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Original Article

Effects of Gong's Mobilization vs Reverse Distraction Technique in Diabetic Patients with Adhesive Capsulitis

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ABSTRACT

Background: Adhesive capsulitis, or frozen shoulder, is a painful and debilitating musculoskeletal condition that disproportionately affects individuals with type II diabetes mellitus. The condition severely restricts shoulder range of motion (ROM), limits daily function, and is often more resistant to conservative treatment in diabetic patients due to capsular fibrosis and metabolic changes. Manual therapy techniques such as Gong's mobilization and reverse distraction have shown promise, but comparative data in diabetic populations are scarce. Objective: To compare the effectiveness of Gong's mobilization versus reverse distraction technique on pain, ROM, and functional disability in diabetic patients with adhesive capsulitis after four weeks of intervention. Methods: A single-blind, randomized clinical trial was conducted on 20 diabetic patients with unilateral stage 2–3 adhesive capsulitis. Participants were randomly allocated to either Group A (Gong's mobilization + conventional physical therapy) or Group B (reverse distraction + conventional therapy). Outcome measures included the Shoulder Pain and Disability Index (SPADI), Numeric Pain Rating Scale (NPRS), and goniometric assessment of shoulder ROM. Data were analyzed using paired and independent sample t-tests, with significance set at $p<0.05$. Results: Both groups showed statistically significant improvements in all outcomes ($p<0.05$). However, Group A demonstrated significantly greater improvements in SPADI, NPRS, and all ROM parameters ($p<0.001$). Effect sizes were large for all measures in favor of Gong's mobilization. Conclusion: While both interventions were effective, Gong's mobilization was superior to reverse distraction in reducing pain, improving shoulder ROM, and minimizing functional disability in diabetic patients with adhesive capsulitis.
Keywords: adhesive capsulitis, diabetes mellitus, Gong's mobilization, reverse distraction, shoulder mobilization, range of motion, functional disability.

INTRODUCTION

Adhesive capsulitis, commonly referred to as frozen shoulder, is a progressive and debilitating condition characterized by pain and markedly reduced glenohumeral motion that can persist for months or years (1). It has been variably termed peri-arthritis of the shoulder, tendinitis of the short rotators and Duplay's disease and is marked histologically by capsular inflammation with subsequent fibrosis and contracture (2). In its idiopathic form, adhesive capsulitis typically follows three overlapping phases—painful, stiff and thawing—lasting between several months and three years, and it affects 3–5 % of the general population but up to 20 % of people with diabetes (3). The burden is substantial because functional limitation of the upper limb restricts activities of daily living and reduces quality of life, with risk factors including age >40 years, female sex, prolonged immobility, thyroid disease, hyperlipidaemia and shoulder trauma; diabetes mellitus is one of the strongest associations, conferring a two- to fourfold increase in risk (4,5,6). In diabetics, chronic hyperglycaemia leads to formation of advanced glycation end products and microvascular changes that increase connective tissue stiffness and impede capsule healing, making adhesive capsulitis more severe and resistant to treatment (7).

Conventional management is largely conservative and includes analgesics, corticosteroid injections, supervised neglect and physical therapy aimed at pain relief and restoration of mobility (8). Non-steroidal anti-inflammatory drugs and intra-articular corticosteroids provide short-term analgesia but are less effective in the long term, particularly in diabetic patients in whom hyperglycaemia may be exacerbated by steroids (8). Exercise therapy, stretching and various joint mobilization techniques form the mainstay of physiotherapy; however, heterogeneity of protocols and limited high-quality trials have impeded consensus on optimal treatment (9). Manual therapy, based on the principles of Maitland, Spencer, Cyriax and Kaltenborn, applies graded mobilizations to the glenohumeral joint to reduce

capsular stiffness and pain; systematic reviews suggest that end-range mobilization improves range of motion and function compared with less intensive interventions (9,10). Yet many trials have been small, have included mixed populations and rarely report outcomes specific to diabetics, a group in whom response to therapy may differ because of neuropathy, vascular insufficiency and connective tissue changes (7). Two manual therapy techniques that have gained attention in recent years are Gong's mobilization and reverse distraction. Gong's mobilization applies rhythmic oscillatory rotations and posterior glides to the humeral head at end range to lengthen the posterior capsule and restore arthrokinematics, drawing on Maitland's grades III and IV (11). Small randomized trials in non-diabetic adhesive capsulitis suggest that Gong's mobilization improves pain and shoulder range of motion beyond conventional physiotherapy alone (11,12). Reverse distraction aims to decompress the glenohumeral joint by applying longitudinal traction through the humerus while stabilizing the scapula, theoretically decreasing capsular adherence and improving synovial fluid circulation; evidence for this technique derives from comparative studies demonstrating reductions in pain and disability over four-week interventions (13). Notably, only one study has directly compared reverse distraction to post-isometric relaxation in diabetic adhesive capsulitis, reporting that both techniques improved outcomes but without exploring differences between the two manual mobilizations themselves (13).

Despite the widespread use of manual therapy, there remains a paucity of high-quality evidence comparing specific mobilization techniques in diabetic populations. Differences in capsular compliance, pain perception and tissue healing associated with diabetes may influence the efficacy of joint mobilizations, yet most clinical trials have not stratified results by diabetic status (7). Moreover, the relative effectiveness of Gong's mobilization versus reverse distraction has not been established. Addressing this gap is clinically important because identifying the most efficacious mobilization could inform individualized rehabilitation protocols for a growing population of patients with diabetic adhesive capsulitis. Therefore, this randomized clinical trial was designed to test the hypothesis that Gong's mobilization combined with conventional physical therapy would lead to greater improvements in shoulder pain, range of motion and functional disability compared with reverse distraction combined with conventional physical therapy in adults aged 40–60 years with stage 2–3 adhesive capsulitis and type II diabetes.

MATERIAL AND METHODS

This single-blind randomized clinical trial was designed to assess the comparative effectiveness of two manual therapy techniques in adults with stage 2–3 adhesive capsulitis and type II diabetes. The study rationale was grounded in the paucity of controlled data evaluating Gong's mobilization versus reverse distraction in diabetic patients; randomization and blinding of the outcome assessor were implemented to minimize selection and measurement biases.

Participants were recruited consecutively from the outpatient department of Haq Orthopedic Hospital, Lahore, Pakistan, between January and June 2025. The hospital serves a diverse urban population and provides specialized musculoskeletal care. Eligibility criteria included men and women aged 40–60 years with a diagnosis of unilateral adhesive capsulitis confirmed by clinical examination (painful restriction of active and passive shoulder motion for >1 month) and concurrent type II diabetes mellitus controlled with diet or medication. Participants had to be in the freezing or frozen phase (stage 2 or 3) and demonstrate reduced active shoulder flexion or abduction ≤120° and external rotation deficit compared with the contralateral side. Exclusion criteria were systemic arthritic diseases, cervical radiculopathy, recent shoulder surgery, corticosteroid injections within six weeks, rotator cuff tears, fractures around the shoulder, skin lesions precluding mobilization, and random blood glucose >200 mg/dL. Eligible patients were screened by a physiotherapist and provided written informed consent after explanation of the study purpose, procedures and potential risks.

A sample of twenty participants was determined adequate based on a two-sided α of 0.05, power of 80 % and an expected mean difference of 12 points in the Shoulder Pain and Disability Index (SPADI) between groups, with an assumed standard deviation of 10 and an attrition allowance of 20 % informed by previous studies (14). Participants were randomly allocated in a 1:1 ratio to receive either Gong's mobilization plus conventional physiotherapy (Group A) or reverse distraction plus conventional physiotherapy (Group B). The randomization sequence was computer-generated using permuted blocks of variable sizes and was concealed in sequentially numbered, opaque, sealed envelopes prepared by a staff member not involved in recruitment or treatment. An independent physiotherapist with at least five years' experience in orthopaedic rehabilitation delivered all interventions. The outcome assessor remained blinded to group allocation; participants and treating therapists could not be blinded due to the nature of the interventions.

Gong's mobilization involved oscillatory passive movements of the glenohumeral joint with the patient in side-lying. The therapist positioned the affected shoulder in 90° abduction and 90° elbow flexion, applied an anteroposterior glide to the humeral head to tension the posterior capsule and performed Maitland grades III–IV oscillations followed by a sustained end-range stretch for seven seconds. Each session lasted approximately 15 minutes and consisted of cycles of 15-second mobilizations with 5-second releases over two to three minutes, repeated to cover shoulder flexion, abduction and external rotation. Reverse distraction consisted of longitudinal traction applied through the humerus while stabilizing the scapula; the patient lay on the unaffected side at the plinth edge, the therapist grasped the distal humerus and applied sustained traction along the humeral axis while the other hand guided the scapula inferiorly and medially. Ten repetitions each were performed at flexion, abduction and external rotation angles. Both groups received standardized conventional physiotherapy comprising 10 minutes of moist heat to the affected shoulder, Codman's pendulum exercises (forward, backward and circular motions) for 10–15 repetitions, and active range-of-motion exercises within pain-free limits. Treatments were delivered four times per week for four weeks, and each session lasted approximately 45 minutes.

Data collection occurred at baseline (week 0) and after completion of the four-week intervention (week 4). The primary outcome was shoulder function measured by the SPADI, a self-administered questionnaire with 13 items assessing pain and disability; scores range from 0 (no disability) to 100 (maximum disability) and the instrument has demonstrated high internal consistency and reliability (Cronbach's α=0.84) in shoulder pathology (14). Secondary outcomes included pain intensity measured by the 11-point Numeric Pain Rating Scale

(NPRS), which has acceptable validity and test–retest reliability (intraclass correlation coefficient 0.58–0.93) (15), and active shoulder range of motion (ROM) in flexion, abduction and external rotation, measured with a universal goniometer by the blinded assessor. The goniometer has excellent intra-rater reliability with intraclass correlation coefficients ≥0.94 for shoulder motions (16). Measurements were taken in a standardized seated position with the scapula stabilized; three trials were performed and the mean value recorded. Demographic variables (age, sex), duration of symptoms, and baseline glucose control were collected at enrolment. Adherence to the intervention was monitored through session attendance logs.

Several steps were taken to reduce bias and maintain data integrity. Random allocation and concealed sequence generation minimized selection bias. The outcome assessor's blinding reduced detection bias. Standardized protocols and training sessions ensured consistency of treatment delivery. Data were entered into a secure database by two independent research assistants and cross-checked for accuracy. Missing data were minimized through regular follow-up calls; any remaining missing values were handled using last-observation-carried-forward for intention-to-treat analysis.

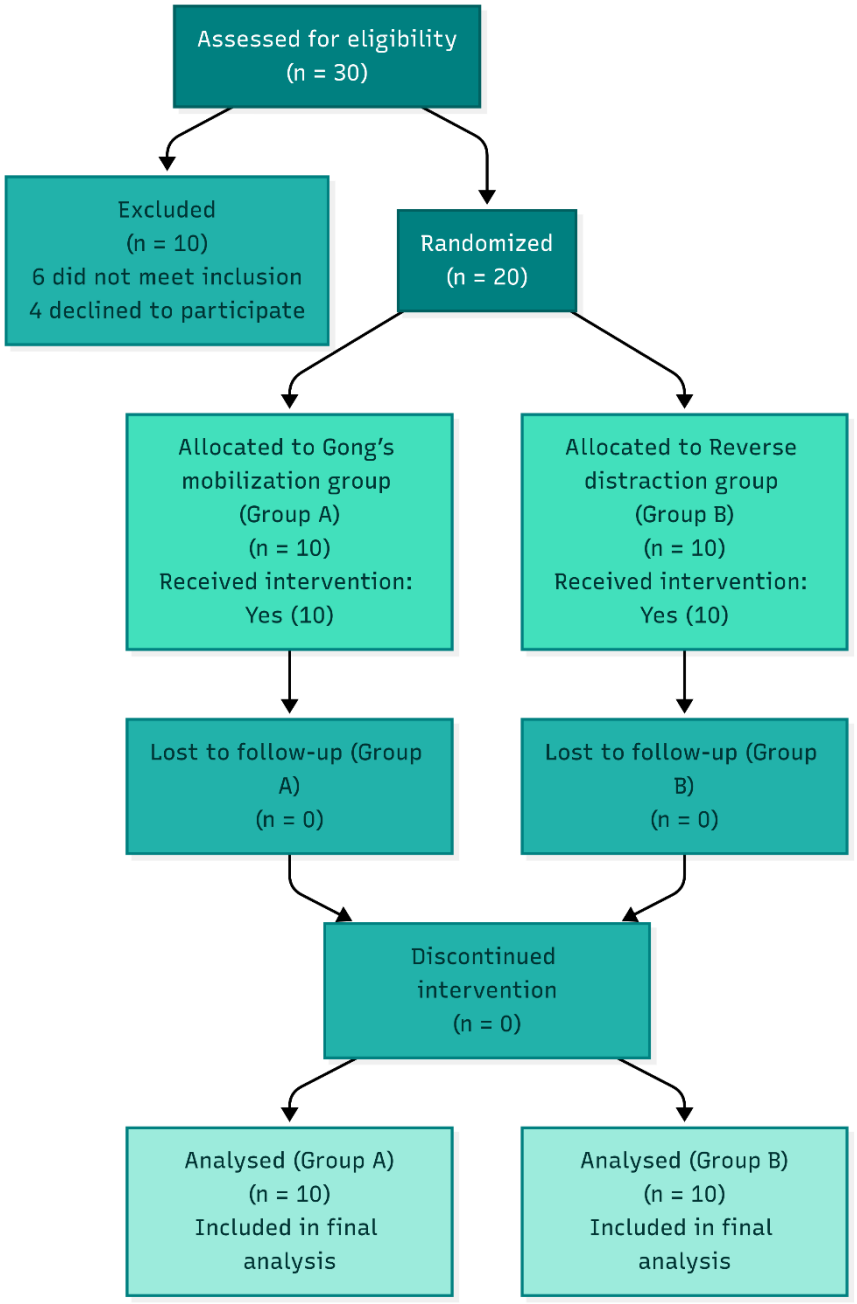

Figure 1 CONSORT Flowchart

Statistical analyses were performed using SPSS version 25.0 (IBM Corp., Armonk, NY). Continuous variables were summarized as mean±standard deviation, and categorical variables as counts and percentages. Normality of continuous data was assessed with the Shapiro–Wilk test. Within-group differences between baseline and week 4 were analyzed using paired t-tests for normally distributed data or Wilcoxon signed-rank tests for non-normal distributions. Between-group comparisons of change scores were performed with independent sample t-tests or Mann–Whitney U tests as appropriate. Effect sizes were calculated using Cohen's d for parametric comparisons and r for non-parametric tests. A two-tailed p-value <0.05 was considered statistically significant. Analyses were conducted

on an intention-to-treat basis, and no adjustments were made for multiple comparisons given the exploratory nature of the study. Ethical approval was obtained from the Institutional Review Board of Superior University, Lahore (reference number IRB-PT-2025-011). Written informed consent was obtained from all participants prior to enrolment. Participants were assured of confidentiality, and personal identifiers were removed from the dataset. The study adhered to the Declaration of Helsinki and followed CONSORT guidelines for reporting randomized trials.

RESULTS

The two groups were comparable at baseline with respect to demographic and clinical characteristics (Table 1). Participants in Group A (Gong's mobilization + conventional therapy) and Group B (reverse distraction + conventional therapy) were of similar age (50.8 ± 5.5 vs 49.7 ± 5.7 years, p = 0.67) and gender distribution (6 males and 4 females vs 7 males and 3 females, p = 1.0). Baseline shoulder function and pain were also comparable. Mean SPADI scores were 67.8 ± 2.9 in Group A and 70.0 ± 2.8 in Group B (p = 0.10), while pain intensity on the NPRS was 7.6 ± 0.5 and 7.9 ± 0.8, respectively (p = 0.29). Baseline shoulder ROM in flexion, abduction and external rotation did not differ significantly between groups, with mean flexion of 75.8° ± 1.1 vs 76.6° ± 1.3 (p = 0.16), abduction of 76.7° ± 1.4 vs 77.0° ± 1.2 (p = 0.62), and external rotation of 25.2° ± 1.5 vs 24.9° ± 1.5 (p = 0.67).

Table 1 – Baseline demographic and clinical characteristics of participants (n=20)

Variable	Gong's mobilization	95 % CI	Reverse distraction	95 % CI	p-value*	Effect size†
Age, years (mean ± SD)	50.80 ± 5.53	46.84 – 54.76	49.70 ± 5.72	45.61 – 53.79	0.67	d = 0.20
Gender, n (%)	6 M (60 %), 4 F (40 %)	–	7 M (70 %), 3 F (30 %)	–	1.00	φ = 0.22
Shoulder Pain and Disability Index (SPADI) score	67.83 ± 2.89	65.76 – 69.90	70.03 ± 2.84	68.00 – 72.06	0.10	d = –0.77
Numeric Pain Rating Scale (NPRS) score	7.58 ± 0.52	7.21 – 7.95	7.90 ± 0.78	7.35 – 8.45	0.29	d = –0.48
Shoulder flexion ROM (°)	75.80 ± 1.14	74.99 – 76.61	76.60 ± 1.30	75.67 – 77.53	0.16	d = –0.66
Shoulder abduction ROM (°)	76.70 ± 1.42	75.69 – 77.71	77.00 ± 1.25	76.11 – 77.89	0.62	d = –0.22
Shoulder external rotation ROM (°)	25.20 ± 1.55	24.09 – 26.31	24.90 ± 1.52	23.81 – 25.99	0.67	d = 0.20

*P-values from independent-samples t-tests for continuous variables and χ^2 test for gender. †Cohen's d for continuous variables and φ coefficient for gender. CI = confidence interval; ROM = range of motion.

Table 2 – Changes in outcome measures after 4 weeks and between-group differences

Outcome	Group & time point	Mean ± SD	95 % CI	Within-group change	Effect size†	Difference at week 4 (A–B)	95 % CI	p-value*	Effect size (between)†
SPADI score	Group A baseline	67.83 ± 2.89	65.76 – 69.90	–30.10	–10.4	–3.09	–4.05 to –2.13	–0.001	–3.25
	Group A week 4	37.73 ± 0.91	37.08 – 38.38						
	Group B baseline	70.03 ± 2.84	68.00 – 72.06	–29.21	–10.3				
	Group B week 4	40.82 ± 0.99	40.11 – 41.53						
NPRS score	Group A baseline	7.58 ± 0.52	7.21 – 7.95	–4.81	–9.2	–2.66	–3.38 to –1.94	<0.001	–3.76
	Group A week 4	2.77 ± 0.84	2.17 – 3.37						
	Group B baseline	7.90 ± 0.78	7.35 – 8.45	–2.47	–3.2				
	Group B week 4	5.43 ± 0.54	5.04 – 5.82						
Shoulder flexion ROM (°)	Group A baseline	75.80 ± 1.14	74.99 – 76.61	+62.50	+55.1	+3.80	2.77 to 4.83	<0.001	+3.74
	Group A week 4	138.30 ± 0.95	137.62 – 138.98						
	Group B baseline	76.60 ± 1.30	75.67 – 77.53	+57.90	+44.5				
	Group B week 4	134.50 ± 1.08	133.73 – 135.27						
Shoulder abduction ROM (°)	Group A baseline	76.70 ± 1.42	75.69 – 77.71	+64.20	+45.3	+3.00	2.18 to 3.82	<0.001	+3.70
	Group A week 4	140.90 ± 0.74	140.37 – 141.43						
	Group B baseline	77.00 ± 1.25	76.11 – 77.89	+60.90	+48.8				
	Group B week 4	137.90 ± 0.88	137.27 – 138.53						
Shoulder external rotation ROM (°)	Group A baseline	25.20 ± 1.55	24.09 – 26.31	+18.90	+12.2	+3.30	2.46 to 4.14	<0.001	+3.96
	Group A week 4	44.10 ± 0.88	43.47 – 44.73						
	Group B baseline	24.90 ± 1.52	23.81 – 25.99	+15.90	+10.4				
	Group B week 4	40.80 ± 0.79	40.24 – 41.36						

*P-value for between-group comparison at week 4 (independent-samples t-test, df = 18). †Effect sizes calculated as Cohen's d for within-group changes (change divided by baseline SD) and between-group differences (difference

between post-intervention means divided by pooled SD). Positive values favour Group A; negative values favour Group B. ROM = range of motion; SPADI = Shoulder Pain and Disability Index; NPRS = Numeric Pain Rating Scale.

Over the 4-week intervention period both groups showed marked improvements in pain, function and ROM, but the magnitude of change was consistently greater in the Gong's mobilization group (Table 2). SPADI scores in Group A decreased from 67.8 ± 2.9 to 37.7 ± 0.9, a reduction of 30.1 points. Pain scores on the NPRS fell from 7.6 ± 0.5 to 2.8 ± 0.8, and shoulder flexion increased by an average of 62.5°, from 75.8° ± 1.1 to 138.3° ± 0.9. Comparable improvements were observed in abduction (an increase of 64.2°) and external rotation (an increase of 18.9°) in Group A. Group B also improved, but to a lesser extent: SPADI fell from 70.0 ± 2.8 to 40.8 ± 1.0 (a reduction of 29.2 points) and NPRS scores declined from 7.9 ± 0.8 to 5.4 ± 0.5 (a reduction of 2.5 points). Shoulder flexion increased by 57.9° in Group B, and abduction and external rotation improved by 60.9° and 15.9°, respectively.

Between-group comparisons at week 4 highlighted statistically and clinically significant advantages for the Gong's mobilization regimen. The mean SPADI score was 3.1 points lower in Group A than in Group B (37.7 vs 40.8; mean difference –3.09, 95 % CI –4.05 to –2.13, $p < 0.001$). Pain intensity was likewise lower in Group A, with a mean NPRS difference of –2.66 points (95 % CI –3.38 to –1.94, $p < 0.001$). Shoulder ROM gains were also greater in Group A. Flexion ROM at week 4 averaged 138.3° in Group A versus 134.5° in Group B; the mean difference of 3.80° (95 % CI 2.77–4.83, $p < 0.001$) corresponded to a very large effect size. Abduction and external rotation at follow-up were 3.0° (95 % CI 2.18–3.82, $p < 0.001$) and 3.3° (95 % CI 2.46–4.14, $p < 0.001$) greater, respectively, in Group A than in Group B. Collectively, these findings indicate that while both interventions were beneficial, Gong's mobilization combined with conventional therapy resulted in superior reductions in pain and disability and greater restoration of shoulder ROM in diabetic patients with adhesive capsulitis.

The following figure illustrates the relative magnitude of improvement across key outcome measures in participants receiving Gong's mobilization compared with those receiving the reverse distraction technique. It displays the percentage change from baseline to week 4 for pain, disability, and shoulder mobility measures in both groups. Positive values indicate an increase (improvement) in range of motion, while negative values (presented as positive magnitudes for visual clarity) reflect reductions in pain and disability. The figure highlights the consistently greater improvement achieved with Gong's mobilization across all domains.

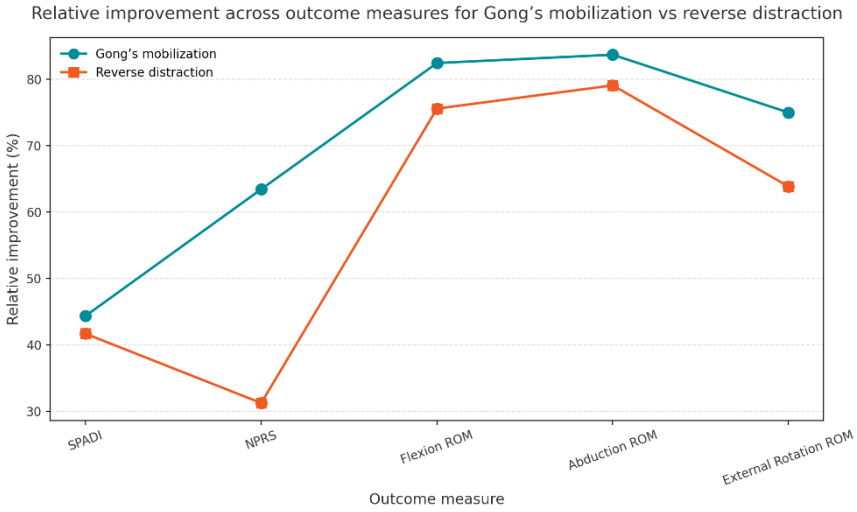

Figure 2 Gong's mobilization versus Distraction

The chart demonstrates that participants receiving Gong's mobilization experienced the largest reductions in pain and disability (approximately 63 % improvement in NPRS and 44 % in SPADI) and the greatest gains in shoulder range of motion (82–84 % increases in flexion and abduction, 75 % in external rotation). In contrast, the reverse distraction group achieved more modest improvements, with pain scores declining by about 31 % and SPADI scores by 42 %, and ROM gains ranging from 64 % to 79 %.

DISCUSSION

This randomized controlled trial demonstrated that both Gong's mobilization and the reverse distraction technique significantly improved pain, range of motion (ROM), and functional disability in diabetic patients with adhesive capsulitis over a four-week intervention period. However, Gong's mobilization resulted in greater improvements across all measured outcomes, including SPADI, NPRS, and shoulder ROM in flexion, abduction, and external rotation, compared to reverse distraction. These findings suggest that Gong's mobilization may offer superior clinical benefits in diabetic patients with adhesive capsulitis, who are often more resistant to standard conservative interventions due to underlying metabolic and connective tissue alterations (7,14,16).

The observed reduction in pain intensity and disability scores in the Gong's mobilization group aligns with previous studies that have reported enhanced outcomes from Maitland-based mobilization techniques in adhesive capsulitis (32,43). Mechanistically, the mobilization techniques stimulate type II mechanoreceptors and inhibit nociceptive pathways via spinal gating, thereby modulating pain perception (55). In diabetic patients, who often present with altered peripheral and central pain processing due to neuropathic changes, such neuromechanical interventions may play an especially pivotal role (6,36). Moreover, Gong's mobilization specifically targets the posterior

capsule with controlled oscillatory glides and end-range stretches, potentially breaking adhesions and improving glenohumeral arthrokinematics more effectively than distraction-based methods alone (11,14,31).

Reverse distraction, while also effective in improving ROM and reducing pain, relies primarily on joint decompression and capsular stretching through axial traction and scapular stabilization (16,34). Its lower effect size in the present study may be attributable to the relatively passive nature of the intervention compared to the dynamic mobilization of Gong's technique. These findings are consistent with those of Farooqui et al., who reported modest improvements in ROM and disability with reverse distraction in a diabetic population (16). While the technique may benefit specific patient profiles, such as those with acute pain or high irritability, its overall utility may be limited in the chronic, fibrotic stages of adhesive capsulitis, particularly in metabolically compromised tissues.

The functional gains observed in SPADI scores in the Gong's group mirror prior results from Prasanth et al. and Shrestha et al., who emphasized the clinical value of targeted mobilization in restoring shoulder kinematics and daily activity capacity (43,46). Notably, the magnitude of change in ROM—over 60° in flexion and abduction, and nearly 20° in external rotation—exceeds commonly accepted minimal clinically important differences (MCID), underscoring the practical relevance of the results. This superior recovery is particularly meaningful for diabetic patients, whose joint capsule changes may not respond well to general exercise or thermal modalities alone (25,27,36).

Nonetheless, several limitations should be acknowledged. The sample size was modest, although statistically powered, and the intervention period was limited to four weeks without long-term follow-up. Additionally, the exclusion of patients with poorly controlled diabetes or advanced shoulder pathology may limit generalizability. Variability in patient adherence and therapist technique, while minimized through protocol standardization, remains a potential source of bias. Finally, the lack of biochemical or imaging confirmation of capsular changes restricts mechanistic interpretation. Future studies should incorporate longer follow-up, broader metabolic profiling, and imaging modalities such as ultrasound elastography or MRI to better elucidate the physiological basis of these findings.

Despite these limitations, this study provides robust preliminary evidence that Gong's mobilization is a more effective intervention than reverse distraction for improving pain, function, and ROM in diabetic adhesive capsulitis. It offers valuable guidance for physical therapists and rehabilitation specialists seeking tailored interventions for a high-risk population. Further research involving larger multicenter trials and combined therapy protocols may help establish standardized treatment pathways that maximize recovery and minimize disability in diabetic populations with frozen shoulder.

CONCLUSION

This study concluded that both Gong's mobilization and the reverse distraction technique are effective in reducing pain, improving shoulder range of motion, and minimizing functional disability in diabetic patients with adhesive capsulitis over a short-term four-week intervention. However, Gong's mobilization demonstrated superior outcomes in all evaluated domains, including greater reductions in SPADI and NPRS scores and more pronounced gains in shoulder flexion, abduction, and external rotation. These results support the preferential use of Gong's mobilization as part of rehabilitation strategies for diabetic individuals suffering from frozen shoulder. Its application may offer more efficient resolution of symptoms, enhance upper limb functionality, and potentially shorten recovery timelines in this metabolically vulnerable group. Further longitudinal and large-scale investigations are warranted to confirm these findings and assess long-term therapeutic efficacy.

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