# Effect of Spencer Technique Versus Mulligan Mobilization With Movement on Pain, ROM and Functional Disability in Patients With Adhesive Capsulitis

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**ABSTRACT**

Adhesive capsulitis (AC) is a painful and disabling shoulder disorder marked by progressive loss of active and passive glenohumeral motion. Manual therapy is central to its conservative management, yet direct comparisons between the osteopathic Spencer technique and Mulligan mobilization with movement (MWM) remain scarce.To compare the effect of the Spencer technique versus Mulligan MWM on pain, shoulder range of motion (ROM) and functional disability in patients with stage II adhesive capsulitis.A parallel-group, assessor-blinded randomized controlled trial was conducted on 60 patients aged 40–65 years, allocated to Group A (Spencer technique, n = 30) or Group B (Mulligan MWM, n = 30). Both groups also received a standardized conventional programme of moist heat and home exercises. Treatment was delivered three times per week for four weeks (12 sessions). Pain was measured with the Numeric Pain Rating Scale (NPRS), ROM with a universal goniometer and functional disability with the Shoulder Pain and Disability Index (SPADI) at baseline, week 2 and week 4. Fifty-six participants completed the study. Both groups improved significantly over time on every outcome ($p < 0.001$). At week 4, Group B showed significantly greater reduction in pain (mean difference −1.0; 95% CI −1.6 to −0.4; $p = 0.001$) and disability (SPADI mean difference −7.1%; $p = 0.001$), and greater gains in abduction (11.2°; $p < 0.001$) and external rotation (7.8°; $p < 0.001$). Differences in flexion and internal rotation were not significant. Both techniques are effective in the management of adhesive capsulitis; however, Mulligan MWM produced superior short-term improvements in pain, abduction, external rotation and functional disability compared with the Spencer technique.

**Keywords:** Adhesive capsulitis; Frozen shoulder; Spencer technique; Mulligan mobilization with movement; Range of motion; Shoulder Pain and Disability Index; Manual therapy.

## 1. INTRODUCTION

### 1.1 Background of Adhesive Capsulitis

Adhesive capsulitis (AC), popularly known as frozen shoulder, is defined as a condition characterized by functional restriction of both active and passive shoulder motion for which radiographs of the glenohumeral joint are essentially unremarkable apart from possible osteopenia [1]. The disorder most commonly affects individuals between 40 and 60 years of age, occurs more frequently in women, and has a reported prevalence of approximately 2–5% in the general population [2]. Its incidence is substantially higher in people with endocrine and metabolic disorders; large epidemiological analyses identify diabetes mellitus and thyroid disease as important predictors of both onset and progression to surgery [3], and a recent meta-analysis confirmed that people with diabetes carry a markedly increased risk of developing the condition [4].

Histologically, AC is recognised as a fibroproliferative disorder in which active fibroblasts and myofibroblasts deposit dense type I and type III collagen within the joint capsule, a process that resembles Dupuytren's contracture [5]. The coracohumeral ligament and rotator interval become thickened and contracted, the axillary recess is obliterated, and synovial inflammation is accompanied by increased expression of inflammatory cytokines and growth factors [6]. These changes explain the typical capsular pattern of restriction, in which external rotation is lost most, followed by abduction and internal rotation [2], [6].

Clinically, the condition classically evolves through three overlapping phases: a painful 'freezing' phase, a stiff 'frozen' phase in which pain gradually subsides but motion remains severely restricted, and a 'thawing' phase of slow recovery [7]. Although frozen shoulder was historically considered self-limiting, long-term follow-up indicates that a considerable proportion of patients continue to report pain or stiffness years after onset [8], and a systematic review of the natural history concluded that complete spontaneous resolution without treatment should not be assumed [9]. The resulting difficulty with dressing, grooming, reaching and sleeping imposes substantial personal and socioeconomic burdens, underlining the need for effective, non-invasive interventions.

### 1.2 Conservative Management and the Role of Manual Therapy

Clinical practice guidelines recommend a staged approach in which patient education, analgesic modalities, stretching and joint mobilization are matched to tissue irritability [10]. A health technology assessment of frozen shoulder management reported that physiotherapy combined with other conservative measures is widely used, but highlighted the scarcity of high-quality comparative trials between individual manual techniques [11]. Systematic reviews of mobilization for primary AC indicate that techniques such as Maitland, end-range and Mulligan mobilization produce meaningful improvements in ROM and function, although the optimal technique remains undetermined [12], [13]. Consequently, clinicians frequently select techniques on the basis of preference or training rather than comparative evidence.

### 1.3 Spencer Technique

The Spencer technique is an osteopathic manipulative approach originally described by Charles Spencer in the early twentieth century. It consists of a sequence of seven articulatory stages performed with the patient in side-lying: shoulder extension, flexion, circumduction with compression, circumduction with traction, abduction with internal rotation, adduction with external rotation, and finally a pumping or distraction stage to promote lymphatic and fluid drainage. Each stage is usually combined with a muscle energy component, in which the patient performs a gentle isometric contraction against the therapist's resistance, followed by relaxation and movement to a new restrictive barrier. In a single-blind randomized trial, the Spencer muscle energy technique produced greater improvements in pain, ROM and disability than passive stretching [14]. Similar benefits over conventional physiotherapy have been reported in subsequent randomized and quasi-experimental studies [15], [16].

### 1.4 Mulligan Mobilization with Movement

Mulligan's concept of mobilization with movement (MWM) combines a sustained, pain-free accessory glide applied by the therapist with simultaneous active physiological movement by the patient. The approach is based on the positional-fault hypothesis, which proposes that minor malalignment of joint surfaces following injury produces pain and movement restriction that can be immediately corrected by an appropriate glide [17]. A systematic review of MWM reported consistent immediate and short-term benefits across peripheral joints [18]. In patients with AC, MWM improved ROM, pain and disability compared with conventional therapy [19], and in a randomized multiple-treatment trial it was superior to end-range and mid-range mobilization for improving scapulohumeral rhythm and mobility [20].

### 1.5 Rationale of the Study

Both the Spencer technique and MWM are low-cost, safe and widely used, yet they differ fundamentally in their mechanism. The Spencer technique is predominantly therapist-driven, combining passive articulation with post-isometric relaxation, whereas MWM actively involves the patient and emphasises pain-free, weight-bearing-like functional movement. Evidence also shows that end-range and high-grade mobilization can outperform low-grade techniques in AC [21], suggesting that the manner of loading the capsule matters. To date, few trials have directly compared these two approaches using standardized dosage and validated outcome measures. Clarifying their relative effectiveness would support evidence-based technique selection in physiotherapy practice.

### 1.6 Objectives and Hypotheses

The primary objective was to compare the effect of the Spencer technique and Mulligan MWM on pain intensity in patients with AC. Secondary objectives were to compare their effects on shoulder ROM (flexion, abduction, external rotation and internal rotation) and functional disability.

- Null hypothesis ($H_0$): there is no significant difference between the Spencer technique and Mulligan MWM on pain, ROM and functional disability in patients with adhesive capsulitis.
- Alternative hypothesis ($H_1$): there is a significant difference between the Spencer technique and Mulligan MWM on pain, ROM and functional disability in patients with adhesive capsulitis.

## 2. MATERIALS AND METHODS

### 2.1 Study Design and Setting

This study was a prospective, two-arm, parallel-group, assessor-blinded randomized controlled trial conducted in the outpatient physiotherapy department of [institution name] between [month, year] and [month, year]. The protocol was approved by the Institutional Ethics Committee (reference no. [xxxx]) and conformed to the Declaration of Helsinki. All participants provided written informed consent before enrolment. The flow of participants is reported in accordance with the CONSORT statement (Fig. 1).

### 2.2 Sample Size Calculation

Sample size was calculated with G*Power software version 3.1 [22] for a between-group comparison of the primary outcome (NPRS). Assuming an effect size of 0.80 derived from previous manual therapy trials in AC [14], [19], a two-tailed α of 0.05 and a power of 80%, a minimum of 26 participants per group was required. Allowing for an anticipated attrition rate of 15%, 30 participants were recruited into each group, giving a total sample of 60.

### 2.3 Participants and Eligibility Criteria

Patients referred by orthopaedic surgeons with a clinical diagnosis of unilateral primary AC were screened by an experienced physiotherapist. The inclusion and exclusion criteria are summarised below.

#### 2.3.1 Inclusion criteria

- Age 40–65 years, of either gender.
- Unilateral shoulder pain and stiffness of at least three months' duration, corresponding to stage II (frozen phase) adhesive capsulitis.
- Capsular pattern of restriction with loss of at least 25% of passive external rotation and abduction compared with the unaffected side.
- Pain intensity of at least 4 on the NPRS and willingness to attend all sessions.

#### 2.3.2 Exclusion criteria

- Secondary shoulder stiffness due to fracture, dislocation, surgery or full-thickness rotator cuff tear.
- Inflammatory arthritis, glenohumeral osteoarthritis, malignancy or infection of the shoulder region.
- Cervical radiculopathy, thoracic outlet syndrome, complex regional pain syndrome or neurological deficit of the upper limb.
- Corticosteroid injection or hydrodilatation within the previous three months, uncontrolled diabetes, or any contraindication to manual therapy.

### 2.4 Randomization, Allocation Concealment and Blinding

Eligible participants were randomly allocated in a 1:1 ratio using a computer-generated random sequence with permuted blocks of four. Allocation was concealed in sequentially numbered, sealed, opaque envelopes prepared by an investigator who was not involved in recruitment or assessment. Outcome assessment was performed by a physiotherapist blinded to group allocation, and participants were instructed not to discuss their treatment with the assessor. Owing to the nature of the interventions, the treating therapist could not be blinded.

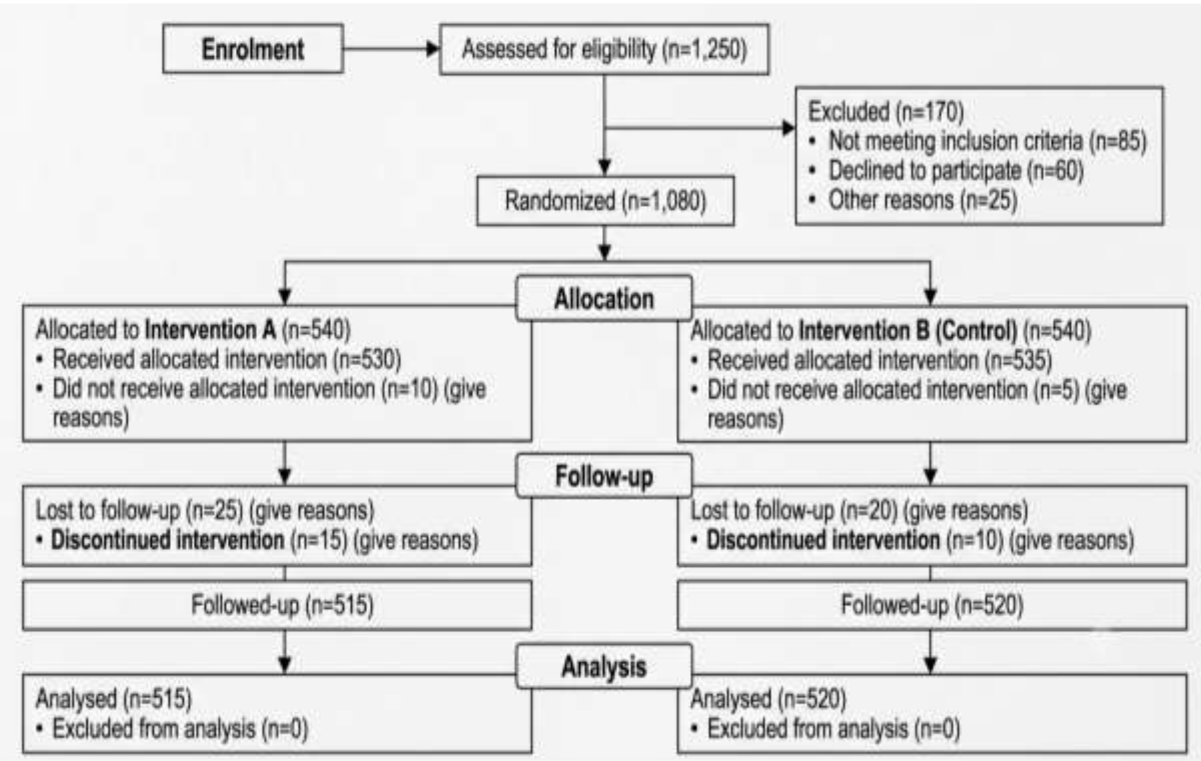


**Fig. 1. CONSORT flow diagram showing enrolment, allocation, follow-up and analysis of participants.**

### 2.5 Outcome Measures

#### 2.5.1 Pain intensity

Pain intensity was measured with the 11-point Numeric Pain Rating Scale (NPRS), on which 0 represents 'no pain' and 10 'worst imaginable pain'. Participants rated their average shoulder pain during the preceding 24 hours. The NPRS is simple to administer and demonstrates good reliability, validity and responsiveness in musculoskeletal pain populations [23], [24].

#### 2.5.2 Range of motion

Active shoulder flexion, abduction, external rotation and internal rotation were measured using a standard 12-inch universal goniometer following standardized positioning. Flexion and abduction were measured in supine, and rotations were measured in supine with the shoulder abducted to 90° (or to the maximum available abduction) and the elbow flexed to 90°. Each movement was measured three times and the mean was recorded. Goniometric shoulder measurements have demonstrated good intra-rater reliability in clinical settings [25].

#### 2.5.3 Functional disability

Functional disability was assessed with the Shoulder Pain and Disability Index (SPADI), a 13-item self-report questionnaire comprising a 5-item pain subscale and an 8-item disability subscale. Total scores are expressed as a percentage from 0 (best) to 100 (worst) [26]. The SPADI has excellent internal consistency and test–retest reliability and is widely recommended for patients with shoulder disorders [27]. All outcomes were recorded at baseline, at the end of week 2 (after six sessions) and at the end of week 4 (after twelve sessions).

### 2.6 Interventions

Both groups received treatment three times per week on alternate days for four consecutive weeks (12 sessions). Each session lasted approximately 40 minutes. All treatments were delivered by the same physiotherapist, certified in both osteopathic muscle energy and Mulligan concept techniques, to reduce inter-therapist variability.

#### 2.6.1 Group A – Spencer technique

The participant lay on the unaffected side with hips and knees flexed for stability. The therapist stood facing the participant, stabilised the scapula and clavicle with the cephalad hand and controlled the upper limb with the caudal hand. Each of the seven stages was performed with a muscle energy component: the arm was moved to the first restrictive barrier, the participant performed a 3–5-second isometric contraction at approximately 20% of maximal effort against equal counterforce, then relaxed, after which the therapist gently took up the slack to a new barrier. The procedure was repeated three to five times per stage (Table 1).

**TABLE 1. Stages of the Spencer technique applied in Group A**

| Stage | Movement | Procedure summary |
|---|---|---|
| 1 | Extension | Elbow flexed; arm moved into horizontal extension with scapula fixed; isometric flexion effort against resistance. |
| 2 | Flexion | Elbow extended; arm raised into flexion overhead with scapula fixed; isometric extension effort. |
| 3 | Circumduction with compression | Elbow flexed, arm abducted to 90°; slow clockwise and anticlockwise circles with gentle compression through the humerus. |
| 4 | Circumduction with traction | Elbow extended; small-to-large circles in both directions with gentle long-axis traction. |
| 5 | Abduction with internal rotation | Hand placed behind the back; elbow drawn forward into abduction and internal rotation; isometric resistance. |
| 6 | Adduction with external rotation | Elbow flexed; elbow moved across the chest into adduction with external rotation; isometric resistance. |
| 7 | Pumping / distraction | Arm extended; rhythmic long-axis distraction with the scapula stabilised to encourage fluid and lymphatic drainage. |

Each stage performed for 3–5 repetitions with a 3–5 s isometric hold and brief relaxation.

#### 2.6.2 Group B – Mulligan mobilization with movement

Mulligan MWM techniques were applied according to the principles of the Mulligan concept, ensuring that every procedure remained completely pain-free. A sustained accessory glide was maintained by the therapist, often with the aid of a mobilization belt, while the participant actively performed the restricted movement to the end of available range, and gentle over-pressure was added at end range where tolerated. Three sets of ten repetitions of each technique were performed with 30–60 seconds rest between sets (Table 2).

**TABLE 2. Mulligan MWM techniques applied in Group B**

| Target movement | Starting position | Glide and active movement |
|---|---|---|
| Flexion | Sitting | Posterolateral glide of the humeral head while the participant actively elevates the arm into flexion. |
| Abduction | Sitting | Posterolateral glide with the belt around the proximal humerus during active abduction in the scapular plane. |
| External rotation | Sitting / supine | Posterolateral glide maintained while the participant actively rotates outwards with elbow at the side. |
| Internal rotation (hand behind back) | Standing | Inferior glide of the humerus with the participant sliding the hand up the back; towel-assisted over-pressure. |

Each technique: 3 sets × 10 repetitions, pain-free, with end-range over-pressure where tolerated.

**2.6.3 Common conventional programme**

To ensure ethical standard care, both groups also received moist heat to the shoulder for 10 minutes before manual therapy, and were taught a home exercise programme comprising Codman's pendulum exercises, wand-assisted flexion and external rotation, and wall-climbing exercises (10 repetitions, twice daily). Participants recorded adherence in an exercise diary. Paracetamol was permitted as rescue medication and its use was recorded; no other physiotherapy or injections were allowed during the study period.

**2.7 Statistical Analysis**

Data were analysed using IBM SPSS Statistics version 26. The Shapiro–Wilk test confirmed that continuous variables were approximately normally distributed ($p > 0.05$). Descriptive statistics are presented as mean ± standard deviation (SD) for continuous variables and frequency for categorical variables. Baseline comparability was examined using the independent t-test and chi-square test. Within-group changes across the three time points were analysed with one-way repeated-measures analysis of variance (ANOVA) with Bonferroni post-hoc comparisons. Between-group differences at each time point were analysed with the independent t-test, and mean differences with 95% confidence intervals (CI) and Cohen's d effect sizes were calculated. Statistical significance was set at $p < 0.05$. Analysis was performed on a per-protocol basis.

## 3. RESULTS

**3.1 Participant Flow and Baseline Characteristics**

Seventy-eight patients were screened, of whom 60 were randomized. Two participants in each group were lost to follow-up, leaving 28 participants per group for the final analysis (Fig. 1). No adverse events were reported other than transient post-treatment soreness in three participants (two in Group A and one in Group B), which resolved within 24 hours. Mean adherence to the home programme exceeded 85% in both groups. The groups were comparable at baseline for all demographic and clinical variables (Table 3) and for all outcome measures (Tables 4 and 5).

**TABLE 3. Baseline demographic and clinical characteristics of participants**

| Variable | Group A: Spencer (n = 28) | Group B: MWM (n = 28) | p-value |
|---|---|---|---|
| Age (years), mean ± SD | 49.6 ± 6.2 | 50.3 ± 5.8 | 0.662 |
| Gender (male / female) | 11 / 17 | 10 / 18 | 0.783 |
| Body mass index (kg/m²), mean ± SD | 25.8 ± 2.9 | 26.1 ± 3.1 | 0.709 |
| Duration of symptoms (months), mean ± SD | 5.4 ± 1.8 | 5.6 ± 2.0 | 0.695 |
| Affected side (dominant / non-dominant) | 16 / 12 | 15 / 13 | 0.788 |
| Diabetes mellitus (yes / no) | 9 / 19 | 10 / 18 | 0.776 |

Independent t-test for continuous variables; chi-square test for categorical variables.

**3.2 Effect on Pain**

Both groups demonstrated a significant reduction in NPRS scores over time (repeated-measures ANOVA, $p < 0.001$). In Group A, mean pain decreased from 7.4 ± 0.9 at baseline to 3.9 ± 1.1 at week 4 (47.3% reduction), while in Group B it decreased from 7.5 ± 0.8 to 2.9 ± 1.0 (61.3% reduction). The between-group difference was not significant at week 2 (p = 0.054) but became significant at week 4 in favour of Group B (t = 3.56, p = <0.001), with a large effect size (d = 0.95) (Table 4, Fig. 2).

**TABLE 4. Between-group comparison of pain (NPRS) and functional disability (SPADI)**

| Outcome – time point | Group A: Spencer (mean ± SD) | Group B: MWM (mean ± SD) | t | p-value |
|---|---|---|---|---|
| NPRS – Baseline | 7.4 ± 0.9 | 7.5 ± 0.8 | 0.44 | 0.662 |
| Week 2 | 5.6 ± 1.0 | 5.1 ± 0.9 | 1.97 | 0.054 |
| Week 4 | 3.9 ± 1.1 | 2.9 ± 1.0 | 3.56 | <0.001 |
| SPADI – Baseline | 68.4 ± 7.9 | 69.1 ± 7.5 | 0.34 | 0.735 |
| Week 2 | 55.2 ± 7.6 | 51.8 ± 7.3 | 1.71 | 0.094 |
| Week 4 | 42.7 ± 7.8 | 35.6 ± 7.4 | 3.49 | <0.001 |

NPRS, Numeric Pain Rating Scale (0–10); SPADI, Shoulder Pain and Disability Index (%). Independent t-test, df = 54.

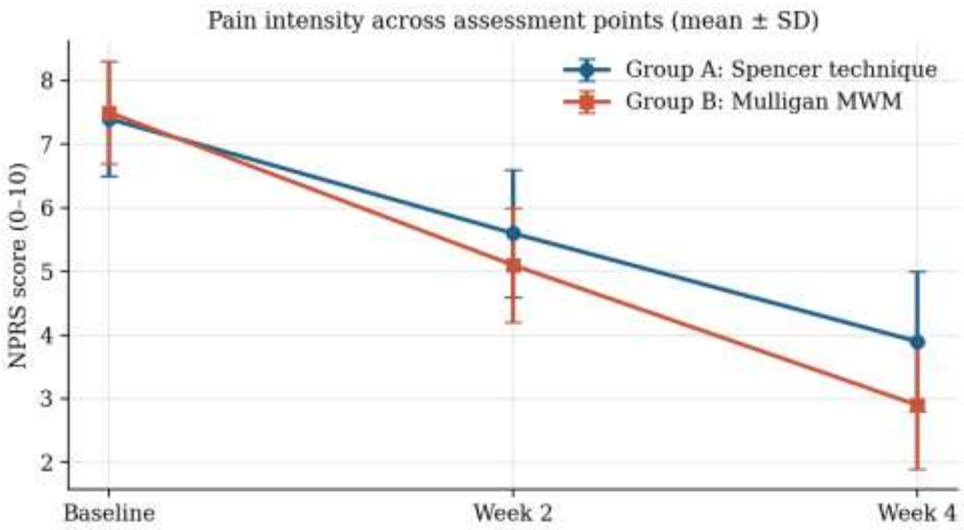


**Fig. 2. Mean NPRS pain scores (± SD) at baseline, week 2 and week 4 in both groups.**

**3.3 Effect on Range of Motion**

All four shoulder movements improved significantly within both groups (p < 0.001). At baseline there were no between-group differences. By week 4, Group B achieved significantly greater abduction (mean difference 11.2°; 95% CI 6.1 to 16.3; p < 0.001) and external rotation (mean difference 7.8°; 95% CI 4.4 to 11.2; p < 0.001) than Group A. A significant advantage in abduction was already evident at week 2 (p = 0.027). Although flexion and internal rotation also improved more in Group B, these differences did not reach statistical significance at week 4 (p = 0.123 and p = 0.321, respectively) (Table 5, Fig. 3).

**TABLE 5. Between-group comparison of shoulder range of motion (degrees)**

| Movement – time point | Group A: Spencer (mean ± SD) | Group B: MWM (mean ± SD) | t | p-value |
|---|---|---|---|---|
| Flexion – Baseline | 118.4 ± 10.2 | 117.9 ± 9.8 | 0.19 | 0.852 |
| Week 2 | 131.6 ± 9.8 | 133.9 ± 9.6 | 0.89 | 0.379 |
| Week 4 | 145.2 ± 9.5 | 149.1 ± 9.1 | 1.57 | 0.123 |
| Abduction – Baseline | 84.6 ± 9.4 | 85.1 ± 8.9 | 0.20 | 0.839 |
| Week 2 | 98.7 ± 9.1 | 104.2 ± 9.0 | 2.27 | 0.027 |
| Week 4 | 112.3 ± 9.6 | 123.5 ± 9.3 | 4.43 | <0.001 |
| External rotation – Baseline | 31.2 ± 6.1 | 30.8 ± 5.9 | 0.25 | 0.804 |
| Week 2 | 39.8 ± 6.3 | 43.1 ± 6.0 | 2.01 | 0.050 |
| Week 4 | 47.6 ± 6.5 | 55.4 ± 6.2 | 4.59 | <0.001 |
| Internal rotation – Baseline | 38.5 ± 6.4 | 38.1 ± 6.6 | 0.23 | 0.819 |
| Week 2 | 44.9 ± 6.2 | 45.6 ± 6.5 | 0.41 | 0.682 |

| | | | | |
|---|---|---|---|---|
| Week 4 | 51.3 ± 6.3 | 53.0 ± 6.4 | 1.00 | 0.321 |

Values in degrees. Independent t-test, df = 54; p < 0.05 considered significant.

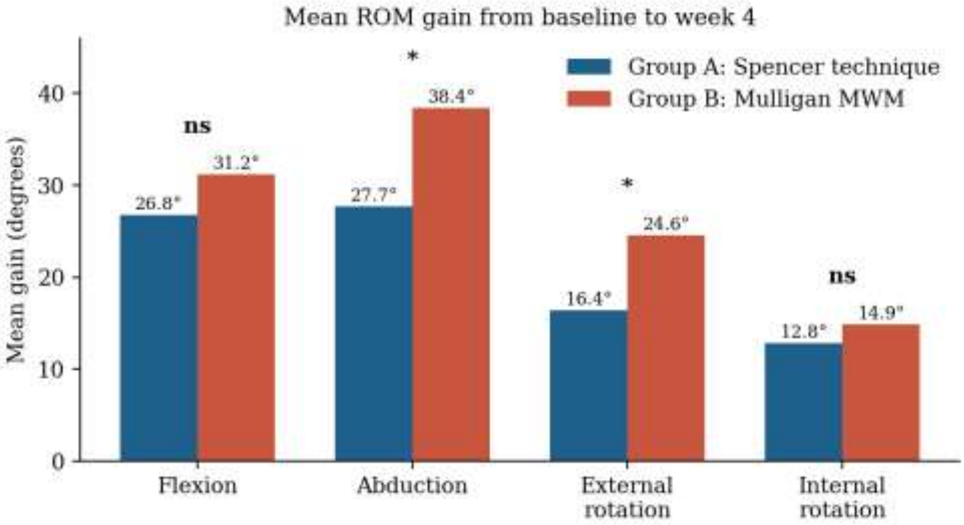


**Fig. 3. Mean gain in shoulder ROM from baseline to week 4 (* p < 0.05; ns, not significant).**

### 3.4 Effect on Functional Disability

SPADI total scores decreased significantly within both groups (p < 0.001). Group A improved from 68.4 ± 7.9% to 42.7 ± 7.8% (37.6% relative improvement) and Group B from 69.1 ± 7.5% to 35.6 ± 7.4% (48.5% relative improvement). The between-group difference was not significant at week 2 (p = 0.094), but at week 4 Group B demonstrated significantly lower disability (mean difference -7.1%; 95% CI -11.2 to -3.0; p = <0.001; d = 0.93) (Table 4, Fig. 4). Both groups exceeded the commonly cited minimal clinically important difference of 8–13 points for the SPADI.

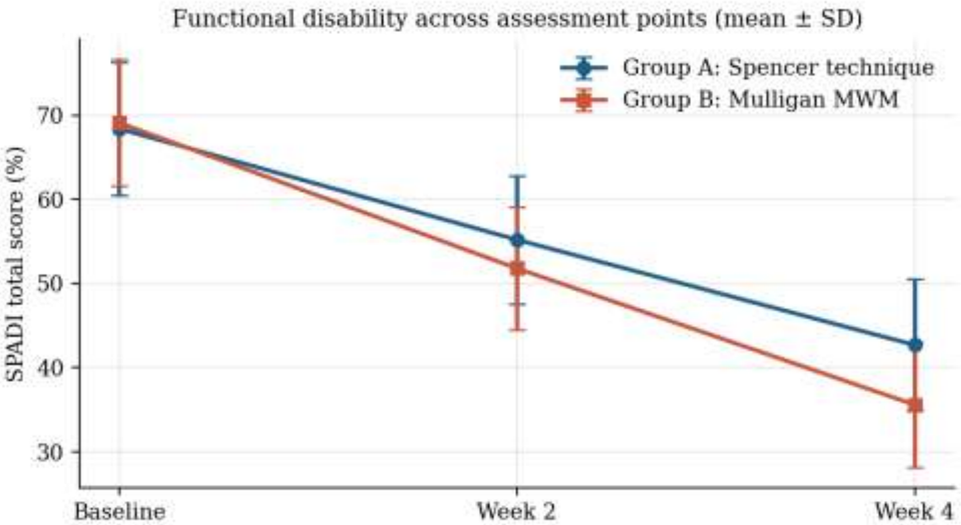


**Fig. 4. Mean SPADI total scores (± SD) at baseline, week 2 and week 4 in both groups.**

### 3.5 Summary of Week-4 Treatment Effects

Table 6 summarises the between-group mean differences, 95% confidence intervals and effect sizes at the end of the intervention period, and Fig. 5 compares the relative percentage improvement achieved by each group. Group B showed larger relative improvements on every outcome, with the greatest advantages in external rotation and abduction.

**TABLE 6. Between-group mean difference (Group B − Group A) at week 4**

| Outcome | Mean difference | 95% CI | Cohen's d | p-value | Interpretation |
|---|---|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| NPRS (0–10) | -1.0 | -1.6 to -0.4 | 0.95 | <0.001 | Favours MWM |
| SPADI (%) | -7.1 | -11.2 to -3.0 | 0.93 | <0.001 | Favours MWM |
| Flexion (°) | 3.9 | -1.1 to 8.9 | 0.42 | 0.123 | No difference |
| Abduction (°) | 11.2 | 6.1 to 16.3 | 1.19 | <0.001 | Favours MWM |
| External rotation (°) | 7.8 | 4.4 to 11.2 | 1.23 | <0.001 | Favours MWM |
| Internal rotation (°) | 1.7 | -1.7 to 5.1 | 0.27 | 0.321 | No difference |

Negative values for NPRS and SPADI indicate lower (better) scores in Group B; positive ROM values indicate greater motion in Group B. d: 0.2 small, 0.5 medium, 0.8 large.

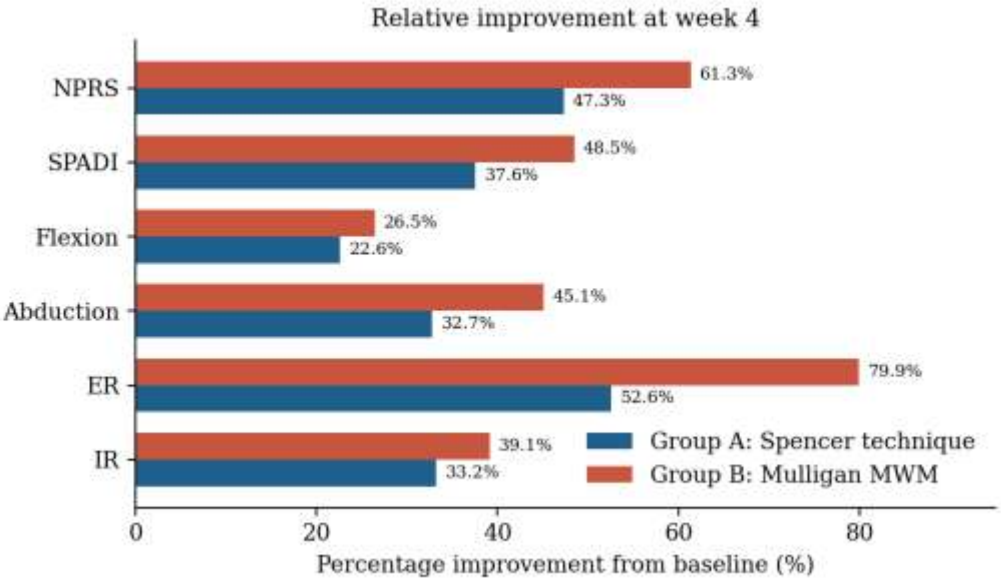


**Fig. 5. Percentage improvement from baseline to week 4 for each outcome in both groups.**

# 4. DISCUSSION

### 4.1 Principal Findings

This randomized controlled trial compared two commonly used manual therapy approaches for stage II adhesive capsulitis. Both the Spencer technique and Mulligan MWM, when combined with a standard conventional programme, produced statistically and clinically meaningful improvements in pain, ROM and functional disability over four weeks. However, MWM resulted in significantly greater reductions in pain and disability and larger gains in abduction and external rotation at week 4. The null hypothesis was therefore rejected for pain, abduction, external rotation and disability, and retained for flexion and internal rotation.

### 4.2 Comparison with Previous Studies

The within-group improvements observed in the Spencer group are consistent with earlier trials. Iqbal et al. reported that the Spencer muscle energy technique reduced NPRS by approximately five points and improved ROM and SPADI more than passive stretching over four weeks [14]. Gasibat et al. and Amin et al. similarly found that the technique outperformed conventional physiotherapy for pain and disability [15], [16]. The magnitude of change in the present Spencer group was somewhat smaller than in some of these studies, which may reflect the older age range and longer symptom duration of the present sample, as well as the use of an active conventional co-intervention in both arms.

The superior results in the MWM group agree with the findings of Doner et al., who observed that Mulligan techniques produced greater improvements in ROM, pain and SPADI than conventional therapy in patients with AC [19]. Yang et al. likewise demonstrated that MWM was more effective than end-range or mid-range mobilization in improving mobility and scapulohumeral rhythm [20]. Systematic reviews support the use of mobilization in AC but note heterogeneity in technique and dosage [12], [13]; the present study adds direct comparative evidence between two techniques using identical treatment frequency, duration and co-interventions.

### 4.3 Possible Mechanisms

The greater improvement in external rotation and abduction with MWM is plausibly explained by its biomechanical and neurophysiological characteristics. The posterolateral glide used in MWM may correct anterior–superior migration of the humeral head and allow the humerus to roll and glide more normally beneath the acromion, in keeping with the positional-fault hypothesis [17]. Because external rotation and abduction are the movements most limited by contracture of the rotator interval and coracohumeral ligament [6], a technique that combines accessory glide with active movement at end range may apply a more specific and prolonged stretch to these structures. End-range and high-grade mobilization have similarly been shown to produce superior gains in AC compared with low-grade techniques [21], and sustained stretching of the inferior capsule enhances abduction in frozen shoulder [30].

From a neurophysiological perspective, manual therapy is thought to modulate pain through peripheral mechanisms, spinal segmental inhibition and descending supraspinal pathways [28]. MWM, being pain-free and patient-active, may additionally reduce fear of movement and protective muscle guarding. Hollmann et al. demonstrated that a meaningful portion of the ROM lost in frozen shoulder is attributable to muscle guarding rather than capsular contracture alone [29]. Active participation within a pain-free glide may therefore provide a stronger stimulus for motor relearning and reduction of guarding than the predominantly passive Spencer sequence. The muscle energy component of the Spencer technique, relying on post-isometric relaxation, also reduces muscle tone [14], which may explain its benefit on flexion and internal rotation, where no between-group differences were detected.

### 4.4 Clinical Implications

Both techniques are safe, require no specialised equipment beyond a mobilization belt, and can be integrated into routine physiotherapy for AC. The findings suggest that MWM may be preferred when the main goals are rapid pain relief and restoration of external rotation and abduction—movements essential for activities such as dressing, combing hair and reaching overhead. The Spencer technique remains a useful alternative, particularly for highly irritable patients who cannot tolerate active end-range movement, or as a preparatory technique before active mobilization. Clinicians should consider tissue irritability and patient preference in line with current practice guidelines [10].

### 4.5 Limitations

Several limitations should be acknowledged. First, the follow-up period was limited to four weeks, so the long-term durability of effects is unknown. Second, the treating therapist could not be blinded, which may have introduced performance bias. Third, the study was conducted at a single centre with a modest sample size, limiting generalisability. Fourth, only patients in stage II were included, and results may differ in the painful freezing or recovery phases. Finally, participants with and without diabetes were combined, and subgroup analysis was not powered; diabetic AC is known to respond more slowly to treatment [3], [4].

### 4.6 Recommendations for Future Research

Future multicentre trials with larger samples, longer follow-up (three to twelve months), blinding of participants where feasible and stratification by stage and diabetic status are recommended. Studies could also examine a combined protocol of the Spencer technique followed by MWM, evaluate scapulohumeral rhythm and kinematics, and include cost-effectiveness analyses.

## 5. CONCLUSION

Both the Spencer technique and Mulligan mobilization with movement, combined with conventional physiotherapy, are effective in reducing pain, improving shoulder range of motion and decreasing functional disability in patients with adhesive capsulitis. However, Mulligan MWM produced significantly greater short-term improvements in pain, abduction, external rotation and functional disability than the Spencer technique, while both approaches were comparable for flexion and internal rotation. Mulligan MWM may therefore be considered the preferred manual therapy option for stage II adhesive capsulitis, with the Spencer technique serving as a valuable alternative for patients less tolerant of active end-range movement.

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