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A case study on the effect of extracorporeal shock wave therapy (ESWT) combined with spencer muscle energy technique and home exercise program in alleviating the symptoms of adhesive capsulitis

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Abstract
Back ground: Adhesive Capsulitis (AC) or Frozen Shoulder, is a condition marked by pain and restricted range of motion in the glenohumeral joint, often linked to factors like diabetes, trauma, and autoimmune diseases. It progresses through three phases: Freezing, Adhesive, and Resolution. AC affects 2-5% of the population, with women being most commonly affected. Extracorporeal Shock Wave Therapy (ESWT) and Spencer Muscle Energy Technique (SME Technique) are used to treat AC. ESWT promotes tissue healing and pain relief, while SME Technique improves joint mobility through soft tissue manipulation. This study evaluates the combined effectiveness of ESWT, SME Technique, and a Home Exercise Program in reducing pain, improving ROM, and decreasing functional disability in AC participant.
Aim of the Study: The aim of this case study was to evaluate the effect of combining Extracorporeal Shock Wave Therapy (ESWT), Spencer Muscle Energy Technique & a Home Exercise Program in alleviating the symptoms of Adhesive Capsulitis, with a focus on pain reduction, improvement in Range of Motion (ROM), and reduction in functional disability.
Methodology: This case study had evaluated the combined effects of ESWT, SME Technique, and a Home Exercise Program on a 45-year-old female with right side shoulder pain & restricted ROM experiencing symptoms from past 4 months, with difficulty in preforming daily activities and was diagnosed with Adhesive Capsulitis by an Orthopaedician. Inclusion criteria included participant aged 35-60 years with pain and restricted ROM and experiencing symptoms for more than 2 months. The participant was excluded from the study if they had active infection on affected shoulder, history of any prior shoulder surgery or pregnancy. Treatment consisted of ESWT (8 Hz, 2000 pulses, 0.06-0.14 mJ/mm^2), with SME Technique (7 steps of it), and a daily Home Exercise Program. The participant had received 3 sessions per week for 2 weeks. Outcome measures, including NPRS for pain, ROM via Goniometer and SPADI for functional disability, was assessed at baseline and after 2 weeks of intervention.
Result: After 2 weeks of intervention, the participant demonstrated significant improvements: in NPRS score: pain intensity decreased from 7.5 to 3, with a reduction of 4.5 points in intensity, improvement in ROM: Flexion (+40°), Extension (+20°), Abduction (+40°), External Rotation (+30°), and Internal Rotation (+30°) and reduction in Functional Disability (SPADI): The score improved from 70% to 30%, a 40% reduction. These results indicate substantial pain relief, enhanced ROM, and improved functional capacity.
Conclusion: This case study shows that combining ESWT, SME Technique, and a Home Exercise Program effectively reduces pain, improves ROM, and decreases functional disability in Adhesive Capsulitis, enhancing their quality of life.

Keywords: Adhesive capsulitis, ESWT (Extracorporeal Shock Wave Therapy), SME technique (Spencer Muscle Energy Technique), home exercise program, pain, ROM, functional disability

Introduction
Adhesive capsulitis (AC), commonly known as Frozen Shoulder [1]. Adhesive capsulitis is a prevalent shoulder condition marked by a progressive onset of pain and a restricted active and

passive range of motion (ROM) in the glenohumeral joint [2], associated with functional disability [1]. It occurs due to inflammation, leading to the formation of fibrous tissue, which can cause the joint capsule to become tight [1]. The aetiology of this condition remains unidentified, but it is linked to several factors such as being female, having diabetes, thyroid disorders, experiencing trauma, stroke, heart attack and having a history of autoimmune diseases [3]. AC progresses through three overlapping phases:

1. **Painful freezing phase:** lasts 2 to 9 months, marked by pain and stiffness around the shoulder, often worsening at night,
2. **Adhesive phase:** lasts 4 to 12 months, characterized by restricted range of motion(ROM) and gradual pain relief,
3. **Resolution phase:** lasts 12 to 42 months, with spontaneous improvement in ROM [4].

It has a prevalence of 2-5% in the normal population, approximately 70% of cases are female [5]. Some studies described AC as self-limiting disorder that will resolve in 1-3 years, It can also occur bilaterally at the same time [6].

Operational definition

Extracorporeal Shock Wave Therapy (ESWT) uses pulsed sound waves with short duration and high-pressure amplitude. It promotes revascularization and stimulates the healing of connective tissues, there by alleviating pain and improving shoulder function [7-8].

Spencer Muscle Energy Technique (SME technique): The Spencer technique, is an Osteopathic Manipulative Treatment (OMT) that involves positioning, sequencing, and slow stretching of the shoulder complex within pain-free limits. It uses muscle energy technique to improve the mobility of the glenohumeral and scapulothoracic joints through soft tissue mobilization [9].

This effective management aims to assess the effectiveness of a combined therapeutic approach (Extracorporeal Shock Wave Therapy with Spencer Muscle Energy Technique and Home Exercise Program) in reducing pain, improving ROM and reducing functional disability in a participant with adhesive capsulitis. A combination of different therapeutic approaches is often employed for this purpose.

Objective: To assess the effectiveness of combining ESWT with SME Technique on pain relief, ROM improvement, and functional disability in participant diagnosed with Adhesive Capsulitis.

Methodology

Study Design: This case study involves a single participant (case 1) treated over 2 weeks, with ESWT, SME Technique & Home Exercise Program with outcome measurement at base line & after 2 weeks of intervention evaluated using NPRS, Goniometer and SPADI.

Participant Selection Source: The Adhesive capsulitis participant was screened for eligibility from the Orthopaedics OPD, Physiotherapy OPD of UPUMS, Saifai. After satisfying inclusion and exclusion criteria, the participant was enrolled in the study.

Participant Selection Criteria

Inclusion Criteria	Exclusion Criteria
• Participant diagnosed with Adhesive Capsulitis by an Orthopaedician.	• Surgical intervention on the affected shoulder.
• Age 35-60 years.	• Active infection or abscess in the affected shoulder.
• Both male and female.	• Untreated shoulder subluxation, dislocation & fracture.
• Willing to participate in the study and attend follow up session.	• Pregnancy
• Painful restricted movement of shoulder, for more than 2 months.	• Artificial pacemaker
	• Metallic implant in the upper arm.

Intervention protocol

This protocol was designed for the treatment of Adhesive Capsulitis focusing on Pain, ROM and Functional disability. The entire treatment process was sufficiently explained, & voluntary agreement was obtained before the delivery of the treatment. A detail history was taken and a preset data form was filled out by the participant. Past history of illness & any systemic disease was inquired cautiously. A complete physical examination, including general physical examination, examination of the shoulder joint.

The treatment protocol consisted of the following components:

(ESWT with SME Technique and Home Exercise Program)

The Participant was treated with a radial ESWT modus unit of 2000 shots on the anterior aspect of the shoulder joint crossing the midline of the joint with energy flux density ranged from low to moderate according to each participant tolerance of pain (0.06-0.14 mJ/mm^2) with a pressure of 4 bar and at an 8 Hz frequency, in continuous mode using a 25 mm of convex applicator[1] after that therapist had perform seven steps of SME Technique[9] and a Home Exercise Program which was explained to her at baseline including: (Pendulum exercise, Wall climbing, and Wand exercise), to be performed three times a day for 2 weeks, and an application of hot pack for 15 minutes before performing the exercises, demonstration on exercises was given on 1st day, of Enrollment in the study & on subsequent follow up it will be checked whether they were doing the exercises properly or not [11]. With monitoring via video calls. The participant was scheduled for follow-up sessions three times a week for 2 weeks [10].

Procedure

1. **Preparation:** Make the participant sit in a suitable & comfortable position, examine the area to be treated, clean the shoulder with antiseptic and apply coupling gel.
2. **ESWT application:** use a handheld applicator in circular motions to deliver shock waves. Inspect the area after treatment. Then the therapist will perform SME technique.
3. **SME Technique:** with the participant lying in side line position, stabilize the shoulder and perform seven steps of spencer one after the other: Shoulder extension with elbow flexion, Shoulder flexion with elbow extension, Circumduction with compression, Circumduction with distraction, Shoulder abduction & internal rotation with elbow flexion, Shoulder adduction & external rotation with elbow flexion, stretching tissue & pumping fluids with arm extended (Glenohumeral pump). After each step

ask the participant to perform isometric contraction and relaxation against slight resistance for 5 seconds, where the barrier is met. Repeat it for 5 times with rest intervals [9]

4. After the completion to treatment, teach the participant with Home Exercise Program.
5. Which include Pendulum exercises, Wall climbing, and Wand exercise performed 5 repetitions, thrice a day [10].
6. After 2 weeks of intervention: reassess pain levels, ROM and functional disability and record it.

Fig 1: Participant on treatment with ESWT.

Fig 2: Showing 7 steps of Spencer Muscle Energy Technique.

Step 1. Shoulder extension with elbow flexion.
Step 2. Shoulder flexion with elbow extension.
Step 3. Circumduction with compression.
Step 4. Circumduction with distraction.
Step 5. Shoulder abduction & internal rotation with elbow flexion.
Step 6. Shoulder adduction & external rotation with elbow flexion.
Step 7. Stretching tissue & pumping fluids with arm extended (Glenohumeral pump).

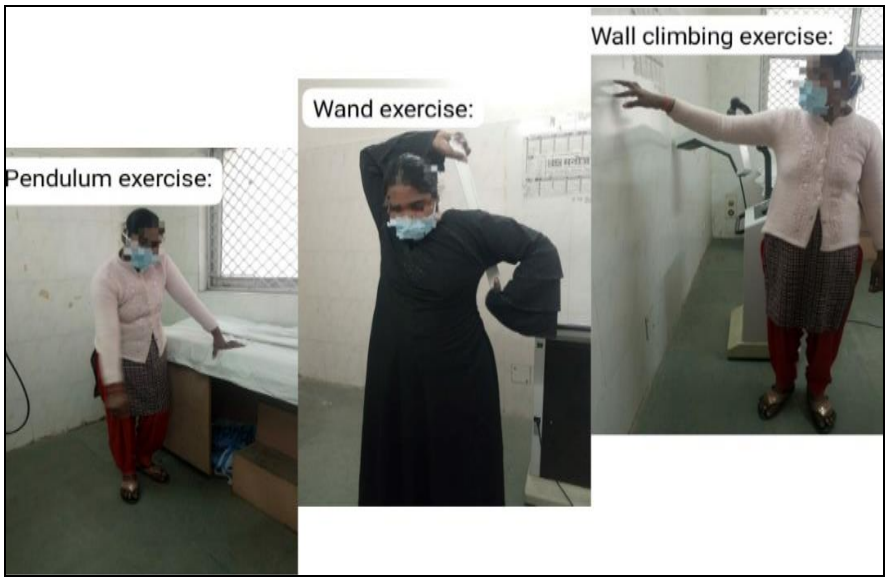

Fig 3: Showing Prescribed Home Exercises.

Case description

A 45-year-old female office worker presented to the physiotherapy outpatient department (OPD) with a primary complaint of right shoulder pain and a gradual reduction in range of motion (ROM) over the preceding four months. The participant described pain during movement, particularly with overhead motions, and reported difficulty performing daily activities such as combing her hair, dressing, and reaching for objects on higher shelves. Importantly, there was no history of trauma or underlying medical conditions that could have contributed to her symptoms.

After a thorough clinical examination, she was diagnosed with Adhesive Capsulitis (commonly known as Frozen Shoulder) by an orthopedic specialist. The diagnosis was based on her symptoms and clinical presentation, with a characteristic pattern of shoulder stiffness, pain, and limited ROM. Upon meeting the inclusion and exclusion criteria for the study, the participant was informed in detail about the treatment protocol and the objectives of the intervention. Written informed consent was obtained from her, and she agreed to participate in the study and attend all follow-up sessions.

The participant was treated with a combination of Extracorporeal Shock Wave Therapy (ESWT) and the Spencer Muscle Energy Technique (SME Technique), both aimed at reducing pain, improving ROM, and addressing the underlying pathophysiology of Adhesive Capsulitis. Additionally, a Home Exercise Program was prescribed, consisting of pendulum exercises, wall climbing, and wand exercises, to be performed three times a day for the duration of two weeks. Video calls were utilized to monitor adherence to the home exercise regimen and to provide guidance and support.

The intervention was administered three times per week over a period of two weeks. The outcome measures were assessed at baseline (prior to the intervention) and after two weeks of treatment. The primary outcome measures included the Numerical Pain Rating Scale (NPRS) for pain intensity, a Goniometer to assess ROM, and the Shoulder Pain and Disability Index (SPADI) to evaluate functional disability.

Results showed significant improvements in both pain reduction and ROM. Specifically, there was a 4.5-point reduction in pain intensity on the NPRS, indicating a notable decrease in discomfort. ROM assessments demonstrated marked improvement, with increases in the following movements: Flexion (+40), Extension (+20°), Abduction (+40°), External Rotation (+30°), Internal Rotation (+30°)

Additionally, functional disability as measured by the SPADI was reduced by 40%, reflecting a significant improvement in the participant's ability to engage in daily activities. The participant reported that she was able to return to activities of daily living that had previously been difficult or impossible, such as combing her hair, dressing independently, and reaching for objects on higher shelves.

Outcome measures

Pain: NPRS was used to measure pain intensity.

ROM: Goniometer was used of shoulder ROM.

Functional disability: SPADI questionnaire, was used for assessing shoulder pain & disability levels.

Result obtained after 2 weeks of intervention

Pain (NPRS): at base line pain of 7.5 intensity (severe pain) was obtained and after 2 weeks of intervention, the participant reported a pain of 3 intensity (mild pain) a significant reduction in pain was obtained.

ROM (Goniometer): Flexion increased from 125° to 165°, Extension increased from 30° to 50°, Abduction increased from 90° to 130°, External rotation increased from 35^0 to 65^0 and Internal rotation increased from 45° to 75°.

SPADI: 70% SPADI scores was obtained at baseline indicating high level of disability, 30% SPADI score was obtained after 2 weeks of intervention, a 40% reduction in the SPADI score, indicating a significant improvement in functional disability.

After 2 weeks intervention following changes were observed:

Table 1: Pain- NPRS

Baseline NPRS:	After 2 week of intervention, NPRS:	Change:
7.5/10	3/10	-4.5

Table 2: Range of Motion- Goniometry

	Baseline ROM	After 2 week of intervention, ROM	Change (Degrees)
Flexion	125^0	165º	$+40^0$
Extension	30^0	50^0	$+20^0$
Abduction	90^0	130^0	$+40^0$
External rotation	35^0	65^0	$+30^0$
Internal rotation	45^0	75^0	$+30^0$

Table 3: Functional Disability-Spadi

Baseline SPADI Score	After 2 week of intervention, SPADI	Change in SPADI
70%	30%	40% reduction in the SPADI score, indicating a significant improvement in functional disability.

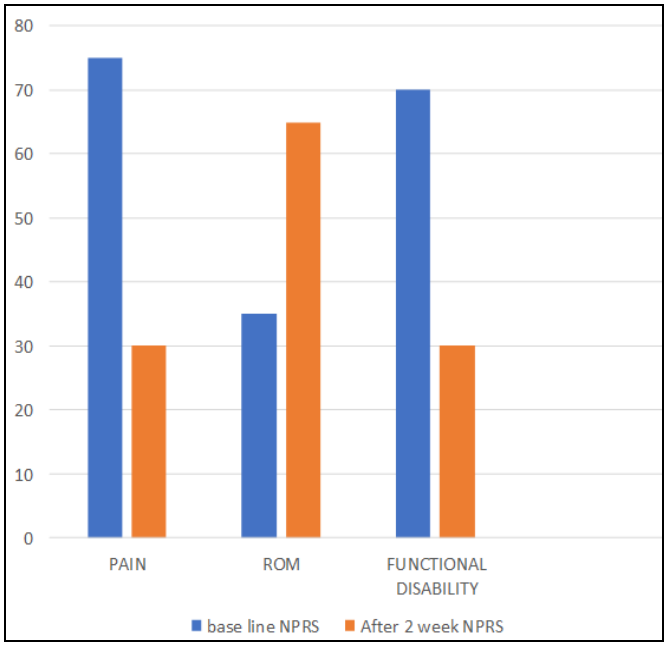

Fig 1: Change in out comes

The over all outcome had reflected a great reduction in pain intensity, increase in ROM enhanced shoulder function and reduction in functional disability. After 2 weeks of intervention she stated that, being able to return to more activities of daily living, such as combing her hair and reaching for objects on higher shelves.

Discussion

Elerian AE *et al.* (2021) found that the participants who received ESWT showed better improvement in shoulder pain, ROM and disability level as compare to those who received intra articular corticosteroid injection after 3 months of intervention [1].

Jivani R *et al.* (2021) evaluated that SME technique and conventional physiotherapy is more effective in improving pain, reducing disability and increasing range of motion as compare to Maitland mobilization and conventional physiotherapy [12].

Iqbal M *et al.* (2020) detect that spencer joint mobility and muscle energy technique was found to be more effective than passive stretching exercises to reduce pain, to improve range of motion and functionality in treating participants with AC.[9]

Alarab A *et al.* (2018) reported that shock wave therapy and ultra sound therapy group when given with exercises were both effective in decreasing pain and increasing ROM most influential results in alleviating symptoms seen with shock wave therapy [11].

Conclusion

This case study demonstrates that the combination of ESWT, Spencer MET, and a Home Exercise Program can be an effective treatment strategy for managing Adhesive Capsulitis. The participant showed significant reductions in pain, improvements in ROM, and reduced functional disability, which contributed to a better quality of life. Further research with larger sample sizes and control groups is needed to validate these findings and explore the long-term benefits of this combined treatment approach.

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