Gong's mobilization versus Maitland mobilization for shoulder pain and disability in diabetic patients with periarthritis of the shoulder: a randomised pilot study

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Abstract—**Background. Adhesive capsulitis (frozen shoulder, periarthritis of the shoulder) is substantially more common in people with diabetes mellitus than in the general population, and tends to be more refractory to treatment in this group. Joint mobilization is a mainstay of conservative management, but the relative merits of mid-range and end-range techniques in diabetic patients are not established. Gong's mobilization is an end-range technique that combines anterior-to-posterior humeral head glide, capsular distraction and grade III–IV oscillation; Maitland mobilization as applied here is a mid-range caudal glide of the glenohumeral joint.**

Objective. To compare the effect of Gong's mobilization with that of Maitland mobilization on shoulder pain and self-reported disability in diabetic patients with stage II periarthritis of the shoulder.

Methods. Twenty patients with diabetes mellitus and unilateral periarthritis of the shoulder of three to six months' duration were recruited from two hospitals in Gurugram, Haryana, and randomly allocated by sealed opaque envelope to a Maitland mobilization group (n = 10) or a Gong's mobilization group (n = 10). Both groups received two treatment sessions per week for four weeks (eight sessions). The outcome measure was the Shoulder Pain and Disability Index (SPADI), recorded as pain subscale, disability subscale and total raw score at baseline and after four weeks. Within-group change was tested with the Wilcoxon signed-rank test, between-group differences with the Mann–Whitney U test and chi-square test; α was set at 0.05.

Results. Both groups improved significantly from baseline to four weeks on all three SPADI components (all p = 0.005). In the Maitland group the pain subscale fell from 16.50 ± 6.40 to 7.50 ± 3.75, the disability subscale from 23.80 ± 6.97 to 12.00 ± 3.83, and the total raw score from 40.30 ± 12.33 to 19.50 ± 6.12 (a 51.6% reduction). In the Gong's group the corresponding values were 10.80 ± 4.96 to 6.00 ± 3.53, 18.70 ± 6.95 to 10.30 ± 4.47, and 29.50 ± 10.70 to 16.30 ± 6.88 (a 44.7% reduction). The two groups were not balanced at baseline: the Maitland group had significantly higher baseline pain scores (p = 0.018) and total SPADI scores (p = 0.023), and was on average seven years older.

Conclusion. In this pilot study both Gong's mobilization and Maitland mobilization produced clinically and statistically significant reductions in shoulder pain and disability over four weeks in diabetic patients with periarthritis of the shoulder. Because of the small sample and the baseline imbalance between groups, the data do not support a claim of superiority for either technique, and an adequately powered randomised controlled trial with stratified allocation is required.

Index Terms—**adhesive capsulitis; frozen shoulder; diabetes mellitus; Gong's mobilization; Maitland mobilization; SPADI; manual therapy**

I. INTRODUCTION

Adhesive capsulitis, commonly termed frozen shoulder or periarthritis of the shoulder, is a soft-tissue disorder characterised by pain, capsular contracture, and progressive restriction of both active and passive glenohumeral movement.[1] The joint capsule becomes inflamed, thickened and fibrotic; as movement becomes painful the shoulder is used less, and disuse in turn accelerates capsular tightening, producing the self-reinforcing cycle that gives the condition its name.[2]

The condition is generally described in three clinical phases. A painful "freezing" phase, lasting roughly six to nine months, is followed by a "frozen" phase of four to six months in which pain plateaus or eases but stiffness dominates, and finally a "thawing" phase of six months to two years during which movement

gradually returns.[3] Whether the natural history is genuinely self-limiting has been questioned; a systematic review found the evidence for complete spontaneous recovery to be weak, with longitudinal data instead suggesting early improvement that plateaus and leaves residual restriction for years.[4]

Prevalence in the general population is estimated at 2–5%.[5] Among people with diabetes mellitus the reported figure rises to 10–39%, and a meta-analysis has confirmed a strong bidirectional association between adhesive capsulitis and diabetes.[6],[7] In an Indian community sample, diabetes was present in 20.8% of adults reporting shoulder pain compared with 14.6% of those without.[8] Diabetic adhesive capsulitis also appears more resistant to treatment: patients with diabetes show higher rates of failure with conservative management and more frequent recourse to repeat surgical intervention.[9] This makes the diabetic subgroup a clinically important population in which to test conservative techniques specifically, rather than extrapolating from mixed-aetiology samples.

Conservative management aims at pain relief, preservation of range of motion and restoration of function. Electrotherapeutic modalities are widely used but the evidence for their added benefit is modest; a double-blind placebo-controlled trial found no additional benefit from therapeutic ultrasound when added to a physiotherapy programme.[10] Manual mobilization combined with exercise, by contrast, is supported by moderate-quality evidence.[11],[12]

Two mobilization approaches are of particular interest. The Maitland concept, taught by the International Maitland Teachers Association, applies graded passive oscillatory accessory movements — rolling, gliding, spinning and distraction — to painful and stiff synovial joints, typically in the mid-range for irritable presentations.[13] Gong's mobilization is an end-range technique in which a corrective anterior-to-posterior glide is applied to the humeral head while the shoulder is held in a functional position; this is combined with capsular distraction and performance of the restricted movement, followed by grade III and IV oscillation and sustained stretch.[14] Gong et al. reported that this technique improved shoulder medial rotation more than anterior-to-posterior gliding alone, attributing the effect to maintenance of normal humeral head alignment against the glenoid during dynamic movement.[14]

Head-to-head comparisons of these two techniques are scarce. Studies have compared Gong's mobilization with Mulligan's mobilization with movement,[15] with the Spencer technique,[16] and with sustained inferior capsular stretch,[17] and have compared Maitland mobilization with Mulligan mobilization,[18] with muscle energy technique,[19] and with Kaltenborn mobilization.[20] We identified no study comparing Gong's mobilization directly with Maitland mobilization, and none restricted to a diabetic population.

The objective of this pilot study was therefore to compare the effect of Gong's mobilization and Maitland mobilization on shoulder pain and self-reported disability in diabetic patients with periarthritis of the shoulder. The null hypothesis was that there would be no difference between the two techniques.

II. METHODS

2.1 Study design

A two-arm, parallel-group randomised pilot study with pre- and post-intervention assessment.

2.2 Ethical approval

Ethical clearance was obtained from the Institutional Ethics Committee, Department of Physiotherapy, Galgotias University, Uttar Pradesh, and from Saraswati Hospital, Gurugram, Haryana, in accordance with national ethical guidelines for biomedical research on human participants. All participants received a written information sheet and gave written informed consent before enrolment, including consent for publication of anonymised data.

2.3 Setting and participants

Participants were recruited from Saraswati Hospital, Gurugram, and IAS Medicare Hospital, Khandsa Road, Haryana.

Inclusion criteria: physician-diagnosed diabetes mellitus and current antidiabetic medication; periarthritis of the shoulder of three to six months' duration (freezing / stage II); night pain; painful restricted active and passive range of motion in glenohumeral abduction and external rotation; normal plain radiographs; age 30–65 years; both sexes.

Exclusion criteria: age outside the 30–65 year range (paediatric and geriatric populations); bilateral

periarthritis of the shoulder; previous shoulder surgery; rotator cuff tear, biceps sprain or acromioclavicular joint arthritis; recent fracture; cardiovascular disease; current use of hypnotics or analgesics.

2.4 Sample size

As a pilot study, the sample size of 20 (10 per group) was determined pragmatically by the number of eligible patients presenting during the recruitment window rather than by a formal power calculation. The study was designed to estimate effect sizes and assess feasibility for a subsequent adequately powered trial.

2.5 Randomisation

Eligible consenting participants were allocated by simple randomisation using sealed opaque envelopes prepared in advance, giving 10 participants per group. Allocation was not concealed from the treating therapist, and neither participants nor the outcome assessor were blinded.

2.6 Outcome measure

The Shoulder Pain and Disability Index (SPADI) was administered at baseline and after four weeks of intervention. The SPADI is a self-report questionnaire comprising a 5-item pain subscale (maximum raw score 50) and an 8-item disability subscale (maximum raw score 80), giving a maximum total raw score of 130, conventionally expressed as a percentage. Raw subscale and total scores are reported here. For descriptive purposes, scores were additionally categorised as mild, moderate or severe.

2.7 Interventions

Both groups received two sessions per week for four weeks, giving eight sessions in total. All treatment was delivered by the same therapist.

Group I — Maitland mobilization. The participant lay supine with the arm abducted to 30°. The therapist adopted a walk-standing position, grasped the proximal humerus and maintained humeral distraction in the mid-range position. Glenohumeral caudal glide mobilization was applied at a rate of 2–3 glides per second, each glide sustained for 30 seconds, for two sets.

Group II — Gong's mobilization. The participant lay in side-lying with the involved shoulder uppermost, the shoulder abducted to 90° and the elbow flexed to 90° so that the vertical axis of the humerus was maintained. With one hand the therapist supported the elbow and with the other applied an anterior-to-posterior pressure over the humeral head. Maintaining this position, the therapist raised his own body to apply a gentle distraction to the glenohumeral capsule; the distraction was held for 10–15 seconds and released for 5 seconds, repeated over approximately 2–3 minutes. The therapist then maintained the anterior-to-posterior pressure to prevent vertical translation of the humeral head and, supporting the elbow with the other hand, performed shoulder medial rotation. Grade III and IV oscillations were then applied, followed by a sustained grade IV stretch of approximately 7 seconds.

2.8 Statistical analysis

Data were analysed using SPSS. Descriptive statistics (mean, standard deviation, median, minimum, maximum) summarised demographic and outcome variables. Given the small sample, non-parametric tests were used: the Wilcoxon signed-rank test for within-group pre–post change, the Mann–Whitney U test for between-group comparison of continuous variables, and the chi-square test for categorical severity distributions. The significance level was set at $p < 0.05$.

III. RESULTS

3.1 Participant characteristics

Twenty participants were randomised and all twenty completed the four-week intervention; there were no dropouts and no adverse events were reported.

Baseline characteristics are shown in Table 1. The Maitland group comprised 5 men and 5 women, the Gong's group 8 men and 2 women. Mean age was 51.90 ± 6.51 years in the Maitland group and 44.80 ± 8.14 years in the Gong's group, a difference of 7.1 years. Mean height was 161.00 ± 11.53 cm and 167.00 ± 11.81 cm respectively; mean weight was 65.00 kg in both groups.

Baseline SPADI severity categories did not differ significantly between groups (pain, $\chi^2 = 2.397$, $p =$

0.302; disability, $\chi^2 = 1.000$, $p = 0.607$; total SPADI, $\chi^2 = 0.533$, $p = 0.766$; Table 2).

However, baseline SPADI scores treated as continuous variables did differ (Table 3). The Maitland group entered the study with higher pain scores (16.50 ± 6.40 versus 10.80 ± 4.96; U = 19, Z = 2.360, p = 0.018) and higher total SPADI scores (U = 20, Z = 2.273, p = 0.023). The disability subscale did not differ significantly (23.80 ± 6.97 versus 18.70 ± 6.95; U = 28.5, Z = 1.632, p = 0.103). The two groups were therefore not equivalent at baseline, with the Maitland group more symptomatic on entry.

3.2 Within-group change

Both interventions produced statistically significant improvement on every SPADI component over four weeks (Table 4; all p = 0.005).

In the Maitland group, the pain subscale fell from 16.50 ± 6.40 to 7.50 ± 3.75 (mean reduction 9.00 points, 54.5%), the disability subscale from 23.80 ± 6.97 to 12.00 ± 3.83 (11.80 points, 49.6%), and the total raw SPADI score from 40.30 ± 12.33 to 19.50 ± 6.12 (20.80 points, 51.6%; equivalent to a fall from 31.0% to 15.0% of the maximum).

In the Gong's group, the pain subscale fell from 10.80 ± 4.96 to 6.00 ± 3.53 (4.80 points, 44.4%), the disability subscale from 18.70 ± 6.95 to 10.30 ± 4.47 (8.40 points, 44.9%), and the total raw score from 29.50 ± 10.70 to 16.30 ± 6.88 (13.20 points, 44.7%; from 22.7% to 12.5% of the maximum).

Both groups therefore exceeded the commonly cited minimal clinically important difference for the SPADI, and the proportional reductions achieved by the two techniques were of similar magnitude.

3.3 Between-group comparison

Post-intervention scores were numerically lower in the Gong's group on all three components (pain 6.00 versus 7.50; disability 10.30 versus 12.00; total 16.30 versus 19.50). These absolute differences, however, are of the same order as the baseline differences between the groups and cannot be attributed to the intervention: the Maitland group started 5.70 points higher on pain and finished 1.50 points higher, having achieved the larger absolute and proportional reduction.

A formal between-group comparison of change scores, or an analysis of covariance adjusting post-intervention scores for baseline, was not performed. On the available data the null hypothesis of no difference between the two techniques cannot be rejected.

Table 1. Baseline characteristics of participants (n = 20).

Variable	Maitland group (n = 10)	Gong's group (n = 10)
Male, n (%)	5 (50.0)	8 (80.0)
Female, n (%)	5 (50.0)	2 (20.0)
Age, years (mean ± SD)	51.90 ± 6.51	44.80 ± 8.14
Age, median (min–max)	50.50 (42–62)	44.50 (32–55)
Height, cm (mean ± SD)	161.00 ± 11.53	167.00 ± 11.81
Height, median (min–max)	163.50 (142–180)	168.00 (142–185)
Weight, kg (mean ± SD)	65.00 ± 6.27	65.00 ± 6.36
Weight, median (min–max)	65.00 (55–74)	66.50 (55–75)

Table 2. Baseline distribution of SPADI severity categories.

Domain	Category	Maitland, n (%)	Gong's, n (%)	χ^2	df	p
Pain	Mild	2 (20.0)	5 (50.0)	2.397	2	0.302
	Moderate	5 (50.0)	4 (40.0)			
	Severe	3 (30.0)	1 (10.0)			
Disability	Mild	2 (20.0)	4 (40.0)	1.000	2	0.607
	Moderate	7 (70.0)	5 (50.0)			
	Severe	1 (10.0)	1 (10.0)			
Total SPADI	Mild	2 (20.0)	3 (30.0)	0.533	2	0.766
	Moderate	6 (60.0)	6 (60.0)			
	Severe	2 (20.0)	1 (10.0)			

Table 3. Between-group comparison of baseline SPADI scores (Mann–Whitney U test).

Outcome	Group	Mean ± SD	Mean rank	Sum of ranks	U	Z	p
Pain subscale	Maitland	16.50 ± 6.40	13.60	136.00	19.0	2.360	0.018
	Gong's	10.80 ± 4.96	7.40	74.00			
Disability subscale	Maitland	23.80 ± 6.97	12.65	126.50	28.5	1.632	0.103
	Gong's	18.70 ± 6.95	8.35	83.50			
Total SPADI	Maitland	40.30 ± 12.33	13.50	135.00	20.0	2.273	0.023
	Gong's	29.50 ± 10.70	7.50	75.00			

Table 4. Within-group change from baseline to four weeks (Wilcoxon signed-rank test).

Group	Outcome	Baseline (mean ± SD)	4 weeks (mean ± SD)	Mean change	% change	Z	p
Maitland	Pain subscale	16.50 ± 6.40	7.50 ± 3.75	−9.00	−54.5	2.807	0.005
	Disability subscale	23.80 ± 6.97	12.00 ± 3.83	−11.80	−49.6	2.810	0.005
	Total SPADI	40.30 ± 12.33	19.50 ± 6.12	−20.80	−51.6	2.807	0.005
Gong's	Pain subscale	10.80 ± 4.96	6.00 ± 3.53	−4.80	−44.4	2.814	0.005
	Disability subscale	18.70 ± 6.95	10.30 ± 4.47	−8.40	−44.9	2.807	0.005
	Total SPADI	29.50 ± 10.70	16.30 ± 6.88	−13.20	−44.7	2.809	0.005

IV. DISCUSSION

This pilot study compared an end-range mobilization technique (Gong's) with a mid-range accessory glide technique (Maitland) in diabetic patients with periarthritis of the shoulder. The principal finding is that eight sessions of either technique delivered over four weeks produced large and statistically significant reductions in shoulder pain and self-reported disability, with reductions of approximately 45–55% in SPADI scores in both arms. The secondary finding is negative: with 10 participants per group and a baseline imbalance favouring the Gong's arm, these data do not distinguish between the two techniques.

The magnitude of within-group improvement is consistent with the existing literature on manual therapy in adhesive capsulitis. Systematic review evidence supports mobilization combined with conventional therapy for improving range of motion and reducing pain in frozen shoulder,[11],[21] and trials of Maitland mobilization specifically have reported improved SPADI scores and reduced pain when the technique is added to a supervised exercise programme.[12],[22] Studies of Gong's mobilization have likewise reported significant improvement in pain, range of motion and disability.[15],[17],[23]

Several mechanisms may account for the observed effects. Rhythmic oscillatory accessory movement is thought to modulate pain through neurophysiological pathways, stimulating type II dynamic mechanoreceptors and inhibiting nociceptive input, while also improving synovial perfusion in a joint that is painful and functionally restricted.[13] Mechanically, restriction of shoulder medial rotation in adhesive capsulitis has been attributed to anterior displacement of the humeral head; techniques that reposition the humeral head posteriorly against the glenoid may restore more normal arthrokinematics during movement. Gong's technique differs from a simple supine anterior-to-posterior glide in that the corrective pressure is maintained while the restricted movement is actively performed, so that alignment is preserved dynamically rather than statically.[14] The Maitland caudal glide, by contrast, targets inferior capsular extensibility and is applied in the mid-range, which may be better tolerated in more irritable presentations — a plausible explanation for why the more symptomatic Maitland group in this study nonetheless achieved the larger absolute change.

The comparison between techniques must be interpreted with caution. The Maitland group entered the study with significantly higher pain ($p = 0.018$) and total SPADI ($p = 0.023$) scores and was on average seven years older. Groups that start further

from the floor of a scale have more room to improve, and simple randomisation without stratification in a sample of 20 is prone to exactly this kind of imbalance. Comparing raw post-intervention scores across such groups is not valid; comparing percentage change partially addresses the problem but does not eliminate it. Reported in either way, the differences here are small and in this study the Maitland group in fact showed the numerically greater proportional pain reduction, which is the opposite of what a superiority claim for Gong's mobilization would require.

The choice of a diabetic-only sample is a strength, since this population is both disproportionately affected and less responsive to conservative care, and is often diluted within mixed samples in the existing literature.[6],[9] It is also worth noting that glycaemic control was not recorded, and evidence suggests that diabetic frozen shoulder can ultimately recover range of motion equivalent to the contralateral side, so longer follow-up may be informative.[24]

4.1 Limitations

The sample size of 20 was pragmatic rather than powered, and this study should be read as a feasibility and effect-estimation exercise rather than as a definitive comparison. Randomisation was not stratified and produced clinically meaningful baseline imbalance in symptom severity, age and sex distribution. Neither participants, therapist nor assessor were blinded, and a single therapist delivered both interventions, so performance and detection bias cannot be excluded. There was no control or sham arm, so the contribution of natural history, regression to the mean and non-specific treatment effects cannot be separated from the effect of mobilization; this is a particular concern in a condition with a variable natural course. Outcome assessment relied on a single self-report instrument; no objective range-of-motion measurements or functional performance tests were included. Only stage II (freezing) frozen shoulder was studied, limiting generalisability to other stages. There was no follow-up beyond the four-week intervention period, so durability of effect is unknown. Finally, HbA1c and diabetes duration were not recorded, and these may modify treatment response.

4.2 Recommendations for future research

An adequately powered randomised controlled trial is required, with sample size based on the effect estimates reported here, stratified or block randomisation by baseline SPADI, concealed allocation, a blinded assessor, and a third arm receiving conventional therapy alone. Outcome assessment should combine SPADI with goniometric measurement of glenohumeral medial rotation, abduction and external rotation, and should include follow-up at three and six months. Recording HbA1c, diabetes duration and stage of adhesive capsulitis would allow subgroup analysis of treatment response, which several authors have identified as the key gap in the frozen shoulder literature.[21],[25]

V. CONCLUSION

Four weeks of either Gong's mobilization or Maitland mobilization, delivered twice weekly, produced statistically significant and clinically meaningful reductions in shoulder pain and disability in diabetic patients with stage II periarthritis of the shoulder. Both techniques are reasonable options in this population. The study was not powered to detect a difference between them, and baseline imbalance between the groups precludes any conclusion about the superiority of one technique over the other; that question requires a larger, stratified randomised controlled trial.

Declarations

Ethics approval and consent to participate. Approved by the Institutional Ethics Committee, Department of Physiotherapy, Galgotias University, Uttar Pradesh, and by Saraswati Hospital, Gurugram [insert approval reference number and date]. Written informed consent was obtained from all participants.

Consent for publication. Obtained from all participants for publication of anonymised data.

Availability of data. The dataset analysed during the current study is available from the corresponding author on reasonable request.

Competing interests. The authors declare that they have no competing interests.

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Authors' contributions. [Insert per ICMJE criteria — e.g. KK conceived the study, recruited participants, delivered the interventions, collected and analysed the data and drafted the manuscript. PJD supervised the study, contributed to design and revised the manuscript. Both authors read and approved the final manuscript.]

Trial registration. [Insert CTRI registration number, or state "Not registered" — see editorial note 8.]

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