ISSN:3139-0935(Online)

Intemed: International Journal of Research in Integrated Medical Sciences (IJ-RIMS)

Journal homepage: www.intemed.in

Vol.: 2 | Issue: 10 | Oct 2026

Article History: Received: 19-10-2026 Accepted: 21-10-2026 Published:30-10-2026

DOI: doi.org/10.68108/intemed.v2.i10.20

Research Article

GONG'S MOBILIZATION COMPARED WITH THREE-DIRECTIONAL CAPSULAR STRETCHING FOR PAIN, SHOULDER MOVEMENT AND FUNCTION IN STAGE II ADHESIVE CAPSULITIS

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Ethical Clearance:
Institutional Review Board, PES Modern College of Physiotherapy.

ABSTRACT:

Background: In frozen shoulder, fibrosis and adhesion of the joint capsule produce pain, stiffness and a steadily worsening loss of movement. Two manual approaches are widely used: Gong's mobilization, which works at the end of the available range, and capsular stretching applied in three directions. Few studies have compared them directly.

Aim: To compare Gong's mobilization with three-directional capsular stretching for pain, range of motion and functional mobility of the shoulder in adhesive capsulitis.

Methodology: Seventy patients with stage II adhesive capsulitis took part in this experimental study and were divided by odd–even allocation into two equal groups. Group A was treated with Gong's mobilization and Group B with three-directional capsular stretching; both groups also did the same conventional exercises, for 12 sessions spread over 3 weeks. Outcomes were pain on the Numerical Pain Rating Scale, goniometric range of motion and the Constant–Murley Score.

Results: Every outcome improved significantly within both groups ($p < 0.001$). Mean pain fell from 5.14 to 1.54 in Group A and from 5.26 to 2.31 in Group B, and the Constant–Murley Score rose from 51.49 to 70.66 and from 50.63 to 57.37, respectively. Group A gained significantly more than Group B in pain relief, flexion, abduction, internal rotation, external rotation and function.

Conclusion: Each technique helped patients with stage II adhesive capsulitis, but Gong's mobilization gave the larger gains in pain, movement and function.

Keywords: Adhesive capsulitis; Gong mobilization; Three directional capsular stretching; Pain; Range of motion; Functional mobility; Constant Murley Score; Physiotherapy

INTRODUCTION

Adhesive capsulitis (AC), or frozen shoulder, develops slowly: the shoulder becomes painful and both active and passive movement are lost, chiefly because adhesions form inside the glenohumeral (GH) joint capsule [1]. Between 2% and 5% of people are affected, and mobility declines as the condition advances. Movement is reduced in every direction, but flexion, abduction and external rotation usually suffer most [2]. Why the condition starts is still not clear; tissue studies show inflamed synovium and a capsule that becomes increasingly fibrotic. Physiotherapy is regarded as effective, and commonly combines joint mobilization, stretching, range-of-motion (ROM) and strengthening exercise, cold packs, ultrasound and Codman's pendulum exercises [2].

Women develop AC more often than men. Four stages are described. In the first, pain at night predominates while joint movement is still largely preserved. The freezing stage, roughly the third to ninth month, brings marked pain together with stiffness. In the frozen stage, from about the ninth to the fourteenth month, movement is severely limited and pain is felt mainly at the end of range. Recovery follows in the thawing stage (about 15 to 24 months), when pain settles and movement slowly returns, though some stiffness remains [3].

Diabetes is closely linked with AC, and the International Diabetes Federation expects 642 million people worldwide to have diabetes by 2040. Raised blood glucose is thought to drive inflammation and thickening of the capsule, which in turn leads to scarring, adhesions, pain and stiffness [4]. Mechanically, the problem lies mainly in the contracted capsule. A tight anterosuperior capsule blocks external rotation with the arm at the side, a tight anteroinferior capsule blocks external rotation in abduction, and a tight posterior capsule chiefly restricts internal rotation [4].

Mobilization of the joint aims to ease pain and restore movement. By separating (traction) or sliding (glide) the joint surfaces, the therapist stretches the adherent capsule and restores accessory motion without compressing the joint [5]. The force used is chosen from the Maitland grades according to how much discomfort the patient can tolerate. In Gong's mobilization the shoulder is taken to the end of its available range before the technique is applied, so it is also called end-range mobilization. Gong reported an immediate gain in shoulder ROM with this method, and found that giving it in side-lying, where gravity and acceleration act together and the patient is stable and comfortable, increased abduction more than giving it in sitting [6].

Stretching of the capsule is another option. It may lower the pressure inside the joint, open the space between the joint surfaces and help release synovial fluid, which nourishes the capsule and improves joint play [5]. Passive stretching places the capsule under greater tension and may loosen adhesions. The individual stretches can be chosen to suit the parts of the capsule that are tight [5].

Earlier trials found Gong's mobilization to work better than mobilization with movement [1], conventional physiotherapy in patients with type II diabetes [4], muscle energy technique [7] and the Spencer technique [8]. Three-directional capsular stretching has been tested against angular joint mobilization [9]. Both techniques are widely used in the clinic, yet they have rarely been compared with each other. We therefore set out to compare their effects on pain, ROM and functional mobility of the shoulder in patients with AC.

MATERIALS AND METHODS

Study Design and Setting

This was an experimental study in which two groups received different techniques, each together with the same conventional physiotherapy program. Patients were recruited from physiotherapy outpatient departments in and around Pune over 18 months. The Institutional Review Board approved the study before it began.

Sample Size

The sample size formula used was $n = (Z\alpha/2 + Z\beta)^2 \times 2SD^2 / (M1 - M2)^2$, taking $Z\alpha/2 = 1.96$ (two-tailed 5% significance), $Z\beta = 0.84$ (80% power), SD = 1.43, M1 = 3.4 and M2 = 4.4. The result, 32.14, was rounded up to 33 per group, then to 35 per group (70 overall) to allow for a 5% dropout. Purposive sampling was used.

Inclusion Criteria

1. Aged between 40 and 60 years, the age group in which adhesive capsulitis is most common.
2. Men and women [2].
3. Unilateral stage II adhesive capsulitis diagnosed by a physician [2].
4. Pain, stiffness and loss of active and passive movement following the capsular pattern (external rotation, abduction, internal rotation) [1].
5. Flexion and abduction limited to between 90° and 120°.
6. Pain rated 4 to 6 on the Numerical Pain Rating Scale (NPRS).

Exclusion Criteria

1. Another musculoskeletal problem, or a systemic illness such as thyroid disease [4].
2. A recent upper-limb fracture treated conservatively, or recent upper-limb surgery.
3. Malignancy, earlier surgery, infection, injury or a neurological condition involving the affected shoulder [2].

4. A corticosteroid injection, or any earlier treatment or exercise programme for the current episode of frozen shoulder [1].
5. Hypertension or another cardiac condition.
6. Blood glucose at or above 220 mg/dL, or diabetes medication not taken regularly.
7. Any contraindication to joint mobilization.

Procedure

Eighty-two patients were screened, and those who met the selection criteria were invited to take part. Each was told in simple language what the study involved, how long treatment would last, how they would be assessed, what benefit might be expected and that they could leave the study whenever they wished. All gave written informed consent, and their demographic details were entered on a data collection sheet. After the baseline assessment, the 70 participants were assigned by the odd-and-even method to Group A (n = 35; Gong's mobilization plus conventional physiotherapy) or Group B (n = 35; three-directional capsular stretching plus conventional physiotherapy). Both groups were treated four times a week for three weeks, giving 12 sessions. Pain and ROM were recorded at baseline and at the 4th, 8th and 12th sessions, and the Constant–Murley Score before the first and after the last session. The same measures and the same standard procedures were used at every assessment.

Outcome Measures

1. **Numerical Pain Rating Scale:** patients rate their pain on an 11-point scale, where 0 means no pain and 10 the worst pain imaginable. Reported validity coefficients lie between 0.86 and 0.95, with reliability of 0.95–0.96 [10].
2. **Universal goniometer:** all movements were measured with the patient lying supine. Flexion: axis at the centre of the humeral head close to the acromion, fixed arm along the mid-axillary line, moving arm along the shaft of the humerus. Abduction: axis on the front of the acromion, fixed arm parallel to the sternum, moving arm along the front of the humerus. Internal and external rotation: shoulder in 90° abduction with the elbow bent, axis on the olecranon, fixed arm parallel or perpendicular to the floor and moving arm along the ulna towards the ulnar styloid.
3. **Constant–Murley Score (CMS):** a 100-point measure of shoulder function (ICC 0.80–0.87) [11]. Thirty-five points come from the patient's report (pain 15, daily activities 20) and 65 from examination (active ROM 40, strength 25).

Interventions

Group A – Gong's mobilization [2,4] (Figure 1): The patient lay on the unaffected side or sat on a high seat with the affected shoulder upward. The therapist supported the elbow, flexed to 90°, with one hand so that the shoulder rested in 90° of abduction with the humerus upright. The other hand pushed the humeral head from front to back while the therapist lifted their own body slightly to draw gently on the anterior capsule. Each stretch lasted 10–15 seconds with 5 seconds of rest in between, continued for about 2–3 minutes. The patient then lifted the arm into abduction, keeping the elbow bent and avoiding external rotation; the therapist kept up the posterior pressure and distraction, moved with the arm at the same speed and added acceleration at the end of range. Maitland grade III and IV mobilizations came next, finishing with a grade IV stretch held for about 5–7 seconds.

Group B – Three-directional capsular stretching [5,12] (Figure 2): Three parts of the capsule were stretched. For the anterior capsule, the seated patient's arm was taken backwards and held for 20–30 seconds. For the posterior capsule, the arm was brought across the chest and held for 20–30 seconds. For the anterior-inferior capsule, the arm was raised as far as it would go and held for 20–30 seconds.

Conventional physiotherapy (both groups) (Figure 3): (1) wand exercises in standing into flexion, abduction and internal and external rotation, 20 repetitions in each direction, 2 sets, 5-second hold; (2) finger ladder, holding the highest position for 5–10 seconds, 10 repetitions; (3) scapular retraction with a 5-second hold, 10 repetitions; (4) Codman's pendulum exercises forwards and backwards, side to side and in circles, 10 repetitions.

Statistical Analysis

Data were recorded in Microsoft Excel and analysed with SPSS version 26.0. Results are given as mean ± standard deviation (SD), and $p < 0.05$ was taken as significant. The Shapiro–Wilk test was used to check normality. For NPRS, flexion, abduction, internal rotation and CMS, change over time within each group was tested with the Friedman test, followed by Wilcoxon signed-rank tests with Bonferroni correction, and the two groups were compared with the Mann–Whitney U test. External rotation data were normally distributed, so the paired t-test was used within groups and the independent samples t-test between groups.

RESULTS

No participant dropped out, so all 70 were analysed (Group A: 10 men, 25 women; Group B: 13 men, 22 women). The groups were of similar age (48.51 ± 5.98 versus 48.49 ± 5.76 years; Mann–Whitney U test, $p = 0.967$), and their baseline scores on every outcome were alike (Table 1).

Pain

In Group A, mean NPRS dropped steadily from 5.14 ± 0.85 at baseline to 3.74 ± 0.95 at the 4th session, 2.80 ± 0.76 at the 8th and 1.54 ± 0.74 at the end of treatment. The corresponding values in Group B were 5.26 ± 0.74, 4.06 ± 0.73, 3.31 ± 0.76 and 2.31 ± 0.63. Both groups changed significantly over time on the Friedman test ($p < 0.001$), the Bonferroni-corrected Wilcoxon post hoc comparisons were significant, and Group A's fall in pain was significantly larger (Table 2).

Range of Motion

All four movements improved significantly in both groups ($p < 0.001$; Table 1). Flexion in Group A increased quickly and steadily, most noticeably between the 4th and 8th sessions, whereas Group B improved only slightly at first and then markedly by the final assessment; final flexion was 161.49° and 146.83°, respectively. From the 4th session onward, abduction also rose faster in Group A, and Group A pulled ahead in internal and external rotation in the later sessions. Mean gains in Group A versus Group B were 59.23° versus 43.17° for flexion, 55.51° versus 21.49° for abduction, 25.11° versus 12.69° for internal rotation, and 25.34° versus 10.83° for external rotation, each difference being significant ($p < 0.001$; Table 2). Abduction showed the widest gap between the groups.

Functional Mobility

Baseline CMS was much the same in the two groups (51.49 and 50.63). By the end of treatment it had risen by 19.17 points to 70.66 in Group A and by 6.74 points to 57.37 in Group B. Each group improved significantly ($p < 0.001$), and Group A's improvement was significantly greater ($p < 0.001$; Table 2).

DISCUSSION

In this comparison of two manual techniques for stage II adhesive capsulitis, both approaches significantly improved pain, shoulder ROM, and functional mobility, but Gong's mobilization achieved better results overall.

Pain Relief

Pain decreased by about 3.60 points with Gong's mobilization and 2.94 points with three-directional capsular stretching. Because the scores fell at each of the 4th, 8th, and final assessments, relief appears to have built up throughout the program rather than appearing only at the end.

One reason for the stronger pain relief with Gong's mobilization may be that it pairs accessory glide and traction with controlled motion close to the range limit, so it acts both mechanically and neurophysiologically. Stimulation of peripheral mechanoreceptors and spinal neurons may dampen nociceptive input through presynaptic inhibition, and improved nutrient exchange at the cellular level may reduce pain caused by tissue stasis.

Capsular stretching also eased pain. Manohar et al. found capsular stretching better than general shoulder exercise in frozen shoulder [5], and our results agree with theirs. Lengthening the anterior, posterior and inferior capsule may relieve excess tension in the tissue, making movement less painful and reducing protective muscle guarding. On the other hand, stretching an irritable shoulder too hard or too long can itself excite nociceptors and leave the joint sore after treatment; the graded, controlled way in which Gong's mobilization is applied may explain why it relieved pain better.

Effect on Range of Motion

Every movement improved in both groups, but the gains with Gong's mobilization were larger by roughly 16° in flexion, 34° in abduction, 12° in internal rotation, and 14° in external rotation. Abduction showed the biggest difference. The groups started from similar values and moved further apart as treatment continued.

Working at or near the end of the range may account for the extra benefit of Gong's mobilization. Rhythmic oscillation activates type II dynamic mechanoreceptors and suppresses type IV nociceptors, and may improve local blood flow, all of which can ease capsular restriction and restore accessory movement. Gong explained that full shoulder movement needs the humeral head to sit correctly against the glenoid. In frozen shoulder, the head tends to shift forward and downward, and pushing it backward during mobilization helps restore normal rolling and gliding at the joint [6].

Amjad and Asghar reported that both Gong's mobilization and Mulligan's mobilization with movement helped, but ROM improved more with Gong's technique [1]. Our results point the same way, perhaps because applying the technique at end range keeps the joint well positioned while it is glided from front to back.

The improvement seen with three-directional capsular stretching can be explained by its direct action on the contracted capsule in several planes, which improves joint play and tissue extensibility. This matters because adhesive capsulitis limits movement in more than one plane at the same time.

Effect on Functional Mobility

Function, measured by the CMS, improved in both groups but far more with Gong's mobilization, showing that less pain and more movement led to better use of the shoulder. In diabetic patients with adhesive capsulitis, Kamani Raveendhra Babu and Ramalingam likewise found that Gong's mobilization improved movement and pain more than conventional physiotherapy [4]. As the CMS combines pain, daily activities, ROM and strength, the larger rise in this score suggests a benefit from Gong's mobilization that goes beyond joint movement alone.

Gong's mobilization may therefore be the better choice when quick gains in movement, pain and function are the main aims, and capsular stretching can serve as an alternative or an addition. Both groups did the same conventional exercises. In Codman's pendulum exercise, gravity separates the joint surfaces, and the gentle traction and swinging movement help circulate synovial fluid, which may have added to the relief of pain and the gain in movement [5].

Limitations

Patients were not followed up after treatment ended, so we cannot say whether the benefits lasted. Neither the therapist nor the participants were blinded, which may have introduced performance and assessment bias. Only pain, ROM and CMS were measured; quality of life, satisfaction, muscle strength and recurrence were not.

Future Scope

Further work should follow patients over a longer period, compare Gong's mobilization with other manual techniques, add measures such as SPADI, DASH, quality of life, strength, satisfaction and cost-effectiveness, and

test whether combining Gong's mobilization with other physiotherapy methods brings further benefit.

CONCLUSION

In stage II adhesive capsulitis, Gong's mobilization and three-directional capsular stretching both reduced pain and improved shoulder movement and function. Gong's mobilization, however, produced significantly greater gains in pain, flexion, abduction, internal and external rotation and overall function, and may be the more effective physiotherapy option for these patients.

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Table 1: Within-group comparison of pre- and post-intervention outcome measures

Outcome	Group	Pre (mean ± SD)	Post (mean ± SD)	Mean diff.	SD diff.	Effect size	Test value	p-value
NPRS †	A	5.14 ± 0.85	1.54 ± 0.74	3.60	0.91	0.89	5.221	< 0.001*
	B	5.26 ± 0.74	2.31 ± 0.63	2.94	0.87	0.88	5.231	< 0.001*
Flexion (°)†	A	102.26 ± 10.24	161.49 ± 7.95	59.23	11.91	0.88	5.161	< 0.001*
	B	103.66 ± 10.65	146.83 ± 6.95	43.17	11.94	0.87	5.160	< 0.001*
Abduction (°)†	A	105.11 ± 10.03	160.63 ± 6.30	55.51	11.62	0.88	5.161	< 0.001*
	B	104.97 ± 9.27	126.46 ± 9.49	21.49	9.93	0.87	5.162	< 0.001*
Internal rotation (°)†	A	29.09 ± 4.71	54.20 ± 5.74	25.11	5.71	0.88	5.163	< 0.001*
	B	28.26 ± 3.42	40.94 ± 3.77	12.69	2.43	0.87	5.170	< 0.001*

Outcome	Group	Pre (mean ± SD)	Post (mean ± SD)	Mean diff.	SD diff.	Effect size	Test value	p-value
External rotation (°)‡	A	26.51 ± 5.45	51.86 ± 6.33	25.34	6.26	1.40	23.937	< 0.001*
	B	27.17 ± 5.71	38.00 ± 5.06	10.83	2.44	1.48	26.220	< 0.001*
CMS†	A	51.49 ± 4.82	70.66 ± 5.98	19.17	5.67	0.88	5.162	< 0.001*
	B	50.63 ± 4.34	57.37 ± 4.06	6.74	3.16	0.87	5.173	< 0.001*

Group A: Gong's mobilization; Group B: three-directional capsular stretching (n = 35 each). †Wilcoxon signed-rank test (Z value); ‡paired t-test (t value). *Significant. NPRS: Numerical Pain Rating Scale; CMS: Constant–Murley Score.

Table 2: Between-group comparison of improvement (pre minus post / post minus pre)

Outcome	Group A mean improvement ± SD	Group B mean improvement ± SD	Difference (A − B)	Test value	p-value
NPRS reduction†	3.60 ± 0.91	2.94 ± 0.87	0.66	Z = 2.84	0.005*
Flexion (°)†	59.23 ± 11.91	43.17 ± 11.94	16.06	Z = 4.65	< 0.001*
Abduction (°)†	55.51 ± 11.62	21.49 ± 9.93	34.03	Z = 6.91	< 0.001*
Internal rotation (°)†	25.11 ± 5.71	12.69 ± 2.43	12.43	Z = 6.96	< 0.001*
External rotation (°)‡	25.34 ± 6.26	10.83 ± 2.44	14.51	t = 12.77	< 0.001*
CMS†	19.17 ± 5.67	6.74 ± 3.16	12.43	Z = 6.93	< 0.001*

†Mann–Whitney U test; ‡independent samples t-test. *Significant. NPRS: Numerical Pain Rating Scale; CMS: Constant–Murley Score.

FIGURE LEGENDS

Figure 1: Gong's mobilization performed in side-lying position with the affected shoulder uppermost.

Figure 2: Three-directional capsular stretching: (a) anterior capsule stretch; (b) posterior capsule stretch in cross-body adduction; (c) anterior-inferior capsule stretch with the arm elevated to the maximum available range.

Figure 3: Conventional physiotherapy exercises: (a) finger ladder exercise; (b) Codman's pendulum exercise.

Faces have been blurred to protect the identity of participants.