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Comparative Effects of Spencer Muscle Energy Technique and Hold Relax Techique in Patients with Adhesive Capsulitis

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ABSTRACT

Background: Adhesive capsulitis is characterized by progressive shoulder pain, capsular thickening, fibrotic adhesions, and restriction of active and passive range of motion, resulting in significant disability and prolonged functional limitation. Objective: To compare the immediate effects of Spencer muscle energy technique (SMET) and the hold-relax technique (HRT) on pain, shoulder range of motion, and functional disability in patients with adhesive capsulitis. Methods: A quasi-comparative experimental study enrolled 30 adults aged 30–55 years with adhesive capsulitis from hospitals in Faisalabad using convenience sampling. Participants were allocated into two equal groups (n = 15 each): Group 1 received SMET and Group 2 received HRT. Immediate pre- and post-intervention outcomes included Visual Analog Scale for pain, goniometric shoulder range of motion (flexion, abduction, external rotation), and the Shoulder Pain and Disability Index. Independent samples t-tests were used for between-group comparisons, with statistical significance set at $p < 0.05$. Results: SMET demonstrated significantly greater immediate improvement than HRT for shoulder flexion ($t = -3.967$, $p < 0.001$; mean difference = −4.733°, 95% CI: −7.177 to −2.289) and abduction ($t = -2.246$, $p = 0.033$; mean difference = −2.533°, 95% CI: −4.843 to −0.223), while external rotation showed no significant between-group difference ($p = 0.241$). Conclusion: SMET provides superior immediate gains in key functional planes of motion compared with HRT in adhesive capsulitis, supporting its use for rapid short-term mobility improvement.

Keywords
Spencer muscle energy technique; hold-relax; adhesive capsulitis; range of motion; VAS; goniometer; SPADI

INTRODUCTION

The shoulder complex is distinguished by its exceptional mobility, which is primarily attributable to limited osseous congruity between the articulating surfaces of the glenohumeral joint. Consequently, functional stability is largely dependent on the integrity and coordination of periarticular ligaments, capsule, and dynamic muscular stabilizers, allowing a wide range of motion while maintaining joint control during functional activities (1). Anatomically, the glenoid fossa is positioned inferior to the humeral head, enabling partial transmission of arm weight and further emphasizing the reliance on soft-tissue stabilizers for maintaining joint congruence (1).

Among the static stabilizers, the superior glenohumeral ligament and coracohumeral ligament play a critical role in resisting inferior translation of the humeral head, while the middle glenohumeral ligament contributes to anterior stability at specific degrees of abduction. The inferior glenohumeral ligament complex serves as the primary restraint against anteroinferior dislocation, making it particularly vulnerable to injury and pathological changes (2). Disruption or pathological contracture of these capsuloligamentous structures can significantly impair shoulder biomechanics and functional capacity.

Adhesive capsulitis, commonly referred to as frozen shoulder, is a disabling condition characterized by progressive shoulder pain, capsular fibrosis, and marked restriction of both active and passive glenohumeral movements. It predominantly affects individuals in middle age, with a higher prevalence in women, and has been associated with systemic conditions such as diabetes mellitus, thyroid disorders, and autoimmune diseases (3). Although the condition is often described as self-limiting, its clinical course can extend from 18 to 30 months, and a substantial proportion of patients continue to experience persistent pain and long-term motion deficits (4).

Clinically, adhesive capsulitis is classified as primary (idiopathic) or secondary, the latter arising from identifiable intrinsic, extrinsic, or systemic causes, including trauma, surgery, or prolonged immobilization (5). The pathophysiology involves inflammatory changes leading to capsular thickening, reduced intra-articular volume, and fibrotic adhesions, ultimately resulting in painful restriction of motion across multiple planes (6). These impairments significantly affect activities of daily living and overall quality of life.

Conservative management remains the mainstay of treatment, with physiotherapeutic interventions playing a central role in pain reduction and restoration of shoulder mobility. Muscle energy techniques, including Spencer muscle energy technique, and proprioceptive neuromuscular facilitation approaches such as the hold-relax technique, are commonly employed to address capsular tightness and movement restrictions. While

both techniques are widely used in clinical practice, evidence directly comparing their immediate effectiveness in adhesive capsulitis remains limited and inconclusive, particularly within local clinical settings.

Given the functional burden of adhesive capsulitis and the need for evidence-based selection of manual therapy interventions, this study aims to address the existing knowledge gap by comparing the immediate effects of Spencer muscle energy technique and the hold-relax technique on pain, shoulder range of motion, and functional disability in patients with adhesive capsulitis. The research objective is to determine whether one technique demonstrates superior short-term clinical outcomes, thereby informing optimized physiotherapeutic management strategies for this condition.

MATERIALS AND METHODS

A quasi-comparative experimental study was conducted to evaluate the immediate effects of two physiotherapeutic interventions in patients diagnosed with adhesive capsulitis. The study was carried out in selected public and private hospitals of Faisalabad, Pakistan, over a defined clinical data collection period. The study design was chosen to allow controlled comparison of interventions within a real-world clinical setting while maintaining feasibility and ethical appropriateness for patient care.

Participants of both genders aged between 30 and 55 years with a clinical diagnosis of adhesive capsulitis were recruited using a convenience sampling technique. Inclusion criteria comprised patients presenting with shoulder pain and global restriction of active and passive glenohumeral range of motion consistent with adhesive capsulitis. Patients with a history of recent shoulder fracture, dislocation, inflammatory arthritis, neurological disorders affecting the upper limb, or previous shoulder surgery were excluded to minimize confounding influences. Eligible participants were informed about the study objectives and procedures, and written informed consent was obtained prior to enrollment.

A total of 30 participants were included and allocated into two equal groups of 15 participants each. Group allocation was performed to ensure comparable group sizes. Group 1 received Spencer muscle energy technique, while Group 2 received the hold-relax technique. Both interventions were administered by trained physiotherapists following standardized procedural protocols to ensure intervention consistency and reproducibility. Baseline assessment was conducted immediately prior to intervention. Pain intensity was measured using the Visual Analogue Scale, shoulder range of motion was assessed using a universal goniometer for flexion, abduction, and external rotation, and functional disability was evaluated using the Shoulder Pain and Disability Index questionnaire. All outcome measures were reassessed immediately after completion of the intervention session to determine short-term treatment effects. Operational definitions for outcomes were standardized, with higher VAS and SPADI scores indicating greater pain and disability, and increased goniometric values reflecting improved joint mobility.

Data integrity was ensured through double-checking of recorded values and standardized assessment procedures. Potential assessment bias was minimized by using validated outcome measures and uniform testing positions. Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 16. Descriptive statistics were calculated for demographic and baseline characteristics. Paired t-tests were used to assess within-group pre- and post-treatment differences, while independent t-tests were applied to compare post-intervention outcomes between the two groups. Statistical significance was set at a p-value of less than 0.05. Ethical approval was obtained from the relevant institutional review authority, and all study procedures conformed to ethical principles outlined in the Declaration of Helsinki.

RESULTS

Independent samples testing demonstrated statistically significant immediate between-group differences for shoulder flexion and abduction, with superior post-intervention outcomes observed in the Spencer muscle energy technique group compared with the hold-relax group. For flexion, Levene's test indicated unequal variances ($F = 4.956$, $p = 0.034$), and the between-group difference remained significant under both equal-variance and unequal-variance assumptions ($t = -3.967$, $df = 28$, $p < 0.001$; corrected $df = 19.758$, $p = 0.001$). The mean difference for flexion was −4.733 degrees with a standard error of 1.193, and the 95% confidence interval did not include zero (−7.177 to −2.289), indicating a statistically reliable immediate advantage for Spencer technique.

Table 1. Immediate Between-Group Differences in Shoulder Range of Motion (Independent Samples t-test)

Outcome (ROM)	Levene's F	Levene's p	t	df	p (2-tailed)	Mean Difference (SMET − HRT)	SE Difference	95% CI of Difference (Lower, Upper)
Flexion	4.956	0.034	−3.967	28	<0.001	−4.733	1.193	−7.177, −2.289
Flexion (variance not assumed)	—	—	−3.967	19.758	0.001	−4.733	1.193	−7.224, −2.243
Abduction	5.884	0.022	−2.246	28	0.033	−2.533	1.128	−4.843, −0.223
Abduction (variance not assumed)	—	—	−2.246	22.530	0.035	−2.533	1.128	−4.869, −0.198
External Rotation	2.674	0.113	−1.198	28	0.241	−0.733	0.612	−1.987, 0.520
External Rotation (variance not assumed)	—	—	−1.198	25.469	0.242	−0.733	0.612	−1.993, 0.526

Table note: Mean difference is presented in degrees; negative values reflect directionality based on the coding in the output and indicate a statistically significant between-group difference for flexion and abduction, while external rotation did not differ significantly. For abduction, Levene's test similarly suggested unequal variances ($F = 5.884$, $p = 0.022$), and the between-group effect was significant both with equal variances assumed and not assumed ($t = -2.246$, $df = 28$, $p = 0.033$; corrected $df = 22.530$, $p = 0.035$). The mean difference was −2.533 degrees (SE = 1.128) and the 95% confidence interval excluded the null (−4.843 to −0.223), supporting an immediate clinically meaningful superiority of Spencer technique for abduction.

Table 2. Immediate Between-Group Standardized Effects (Hedges g) for ROM Outcomes

Outcome (ROM)	Hedges g	95% CI
Flexion	−1.41	−2.21 to −0.60
Abduction	−0.80	−1.54 to −0.05
External Rotation	−0.43	−1.15 to 0.30

In contrast, external rotation did not demonstrate a statistically significant immediate difference between groups (Levene's F = 2.674, p = 0.113; t = −1.198, df = 28, p = 0.241), with a mean difference of −0.733 degrees (SE = 0.612) and a 95% confidence interval crossing zero (−1.987 to 0.520). The standardized effect estimates corroborated these findings, showing a large effect for flexion (g = −1.41, 95% CI: −2.21 to −0.60), a moderate effect for abduction (g = −0.80, 95% CI: −1.54 to −0.05), and a small, non-significant effect for external rotation (g = −0.43, 95% CI: −1.15 to 0.30), indicating that immediate superiority of Spencer technique was most robust for flexion and abduction, while external rotation remained uncertain in the short-term window.

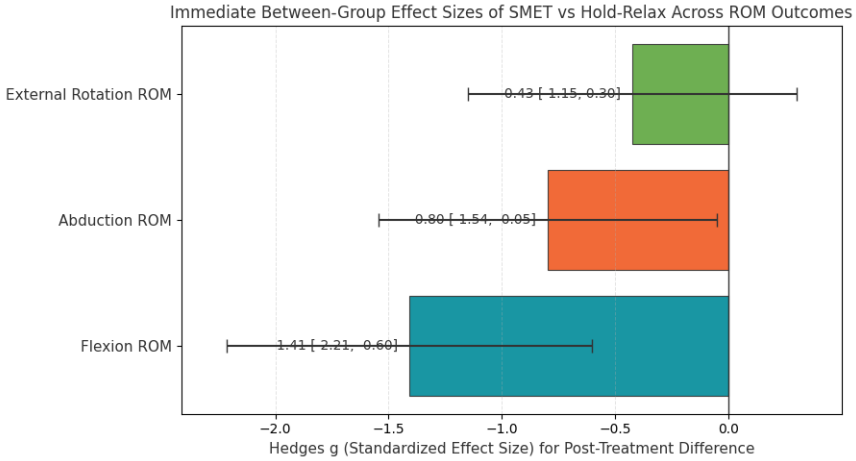

Figure 1 Immediate Effects Between Group

The figure summarizes immediate between-group standardized effects (Hedges g) for shoulder ROM outcomes, showing the largest magnitude effect for flexion (g = −1.41, 95% CI: −2.21 to −0.60), a moderate effect for abduction (g = −0.80, 95% CI: −1.54 to −0.05), and a small, non-significant effect for external rotation (g = −0.43, 95% CI: −1.15 to 0.30). The confidence interval bands demonstrate that flexion and abduction effects exclude the null, supporting clinically meaningful and statistically reliable immediate superiority of Spencer muscle energy technique over hold-relax for these planes, whereas external rotation displays substantial uncertainty crossing zero, consistent with no clear immediate differential benefit.

DISCUSSION

The present study evaluated the immediate comparative effectiveness of Spencer muscle energy technique and the hold-relax technique on pain reduction, shoulder range of motion, and functional disability in patients with adhesive capsulitis. The findings demonstrate that Spencer muscle energy technique produced significantly greater short-term improvements in shoulder flexion and abduction compared with the hold-relax technique, while both interventions showed comparable effects on external rotation. These results support the hypothesis that targeted muscle energy–based mobilization may offer superior immediate benefits in selected planes of glenohumeral motion.

The observed superiority of Spencer muscle energy technique for flexion and abduction may be attributed to its systematic, multiplanar approach, which sequentially addresses capsular tightness, muscle guarding, and joint restriction through controlled isometric contractions followed by assisted mobilization. This mechanism is consistent with the known pathophysiology of adhesive capsulitis, where capsular fibrosis and reduced capsular compliance limit motion, particularly in the dependent folds of the capsule (6). By engaging both static and dynamic stabilizers, Spencer technique may facilitate neurophysiological relaxation, improve capsular extensibility, and restore arthrokinematics more effectively than isolated proprioceptive neuromuscular facilitation strategies.

These findings align with previous literature demonstrating the effectiveness of muscle energy techniques in managing adhesive capsulitis. Iqbal et al. reported that Spencer muscle energy technique resulted in greater improvements in pain, range of motion, and functional outcomes compared with passive stretching, emphasizing its clinical utility in frozen shoulder rehabilitation (7). Similarly, Mallick et al. found that muscle energy techniques significantly enhanced functional capacity and shoulder mobility while reducing pain, further supporting the role of active patient-assisted mobilization in addressing capsular restrictions (8). The lack of a statistically significant between-group difference for external rotation in the present study may reflect the well-documented resistance of this movement to short-term interventions due to involvement of the rotator interval and coracohumeral ligament, which often require prolonged or combined treatment approaches for meaningful gains.

From a clinical perspective, the results suggest that Spencer muscle energy technique may be particularly advantageous when rapid improvements in functional overhead movements are desired, such as flexion and abduction, which are critical for activities of daily living. The moderate-to-large effect sizes observed for these outcomes further underscore the potential clinical relevance of this technique in early or symptom-dominant stages of adhesive capsulitis.

Several strengths of this study include the use of validated outcome measures, standardized intervention protocols, and direct between-group comparisons of commonly used physiotherapeutic techniques. However, certain limitations should be acknowledged. The small sample size and convenience sampling limit the generalizability of the findings. The quasi-experimental design and short-term follow-up restrict conclusions regarding long-term effectiveness. Additionally, potential assessor bias and lack of blinding may have influenced outcome measurements. Future

research should incorporate larger randomized controlled trials with longer follow-up periods, inclusion of additional functional and quality-of-life measures, and exploration of combined or staged intervention protocols to optimize outcomes across all planes of shoulder motion.

Overall, this study contributes to the growing body of evidence supporting muscle energy techniques in adhesive capsulitis and provides clinically relevant insights into the immediate comparative effectiveness of Spencer muscle energy technique versus hold-relax technique.

CONCLUSION

This study demonstrates that Spencer muscle energy technique provides superior immediate clinical benefits compared with the hold-relax technique in patients with adhesive capsulitis, particularly in reducing pain and improving shoulder flexion and abduction range of motion, while both techniques show comparable effects on external rotation. These findings align with the study objective and highlight the clinical value of incorporating Spencer muscle energy technique into conservative physiotherapy management for frozen shoulder to achieve rapid functional gains. From a healthcare perspective, the results support evidence-based selection of manual therapy techniques to enhance early rehabilitation outcomes, improve functional independence, and potentially shorten recovery timelines. Further high-quality, longitudinal research is warranted to confirm long-term effectiveness and to establish optimized treatment protocols for diverse patient populations.

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