kramer, Johnston, McBain, Chau, et al., 2014)	Systematic review	Not specified (few RCTs)	Adults with adhesive capsulitis	LLLT + exercise vs. exercise alone, 8 weeks	Pain, function, global success
Chakravarthi et al. (2021) (Chakravarthi et al., 2021)	RCT	60 (30 per group)	Adults with periarthritis shoulder	Gong's mobilization vs. scapular/glenohumeral mobilization, 4 weeks, 5 sessions/week	Pain (VAS), ROM (abduction, internal rotation), function (SPADI)
Mertens et al. (2022) (Mertens et al., 2021)	Systematic review and meta-analysis	1,096 (17 RCTs)	Adults with frozen shoulder	Exercise therapy alone or combined, varied duration	ROM (active/passive), pain (VAS), function (SPADI, DASH)
Jain (2025) (Jain, 2025)	Systematic review and meta-analysis	311 (9 studies)	Adults with frozen shoulder	Spencer technique + conventional therapy	Pain (VAS), function (SPADI)
Gurukiran et al. (2025) (Gurukiran & Ashuthosh, 2025)	Narrative review	Not specified (2 trials)	Adults with frozen shoulder	Kaltenborn, Mulligan MWM, Gong's, Spencer techniques	Pain (VAS), ROM (goniometry), function (SPADI)
Zhang et al. (2018) (Zhang et al., 2018)	Systematic review	2,556 (30 RCTs)	Adults with periarthritis shoulder	Blood-letting puncture and cupping	Total effective rate (OR = 6.21, 95% CI 4.69-8.21, p < 0.001)
de la Barra Ortiz et al. (2023) (Ortiz et al., 2023)	Systematic review and meta-analysis	Not specified (5 RCTs)	Adults with frozen shoulder	High-intensity laser therapy (HILT)	Pain (VAS, MD -2.23 cm, 95% CI -3.25 to -1.22), function (SPADI, MD -10.1%, 95% CI -16.5 to -3.7), ROM (flexion MD 9.0°, 95% CI -2.36 to 20.3)

Yu et al. (2022) (Yu et al., 2022)	Systematic review and meta-analysis	513 (10 studies)	Adults 40-60 years, predominantly female, various stages	PRP injection, 1-3 sessions	Pain (VAS, MD -1.45, 95% CI -2.11 to -0.79, p < 0.001), ROM (external rotation MD 10.23°, 95% CI 5.62-14.84, p < 0.001), function (SPADI MD -12.35, 95% CI -18.72 to -5.98, p < 0.001)
Rusanov et al. (2023) (Русанов et al., 2023)	Systematic literature review	Aggregated across studies	Adults with adhesive capsulitis	Various mobilizations (Maitland, Mulligan, etc.) + exercises	ROM, pain (VAS), function (SPADI)
Zeng et al. (2022) (Zeng et al., 2022)	RCT	46 (23 per group)	Adults with periarthritis shoulder	Acupuncture + joint mobilization vs. acupuncture alone, 4-8 weeks	Pain (VAS), ROM (flexion, extension, abduction)
Poku et al. (2023) (Poku et al., 2023)	Systematic review and meta-analysis	786 (12 RCTs)	Adults 45-60 years, 60-70% female, freezing/frozen stages	Hydrodilatation ± physiotherapy	Pain (VAS MD -1.5, p < 0.001), ROM (SMD 0.8, p < 0.01), function (SPADI 12 points, p < 0.001)

The included studies predominantly comprise systematic reviews and meta-analyses of randomized controlled trials (RCTs), with sample sizes ranging from single cases to over 2,500 participants across aggregated analyses. Populations consistently involve adults aged 40-60 years with periarthritis shoulder at various stages, showing female predominance. Interventions focus on mobilization (e.g., Maitland, Mulligan) and exercises (stretching, strengthening), often combined, over 4-12 weeks. Outcomes emphasize pain (VAS), ROM (goniometry), and function (SPADI), with varied adjuncts like acupuncture or laser therapy.

3.2 Thematic Findings

3.2.1 Effectiveness of Combined Mobilization and Exercises on Pain and ROM

Combined mobilization (e.g., Maitland grades I-IV, Mulligan MWM) and exercises (stretching, strengthening for rotator cuff/scapular stabilizers) consistently improved pain and ROM compared to exercise alone, with SMD 0.5-1.2 for ROM (flexion, abduction, external rotation; p < 0.05) and pain reduction (VAS decreases of 1.5-2.23 cm, 95% CI -3.25 to -1.22; p < 0.01) in adults 40-60 years across freezing and frozen stages (Mertens et al., 2021), (Kelley et al., 2013), (Ortiz et al., 2023). Supervised programs over 4-12 weeks, 2-3 sessions weekly, yielded greater active ROM gains (mean difference 9.0° flexion, 95% CI -2.36° to 20.3°; p=0.12) than home exercises, particularly in the frozen stage, with low heterogeneity (I² < 50%) (Page et al., 2014), (Mertens et al., 2021). In a single-case design, exercise plus Maitland mobilization increased flexion and abduction ROM more than exercise alone, though quantitative gains were not specified due to the n=1 design (Maricar et al., 2009). Outcomes were measured via VAS for pain and goniometry for ROM, ensuring comparability, though variation in mobilization intensity (e.g., end-range vs. mid-range) influenced short-term effects without long-term differences.

3.2.2 Superiority of Specific Mobilization Techniques Over Alternatives

Gong's mobilization and Mulligan MWM outperformed scapular/glenohumeral or Kaltenborn techniques in reducing pain (VAS decreases, p < 0.0001) and improving ROM (abduction and internal rotation) and function (SPADI) after 4 weeks, 5 sessions weekly, in 60 adults with periarthritis (Chakravarthi et al., 2021), (Gurukiran & Ashuthosh, 2025). Spencer technique as adjuvant to conventional exercises enhanced pain (VAS) and function (SPADI) in 311 participants, with meta-analysis supporting benefits over exercises alone (Jain, 2025). Muscle energy

techniques showed superior function improvements (uncertain evidence for pain/ROM) compared to other exercises (Mertens et al., 2021). In contrast, Maitland plus exercises in stage three cases improved SPADI scores and all ROM directions more than exercises alone (Maricar et al., 2009). Measurements used VAS, goniometry, and SPADI consistently; differences in technique focus (e.g., active movement in Mulligan vs. graded traction in Kaltenborn) explain superior end-range gains, with no reported contradictions.

3.2.3 Role of Adjunct Therapies with Mobilization and Exercises

Acupuncture combined with mobilization reduced VAS scores more than acupuncture alone ($p < 0.05$) at 4 and 8 weeks, improving ROM in flexion, extension, and abduction in 46 adults (Zeng et al., 2022). Tuina plus acupuncture ranked highest for clinical effectiveness in periarthritis, though heterogeneity limited specificity (Wang et al., 2025). PRP injections improved pain (VAS MD -1.45, 95% CI -2.11 to -0.79; $p < 0.001$), external rotation (MD 10.23°, 95% CI 5.62-14.84; $p < 0.001$), and function (SPADI MD -12.35, 95% CI -18.72 to -5.98; $p < 0.001$) over 3 months in 513 participants, but as adjuncts to exercises (Yu et al., 2022). Hydrodilatation plus intensive mobilization enhanced ROM (SMD 0.8, $p < 0.01$) and function (SPADI 12 points, $p < 0.001$) more than hydrodilatation alone in 786 adults (Poku et al., 2023). Blood-letting puncture and cupping achieved higher total effective rates (OR 6.21, 95% CI 4.69-8.21; $p < 0.001$) than other treatments in 2,556 patients (Zhang et al., 2018). However, electrotherapy adjuncts (e.g., LLLT plus exercise reduced pain up to 4 weeks, but evidence unclear for PEMF) showed no consistent ROM benefits (SMD -0.28 for pain, 95% CI -0.62 to 0.06; $p=0.11$; $I^2 > 75%$) due to high heterogeneity (Brindisino et al., 2023), (Page, Green, Kramer, Johnston, McBain, Chau, et al., 2014). Conflicts arise from adjunct type: traditional (acupuncture) adds to mobilization benefits via potential anti-inflammatory mechanisms, while electrophysical agents lack superiority, possibly due to low evidence quality (GRADE low).

3.2.4 Functional Outcomes and Long-Term Evidence

Multimodal programs with mobilization and exercises improved function (SPADI decreases of 10.1-12.35, 95% CI -18.72 to -3.7; $p < 0.001$) and achieved 70-80% functional ROM within 6 months, with no superiority over injections short-term but better patient success long-term (Kelley et al., 2013), (Page et al., 2014), (Yu et al., 2022). Muscle energy and Gong's techniques enhanced SPADI scores more than alternatives ($p < 0.0001$) (Mertens et al., 2021), (Chakravarthi et al., 2021). In 1,096 participants, exercises alone or combined yielded uncertain function differences, with no long-term data (Mertens et al., 2021). Kinect validation confirmed ROM reliability for function assessment in 27 participants (ICC 0.864-0.942 for active ROM) (Lee et al., 2015). SPADI and DASH were primary measures; long-term uncertainty stems from follow-ups limited to 3-6 months, contrasting short-term consistency.

3.3 Summary of Evidence

Theme	Key Finding	Population Applicability	Effect Direction	Confidence Level	Supporting Studies
Effectiveness of Combined Mobilization and Exercises on Pain and ROM	SMD 0.5-1.2 for ROM ($p < 0.05$); VAS decrease 1.5-2.23 cm (95% CI -3.25 to -1.22; $p < 0.01$)	Adults 40-60 years, various stages (matches question population)	Positive	Strong (consistent across multiple high-quality reviews)	Mertens et al. (Mertens et al., 2021), Kelley et al. (Kelley et al., 2013), de la Barra Ortiz et al. (Ortiz et al., 2023)
Superiority of Specific Mobilization Techniques	VAS decrease ($p < 0.0001$); superior ROM/SPADI vs. alternatives	Adults with periarthritis shoulder (matches question population)	Positive	Moderate (consistent but technique-specific)	Chakravarthi et al. (Chakravarthi et al., 2021), Gurukiran et al. (Gurukiran & Ashuthosh, 2025), Jain (Jain, 2025)

Role of Adjunct Therapies	OR 6.21 (95% CI 4.69-8.21; p < 0.001) for cupping; VAS MD -1.45 (95% CI -2.11 to -0.79; p < 0.001) for PRP; null for electrotherapy (SMD -0.28, 95% CI -0.62 to 0.06; p=0.11)	Adults 40-60 years, various stages (matches question population)	Mixed	Limited (inconsistent adjunct effects)	Zeng et al. (Zeng et al., 2022), Yu et al. (Yu et al., 2022), Brindisino et al. (Brindisino et al., 2023)
Functional Outcomes and Long-Term Evidence	SPADI decrease 10.1-12.35 (95% CI -18.72 to -3.7; p < 0.001); 70-80% functional ROM in 6 months; uncertain long-term	Adults with frozen shoulder (matches question population)	Positive (short-term); Null (long-term)	Moderate (strong short-term, limited long-term data)	Page et al. (Page et al., 2014), Poku et al. (Poku et al., 2023), Mertens et al. (Mertens et al., 2021)

4. Discussion

4.1 Principal Findings and Their Interpretation

The synthesis reveals that combining mobilization with exercises robustly alleviates pain and restores ROM in periarthritis shoulder, likely by mechanically disrupting capsular adhesions and promoting synovial fluid dynamics, as inferred from improved passive external rotation (SMD 0.8, p < 0.01) in early stages. This pattern emerges because mobilization applies targeted forces to remodel fibrotic tissue, while exercises build active control, creating a synergistic effect not evident in isolated interventions—supervised programs yield SMD 0.5-1.2 (p < 0.05) where home exercises falter due to inconsistent dosing. Confidence is high for short-term pain relief (VAS reductions of 1.5-2.23 cm, 95% CI -3.25 to -1.22) given consistent RCT evidence, but tentative for function (SPADI -10.1 to -12.35, 95% CI -18.72 to -3.7) owing to heterogeneous measures like SPADI versus DASH. No direct mechanistic data on biological pathways, such as reduced inflammation or altered collagen remodeling, were reported, representing a key gap that limits causal inference; patterns suggest physiological restoration via joint gliding, but without biomarkers, interpretations rely on clinical outcomes. This review advances understanding by highlighting technique-specific advantages (e.g., Mulligan's active glides over Kaltenborn's traction for end-range ROM, p < 0.0001), visible only through cross-study comparison, underscoring mobilization's role in accelerating the natural thawing phase for 70-80% of patients within 6 months.

4.2 Comparison with Existing Literature and Resolution of Contradictions

Findings align with prior guidelines emphasizing multimodal therapy over single modalities, as mobilization plus exercises mirrors recommended protocols for capsular stretching, explaining consistent short-term superiority (SMD 0.5-1.0, p < 0.05) through enhanced tissue extensibility not achievable via exercises alone. This mechanistic consistency bolsters robustness, as repeated RCTs confirm benefits in female-predominant cohorts aged 40-60, reflecting the condition's demographic skew. Contradictions appear in adjunct efficacy: while acupuncture-mobilization combinations reduce VAS more than acupuncture (p < 0.05), electrotherapy shows null effects (SMD -0.28, 95% CI -0.62 to 0.06; p=0.11), potentially due to high heterogeneity (I² > 75%) from variable protocols (e.g., LLLT wavelengths 780-904 nm vs. sham) and low-quality evidence (GRADE low), contrasting moderate PRP benefits (MD -1.45 VAS, p < 0.001). This may reflect genuine heterogeneity in early- versus late-stage application, where invasive adjuncts like PRP address inflammation better in freezing phases, while non-invasive electrotherapy fails amid poor penetration in fibrotic tissue; no studies directly compared stages, leaving this unsubstantiated. Publication bias risk is moderate, as positive mobilization findings dominate, possibly from selective reporting in physiotherapy contexts, though null electrotherapy results mitigate this. Recent studies (2023-2025) using Bayesian meta-analysis refine rankings (e.g., Tuina + acupuncture superior), evolving from earlier Cochrane reviews' uncertainties via advanced synthesis, enhancing reliability over fixed-site comparisons in older trials.

4.3 Practical Implications

For adults aged 40-60 years in freezing or frozen stages, integrating Mulligan or Gong's mobilization with supervised exercises (4-12 weeks, 2-3 sessions weekly) offers targeted pain relief (VAS -1.5 to -2.23 cm) and ROM gains, particularly benefiting females with idiopathic periarthritis who face 2:1 prevalence and daily activity limitations. Clinicians should prioritize these over isolated strengthening, advising progression from passive to active ROM to maximize SPADI improvements (-10.1 to -12.35 points), while monitoring for low adverse events. In public health, cost-effective programs could reduce disability in 70-80% of cases within 6 months, warranting integration into primary care for early intervention to curb work absenteeism. Regulatory implications favor conservative therapy endorsement over injections, given comparable long-term function without procedural risks, though adjuncts like PRP suit severe cases (external rotation +10.23°, p < 0.001). No safe threshold for delayed treatment

exists, as untreated progression exacerbates fibrosis, implying population-wide physiotherapy access to prevent chronicity. Caveats apply: implications derive from mixed-stage evidence, not exclusively thawing phases, and exclude secondary periarthritis; electrotherapy recommendations remain weak due to null findings.

4.4 Strengths and Limitations

Strengths include comprehensive thematic synthesis across diverse designs, prioritizing extracted data for robust comparisons, and focus on clinical outcomes relevant to periarthritis management. Limitations of included studies encompass variable quality (e.g., low GRADE for adjuncts), short follow-ups (3-6 months), and inconsistent staging, potentially inflating short-term effects. This review's limitations involve abstract-based extraction without full-text bias assessment, no formal meta-analysis computation, and reliance on aggregated samples without individual participant data.

5. Gaps and Future Directions

Evidence gaps include long-term outcomes beyond 6 months, as most studies report uncertain function persistence despite short-term SPADI gains (-10.1 to -12.35, $p < 0.001$), limiting applicability to full recovery trajectories. Mechanistic data on pathways like capsular inflammation or collagen turnover is absent, hindering causal explanations for mobilization's ROM benefits (SMD 0.5-1.2). Adjunct contradictions (e.g., positive PRP vs. null electrotherapy) stem from heterogeneous protocols, with no head-to-head trials in stage-specific populations. Underrepresented groups include secondary periarthritis (e.g., post-trauma) and older adults >60 years, where female predominance may not hold. Future RCTs should target exact periarthritis populations with standardized staging, incorporating biomarkers for mechanisms and 12-24 month follow-ups. Methodological advances like personalized dosing via Kinect ROM (ICC 0.864-0.942) and component analyses (e.g., mobilization intensity) would resolve uncertainties, alongside diverse cohorts to address demographic gaps.

6. Conclusion

Mobilization combined with exercises effectively reduces pain (VAS decreases of 1.5-2.23 cm, 95% CI -3.25 to -1.22; $p < 0.01$) and improves ROM (SMD 0.5-1.2, $p < 0.05$) and function (SPADI -10.1 to -12.35, 95% CI -18.72 to -3.7; $p < 0.001$) in adults aged 40-60 years with periarthritis shoulder across freezing and frozen stages, with moderate to strong confidence from consistent RCT syntheses, though evidence draws from mixed idiopathic cases matching the primary population. Techniques like Mulligan MWM or Gong's, integrated over 4-12 weeks, outperform alternatives for 70-80% functional recovery within 6 months, highlighting their role in disrupting adhesions without adjunct reliance. Long-term efficacy remains uncertain due to sparse follow-up data, representing the critical unresolved question for refining protocols. These findings underscore mobilization-exercise synergy's potential to enhance quality of life and reduce disability in a condition affecting daily function, motivating scalable physiotherapy adoption; further mechanistic research will solidify causal links, ensuring tailored interventions mitigate periarthritis's broader musculoskeletal burden.

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