Systematic Review and Meta-Analysis

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Effectiveness of scapular mobilization in patients with primary adhesive capsulitis

A systematic review and meta-analysis

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Abstract

Background: The aim of this study was to determine the effectiveness of scapular mobilization on range of motion, shoulder disability, and pain intensity in patients with primary adhesive capsulitis (AC).

Methods: An electronic search was performed in the MEDLINE, EMBASE, SCOPUS, CENTRAL, LILACS, CINAHL, SPORTDiscus, and Web of Science databases up to March 2023. The eligibility criteria for selected studies included randomized clinical trials that included scapular mobilization with or without other therapeutic interventions for range of motion, shoulder disability, and pain intensity in patients older than 18 years with primary AC. Two authors independently performed the search, study selection, and data extraction, and assessed the risk of bias using the Cochrane Risk of Bias 2 tool.

Results: Six randomized clinical trials met the eligibility criteria. For scapular mobilization versus other therapeutic interventions, there was no significant difference in the effect sizes between groups: the standard mean difference was -0.16 (95% confidence interval [CI] = –0.87 to 0.56; P = .66) for external rotation, –1.01 (95% CI = –2.33 to 0.31; P = .13) for flexion, –0.29 (95% CI = –1.17 to 0.60; P = .52) for shoulder disability, and 0.65 (95% CI = –0.42 to 1.72; P = .23) for pain intensity.

Conclusions: Scapular mobilization with or without other therapeutic interventions does not provide a significant clinical benefit regarding active shoulder range of motion, disability, or pain intensity in patients with primary AC, compared with other manual therapy techniques or other treatments; the quality of evidence was very low to moderate according to the grading of recommendation, assessment, development and evaluation approach.

Abbreviations: AC = adhesive capsulitis, CI = confidence interval, GRADE = grading of recommendation, assessment, development and evaluation, SMD = standard mean difference.

Keywords: adhesive capsulitis, frozen shoulder, meta-analysis, musculoskeletal manipulations, range of motion, scapular mobilization

1. Introduction

Adhesive capsulitis (AC) is a clinical condition described by Neviaser in 1945.[1] Additionally, "*frozen shoulder*" and "*scapulohumeral periarthritis*" are terms that have also been used by several authors to describe it.[2] AC is characterized by the spontaneous onset of pain and gradual, progressive loss of active and passive shoulder motion, as a consequence of chronic inflammation of the synovial membrane with progressive fibrosis and contracture of the glenohumeral joint capsule.[3] The prevalence of AC in the general population is 2% to 5%, and it most commonly affects women between 40 and 60 years.[4] Despite extensive research in this field, the etiology and pathophysiology still remains controversial.[5]

AC is classified into primary and secondary.[6] AC with insidious onset and idiopathic origin is considered primary, while secondary AC include all cases in which an underlying etiology or associated condition can be identified. This can be subdivided into 3 categories; intrinsic, extrinsic or systemic factors.[6] Traditionally, primary AC has been described as a self-limiting condition that progresses through a natural history of painful, frozen, and thawing phases, leading to full recovery without

COH and FAQ contributed equally to this work.

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treatment.[3,7] However, a recent systematic review showed a lack of evidence to support the theoretical phases of AC.[8]

Conservative treatment is recommended as the first line of clinical management of primary AC.[9] Several systematic reviews have been evaluated the clinical effectiveness of physiotherapy interventions, such as: different types of therapeutic exercise (i.e., codman, functional, isometric, stretching, or proprioceptive neuromuscular facilitation exercises);[10–14] physical agents (i.e., ultrasound, deep heat, or electrotherapy);[13,15–17] and manual therapy techniques (i.e., glenohumeral, scapulothoracic, acromioclavicular, sternoclavicular and cervical spine mobilizations, Mulligan mobilization with movement, muscular energy techniques, or myofascial release).[10,13,18–22] Regarding the manual therapy, usually these techniques have been primarily focused on mobilization of the glenohumeral joint in these patients.[18]

Currently, optimal scapular position and motion are considered essential for normal shoulder function.[23] In this sense, the association between altered scapular kinematics and AC has been previously established.[24–26] Compared with the unaffected side and healthy participants, patients with AC showed an increase in upward and scapular external rotation.[24,25] Additionally, there is a trend in posterior tilt decrease, but this is not significative in all studies.[26] According to this, several authors have proposed that altered scapular kinematics could be a key mechanism behind the symptoms associated with AC.[23–26] Therefore, this biomechanical factor highlights the need to include the scapula when developing treatment strategies in these patients.

In recent decades, physiotherapists have used manual therapy with or without therapeutic exercise to improve the range of motion and shoulder function in patients with primary AC.[10,18,22] Indeed, scapular mobilization is a manual therapy technique widely used in the management of musculoskeletal disorders of the shoulder; it involves the manual application of a sustained mobilization (in 4 directions) to the scapulothoracic joint.[27] However, despite the biomechanical foundations, clinical rationale how improving range of motion or shoulder function using a passive scapular joint mobilization technique remains unclear.[28]

Conversely, several clinical trials have been studied the effects of scapular mobilization in patients with AC.[29–34] However, there is a considerable uncertainty concerning the effectiveness of scapular mobilization in restoring normal range on motion in these patients. According to our knowledge, no previous systematic reviews have studied the effects of this manual therapy technique on clinical outcomes in patients with primary AC. Therefore, the aim of this systematic review with meta-analysis was to determine the effectiveness of scapular mobilization with or without other therapeutic interventions on shoulder range of motion, shoulder disability, and pain intensity in patients with primary AC.

2. Methods

2.1. Protocol and registration

This systematic review and meta-analysis was performed and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement and followed the recommendations of the Cochrane Collaboration Handbook.[35,36] The registration number in the International Prospective Register of Systematic Reviews is CRD42021290871. Since all data included are published in randomized clinical trials, this systematic review did not require ethical approval.

2.2. Eligibility criteria

Studies that met the following criteria were considered: Population: patients over 18 years with medical diagnosis of unilateral idiopathic or primary AC, with the presence of pain and limited range of motion in the affected shoulder for at least 3 months; Type of intervention: patients treated with passive scapular mobilization with or without other therapeutic interventions (i.e., exercises, physical agents, or other manual therapy techniques); Type of comparison: patients treated with other interventions such as exercises, physical agents (i.e., extracorporeal shockwave, ultrasound, transcutaneous electrical nerve stimulation, or hot packs), or other manual therapy techniques (i.e., massage, joint mobilizations, manipulations, Mulligan mobilization with movement, or myofascial release); Types of outcomes: the primary outcome was passive or active shoulder range of motion, the secondary outcomes were shoulder disability, or pain intensity; and Types of studies: randomized clinical trials or controlled clinical trials.

The exclusion criteria were as follows: Studies involving patients with secondary AC; Studies involving patients with other pathologies of the shoulder joint complex, such as fractures/dislocations, severe osteoarthritis in the acromioclavicular or glenohumeral joint, glenohumeral instability such as anteroinferior labral (Bankart), superior labrum anterior to posterior, or partial or full-thickness rotator cuff tears in the affected shoulder; Studies involving patients with a history of acute trauma or previous surgery in the affected shoulder; Studies involving patients treated with corticoid injection in the affected shoulder in the last 12 months; or Studies involving patients with rheumatologic (i.e., rheumatoid arthritis or systemic lupus erythematosus), neurological (i.e., stroke, Alzheimer or Parkinson's), or systemic diseases (i.e., diabetes or thyroid disease).

2.3. Electronic search

We systematically searched MEDLINE (via PubMed), EMBASE, SCOPUS, the Cochrane Central Register of Controlled Trials (CENTRAL), the Latin American and the Caribbean Literature in Health Sciences (LILACS), the Cumulative Index to Nursing and Allied Health Literature (CINAHL), SPORTD iscus, and Web of Science databases from inception until March 2023. The search strategies for each database are available in the supplemental content (see Table S1, Supplemental Digital Content, http://links.lww.com/MD/J58).

2.4. Study selection

Two authors (CO-H and VM-R) independently screened the titles and abstracts of the references retrieved from the searches. We obtained the full text for references that either author considered to be potentially relevant. We involved a third reviewer (FA-Q) if consensus could not be reached.

2.5. Data collection process

Two authors (IC-V and EE-F) independently extracted relevant data for each trial. The following data were extracted from the original reports: Authors and year of publication; Country; Sample characteristics (sample size, age, distribution, and sex); Characteristics of scapular mobilization group; Characteristics of comparison group; Length of follow-up and main outcomes; and Main results.

2.6. Risk of bias in individual studies

The risk of bias 2 assessment was performed using the Cochrane RoB tool.[37] This tool assesses the RoB according to the following 6 domains: bias arising from the randomization process, bias due to deviations from intended interventions, bias due to missing outcome data, bias in measurement of the outcome, bias in selection of the reported result, and overall bias. Each domain could be considered as "low," "some concerns," or "high" RoB.

Data extraction and quality assessment were independently performed by 2 reviewers (FA-Q and CO-H). We involved a third reviewer (HG-E) if a consensus could not be reached. The agreement rate between the reviewers was calculated using kappa statistics.

2.7. Statistical methods

Active shoulder range of motion (glenohumeral external rotation and flexion), shoulder disability, and pain intensity were analyzed as continuous outcomes; the effect size was calculated as the standard mean difference (SMD). We calculated the SMD score by using Cohen d as the effect size statistic, considering the effect to be trivial (< 0.2), small (0.2–0.5), medium (0.6–0.8), or large (> 0.8).[38] Additionally, depending on the heterogeneity of the data, the Hartung-Knapp-Sidik-Jonkman random effect or Mantel–Haenszel fixed effect methods were used to quantify the pooled effect size of the studies included; the effect sizes were presented as SMD and respective 95% confidence intervals (CIs) in a range between 2 and −2. The heterogeneity of results across studies was evaluated using the I^2 statistic, which considers 0 to 40% as "may not be important," 30% to 60% as "moderate," 50% to 90% as "substantial," and 75% to 100% as "considerable" heterogeneity.[35] We additionally considered visual inspection for overlapping CIs in the forest plots, as well as the corresponding p-values. The meta-analysis was performed with RevMan 5.4 (Copenhagen, The Nordic Cochrane Centre, The Cochrane Collaboration).

2.8. Rating the quality of evidence

The synthesis and quality of evidence for each outcome were assessed using the Grading of Recommendation, Assessment, Development and Evaluation (GRADE).[39] The quality of the evidence was classified into 4 categories: high, moderate, low, and very low.[40] We used the GRADE profiler (GRADEpro) to import the data from RevMan 5.4 to create a "summary of findings" table.

3. Results

3.1. Study selection

A total of 127 studies were found through electronic searches (Fig. 1). Finally, 6 trials met the eligibility criteria and were included in this systematic review.[29–34] The kappa agreement rate between reviewers was 0.91. The excluded studies and the reasons for their exclusion are available in Table S2, Supplemental Digital Content, http://links.lww.com/MD/J59.

3.2. Study characteristics

A summary of the included studies is presented in Table 1. The overall population included 258 patients (124 in the scapular mobilization group and 134 in the other treatments group). The mean age was 52.8 years (± 2.1) and the mean follow-up was 31 days (1 to 84).

3.3. Risk of bias assessment in individual studies

The RoB2 assessment is presented in Figures 2 and 3. For the overall bias, 33.3% of the trials were scored as "high risk" of bias,[29,32] 50% were scored as "some concerns,"[30,33,34] and 16.7% were scored as "low risk" of bias.[31] For the randomization process, 33.3% of the clinical trials were scored as "high risk,"[29,32] 33.3% as "some concerns,"[30,33] and 33.3% as "low risk" of bias.[31,34] For the missing outcome data, 100% of the trials were scored as "low risk."[29–34] Finally, for the selection of the reported result, 83.3% of the trials were scored as "some concerns."[29–31,33,34]

3.4. Synthesis of results

3.4.1. Shoulder range of motion

3.4.1.1. External rotation Five studies included data used to perform a meta-analysis of glenohumeral active external rotation measured with a goniometer.[29–33] Two studies showed no significant difference in the pooled SMD estimate between scapular mobilization versus other techniques (SMD = −0.79, CI = −1.98 to 0.41, P = .20), with a substantial heterogeneity (I^2 = 88%, P = .004).[29,30] Three studies showed no significant difference in the pooled SMD estimate between scapular mobilization versus other treatment (SMD = 0.27, CI = −0.58 to 1.13, P = .53), with a substantial heterogeneity (I^2 = 80%, P = .007).[31–33] The overall effect size in the pooled SMD estimate was −0.16 (trivial effect size), CI −0.87 to 0.56, P = .66, with a substantial heterogeneity (I^2 = 85%, P < .0001). These results are presented in Figure 4. There was a very low quality of evidence according to the GRADE rating.

3.4.1.2. Flexion Three studies included data used to perform a meta-analysis of glenohumeral active flexion measured with a goniometer.[29–31] Two studies showed no significant difference in the pooled SMD estimate between scapular mobilization versus other techniques (SMD = −0.96, CI = −3.31 to 1.39, P = .42), with a considerable heterogeneity (I^2 = 96%, P < .00001).[29,30] One study showed a significant difference in the pooled SMD estimate between scapular mobilization versus other treatment (SMD = −1.14, CI = −1.69 to −0.59, P < .0001).[31] The overall effect size in the pooled SMD estimate was −1.01 (large effect size), CI −2.33 to 0.31, P = .13, with a considerable heterogeneity (I^2 = 93%, P < .0001). These results are presented in Figure 5. There was a moderate quality of evidence according to the GRADE rating.

3.4.2. Shoulder disability Three studies included data used to perform a meta-analysis of shoulder disability measured with questionnaires. [31–33] These studies showed no significant difference between scapular mobilization versus other treatment; the overall effect size in the pooled SMD estimate was −0.29 (small effect size), CI = −1.17 to −0.60, P = .52, with a substantial heterogeneity (I^2 = 81%, P < .005). These results are presented in Figure 6. There was a very low quality of evidence according to the GRADE rating.

3.4.3. Pain intensity Four studies included data used to perform a meta-analysis of pain intensity.[29–32] Two studies showed no significant difference in the pooled SMD estimate between scapular mobilization versus other techniques (SMD = 1.15, CI = −0.77 to 3.06, P = .24), with a considerable heterogeneity (I^2 = 95%, P < .0001).[29,30] Two studies showed no significant difference in the pooled SMD estimate between scapular mobilization versus other treatment (SMD = 0.15, CI = −1.59 to 1.89, P = .86), with a considerable heterogeneity (I^2 = 93%, P = .0002).[31,32] The overall effect size in the pooled SMD estimate was 0.65 (medium effect size), CI −0.42 to 1.72, P = .23, with a considerable heterogeneity (I^2 = 92%, P < .0001). These results are presented in Figure 7. There was a very low quality of evidence according to the GRADE rating.

The overall quality and summary of evidence with the GRADE approach is presented in.

see Table S3, Supplemental Digital Content, http://links.lww.com/MD/J60.

4. Discussion

This systematic review and meta-analysis aimed to determine the clinical effectiveness of scapular mobilization in patients with primary AC. The main findings of our study were that passive scapular mobilization with or without other therapeutic interventions does not provide a significant clinical benefit regarding active shoulder range of motion, disability, or pain

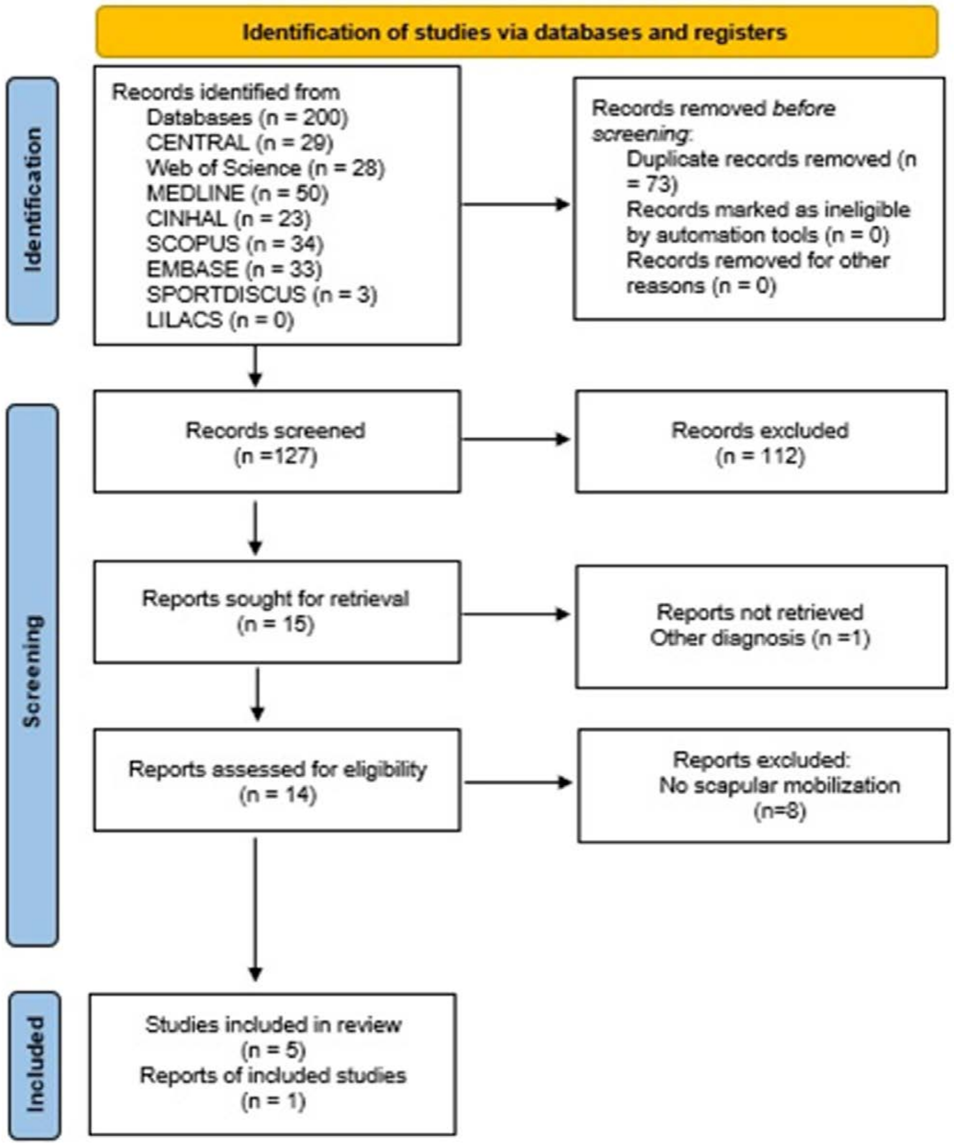

Figure 1. PRISMA flowchart diagram. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

intensity in these patients, compared with other manual therapy techniques or other treatments.

Regarding AC diagnosis, there is no established reference standard and it is often a diagnosis of exclusion based entirely on clinical history and physical examination.[41] However, the evidence for clinical examination validity and reliability is low.[5] Additionally, AC it is frequently poorly diagnosed, due to factors such lack of agreement on definitions and/or classifications, confusing terminology, and difficulty in distinguishing it from other shoulder conditions.[42] Despite this, all trials included in this systematic review recruited patients with a clinical diagnosis of unilateral primary AC, in stage 2 or 3 with a time of 3 to 9 months of clinical evolution.[29–34]

Regarding the evidence analyzed, there is high heterogeneity in the therapeutic interventions with which scapular mobilization was compared. Three clinical trials studied different manual therapy techniques; manual posterior capsule stretching, end-range of glenohumeral joint mobilization, and mobilization with movement of glenohumeral joint.[29,30,34] Other comparisons involved a technique of myofascial release of subscapularis muscle, and conventional treatment that included different types of therapeutic exercises.[31–33] The application of scapular mobilization included glide superior, inferior, distraction, upward and downward rotation, and the studies considered a treatment period of between 2 to 12 weeks. There is also variability about the dose used, with a range between 2 to 5 times per week.

In patients with AC, biomechanical foundations usually indicate that alterations of scapular kinematics are due to a tension of the posterior capsule, which causes the scapula and the humerus to act as a single entity, reducing the sliding of the humeral head.[11,30] Among the most limited movements are scapular depression, downward rotation, posterior tilt, and internal scapular rotation.[24–26,43] Subsequently, this stiffness produces an increased upper and external rotation of the scapula as a compensatory mechanism when the patient performs a shoulder elevation.[24,43] Based on this, the main effects attributed to scapular mobilization include: decreased pain due to stimulation of mechanoreceptors and inhibition of nociceptive information in the dorsal horn of spinal cord; and decrease adhesion of the muscles around the scapula.[30,44] Despite this, our findings showed that scapular mobilization did not present better clinical outcomes compared to other therapeutic interventions. Accordingly, we believe that the addition of scapular mobilization is not required for all patients with primary AC to achieve these clinical benefits.

Currently, concept of natural history of the disease such benign nature and self-limited course is controversial.[8,18] Prospective

Table 1

Characteristics of the included studies.

Author	Country	Population: Sample size (n)	Population: Age yr (mean ± SD)	Intervention: Therapeutic interventions	Intervention: Characteristics/dose	Outcomes	Follow -up	Results
Boruah et al, 2015	India	IG1: 25 IG2: 25	IG1: 49.76 (3.49) IG2: 50.04 (3.34)	IG1: Mobilization with Movement IG2: Scapular Mobilization	IG1: Technique was performed on the involved shoulder as described by Mulligan - 5 sessions in a wk for 3 wk. IG2: Mobilization included superior glide, inferior glide, upward rotation, downward rotation, and distraction - 5 sessions in a week for 3 wk.	SPADI pain score AROM Flex - ER	3 wk	SPADI $P < .001$ AROM flex $P < .001$ AROM ER $P < .001$
Duzgun et al, 2019	Turkey	IG1: 27 IG2: 27	IG1: 51.2 (9.08) IG2: 53.04 (7.8)	IG1: Scapular mobilization IG2: Manual posterior capsule stretching.	IG1: Supero-inferior and circumduction movements 10 times each. A 30-s break was given between each practice. 1 session IG2: Stretching was applied from the elbow with a downward force, was repeated 10 times for 20 s each. A 30-s break was given between each stretching.1session	AROM Flex – ABD – IR – ER Active elevation Active IR Posterior capsule length Pain rest - activity - night	1 d	AROM flex – IR -ABD $P < .001$ AROM ER $P = .106$ Active elevation $P < .001$ Active IR $P = .001$ Posterior capsule Length $P = .201$ Pain rest - Activity - night $P > .05$
Kumar et al, 2016	India	CG: 30 IG: 30	CG: 53.8 (4.76) IG: 54.26 (5.99)	CG: Conventional physical therapy. IG: Scapular mobilization.	CG: Capsular stretching, range of motion ROM and pendulum exercises. Period lasted for 5 days a week for 4 wk. IG: Maitland technique of SM included protraction, retraction, depression, elevation, and rotation. Protraction. Period lasted for 5 days a week for 4 wk.	AROM Flex – ABD – IR – ER PROM Flex – ABD – IR – ER SPADI Total – Pain - disability NPRS	12 wk.	AROM flex – ABD–ER $P < .05$ AROM IR $P = .052$ PROM flex – ABD – IR – ER $P < .05$ SPADI total – pain – disability $P < .05$ NPRS $P < .05$
Preagassame et al, 2019	India	IG: 15 CG: 15	IG: 51.73 (7.70) CG: 51.40 (7.37)	IG: Scapular mobilization. CG: Conventional treatment.	IG: Mobilisation included glade superior, inferior, distraction, upward and downward rotation. The total duration of treatment was 10 days; the frequency was 1 session/day. CG: Wax therapy, capsular stretching, and home exercises. The total duration of treatment was 10 days; the frequency was 1 session/day.	AROM ABD – ER Constant score NPRS	10 Days	AROM ABD – ER $P = .001$ Constant score $P = .001$ NPRS $P = .001$
Sinha et al, 2019	India	IG1: 15 IG2: 17	IG1: 52.0 (7.22) IG2: 55.13 (6.23)	IG1: Scapular mobilization. IG2: Myofascial release of subscapularis.	IG1: Grade III and IV Maitland scapular mobilization was performed of 10 repetitions were applied - 5 sessions in a week, for 2 wk. IG2: Myofascial release utilizing a combination of sustained manual pressure and slow deep strokes to the subscapularis muscle for 7 minutes - 5 sessions in a week, for 2 wk.	NPRS AROM ER SPADI	2 wk	NPRS $P = .19$ AROM ER $P = .57$ SPADI $P = .80$
Yang et al, 2011	Taiwan	IG1: 10 IG2: 12 CG: 10	IG1:56.8 (7.2) IG2:54.9 (10.3) CG: 54.3 (7.6)	IG1: End-range mobilization. IG2: Scapular mobilization. CG: Standardized treatment	IG1: Grade IV anterior-posterior mobilization into a position of maximal humeral elevation - twice a week for 3 months. IG2: Mobilization superiorly and inferiorly, upward, and downward for rotation - twice a week for 3 months. CG: Passive mid-range mobilization, flexion and abduction stretching techniques, physical modalities, and active exercises. - twice a week for 3 months.	PROM ER – IR -ABD Distance HBB FLEX-SF Kinematic upward – tilt posterior - scapulohumeral rhythm	8 wk	PROM ER – IR -ABD $P < .05$ HBB $P > .05$ FLEX-SF $P < .05$ Kinematic $P < .05$

ABD = Abduction, AROM = Active range of motion, CG = Control group, ER = External rotation, FLEX = Flexion, FLEX-SF = Flexi level Scale of Shoulder Function, HBB = Hand behind back, IG = Intervention Group, IR = Internal rotation, NRPS = Pain intensity- numerical rating scale, PROM = Passive range of motion, SD = Standard deviation, SPADI = Shoulder pain and disability index.

and long-term studies have reported variable percentages of loss of range of motion, pain and disability in patients with primary AC.[18,45,46] Regarding the glenohumeral motion restrictions, the authors report a significant restriction in 90% of patients at 7 months of follow-up,[47] and between 30% and 50% of patients present mild or moderate restriction in a follow-up of 3 to 10 years.[45,46,48,49] This is relevant, especially when evidence suggests that the theory of self-resolution of motion is increasingly uncertain.[8] Accordingly, we defined that the primary outcome of our systematic review should be glenohumeral range of motion. Interestingly, in none of the included studies was passive or active range of motion the primary outcome. We believe that difficulties in the range of motion assessment position, especially glenohumeral external rotation, could be the explanation of this finding.

The clinical implications of our results are limited by the quality and quantity of the available evidence. Moderate quality of evidence suggests that Mulligan mobilization with movement, manual glenohumeral posterior capsule stretch, or multidirectional scapular mobilization could be used indistinctly to increase the active shoulder flexion range of motion in patients

Figure 2. Risk of bias summary: review author's judgements about each risk of bias item for each included study.

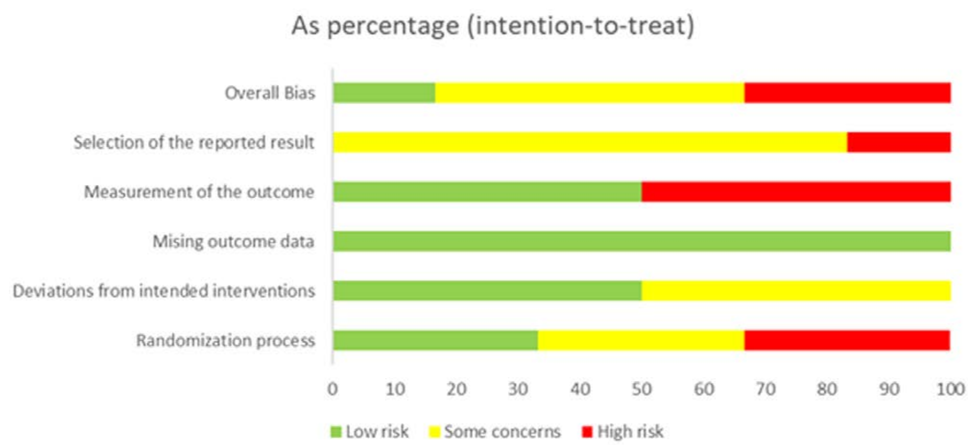

Figure 3. Risk of bias graph: review authors judgments about each risk of bias item presented as percentages across all included studies.

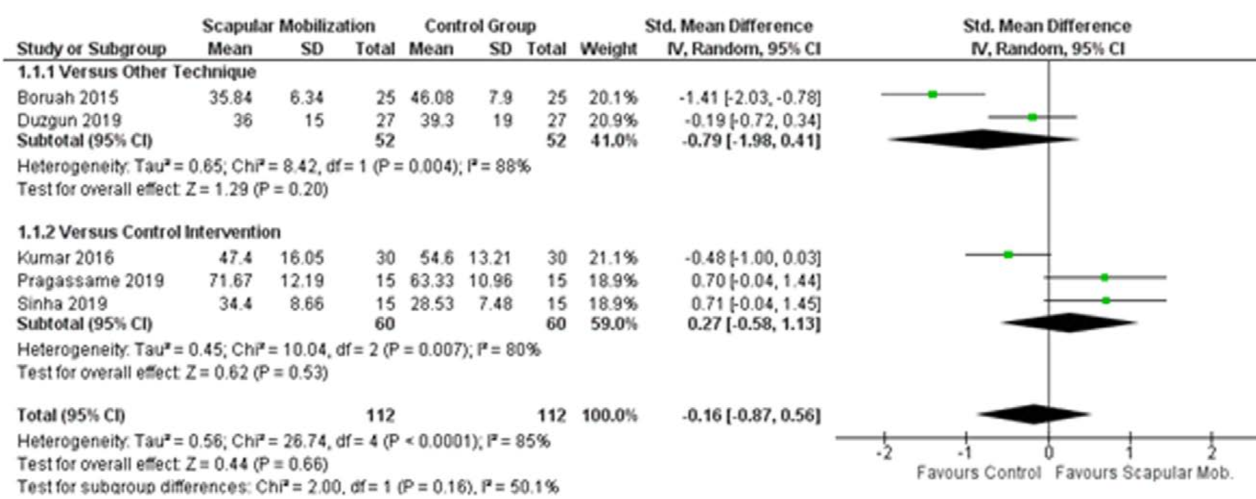

Figure 4. Forest plot of active shoulder external rotation.

with primary AC. Based on our findings, it is not possible to make clinical recommendations as to which manual therapy techniques might be useful for pain relief, improved function or reduced disability, and increased glenohumeral external rotation range of motion in these patients. Additionally, it is also possible that there may be subgroups of patients with primary AC for whom passive scapular mobilization is beneficial; however, no studies have established the characteristics that may help identify them.

Some limitations in our study should be acknowledged. First, even though we searched 8 databases and included articles in 2 different languages, we might have missed articles relevant to our search. Second, in the planning stages, we proposed to perform subgroup analyses based on the doses of scapular mobilization or stage of AC. However, we were unable to do this due to the high clinical heterogeneity of the studies included. Third, the lack of an adequate sample size, unclear concealed allocation, and the lack of blinding of patients and assessors in the included studies,

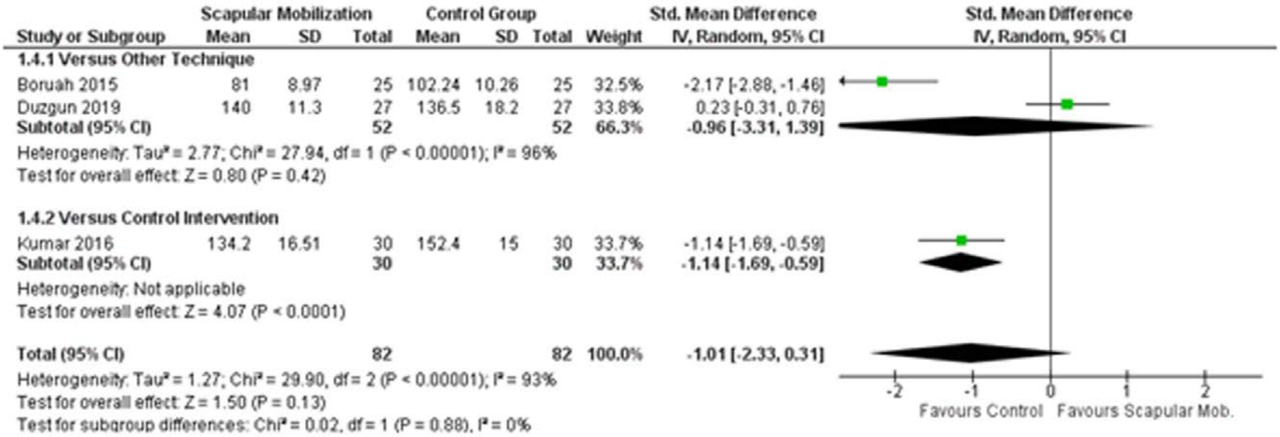

Figure 5. Forest plot of active shoulder flexion.

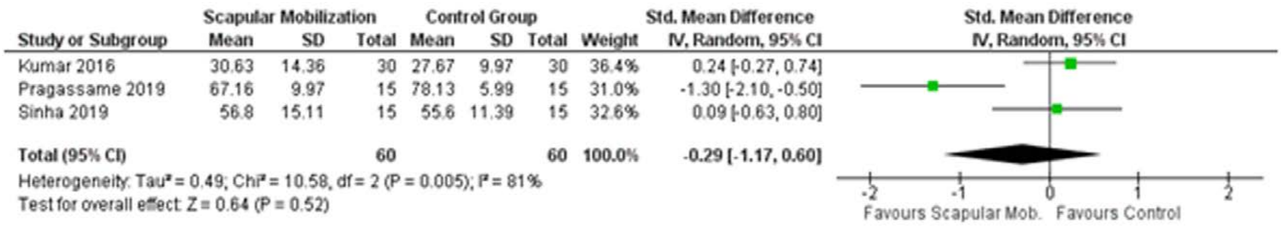

Figure 6. Forest plot of shoulder disability.

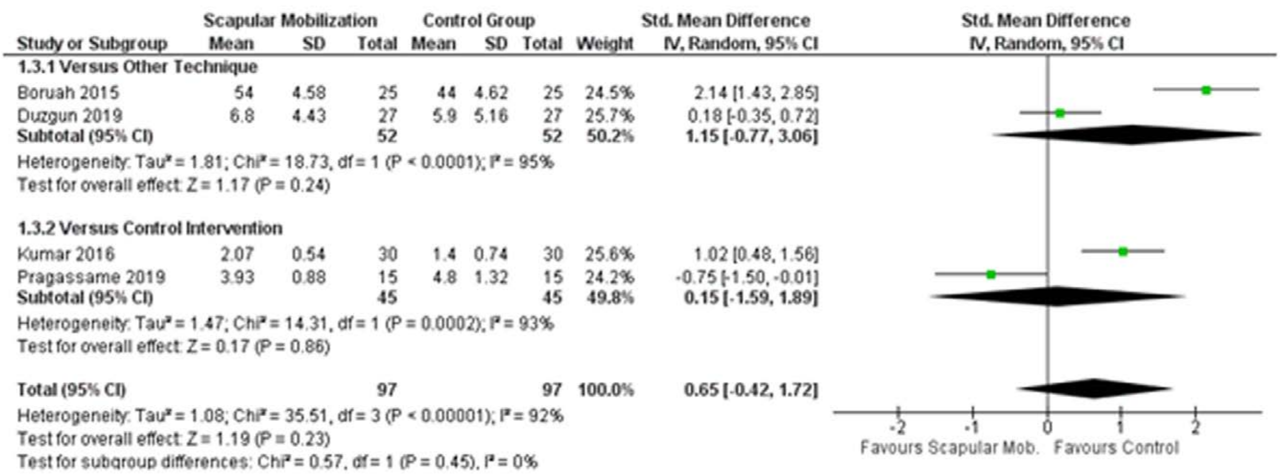

Figure 7. Forest plot of shoulder pain intensity.

could have led us to overestimate the effect size of the interventions studied. Fourth, despite altered scapular kinematics is report in high percentage of patients with primary AC, it relationship is not clearly defined. Altered scapular kinematics may be the cause or the result of a shoulder dysfunction, exacerbate shoulder symptoms or adversely affect treatment or outcomes. Finally, our results should be interpreted with caution in relation to the methodological limitations, high heterogeneity of studies included, and the limited strength of available evidence.

5. Conclusion

Scapular mobilization with or without other therapeutic interventions does not provide a significant clinical benefit regarding active shoulder range of motion, disability, or pain intensity in patients with primary AC, compared with other manual therapy techniques or other treatments; the quality of evidence was very low to moderate according to the GRADE approach. There is a need for higher-quality randomized clinical trials investigating the specific effects of scapular mobilization techniques, including a possible dose-response relationship in the treatment of these patients.

Author contributions

Conceptualization: Cristian Olguín-Huerta, Felipe Araya-Quintanilla, Victoria Moncada-Ramirez, Héctor Gutiérrez Espinoza.
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