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Effects of the Spencer Muscle Energy Technique on pain and shoulder range of motion in a patient with adhesive capsulitis: A case study

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Abstract
Background: Adhesive capsulitis is a progressive shoulder condition characterized by pain and restricted mobility, with a higher prevalence and slower recovery in individuals with diabetes. This case study investigated the effect of the Spencer Muscle Energy Technique (SMET) on pain and shoulder range of motion (ROM) in a patient with diabetic adhesive capsulitis.
Methods: A 44-year-old female with diabetic adhesive capsulitis underwent a four-week physiotherapy program incorporating SMET with conventional treatments. Outcome measures included the Numeric Pain Rating Scale (NPRS), Shoulder Pain and Disability Index (SPADI), and goniometric ROM assessment.
Results: Following intervention, significant improvements were observed across all measures. Pain reduced from 6/10 to 1/10 on NPRS. SPADI improved from 80% to 49%, indicating enhanced functional capacity. Notable gains were observed in shoulder ROM, particularly external rotation (15° to 50°), flexion (145° to 180°), abduction (147° to 177°), and internal rotation (45° to 90°). Muscle strength improved across all muscle groups, with external rotators improving from Grade 2-/5 to 4-/5.
Conclusion: These findings suggest that SMET, when integrated into a comprehensive physiotherapy program, may be effective in improving pain, mobility, and function in diabetic adhesive capsulitis. However, larger sample sizes and controlled trials are needed to validate these findings and establish standardized treatment protocols.

Keywords: Adhesive capsulitis, Spencer Muscle Energy Technique, frozen shoulder, diabetes mellitus, manual therapy, shoulder pain, SPADI, range of motion

Introduction

Adhesive capsulitis, commonly known as frozen shoulder, is a gradually progressive shoulder condition characterized by significant functional impairment and restricted movement. First described by Codman in 1934 [1], the condition presents with pain around the deltoid insertion, difficulty sleeping on the affected side, muscle atrophy, minimal localized tenderness, and significant restriction in both active and passive range of motion, particularly in forward elevation and external rotation [1]. Neviaser (1945) [2] later coined the term "adhesive capsulitis" following surgical examinations that revealed adhesions and capsular thickening, providing a more anatomically accurate description of the condition [2].

Adhesive capsulitis develops clinically in three distinct stages: the freezing stage (2-9 months), characterized by progressive pain and stiffness; the frozen stage (4-12 months), marked by significant stiffness with decreased pain; and the thawing stage (5-24 months), during which gradual improvement in shoulder mobility occurs [3]. The condition affects approximately 2-5% of the general population, with higher prevalence in women aged 40-60 years [4]. Incidence is markedly increased among individuals with metabolic disorders, particularly diabetes mellitus, in whom prevalence may reach 10-36%, likely due to impaired collagen repair mechanisms and chronic inflammation [5].

The Spencer Muscle Energy Technique (SMET), developed by Dr. Charles H. Spencer in 1916, represents a promising manual therapy approach for managing adhesive capsulitis. SMET is an active patient-participatory treatment comprising seven progressive phases of movement that incorporate rhythmic oscillation followed by isometric contraction of the antagonist muscle to achieve new end range through reciprocal inhibition [6]. The seven sequential movements include extension, flexion, and circumduction with compression, circumduction with traction, abduction, internal rotation, and distraction in abduction.

The technique aims to enhance lymphatic flow, improve fascial mobility, increase local circulation, and stretch capsular and periarticular soft tissue structures, collectively contributing to improved functional range and reduced pain [7]. Despite increasing clinical use, evidence supporting the effectiveness of SMET, particularly in diabetic adhesive capsulitis, remains limited. This case study therefore aims to evaluate its effect on shoulder pain and range of motion in a patient with diabetic adhesive capsulitis.

Case Presentation

Patient Information

A 44-year-old female housewife from Greater Noida, India, presented to the Physiotherapy Department with chief complaints of significant pain and stiffness in the left shoulder, worsening at night, particularly when lying on the affected side. Symptoms had been present for two months, with progressive worsening over the preceding two weeks, including pain at rest. The patient was diagnosed with left diabetic frozen shoulder five months prior to presentation.

Relevant medical history included a family history of diabetes mellitus, with the patient herself diagnosed with

diabetes in 2019. She was currently on antidiabetic medications. Clinical investigations revealed poorly controlled diabetes with HbA1c of 8.4% and fasting blood glucose of 180 mg/dL on the day of assessment. No significant surgical history related to the shoulder condition was reported.

Clinical Findings

Physical examination revealed an endomorphic build with BMI of 27.9 (height 157 cm, weight 69 kg). Postural assessment demonstrated forward head posture and rounded shoulders with significant upper trapezius tightness. Grade 2 tenderness was present at the anterolateral aspect of the left shoulder, accompanied by severe pain and crepitus. Apley's scratch test was positive on the left shoulder, suggesting global shoulder mobility restriction consistent with adhesive capsulitis [8].

Table 1: Baseline Clinical and Functional Assessment of the Left Shoulder

Movement	AROM (°)	PROM (°)
Flexion	0-145	0-155
Extension	0-20	0-25
Abduction	0-147	0-150
Internal Rotation	0-45	0-50
External Rotation	0-15	0-18

Baseline pain intensity was 6/10 at rest on the Numeric Pain Rating Scale (NPRS). The Shoulder Pain and Disability Index (SPADI) score was 80%, indicating severe functional disability. Manual muscle testing revealed weakness across all shoulder muscle groups, with external rotators graded at 2-/5, flexors at 4-/5, and extensors at 3-/5.

Diagnostic Assessment

Based on clinical presentation, physical examination findings, positive special testing, and documented history of diabetes mellitus with poor glycemic control, the patient was diagnosed with diabetic adhesive capsulitis of the left shoulder in the frozen stage, characterized by significant range of motion restrictions and persistent pain with functional limitations.

Therapeutic Intervention

A comprehensive four-week physiotherapy program was implemented, incorporating the Spencer Muscle Energy Technique as the primary manual therapy intervention alongside conventional therapeutic exercises. Treatment was structured in progressive weekly phases with specific goals and interventions tailored to the patient's tolerance and clinical progression.

Table 2: Four-Week Progressive Treatment Protocol

Week	Goals	Interventions
1	Pain relief Gentle mobilization	Moist heat (10-15 min pre-session); SM*Et al*l 7 steps (1-3 sets × 5-7 reps, 3×/week); Scapular exercises (5-10 reps × 2 sets, daily)
2	ROM improvement Initiate strengthening	Heat therapy; SMET progression (1-3 sets × 8-10 reps, 3×/week); TheraBand ROM exercises (5-7 reps); End-range stretching (3-5 sec hold); Isometric strengthening (5-10 reps)
3	Strengthening Functional movement	SMET progression (2-3 sets × 10-12 reps, 5×/week); Resistance band exercises for rotators (10 reps × 2 sets, 5×/week); Stretching routine
4	Functional independence Restore full ROM	SMET (2-3 sets, 5×/week); End-range capsular stretches (10-15 reps, 10-15 sec hold)

Spencer Muscle Energy Technique Protocol

The Spencer Muscle Energy Technique was administered through seven sequential movements: (1) shoulder extension, (2) shoulder flexion, (3) circumduction with compression, (4) circumduction with traction, (5) abduction followed by adduction with external rotation, (6) internal rotation, and (7) distraction in abduction. Each movement incorporated rhythmic oscillation at the physiological barrier followed by patient-generated isometric contraction of the antagonist muscle group for 3-5 seconds, facilitating increased range through reciprocal inhibition and post-isometric relaxation.

Supplementary interventions included home exercise programs comprising pendulum exercises (Codman exercises), towel stretches, wall climbing exercises, isometric shoulder strengthening, and progressive resistance band exercises. Patients were educated on glycemic monitoring and its importance in tissue healing [9, 10].

Results

Following four weeks of intervention, the patient demonstrated clinically significant improvements across all outcome measures. Pain intensity decreased progressively from 6/10 at baseline to 4/10 after Week 1, 2/10 after Week 3, and 1/10 at Week 4, representing an 83% reduction in pain. The SPADI score improved from 80% to 49%, indicating substantial enhancement in functional capacity and reduction in disability.

Table 3: Progressive Outcome Measures Over Four Weeks

Measure	Week 1	Week 2	Week 3	Week 4
NPRS (at rest)	6/10	4/10	2/10	1/10
Flexion (°)	0-160	0-166	0-170	0-180
Extension (°)	0-35	0-38	0-43	0-50
Abduction (°)	0-163	0-170	0-174	0-177
Internal Rotation (°)	0-60	0-70	0-80	0-90
External Rotation (°)	0-18	0-26	0-40	0-50

Shoulder range of motion improvements were particularly notable in movements typically most restricted in adhesive capsulitis. External rotation demonstrated the most dramatic improvement, increasing from 15° to 50° (233% increase). Flexion achieved complete restoration from 145° to 180° (24% increase). Internal rotation improved from 45° to 90° (100% increase), abduction from 147° to 177° (20% increase), and extension from 20° to 50° (150% increase). Muscle strength improved across all groups, with external rotators progressing from Grade 2-/5 to 4-/5, flexors from 4-/5 to 5/5, and abductors from 4/5 to 5/5.

Discussion

This case study evaluated the effects of the Spencer Muscle Energy Technique on pain reduction and range of motion

improvement in a patient with diabetic adhesive capsulitis. The results demonstrated clinically significant improvements across all measured outcomes, supporting current evidence that endorses the effectiveness of specific mobilization and exercise therapy in adhesive capsulitis management [9].

The substantial improvements observed in external rotation and abduction are particularly noteworthy, as these movements are typically most restricted in adhesive capsulitis due to capsular contracture, especially of the anteroinferior capsule. The progressive enhancement noted in this patient, particularly in external rotation (15° to 50°) and flexion (145° to 180°), aligns with studies identifying that SMET enhances capsular extensibility through the combination of rhythmic mobilization with isometric contraction, stimulating neuromuscular reflexes including reciprocal inhibition and post-isometric relaxation [7].

Pain reduction from 6/10 to 1/10 by Week 4 represents an 83% decrease in pain intensity. This significant improvement can be attributed to several mechanisms: recurrent capsular stretching, improved synovial fluid circulation, and the neuromodulatory effects of MET, which have been shown to reduce nociceptive irritation and local inflammation [11]. Additionally, the application of moist heat therapy prior to manual therapy likely enhanced tissue extensibility and reduced muscle guarding, which has been recommended to facilitate movement in the early painful stage of adhesive capsulitis [10].

The SPADI improvement from 80% to 49% indicates substantial functional recovery in activities of daily living. Previous studies have demonstrated that supervised exercise combined with shoulder-specific manual therapy produces superior outcomes in adhesive capsulitis compared to exercise alone [12]. This is consistent with the current study, which integrated SMET with progressive strengthening, stretching, and scapular stability exercises.

The patient's diabetic status likely influenced both symptom duration and intensity. Poor glycemic control, evidenced by HbA1c of 8.4%, is associated with increased collagen cross-linking, capsular thickening, and impaired tissue repair [5]. Research indicates that individuals with diabetes may develop adhesive capsulitis up to five times more frequently and may respond more slowly to treatment [13]. Despite these metabolic challenges, the patient's satisfactory progress suggests that SMET may provide therapeutic benefit even in patients with underlying metabolic impairments.

Improvements in muscle strength, particularly in the external rotators (Grade 2-/5 to 4-/5) and flexors (Grade 4-/5 to 5/5), may be related to the gradual incorporation of resistance training and decreased pain inhibition. The active participation required in SMET may also promote neuromuscular activation and functional strengthening [7].

Study Limitations

Several limitations must be acknowledged. The single-subject design limits generalizability of findings to broader populations. The brief four-week intervention period precludes assessment of long-term outcomes and sustainability of improvements. Absence of a control group prevents definitive attribution of outcomes specifically to SMET versus other treatment components. Potential confounding variables including patient motivation, prior physical therapy exposure, and uncontrolled glucose levels may have influenced results. The natural progression of adhesive capsulitis from the frozen to thawing stage may have contributed to some observed improvements independent of intervention.

Clinical Implications

Despite these limitations, findings suggest that SMET, when integrated into a comprehensive evidence-based physiotherapy program, may be an effective intervention for managing diabetic adhesive capsulitis. The technique's emphasis on patient participation, progressive mobilization, and neuromuscular facilitation appears well-suited to address the multifaceted impairments associated with this condition. Future research should employ randomized controlled trial designs with larger sample sizes, extended follow-up periods, and standardized treatment protocols to establish clinical efficacy and optimal dosing parameters.

Conclusion

This case study demonstrates that the Spencer Muscle Energy Technique, when incorporated into a structured physiotherapy program, may effectively reduce pain and improve range of motion, muscle strength, and functional performance in patients with diabetic adhesive capsulitis. Meaningful improvements were observed across all assessed outcomes, including NPRS, SPADI, and goniometric shoulder mobility, with particularly notable gains in external rotation and abduction.

Although these results are consistent with emerging evidence supporting manual therapy interventions for adhesive capsulitis, the single-subject design limits generalizability. Additional controlled studies with larger sample sizes, longer follow-up periods, and standardized treatment protocols are necessary to establish treatment efficacy, determine optimal dosage parameters, and assess outcome sustainability, particularly in diabetic populations who may experience more prolonged recovery trajectories.

The findings support the potential integration of SMET into comprehensive rehabilitation protocols for adhesive capsulitis while highlighting the need for rigorous research to validate its clinical effectiveness and guide evidence-based practice.

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Written informed consent was obtained from the patient for publication of this case report and accompanying clinical data.

Conflict of Interest

The authors declare no conflicts of interest.

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