



EFFECTIVENESS OF HIGH-GRADE MOBILIZATION AND SHORTWAVE DIATHERMY WITH STRETCHING ON SHOULDER PAIN AND DISABILITY INDEX (SPADI) IN STAGE II ADHESIVE CAPSULITIS

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Abstract

Background: Adhesive capsulitis is characterised by a spontaneous onset of shoulder pain accompanied by progressive limitation of both active and passive glenohumeral joint movements. This study was conducted to compare the effectiveness of High Grade Mobilization with stretching and Shortwave Diathermy with stretching in stage II adhesive capsulitis of the shoulder.

Objective: To evaluate and compare the effectiveness of High Grade Mobilization and stretching versus Shortwave Diathermy and stretching on pain, range of motion, and functional disability in stage II adhesive capsulitis.

Methods: Sixty participants with clinical diagnosis of adhesive capsulitis stage II were randomly allocated into two groups. Group A received High Grade Mobilization and stretching, while Group B received Shortwave Diathermy and stretching. The outcome measures were assessed in terms of Visual Analogue Scale (VAS), Range of Motion (ROM), and Shoulder Pain and Disability Index (SPADI).

Results: The mean difference of VAS scores for pre- and post-treatment was 1.76 ± 1.07 in Group A and 1.36 ± 1.35 in Group B respectively. The mean SPADI scores reduced from 33.95 ± 11.82 to 27.00 ± 11.29 in Group A, and from 41.92 ± 8.88 to 35.33 ± 9.59 in Group B. Mean difference in SPADI was 6.27 ± 3.48 in Group A and 6.59 ± 5.50 in Group B. Range of motion (flexion, abduction, external rotation and internal rotation) showed greater improvement in Group A compared to Group B.

Conclusion: Both High Grade Mobilization with stretching and Shortwave Diathermy with stretching were effective in stage II adhesive capsulitis. However, greater improvements in range of motion and functional disability were observed in the mobilization group.

Keywords: Adhesive capsulitis Stage II, High Grade Mobilization, Shortwave Diathermy, Stretching.

Introduction

Adhesive capsulitis of the shoulder is characterised by a spontaneous onset of pain accompanied by progressive restriction of active and passive glenohumeral joint movements. It is a common musculoskeletal disorder with a reported prevalence of 2–5% in the general population and up to 10–22% among individuals with diabetes mellitus^{7,13}. The condition is most frequently observed in individuals aged between 40 and 60 years and is associated with significant disability that interferes with activities of daily living.

Although the precise aetiology remains uncertain, several mechanisms have been proposed. Immunological abnormalities, including raised C-reactive protein, increased cytokine activity, and capsular fibroplasia, have been reported^{5,6}. Histological studies demonstrate capsular thickening, fibroblast proliferation, and collagen deposition, resembling the pathology of Dupuytren's contracture⁶. Adhesive capsulitis is commonly classified into primary (idiopathic) and secondary forms, the latter associated with trauma, surgery, or systemic diseases^{7,8}. Clinically, it progresses through three overlapping stages: painful (stage I), stiff or frozen (stage II), and thawing (stage III), with stage II often marked by severe restriction in range of motion⁹.

Various treatment options have been advocated, including non-steroidal anti-inflammatory drugs, corticosteroid injections, hydrodilatation, manipulation under anaesthesia, and physiotherapy modalities^{10,11}. Within physiotherapy, joint mobilization techniques are widely used to restore joint play and capsular extensibility, while stretching exercises assist in regaining mobility¹⁰. Shortwave diathermy (SWD), a deep heating modality, has been shown to alter the viscoelastic properties of connective tissue, thereby enhancing the effectiveness of stretching^{15,16}.

Despite the widespread use of both mobilization and SWD in clinical practice, limited studies have compared their effectiveness when combined with stretching exercises in stage II adhesive capsulitis. Hence, this study was designed to evaluate and compare the outcomes of high-grade mobilization with stretching versus SWD with stretching on pain, range of motion, and functional disability, as measured by the Shoulder Pain and Disability Index (SPADI).

Objectives

- To evaluate the effectiveness of High-Grade Mobilization with stretching on shoulder pain and disability (SPADI) in subjects with stage II adhesive capsulitis.
- To evaluate the effectiveness of Shortwave Diathermy with stretching on shoulder pain and disability (SPADI) in subjects with stage II adhesive capsulitis.
- To compare the effectiveness of High-Grade Mobilization with stretching versus Shortwave Diathermy with stretching on shoulder pain and disability (SPADI) in stage II adhesive capsulitis.

Materials and Methods

Study Design

This study followed an experimental design and was conducted at the Department of Physiotherapy, S.D.M. College of Medical Sciences and Hospital, Dharwad. Ethical clearance was obtained from the institutional ethical committee prior to commencement of the study.

Participants

Sixty subjects (aged 40–60 years) with a clinical diagnosis of stage II adhesive capsulitis, confirmed by an orthopaedician, were recruited. All participants provided written informed consent before enrolment.

Inclusion criteria

- Age 40–60 years of either gender
- Stage II adhesive capsulitis of the shoulder

Exclusion criteria

- General contraindications to mobilization: malignancy, fracture, hypermobility, inflammation
- General contraindications to stretching: bony block, recent fracture, haematoma, hypermobility
- General contraindications to SWD: haemorrhage, venous thrombosis, arterial disease, metal implants, disturbed skin sensation, tumours

Sample Size

The sample size was calculated from pilot study findings using the formula²⁹:

$$n = \frac{2s_p^2 (z_{1-\alpha/2} + z_{1-\beta})^2}{\mu_d^2}$$

where s_1^2 and s_2^2 represent standard deviations in each group, and μ_d the expected mean difference.

Thirty participants were allocated randomly into each group (Group A and Group B).

Randomization

Participants were randomly allocated using sealed opaque envelopes. Group A received High-Grade Mobilization and stretching, while Group B received SWD and stretching.

Outcome Measures

- **Pain:** Visual Analogue Scale (VAS) — 0 indicated no pain and 10 severe pain
- **Range of Motion (ROM):** Universal goniometer
- **Functional disability:** Shoulder Pain and Disability Index (SPADI) — self-administered questionnaire including pain (5 items) and functional activity (8 items)

Assessments were performed at baseline and after 4 weeks of intervention.

Intervention Protocol

Group A – High-Grade Mobilization with Stretching

Participants received Maitland Grade III and IV mobilization techniques:

- **Grade III:** Large amplitude rhythmic oscillations up to tissue resistance
- **Grade IV:** Small amplitude oscillations at end range into tissue resistance

Oscillations were given at 2–3 per second for 1–2 minutes. Sessions lasted 30 minutes. Techniques included inferior, posterior, and anterior glides (Figures 4–6 in thesis).

Stretching exercises:

- External rotation stretch
- Forward elevation stretch
- Horizontal adduction stretch
- Hand-behind-back (internal rotation) stretch

Each stretch was held for 30 seconds with 10 seconds rest, repeated 4 times, at the limit of tolerable discomfort^{16,22}. Patients were instructed to continue stretching daily at home.

Codman's pendulum exercises were demonstrated and prescribed as part of the home program^{20,30}.

Group B – Shortwave Diathermy (SWD) with Stretching

SWD was administered by capacitor field method (frequency 27.12 MHz, wavelength 11 m). One pad electrode was placed anteriorly and the other posteriorly over the shoulder. Treatment was given using the contraplanar method for 20 minutes at an intensity producing comfortable warmth^{16,33}.

After SWD, the same stretching and Codman's exercises as Group A were prescribed for daily performance.

Duration

Both groups underwent the intervention for 4 weeks.

Statistical Analysis

Data were analysed using SPSS version 16. Descriptive statistics were expressed as mean and standard deviation. Within-group comparisons were analysed using paired t-tests (ROM, SPADI) and Wilcoxon matched pairs test (VAS). Between-group comparisons were performed using unpaired t-tests and Mann–Whitney U tests. A p-value <0.05 was considered statistically significant.

Results

Participant Characteristics

A total of 60 participants with stage II adhesive capsulitis were enrolled, with 30 subjects in each group. The mobilization group included 15 males and 15 females, while the SWD group included 16 males and 14 females. The mean age was comparable between groups (55.7±4.8 years in Group A vs. 53.4±5.2 years in Group B). Occupational distribution was similar across groups, with the majority being housewives and employees.

Pain (VAS)

Both groups demonstrated a statistically significant reduction in VAS scores after intervention.

- Group A (Mobilization + Stretching): Pre 7.27±1.34, Post 5.50±1.53 (mean reduction 1.77±1.07; p<0.001).
- Group B (SWD + Stretching): Pre 7.67±1.60, Post 6.30±1.58 (mean reduction 1.37±1.35; p<0.001).

Between-group analysis revealed greater reduction in Group A, though the difference was not statistically significant (p=0.22).

Range of Motion (ROM)

Both groups showed significant improvement in shoulder ROM, with Group A demonstrating greater gains:

- Flexion: Group A Δ14.7±11.8 vs. Group B Δ11.3±11.1 (p=0.27)
- Abduction: Group A Δ20.2±15.7 vs. Group B Δ10.8±12.0 (p=0.01*)
- External rotation: Group A Δ13.0±9.3 vs. Group B Δ5.2±5.8 (p=0.001*)
- Internal rotation: Group A Δ10.0±7.7 vs. Group B Δ6.5±9.6 (p=0.03*)

Shoulder Pain and Disability Index (SPADI)

Both groups demonstrated significant reduction in SPADI scores after intervention.

- Group A (Mobilization): Pre 33.95±11.82, Post 27.68±11.29 (mean reduction 6.27±3.48; p<0.001).
- Group B (SWD): Pre 41.93±8.88, Post 35.34±9.60 (mean reduction 6.59±5.50; p<0.001).

Although the mean reduction was slightly higher in Group B, the between-group comparison was not statistically significant (p=0.47).

Table 1. Baseline Demographics

Group	Male n (%)	Female n (%)	Mean Age (years)
Mobilization (n=30)	15 (50.0)	15 (50.0)	55.7 ± 4.8
SWD (n=30)	16 (53.3)	14 (46.7)	53.4 ± 5.2

Table 2. VAS Outcomes

Group	Pre (Mean ± SD)	Post (Mean ± SD)	Mean Change (± SD)	p-value
Mobilization	7.27 ± 1.34	5.50 ± 1.53	1.77 ± 1.07	<0.001
SWD	7.67 ± 1.60	6.30 ± 1.58	1.37 ± 1.35	<0.001

Table 3. ROM Outcomes

Movement	Mobilization Δ (Mean $\pm$ SD)	SWD Δ (Mean $\pm$ SD)	p-value
Flexion	14.7 $\pm$ 11.8	11.3 $\pm$ 11.1	0.27
Abduction	20.2 $\pm$ 15.7	10.8 $\pm$ 12.0	0.01*
External rotation	13.0 $\pm$ 9.3	5.2 $\pm$ 5.8	0.001*
Internal rotation	10.0 $\pm$ 7.7	6.5 $\pm$ 9.6	0.03*

Table 4. SPADI Outcomes

Group	Pre (Mean $\pm$ SD)	Post (Mean $\pm$ SD)	Mean Change ($\pm$ SD)	p-value
Mobilization	33.95 $\pm$ 11.82	27.68 $\pm$ 11.29	6.27 $\pm$ 3.48	<0.001
SWD	41.93 $\pm$ 8.88	35.34 $\pm$ 9.60	6.59 $\pm$ 5.50	<0.001

Figure 1. Comparison of mean Visual Analogue Scale (VAS) scores pre- and post-intervention in the mobilization and SWD groups.

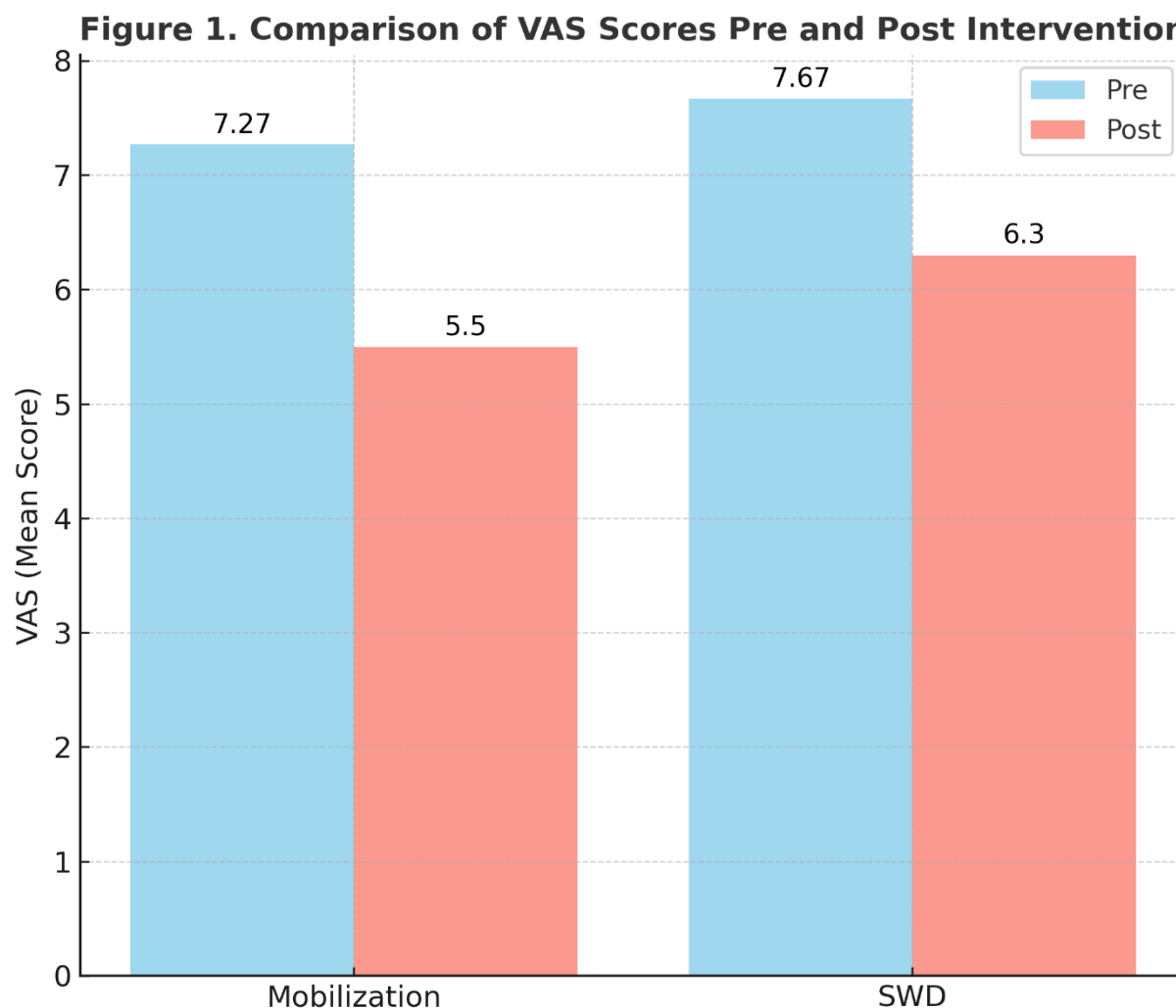


Figure 2. Improvement in shoulder range of motion (ROM) parameters (flexion, abduction, external rotation, and internal rotation) after intervention in mobilization and SWD groups.

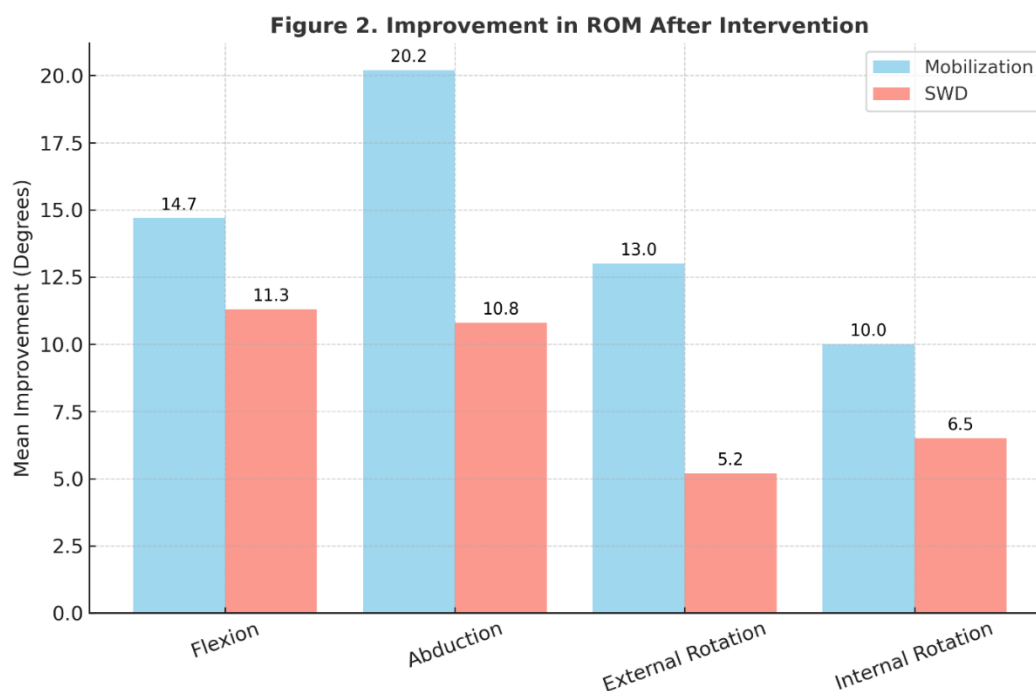
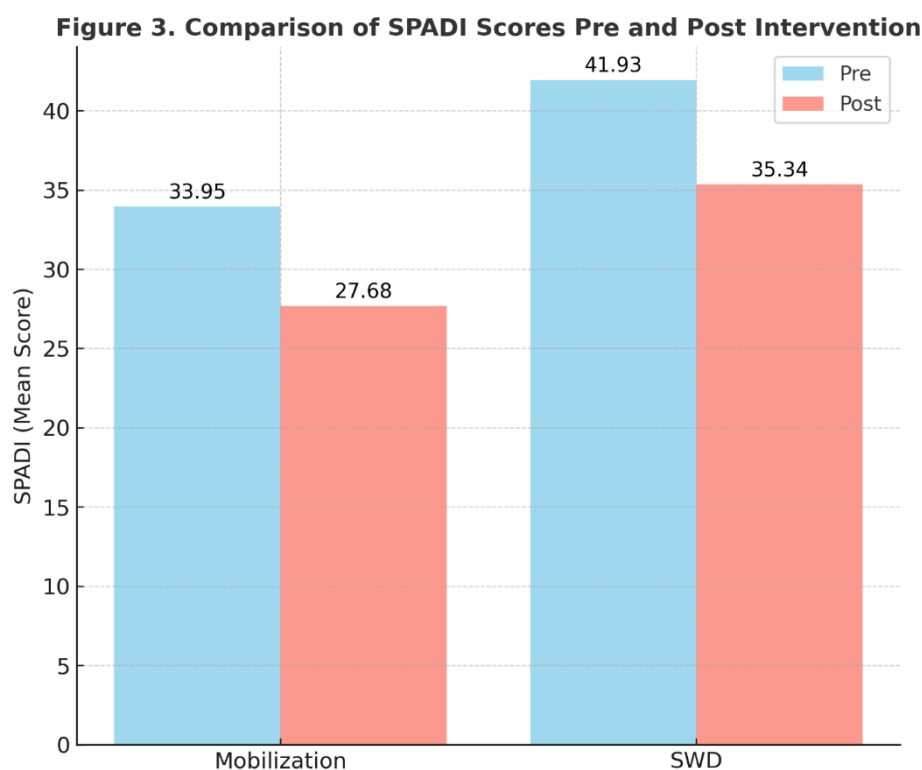


Figure 3. Comparison of mean Shoulder Pain and Disability Index (SPADI) scores pre- and post-intervention in the mobilization and SWD groups.



Discussion

The present study compared the effectiveness of High-Grade Mobilization with stretching and Shortwave Diathermy (SWD) with stretching in stage II adhesive capsulitis. Both groups demonstrated significant improvements in pain, range of motion (ROM), and functional disability as

measured by SPADI after four weeks of intervention. However, greater gains in ROM were observed in the mobilization group, while pain and SPADI improvements were comparable between the two interventions.

Adhesive capsulitis is a condition associated with pain, stiffness, and functional limitation. The pathophysiology involves capsular thickening, fibroblast proliferation, and collagen deposition, leading to restriction of joint mobility^{5,6}. The clinical presentation progresses through three stages, with stage II marked predominantly by stiffness and limited motion⁹. The restoration of arthrokinematics and capsular extensibility is therefore an important therapeutic target in this stage.

In this study, High-Grade Mobilization techniques produced significant improvement in ROM compared to SWD with stretching. These findings are in agreement with previous research showing that mobilization, particularly in end-range positions, enhances glenohumeral mobility and reduces disability¹⁹. Joint mobilization is believed to stimulate mechanoreceptors, modulate pain, and stretch the capsular structures, thereby improving extensibility and restoring joint play¹⁰.

SWD with stretching was also effective in reducing pain and disability, consistent with reports that deep heating increases tissue extensibility and reduces tensile stress at therapeutic temperatures of 40–45°C^{15,16}. SWD has been shown to enhance the effectiveness of stretching and reduce pain and spasm, which explains the significant post-treatment improvements observed in this study. However, the magnitude of ROM gains remained lower than that achieved through mobilization, suggesting that mobilization provides more direct mechanical effects on the capsular restrictions.

The improvement in SPADI scores in both groups confirms that functional outcomes are enhanced irrespective of the modality used. Previous studies have shown that SPADI is a reliable and sensitive tool for monitoring clinical changes in adhesive capsulitis²⁸. In the current study, both interventions resulted in clinically meaningful improvements, though between-group differences were not statistically significant.

The reduction in VAS scores was significant in both groups, indicating that both mobilization and SWD with stretching are effective in pain management. Similar pain reduction with mobilization has been reported in studies comparing high- and low-grade mobilization techniques, where end-range mobilization demonstrated superior outcomes in mobility and disability¹⁹. Likewise, SWD has been reported to be effective in alleviating musculoskeletal pain by improving circulation and reducing muscle guarding^{15,16}.

Overall, the findings suggest that both interventions are beneficial, but mobilization with stretching appears to provide additional advantage in improving joint range of motion. This highlights the importance of incorporating mobilization techniques in the physiotherapy management of stage II adhesive capsulitis to achieve optimal functional recovery.

Conclusion

Both High-Grade Mobilization with stretching and Shortwave Diathermy with stretching were effective in reducing pain, improving range of motion, and decreasing disability in stage II adhesive capsulitis. However, greater improvements in shoulder mobility were observed in the mobilization group, suggesting that High-Grade Mobilization with stretching is more effective in restoring functional outcomes in this population.

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