

COMPARATIVE EFFICACY OF SPENCER'S TECHNIQUE VERSUS MULLIGAN'S TECHNIQUE ON PAIN, RANGE OF MOTION, AND QUALITY OF LIFE IN PATIENTS WITH STAGE II FROZEN SHOULDER

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Keywords

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Abstract

Background: Adhesive capsulitis, commonly known as frozen shoulder, is a painful musculoskeletal condition characterized by progressive shoulder pain, stiffness, and restriction of range of motion (ROM), which may adversely affect functional performance and health-related quality of life. Stage II adhesive capsulitis is associated with persistent pain and considerable restriction of shoulder mobility. Although various manual therapy techniques are used in clinical rehabilitation, comparative evidence regarding Spencer's Technique and Mulligan's Mobilization with Movement (MWM) remains limited. Therefore, this study compared the effects of Spencer's Technique and Mulligan's MWM on pain intensity, shoulder ROM, and health-related quality of life in patients with Stage II idiopathic adhesive capsulitis.

Objective: To compare the effects of Spencer's Technique and Mulligan's MWM on pain intensity, shoulder ROM, and health-related quality of life in patients with Stage II idiopathic adhesive capsulitis.

Methods: This randomized controlled trial included 72 participants with Stage II idiopathic adhesive capsulitis who were recruited from Ibn-e-Sina Hospital and Research Institute and City Hospital, Multan, using a non-probability convenience sampling technique. Participants were randomly allocated into two equal groups (n = 36 per group). Group A received Spencer's Technique with conventional physiotherapy, while Group B received Mulligan's MWM with conventional physiotherapy. Both groups received five treatment sessions per week for four weeks. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), shoulder ROM was measured using a goniometer, and health-related quality of life was assessed using the 36-Item Short Form Health Survey (SF-36). Assessments were

conducted before and after the intervention. Normality was assessed using the Kolmogorov–Smirnov test. Within-group comparisons were performed using paired-samples *t* tests for normally distributed ROM data and Wilcoxon signed-rank tests for non-normally distributed outcomes. Between-group comparisons were performed using the Mann–Whitney *U* test. Statistical analysis was conducted using IBM SPSS Statistics version 26.0, with $p \leq .05$ considered statistically significant.

Results: Both groups demonstrated statistically significant within-group improvements in all eight shoulder ROM measures, including flexion, extension, abduction, adduction, internal rotation, external rotation, horizontal abduction, and horizontal adduction (all $p < .001$). Pain intensity also decreased significantly in both the Spencer’s Technique group ($Z = -5.44$, $p < .001$) and the Mulligan’s MWM group ($Z = -5.40$, $p < .001$). Similarly, all eight SF-36 domains demonstrated statistically significant within-group improvements in both groups (all $p < .001$). Between-group analysis revealed no statistically significant difference in pain intensity ($p = .184$) or most SF-36 domains. However, statistically significant between-group differences were observed in shoulder horizontal adduction ($p = .003$) and the General Health domain of the SF-36 ($p = .015$).

Conclusion: Both Spencer’s Technique and Mulligan’s MWM, when combined with conventional physiotherapy, were associated with significant improvements in pain intensity, shoulder ROM, and health-related quality of life in patients with Stage II idiopathic adhesive capsulitis. Between-group differences were observed specifically for shoulder horizontal adduction and the General Health domain, whereas no significant differences were found for pain intensity or the remaining assessed outcomes.

1. INTRODUCTION

Frozen shoulder, or adhesive capsulitis, is a disabling musculoskeletal disorder characterized by progressive pain, stiffness, and restriction of both active and passive shoulder range of motion (ROM) [1, 2]. Adhesive capsulitis involves inflammatory and fibrotic changes within the glenohumeral joint capsule, including synovial proliferation, capsular fibrosis, and contracture, which progressively impair normal shoulder arthrokinematics and functional movement [3, 4]. Its pathophysiology is multifactorial, with inflammatory mediators contributing to fibroblast proliferation and capsular fibrosis, while thickening and contracture of the capsule and coracohumeral ligament further restrict mobility [3, 5–7]. External rotation is typically the most restricted movement, followed by abduction and internal rotation [8], resulting in difficulties with

reaching, dressing, grooming, lifting, and other activities of daily living.

Clinically, adhesive capsulitis is commonly classified into freezing, frozen, and thawing stages [9, 10]. The freezing stage is characterized predominantly by increasing pain and stiffness, whereas the frozen stage involves persistent restriction of shoulder movement with comparatively less pain. The thawing stage is associated with gradual recovery of mobility and function [10]. Stage II, or the frozen phase, is particularly relevant for rehabilitation because substantial capsular stiffness and multidirectional ROM restriction may persist despite reduced pain intensity [11].

The condition can substantially impair physical function and health-related quality of life (QoL). Pain, restricted mobility, sleep disturbance, and limitations in personal, occupational, domestic, and social activities may adversely affect overall

well-being [12–14]. Muscle weakness and compensatory scapular or trunk movements may further contribute to functional limitations [15, 16]. Accordingly, reducing pain, restoring shoulder mobility, and improving QoL represent important goals of rehabilitation.

Conservative treatment remains the principal approach to adhesive capsulitis and includes pharmacological management, corticosteroid injections, hydro dilatation, exercise, and physiotherapy [17, 18]. Physiotherapy commonly involves stretching, strengthening, electrotherapy, and manual therapy to reduce pain, improve capsular mobility, and restore functional movement [19, 20]. Manual therapy may influence pain and joint mechanics through mechanical and neurophysiological mechanisms, although treatment responses may vary according to the mobilization technique, movement direction, disease stage, and patient characteristics [21, 22]. Therefore, comparison of specific manual therapy techniques is clinically relevant.

Spencer's technique is an orthopedic manual therapy approach consisting of repetitive articulatory movements of the shoulder, including flexion, extension, abduction, adduction, circumduction, and rotation [23, 24]. These multidirectional movements are intended to improve joint mobility and capsular extensibility and may reduce stiffness and pain while facilitating movement [25–28]. This approach may therefore be particularly relevant for patients with Stage II adhesive capsulitis, in whom multidirectional shoulder restriction is prominent.

Mulligan's Mobilization with Movement (MWM) combines a sustained accessory joint glide applied by the therapist with active movement performed by the patient [29]. It is intended to facilitate pain-free movement, optimize joint mechanics, and improve functional ROM [30, 31]. In addition to mechanical effects, MWM may exert hypoalgesic effects through neurophysiological mechanisms [32]. The combination of therapist-applied mobilization and active patient movement distinguishes MWM from conventional passive mobilization.

Although both Spencer's technique and Mulligan's MWM have been investigated for adhesive capsulitis, previous studies have largely examined these approaches independently or against other physiotherapy interventions. Improvements in pain, shoulder mobility, and functional outcomes have been reported following manual therapy, including Spencer's and Mulligan's approaches [23, 33]. However, variations in treatment protocols, patient characteristics, disease stage, outcome measures, and methodological approaches limit direct comparison between the two techniques, particularly in patients with Stage II idiopathic frozen shoulder.

Therefore, the present study compared the effects of Spencer's technique and Mulligan's technique on pain, shoulder ROM, and health-related QoL in patients with Stage II frozen shoulder.

2 CRITICAL ANALYSES OF THE LITERATURE

Current evidence supports manual therapy as a useful component of adhesive capsulitis rehabilitation, particularly for improving pain, shoulder mobility, and functional performance. Recent evidence has further supported Muscle Energy Technique (MET), with a 2026 systematic review and meta-analysis of 16 randomized controlled trials involving 659 participants reporting significant improvements in pain, disability, and shoulder ROM, including external rotation, abduction, and internal rotation [34]. Individual clinical trials have also reported improvements in pain, disability, and shoulder mobility following Spencer's technique compared with conventional physiotherapy or passive stretching [35–39]. However, differences in intervention protocols, comparators, sample characteristics, and outcome measures limit direct interpretation of these findings. Moreover, evidence against less intensive comparators does not necessarily establish superiority over other specialized manual therapy techniques.

Evidence for Mulligan's Mobilization with Movement (MWM) is similarly favorable but remains inconsistent when compared with other

approaches. Comparative studies have reported significant improvements following both Spencer's and Mulligan's techniques, with some findings favoring MWM for pain and functional outcomes [31, 40]. Conversely, other studies have reported greater improvements following Spencer's technique when compared with alternative manual therapy interventions [36, 38]. These differences may reflect variations in treatment dosage, comparator interventions, accompanying exercise programs, outcome measures, and patient characteristics. In addition, several studies combined manual therapy with conventional physiotherapy or therapeutic exercise [31, 35, 40], making it difficult to determine the independent contribution of the manual technique. Thus, although both approaches appear beneficial, their relative effectiveness remains uncertain.

Another limitation of the literature is the predominant emphasis on pain, ROM, and disability, with less attention to patient-centered outcomes such as health-related quality of life. Sarwar et al. [41] and Ghaffar et al. [26] highlighted the importance of considering the broader effects of adhesive capsulitis on daily activities, sleep, social participation, and general well-being. Related evidence on scapular mobilization has also produced mixed findings. Individual studies have reported improvements in pain, ROM, and function [41, 42], whereas pooled evidence has not demonstrated significant additional benefits over comparator interventions for pain, disability, flexion, or external rotation [43]. These inconsistencies highlight the influence of methodological heterogeneity and support the need for well-designed comparative trials using standardized and clinically meaningful outcomes. Overall, the literature suggests that both Spencer's technique and Mulligan's MWM may improve clinical outcomes in adhesive capsulitis, but direct comparative evidence remains limited and heterogeneous. Existing comparisons have generally involved small samples, differing treatment combinations, variable intervention durations, and diverse outcome measures [31, 40]. Furthermore, limited evidence specifically

addresses patients with Stage II frozen shoulder, despite the marked capsular stiffness and restricted mobility characteristic of this stage. The relative lack of health-related QoL assessment represents another important gap. Therefore, a randomized controlled trial directly comparing Spencer's and Mulligan's techniques in Stage II frozen shoulder, while assessing pain, shoulder ROM, and quality of life, is warranted to provide more focused evidence regarding their comparative clinical effects.

3. OBJECTIVE

The objective of this study was to determine the comparative efficacy of Spencer's Technique and Mulligan's Mobilization with Movement (MWM) on pain intensity, shoulder range of motion (ROM), and health-related quality of life in patients with Stage II frozen shoulder.

4. HYPOTHESES

The null hypothesis was that there would be no statistically significant difference between Spencer's Technique and Mulligan's MWM in their effects on pain intensity, shoulder range of motion, and health-related quality of life in patients with Stage II frozen shoulder. The alternative hypothesis was that there would be a statistically significant difference between Spencer's Technique and Mulligan's MWM in their effects on pain intensity, shoulder range of motion, and health-related quality of life in patients with Stage II frozen shoulder.

OPERATIONAL DEFINITIONS

Frozen shoulder, clinically referred to as adhesive capsulitis, is a musculoskeletal condition characterized by shoulder pain and progressive restriction of both active and passive shoulder range of motion due to capsular stiffness and associated functional limitations [13]. Stage II frozen shoulder refers to the phase of adhesive capsulitis characterized by persistent shoulder stiffness, substantial restriction of shoulder range of motion, and continuing pain, although pain may become less prominent than during the initial freezing phase [44]. Spencer's Technique is a standardized osteopathic manual therapy

approach comprising seven articulatory shoulder movements designed to mobilize the glenohumeral and scapulothoracic joints. The technique incorporates rhythmic movements and end-range stretching intended to reduce stiffness, improve tissue extensibility, and facilitate pain-free shoulder range of motion [41]. Mulligan's Technique, specifically Mobilization with Movement (MWM), involves the application of a sustained manual accessory glide to a peripheral joint by the therapist while the patient simultaneously performs the restricted movement actively or passively, with the aim of facilitating pain-free movement and improving joint mobility [45]. Pain intensity refers to the perceived severity of pain experienced by an individual and, in this study, was assessed using the Numeric Pain Rating Scale (NPRS), in which higher scores indicate greater pain intensity [46]. Shoulder range of motion refers to the extent of movement available at the shoulder joint and, in this study, was assessed by measuring flexion, extension, abduction, adduction, internal rotation, external rotation, horizontal abduction, and horizontal adduction using a goniometer [47]. Health-related quality of life refers to an individual's perceived physical, psychological, emotional, and social well-being in relation to their health condition and, in this study, was assessed using the 36-Item Short

Form Health Survey (SF-36), which evaluates eight domains of health status [48].

5. MATERIALS AND METHODS

Study Design and Setting

A randomized controlled trial was conducted to compare the effects of Spencer's Technique and Mulligan's Mobilization with Movement on pain, shoulder range of motion, and health-related quality of life in patients with Stage II frozen shoulder. Data were collected from the physiotherapy departments of Ibn-e-Sina Hospital and Research Institute and City Hospital, Multan.

Duration and Timeline

The study was conducted over a period of six months following approval of the research synopsis by the relevant research board. The intervention was administered over a period of four weeks, with the remaining study period allocated to participant recruitment, baseline assessment, intervention implementation, post-intervention assessment, data management, and statistical analysis.

Sample Size and Sampling Technique

The required sample size was calculated using OpenEpi, yielding a total sample of 72 participants, with 36 participants allocated to each intervention group.

Sample Size For Comparing Two Means

Input Data			
Confidence Interval (2-sided)	95%		
Power	80%		
Ratio of sample size (Group 2/Group 1)	1		
	Group 1	Group 2	Difference*
Mean	53.7	41.92	11.78
Standard deviation	17.4	17.78	
Variance	302.76	316.128	
Sample size of Group 1	36		
Sample size of Group 2	36		
Total sample size	72		

A non-probability convenience sampling technique was used to recruit eligible participants. Participants meeting the predefined eligibility criteria were enrolled and subsequently allocated

to the respective intervention groups according to the study protocol.

Eligibility Criteria

Male and female participants aged 30–55 years with a history of idiopathic Stage II frozen shoulder and a minimum three-month history of shoulder pain were eligible for inclusion [40]. Participants were excluded if they had a previous history of rotator cuff tear, rheumatoid arthritis, gouty arthritis, a tumor involving the shoulder region, thoracic outlet syndrome, or a fracture of the upper limb involving the affected shoulder [40].

Ethical Considerations

The study was conducted in accordance with the ethical guidelines of Superior University, Lahore, and approval was obtained from the relevant institutional ethical committee before commencement of data collection. Written informed consent was obtained from all participants after providing information regarding the study procedures and their rights as research participants. Participation was voluntary, and participants were informed of their right to withdraw from the study at any stage without consequences. Confidentiality and anonymity were maintained throughout data collection, analysis, and reporting. Personal identifiers were not disclosed in any publication or research report, and all reasonable measures were taken to protect participants' privacy and confidentiality.

DATA COLLECTION TOOLS

Numeric Pain Rating Scale (NPRS):

Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), an 11-point scale ranging from 0 (no pain) to 10 (worst imaginable pain). Participants rated their pain according to the standard assessment instructions. The NPRS is widely used in musculoskeletal practice and research and has demonstrated well to excellent reliability, with reported intraclass correlation coefficient (ICC) values of 0.86–0.95. Its validity has also been supported by strong correlations with other pain measures, including the Visual Analogue Scale (VAS) [49].

Goniometer:

Shoulder joint ROM was assessed using a universal goniometer. The instrument was positioned with its axis aligned to the anatomical axis of the joint, while the stationary and moving arms were aligned with the proximal and distal body segments, respectively. Shoulder movements were recorded in degrees according to the predefined assessment procedure. Goniometric assessment has demonstrated well to excellent intra-rater and inter-rater reliability, with reported ICC values ranging from 0.85 to 0.99, supporting its clinical use for measuring joint ROM [50].

36-Item Short Form Health Survey (SF-36):

Health-related quality of life was assessed using the 36-Item Short Form Health Survey (SF-36), a standardized self-administered instrument comprising 36 items across eight health domains: physical functioning, role limitations due to physical health, bodily pain, general health, vitality, social functioning, role limitations due to emotional problems, and mental health. Scores are transformed to a 0–100 scale, with higher scores indicating better perceived health status. The SF-36 has demonstrated good internal consistency and has been extensively validated for clinical and musculoskeletal populations [51].

DATA COLLECTION PROCEDURE

RECRUITMENT AND ENROLMENT

Participants diagnosed with Stage II frozen shoulder were screened according to the predefined eligibility criteria. Following confirmation of eligibility, the participants were informed about the study procedures, and written informed consent was obtained before enrolment. A total of 72 eligible participants were included in the study and allocated equally into two intervention groups, with 36 participants in each group. Group A received Spencer's Technique in addition to conventional physiotherapy, whereas Group B received Mulligan's Technique in addition to conventional physiotherapy.

RANDOMISATION AND BLINDING

Participants were randomly allocated to Group A or Group B using a chit-and-lottery method. The study employed a single-blinded design in which the outcome assessor was blinded to group allocation. Baseline and post-intervention assessments were performed using the predefined outcome measures.

OUTCOME ASSESSMENT

Following enrolment and before initiation of the intervention, baseline assessments were performed. Pain intensity was assessed using the Numeric Pain Rating Scale (NPRS), health-related quality of life was assessed using the 36-Item Short Form Health Survey (SF-36), and shoulder range of motion was measured using a goniometer. The same outcome measures were reassessed following completion of the intervention period.

GROUP A: SPENCER'S TECHNIQUE WITH CONVENTIONAL PHYSIOTHERAPY

Participants allocated to Group a received Spencer's Technique in addition to conventional physiotherapy, **five sessions per week for four weeks**. The participant was positioned in side-lying with the affected shoulder uppermost, while the therapist stood facing the participant and stabilized the superior aspect of the shoulder girdle. Spencer's Technique consisted of a sequence of rhythmic passive movements directed towards mobilization of the glenohumeral and scapulothoracic joints. The sequence included shoulder extension, flexion, circumduction with compression and distraction, abduction, internal rotation, and external rotation. The movements were performed sequentially within the available range with the aim of reducing stiffness and improving shoulder mobility through mobilization of restricted soft tissues and the joint capsule. Three sets of 10 repetitions were performed for each movement according to the study protocol [40].

Conventional physiotherapy consisted of moist heat application for 5–7 minutes before treatment, followed by shoulder isometric exercises, pulley exercises, finger-ladder exercises, pectoral

stretching, and Codman's pendulum exercises. Each exercise was performed for at least three sets of 8–10 repetitions [40].

GROUP B: MULLIGAN'S TECHNIQUE WITH CONVENTIONAL PHYSIOTHERAPY

Participants allocated to Group B received Mulligan's Mobilization with Movement (MWM) in addition to conventional physiotherapy, five sessions per week for four weeks. The participant was positioned appropriately for mobilization, and the therapist applied a sustained accessory glide to the relevant shoulder joint while the participant performed the restricted movement actively within a pain-free range. The mobilization was maintained throughout the active movement. Three sets of 10 repetitions were performed, with a two-minute rest interval between sets [40].

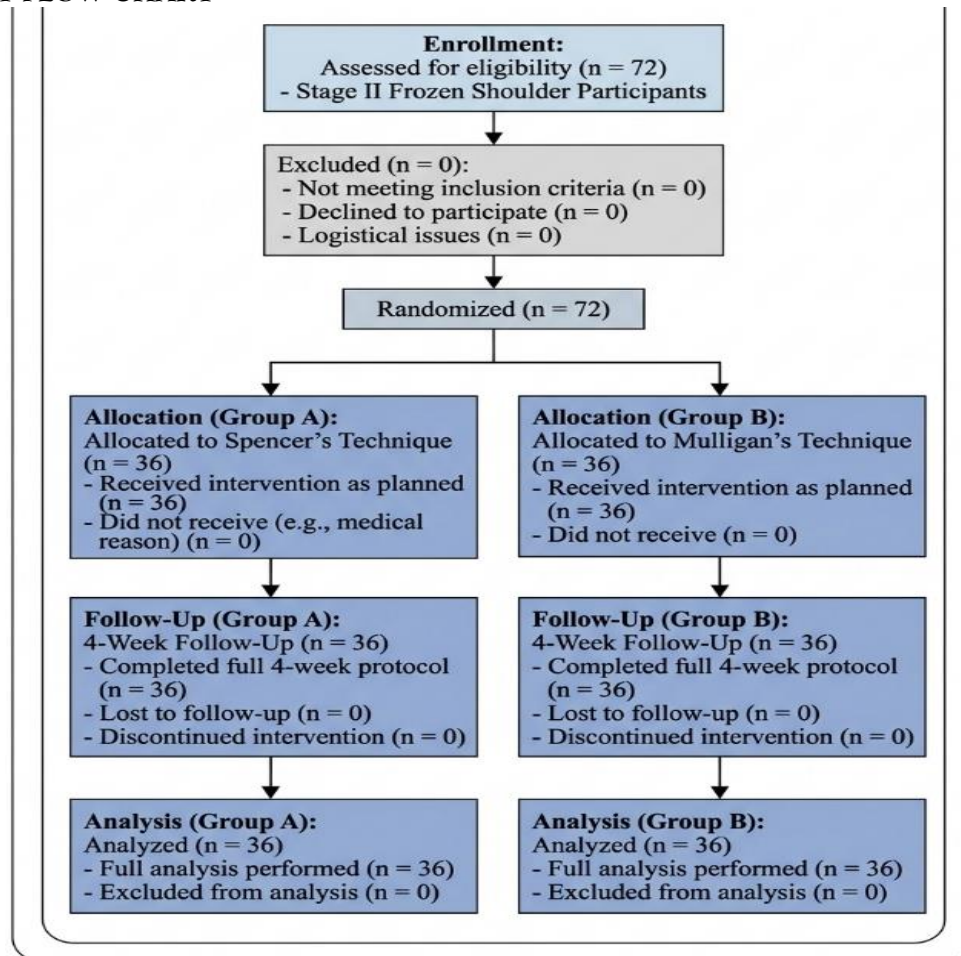
The same conventional physiotherapy protocol provided to Group A was administered to Group B, consisting of moist heat application for 5–7 minutes, shoulder isometric exercises, pulley exercises, finger-ladder exercises, pectoral stretching, and Codman's pendulum exercises. Each exercise was performed for at least three sets of 8–10 repetitions [40]. The intervention was delivered **five sessions per week for four consecutive weeks**.

DATA ANALYSIS

Data were entered, managed, and analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were used to summarize the study variables, with continuous variables presented as mean $\pm$ standard deviation (SD), while categorical variables were presented as frequencies and percentages. The distributional normality of continuous variables was assessed using the Kolmogorov-Smirnov test. For normally distributed data, paired-samples *t*-tests were used to assess within-group changes between baseline and post-intervention measurements, whereas independent-samples *t*-tests were used for between-group comparisons. For non-normally distributed data, the Wilcoxon signed-rank test was used for within-group comparisons, while the Mann-Whitney *U* test was applied for between-group

comparisons. All statistical tests were two-tailed, and a p -value ≤ 0.05 was considered statistically significant.

CONSORT FLOW CHART



6. DATA ANALYSIS AND RESULTS

Table 1 presents the demographic characteristics of the 72 participants included in the final analysis, with 36 participants in each intervention group. The mean age was 42.78 ± 7.14 years in the Spencer's Technique group and 41.73 ± 8.11 years in the Mulligan's Technique group, indicating comparable age distributions between the groups.

Overall, the sample comprised 36 males (50.00%) and 36 females (50.00%). In the Spencer's Technique group, 15 (41.67%) participants were male and 21 (58.33%) were female, whereas the Mulligan's Technique group comprised 21 (58.33%) males and 15 (41.67%) females. Thus, both groups had equal sample sizes, with a relatively balanced distribution of sex across the study population.

Table 1. Demographic Characteristics of Participants

Variable	Spencer's Technique (n = 36)	Mulligan's Technique (n = 36)
Age (years), mean $\pm$ SD	42.78 ± 7.14	41.73 ± 8.11

Gender, n (%)		
Male	15 (41.67%)	21 (58.33%)
Female	21 (58.33%)	15 (41.67%)

Note: Values are presented as mean $\pm$ standard deviation (SD) or frequency and percentage, as appropriate.

As presented in Table 2, the Kolmogorov-Smirnov test indicated that pain intensity was not normally distributed in either the Spencer's Technique or Mulligan's Technique groups ($p < .001$). In contrast, all shoulder ROM variables demonstrated no statistically significant departure from normality in either group, with all p values $>$

.05. All SF-36 domains showed statistically significant deviations from normality in both groups ($p < .05$). Therefore, parametric tests were considered appropriate for ROM variables, whereas non-parametric tests were used for pain intensity and SF-36 domains.

Table 2. Test of Normality for Pain, Shoulder Range of Motion, and SF-36 Domains

Variable	Spencer's Technique p	Mulligan's Technique p
Pain intensity at pre-intervention	$< .001$	$< .001$
Shoulder flexion	.193	.058
Shoulder extension	.116	.200
Shoulder abduction	.200	.200
Shoulder adduction	.200	.200
Shoulder internal rotation	.200	.067
Shoulder external rotation	.200	.200
Shoulder horizontal abduction	.200	.051
Shoulder horizontal adduction	.200	.058
Physical Functioning	.020	.013
Role Limitation due to Physical Health	.020	.040
Bodily Pain	.030	.036
General Health	.038	.014
Vitality	.045	.038
Social Functioning	.014	.030
Role Limitation due to Emotional Problems	.013	.020
Mental Health	.031	.028

Note. P values are from the Kolmogorov-Smirnov test. A p value $> .05$ indicates no statistically significant departure from normality.

As shown in Table 3, the within-group analysis demonstrated a statistically significant reduction in pain intensity following intervention in both the Spencer's Technique group ($Z = -5.44$, $p < .001$) and the Mulligan's Technique group ($Z = -5.40$, $p < .001$). However, the between-group comparison showed no statistically significant difference in post-intervention pain intensity between the two groups ($p = .184$). The corresponding visual representation of the pain intensity results is presented in Figure 1.

Table 3. Within-Group and Between-Group Comparison of Pain Intensity

Outcome	Spencer's Technique (n = 36)	Mulligan's Technique (n = 36)	Between-Group <i>p</i> value
Pain intensity, Pre vs. Post	$Z = -5.44, p < .001$	$Z = -5.40, p < .001$	.184

Note. Within-group comparisons were performed using the Wilcoxon signed-rank test, while the between-group comparison was performed using the Mann-Whitney U test.

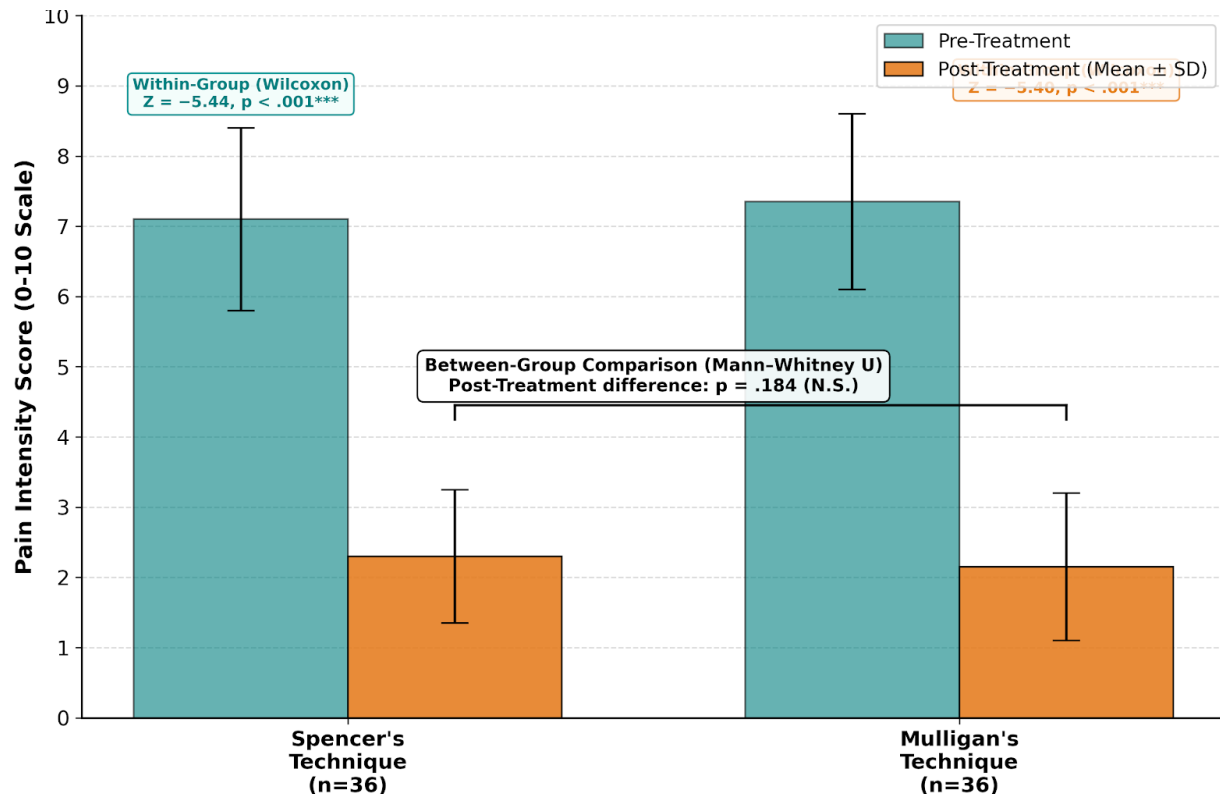


Figure 1: Within-group and between-group comparison of pain intensity before and after intervention.

As presented in Table 4, the within-group analysis demonstrated statistically significant improvements across all eight SF-36 domains following intervention in both the Spencer's Technique and Mulligan's Technique groups, with all within-group comparisons significant at $p < .001$. The between-group analysis showed no

statistically significant differences in most SF-36 domains ($p > .05$). However, a statistically significant between-group difference was observed for the General Health domain ($p = .015$). The corresponding visual representation of the SF-36 outcomes is presented in Figure 2.

Table 4. Within-Group and Between-Group Comparison of SF-36 Domains

SF-36 Domain	Spencer's Technique Z	Mulligan's Technique Z	Between-Group <i>p</i> value
Physical Functioning	5.14***	5.23***	.178

Role Limitation due to Physical Health	5.31***	5.31***	.829
Bodily Pain	5.28***	5.23***	.189
General Health	5.31***	5.31***	.015
Vitality	5.21***	5.24***	.944
Social Functioning	5.16***	5.23***	.085
Role Limitation due to Emotional Problems	5.33***	5.31***	.387
Mental Health	5.24***	5.29***	.446

Note. Z values represent Wilcoxon signed-rank test results for within-group pre- to post-intervention comparisons. **p < .001 for all within-group comparisons. Between-group p values represent Mann-Whitney U test results. A p value ≤ .05 was considered statistically significant

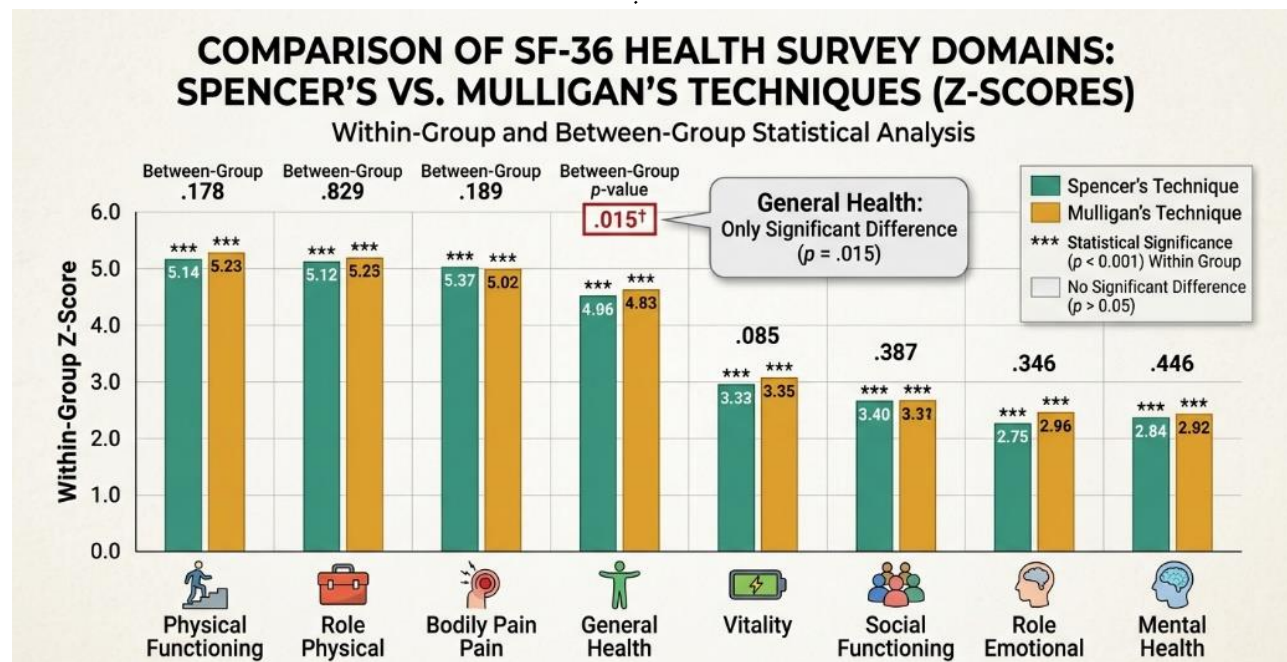


Figure 2: Statistical Comparison of Quality of Life (SF-36) Following Spencer's vs. Mulligan's Techniques (Within-Group Z-Scores and Between-Group p-Values).

Table 5 presents the between-group comparison of shoulder range of motion following the intervention, while the corresponding data are also presented visually in Figure 3 for ease of comparison. No statistically significant between-group differences were observed for shoulder flexion ($p = .206$), extension ($p = .653$), abduction ($p = .816$), adduction ($p = .080$), internal rotation ($p = .112$), external rotation ($p = .113$), or horizontal abduction ($p = .535$). In contrast, a

statistically significant difference was observed for shoulder horizontal adduction ($p = .003$). The Mulligan's Technique group demonstrated a higher mean horizontal adduction ROM ($125.03 \pm 8.73^\circ$) than the Spencer's Technique group ($118.19 \pm 10.08^\circ$). Overall, the findings indicate that the between-group difference was statistically significant only for horizontal adduction, whereas the remaining shoulder ROM variables did not demonstrate statistically significant differences.

Table 5. Between Group Comparison of Shoulder ROM'

Variables	Spencer's Technique Mean $\pm$ SD	Mulligan's Technique Mean $\pm$ SD	p value
Shoulder Flexion	162.46 $\pm$ 13.01	163.78 $\pm$ 12.25	0.206
Shoulder Extension	52.97 $\pm$ 4.94	52.70 $\pm$ 5.04	0.653
Shoulder Abduction	157.84 $\pm$ 15.48	163.57 $\pm$ 12.04	0.816
Shoulder Adduction	35.89 $\pm$ 5.58	37.78 $\pm$ 4.49	0.080
Shoulder Internal Rotation	63.81 $\pm$ 6.51	66.03 $\pm$ 5.34	0.112
Shoulder External Rotation	76.57 $\pm$ 7.83	76.84 $\pm$ 9.01	0.113
Shoulder Horizontal Abduction	39.65 $\pm$ 5.10	40.30 $\pm$ 3.76	0.535
Shoulder Horizontal Adduction	118.19 $\pm$ 10.08	125.03 $\pm$ 8.73	0.003

Note. Values are presented as mean $\pm$ standard deviation. P values represent between-group comparisons. A p value $\leq$.05 was considered statistically significant.

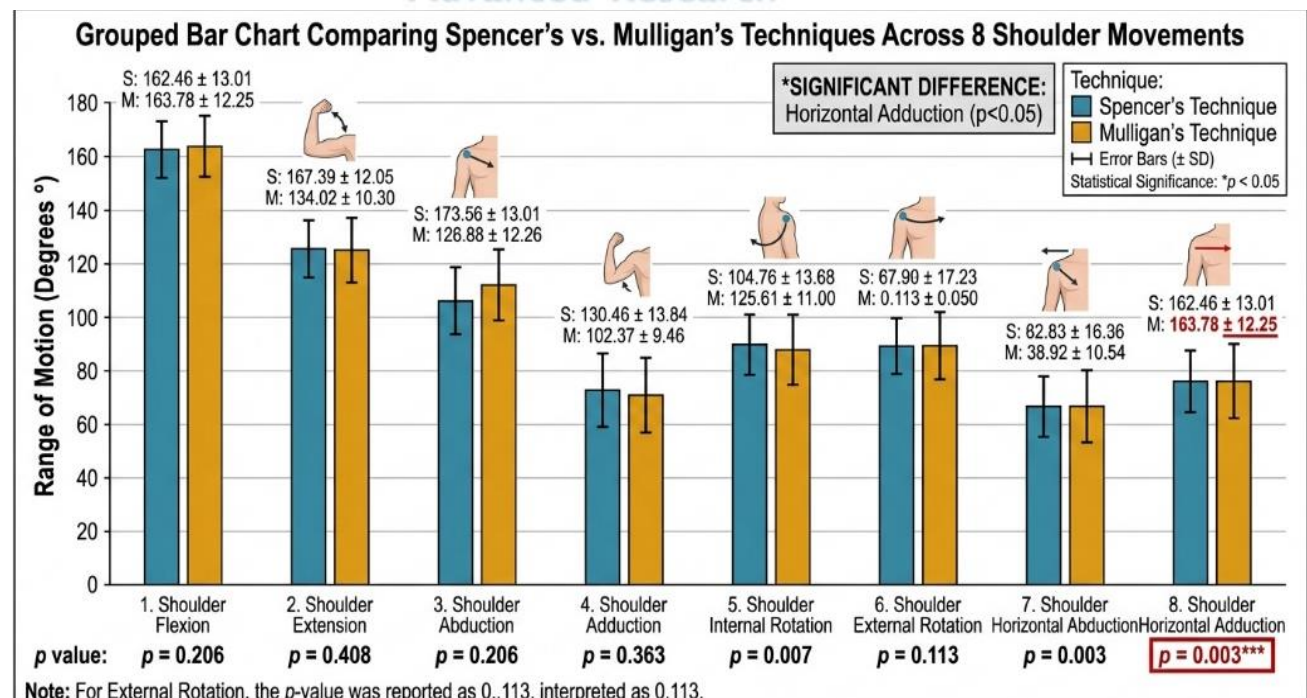


Figure 3: Between-group comparison of shoulder range of motion (ROM) following Spencer's Technique versus Mulligan's Technique.

Table 6. Within-Group Comparison of Shoulder Range of Motion

Variables	Spencer's Technique Pre- test Mean $\pm$ SD	Spencer's Technique Post-test Mean $\pm$ SD	<i>p</i> value	Mulligan's Technique Pre- test Mean $\pm$ SD	Mulligan's Technique Post-test Mean $\pm$ SD	<i>p</i> value
Shoulder Flexion	145.08 $\pm$ 12.17	162.46 $\pm$ 13.01	< .001	143.59 $\pm$ 11.77	163.78 $\pm$ 12.25	< .001
Shoulder Extension	47.17 $\pm$ 5.94	52.97 $\pm$ 4.97	< .001	46.16 $\pm$ 4.77	52.70 $\pm$ 5.04	< .001
Shoulder Abduction	136.97 $\pm$ 15.67	157.84 $\pm$ 15.48	< .001	139.59 $\pm$ 13.64	163.57 $\pm$ 12.04	< .001
Shoulder Adduction	31.84 $\pm$ 4.57	35.89 $\pm$ 5.58	< .001	33.86 $\pm$ 5.22	37.78 $\pm$ 4.49	< .001
Shoulder Internal Rotation	56.78 $\pm$ 7.25	63.81 $\pm$ 6.51	< .001	58.76 $\pm$ 6.71	66.03 $\pm$ 5.34	< .001
Shoulder External Rotation	66.43 $\pm$ 7.14	76.57 $\pm$ 7.83	< .001	64.62 $\pm$ 9.72	76.84 $\pm$ 9.01	< .001
Shoulder Horizontal Abduction	34.54 $\pm$ 5.66	39.65 $\pm$ 5.10	< .001	33.92 $\pm$ 4.34	40.30 $\pm$ 3.76	< .001
Shoulder Horizontal Adduction	107.54 $\pm$ 10.36	118.19 $\pm$ 10.08	< .001	113.05 $\pm$ 9.01	125.03 $\pm$ 8.73	< .001

Note. Values are presented as mean $\pm$ standard deviation. Within-group comparisons were performed using paired-samples *t* tests. A *p* value $\leq$.05 was considered statistically significant.

As presented in **Table 6**, the within-group analysis demonstrated statistically significant improvements in all eight shoulder ROM measures following intervention in both the Spencer's Technique and Mulligan's Technique groups. In the Spencer's Technique group, significant improvements were observed in shoulder flexion, extension, abduction, adduction, internal rotation, external rotation, horizontal abduction, and horizontal adduction, with all comparisons yielding $p < .001$. Similarly, the Mulligan's Technique group demonstrated statistically significant pre- to post-intervention improvements across all eight ROM measures, with all p values $< .001$. These findings indicate significant improvement in shoulder mobility within both treatment groups following the intervention.

6. DISCUSSION

The present study compared Spencer's Muscle Energy Technique (MET) and Mulligan's Mobilization with Movement (MWM) in patients with Stage II adhesive capsulitis. Both groups demonstrated significant within-group improvements in pain, all eight SF-36 domains, and all assessed shoulder ROM parameters, whereas most between-group differences were not statistically significant. Significant differences were identified only for shoulder horizontal adduction and the General Health domain of the SF-36, with greater improvement observed in the Mulligan's MWM group. Overall, both techniques appeared beneficial when combined with conventional physiotherapy. These findings may be explained by the shared therapeutic effects of manual mobilization, including reduction of joint and soft-tissue stiffness, stimulation of

mechanoreceptors, modulation of nociceptive input, and facilitation of shoulder movement, while the concurrent conventional physiotherapy may have further enhanced mobility and functional recovery.

Pain intensity decreased significantly in both groups, with no significant between-group difference (Table 3), indicating comparable pain relief. Spencer's Technique uses sequential shoulder mobilization and stretching, whereas Mulligan's MWM combines an accessory glide with active movement. Both approaches may reduce pain through mechanical stimulation of joint and periarticular tissues and neurophysiological modulation of pain, including activation of mechanoreceptive pathways and reduction of nociceptive sensitivity. The comparable outcomes may therefore reflect overlapping hypoalgesic mechanisms despite differences in the application of the two techniques.

These findings are consistent with Takele et al. (2025), whose systematic review and meta-analysis reported beneficial effects of Spencer's Technique but insufficient evidence of superiority over other manual therapy approaches for pain and ROM [40]. Similarly, Tsai et al. (2026), in a meta-analysis of 16 randomized controlled trials involving 659 participants, reported improvements in pain, disability, and shoulder ROM following Spencer's Technique without establishing superiority over other manual therapy interventions [51]. The present findings therefore align with previous evidence showing improvement with manual therapy without a consistent between-technique difference in pain. The observed improvements may be related to repeat joint movement, capsular stretching, and sensory input produced during manual therapy, which can decrease pain sensitivity while allowing greater tolerance of shoulder movement.

Significant improvements across all eight SF-36 domains in both groups (Table 4) suggest that treatment benefits extended beyond pain and mobility to broader health-related quality of life. A significant between-group difference was observed only in the General Health domain ($p = .015$),

with greater improvement in the Mulligan's MWM group. This may be related to the combination of active movement and sustained accessory mobilization used in MWM, which may facilitate more confident and functional shoulder use. Improvements in mobility and reductions in pain may also enable patients to perform daily activities more effectively, thereby contributing to improvements in perceived general health and well-being. However, the absence of significant differences across the remaining SF-36 domains does not indicate a consistent between-group difference in overall quality of life.

All eight assessed shoulder ROM parameters improved significantly within both groups (Table 6). Most between-group comparisons were statistically comparable, whereas horizontal adduction showed a significant difference favoring Mulligan's MWM (Table 7). These findings are partly consistent with Razzaq et al. (2022), who reported improvements in pain, ROM, and disability following both Mulligan mobilization and MET, with greater overall outcomes reported for Mulligan mobilization [52]. The greater improvement in horizontal adduction observed with MWM may be related to the technique's simultaneous application of an accessory glide and active physiological movement, which may optimize joint mechanics, reduce movement-related pain, and facilitate movement within the available range. Differences between the present and previous findings may also reflect variations in intervention protocols, treatment dosage, disease stage, participant characteristics, and comparator interventions.

Kirker et al. (2023) reported considerable heterogeneity in manual therapy techniques, treatment dosage, exercise programs, and treatment duration for adhesive capsulitis, with evidence quality ranging from poor to very low [53]. The present study adds comparative evidence by evaluating two manual therapy approaches within the same clinical population and treatment period. The comparable improvements across most outcomes indicate that both techniques may be useful components of rehabilitation for Stage II adhesive capsulitis. This may be attributed to the

repeated mobilization and stretching provided by both interventions, which can progressively improve capsular extensibility, stimulate joint mechanoreceptors, reduce protective muscle guarding, and facilitate active shoulder movement. Overall, Spencer's MET and Mulligan's MWM were associated with improvements in pain, shoulder ROM, and health-related quality of life. Mulligan's MWM showed significantly greater improvement in horizontal adduction and the General Health domain, while most outcomes remained statistically comparable between groups. These findings suggest that treatment selection may be guided by the patient's clinical presentation, treatment goals, and response to therapy. The overall similarity between groups may indicate that both techniques produce overlapping mechanical and neurophysiological effects, while the isolated advantages observed with MWM may be related to its combination of therapist-applied accessory mobilization with active patient movement, which can enhance movement confidence and functional use of the shoulder.

7. CONCLUSION

Both Spencer's MET and Mulligan's MWM produced significant improvements in pain intensity, shoulder ROM, and all eight SF-36 domains among patients with Stage II adhesive capsulitis. Most between-group outcomes were statistically comparable; however, Mulligan's MWM demonstrated significantly greater improvement in shoulder horizontal adduction and the General Health domain. Both techniques may therefore be considered useful manual therapy approaches within the rehabilitation of Stage II adhesive capsulitis.

8. LIMITATIONS

The study was conducted in a single clinical setting, which may limit generalizability. The sample size was relatively small, with 36 participants in each group, and participants and treating therapists could not be completely blinded because of the nature of the interventions. Outcomes were assessed immediately after the four-week intervention, without long-term follow-

up. Variability in disease duration, severity, baseline functional status, and comorbidities may also have influenced treatment responses.

9. FUTURE PROSPECTS

Future studies should include larger samples, multiple clinical settings, and longer follow-up periods to determine whether treatment benefits are sustained. Further research should also examine the effectiveness of Spencer's MET and Mulligan's MWM across different stages and durations of adhesive capsulitis and compare different treatment frequencies and intervention doses. Inclusion of more specific shoulder-function measures and systematic consideration of comorbidities may provide additional evidence regarding patient-specific treatment responses.

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