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RESEARCH ARTICLE
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COMPARATIVE EFFECTIVENESS OF HIGH-GRADE MOBILIZATION AND SHORTWAVE DIATHERMY ON SHOULDER RANGE OF MOTION IN STAGE II ADHESIVE CAPSULITIS: A RANDOMIZED CONTROLLED STUDY

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ABSTRACT

Background:
Adhesive capsulitis is a common shoulder condition which causes pain and progressive restriction of shoulder movements. Loss of range of motion (ROM), especially in abduction and external rotation, is the main clinical feature during the frozen stage. Physiotherapy treatment usually includes stretching and mobilization techniques or the use of deep heating modalities like shortwave diathermy.

Objective:
To evaluate and compare the effectiveness of high-grade mobilization with stretching and shortwave diathermy with stretching on shoulder range of motion in subjects with stage II adhesive capsulitis.

Methods:
Sixty subjects diagnosed with stage II adhesive capsulitis were randomly divided into two groups of thirty each. Group A received high-grade mobilization with stretching, and Group B received shortwave diathermy with stretching. Active ROM of flexion, abduction, external rotation, and internal rotation was measured using a universal goniometer at baseline and after four weeks of treatment. Data were analyzed using paired t-tests for within-group and unpaired t-tests for between-group comparisons.

Results:
Both groups showed significant improvements in shoulder ROM after four weeks ($p < 0.001$). Between-group comparison showed that mobilization with stretching produced greater improvement in abduction ($p = 0.012$) and external rotation ($p = 0.0002$) compared to shortwave diathermy with stretching.

Conclusion:
Both treatment methods were effective in improving shoulder ROM in stage II adhesive capsulitis, but high-grade mobilization with stretching showed better gains in abduction and external rotation than shortwave diathermy with stretching.

Keywords: Adhesive capsulitis, high-grade mobilization, shortwave diathermy, range of motion, stretching.

INTRODUCTION

Adhesive capsulitis, also known as frozen shoulder, is a common clinical condition characterised by the gradual onset of shoulder pain and progressive limitation of both active and passive movements of the glenohumeral joint[1]. The condition can be primary, occurring without any known cause, or secondary, following trauma, surgery, prolonged immobilisation or systemic diseases such as diabetes mellitus and thyroid disorders[5].

The prevalence of adhesive capsulitis is reported to be 2–5% in the general population, and is higher among people with diabetes, ranging from 10% in type I to 22% in type II diabetes[5]. It commonly affects individuals between 40–60 years of age, and women are affected more frequently than men[14]. The natural course may last from 1 to 3 years, and in some cases, residual stiffness and functional limitations can persist if proper management is not given.

The exact pathology is still unclear, but capsular fibrosis, thickening, chronic inflammation, and collagen deposition have been noted in histological studies[6]. The disease usually progresses through three stages – the painful "freezing" stage, the stiff "frozen" stage, and the recovery "thawing" stage[9]. The characteristic clinical pattern of restriction involves external rotation being the most affected, followed by abduction and internal rotation[14]. These restrictions in ROM directly interfere with daily functional activities like grooming, overhead reaching, and dressing.

Management of adhesive capsulitis includes various options such as non-steroidal anti-inflammatory drugs, corticosteroid injections, manipulation under anaesthesia, capsular distension, and surgical release[9],[10]. Physiotherapy remains the mainstay of treatment, especially in the frozen stage where pain reduces but stiffness persists. Common physiotherapy methods include stretching exercises and mobilization techniques, which aim to restore joint play and improve capsular extensibility[17].

High-grade mobilization involves passive, controlled oscillatory movements performed at the end range of motion. The biomechanical effect helps in stretching contracted capsuloligamentous structures, while the neurophysiological effect includes stimulation of joint mechanoreceptors and inhibition of nociceptors, which help in reducing pain and increasing mobility[17]. Studies have shown that end-range high-grade mobilization produces greater improvements in shoulder ROM compared to low-grade mobilization[19].

Shortwave diathermy (SWD) is a deep heating modality that delivers electromagnetic energy to periarticular tissues. The heat produced increases tissue extensibility and reduces stiffness. Compared to superficial heating, SWD reaches deeper structures and can cover a larger area[15]. When combined with stretching, it can enhance viscoelastic changes and improve mobility[16].

Although both mobilization and SWD are commonly used in physiotherapy practice, there are limited studies that directly compare their effectiveness in improving ROM in adhesive capsulitis[15]–[19]. Since restriction of motion is the main problem in the frozen stage, identifying the more effective method for improving shoulder ROM is clinically important.

The present study was conducted to compare the effectiveness of high-grade mobilization with stretching and shortwave diathermy with stretching on shoulder range of motion in subjects with stage II adhesive capsulitis.

MATERIALS AND METHODS

Study Design and Setting

The study followed an experimental design with random allocation of subjects into two treatment groups. The research was conducted at the Department of Physiotherapy, S.D.M. College of Medical Sciences and Hospital, Dharwad. Ethical clearance was obtained from the institutional ethics committee prior to the commencement of the study.

Participants

A total of 60 subjects clinically diagnosed with stage II adhesive capsulitis were included. Subjects were referred by orthopaedic consultants and were screened based on the inclusion and exclusion criteria. Stage II adhesive capsulitis was identified clinically by the presence of pain and marked limitation of both active and passive range of motion, especially external rotation, with pain usually present at end ranges[14].

Inclusion criteria:

- Age between 40–60 years
- Either gender
- Clinical diagnosis of stage II adhesive capsulitis of the shoulder

Exclusion criteria:

- Malignancy, recent fracture, hypermobility, or active inflammation (contraindications to mobilization)
- Bony blocks, haematoma, or recent fractures (contraindications to stretching)
- Metal implants, haemorrhage, thrombosis, arterial diseases, tumours, or disturbed skin sensations (contraindications to SWD)

All eligible participants gave informed consent before the start of the study. Baseline demographic data were recorded for age, gender, symptom duration and occupation.

Sample Size and Randomization

Sample size was calculated through a pilot study using the formula for comparison of two means with 80% power and 5% significance level[29]. A total of 60 subjects were randomly assigned to two groups of 30 each using a sealed opaque envelope method. Group A received high-grade mobilization with stretching, and Group B received shortwave diathermy with stretching.

Intervention Protocol

Group A – High-Grade Mobilization with Stretching

Participants in Group A received Maitland Grade III and IV mobilization techniques, including inferior, posterior and anterior glides. Grade III consisted of large amplitude oscillations into tissue resistance, and Grade IV consisted of small amplitude oscillations at the end range. Mobilization was given at a frequency of 2–3 oscillations per second for 1–2 minutes on each glide. Each session lasted for approximately 30 minutes.

This was followed by passive stretching of the shoulder in external rotation, forward elevation, horizontal adduction and internal rotation (hand behind back). Each stretch was maintained for 30 seconds with 10 seconds rest, and repeated four times. The intensity was kept at a level of tolerable discomfort. Codman's pendular exercises were also taught as part of the home program[20].

Group B – Shortwave Diathermy with Stretching

Participants in Group B received shortwave diathermy (SWD) followed by the same stretching and pendular exercise program. SWD was administered using a capacitor field method at 27.12 MHz frequency with electrodes placed in a contraplanar position over the shoulder. The intensity was adjusted until the subject felt a comfortable warmth. Treatment lasted for 20 minutes[15],[16],[33].

Both groups underwent treatment for four weeks. Compliance with home stretching exercises was reinforced regularly.

Outcome Measures

The outcome measure for this study was active shoulder range of motion (ROM), which was measured for:

- Flexion
- Abduction
- External rotation
- Internal rotation

A universal goniometer was used for measurement. Goniometric measurements are considered reliable for shoulder ROM[27]. Measurements were taken at baseline and after four weeks of intervention by the same examiner to reduce variability.

Statistical Analysis

All data were analysed using SPSS version 16. Descriptive statistics were used to find mean and standard deviation. Within-group analysis (pre- and post-treatment) was done using paired t-test. Between-group comparisons were made using unpaired t-test. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 60 participants with stage II adhesive capsulitis were included in the study and randomly divided into two groups, with 30 subjects in each group. Both groups were comparable at baseline in terms of age, gender, and occupational distribution.

Table 1. Baseline Characteristics of Participants

Variable	Group A (Mobilization) (n = 30)	Group B (SWD) (n = 30)
Age (years, Mean ± SD)	55.7 ± 4.8	53.4 ± 5.2
Gender (Male/Female)	15 / 15	16 / 14
Occupation	Housewives, employees	Housewives, employees

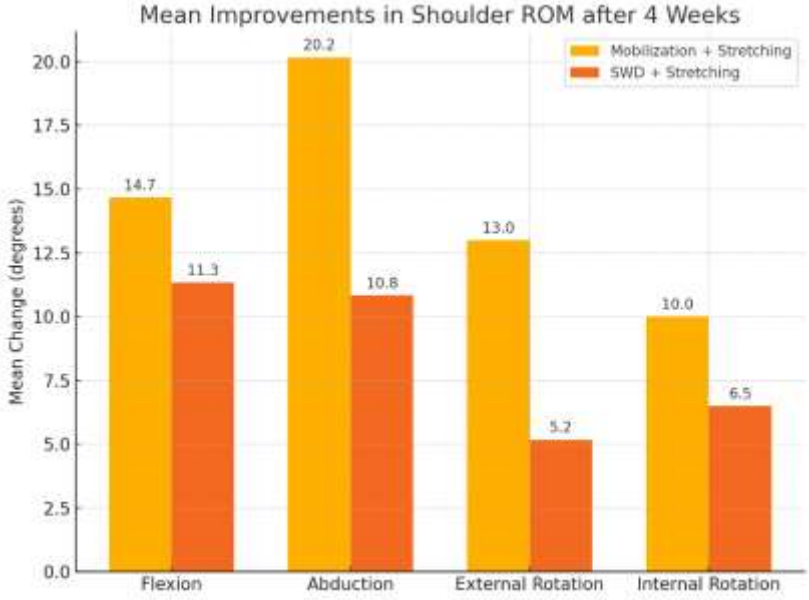
Shoulder Range of Motion

Both groups showed statistically significant improvements in shoulder ROM after four weeks of treatment. Movements assessed included flexion, abduction, external rotation and internal rotation.
Within-group analysis showed significant improvements in all movements ($p < 0.001$). Between-group analysis showed that Group A (mobilization with stretching) had greater improvement in abduction and external rotation compared to Group B (shortwave diathermy with stretching). The differences for flexion and internal rotation were not statistically significant.

Table 2. Shoulder ROM outcomes (degrees)

Movement	Group	Pre mean ± SD	Post mean ± SD	Change mean ± SD	p-value (between groups)
Flexion	Mobilization	120.33 ± 24.70	135.00 ± 23.67	14.67 ± 11.81	0.27
Flexion	SWD	117.33 ± 16.33	128.67 ± 15.81	11.33 ± 11.14	
Abduction	Mobilization	85.83 ± 29.45	106.00 ± 29.69	20.17 ± 15.67	0.012
Abduction	SWD	80.17 ± 22.07	91.00 ± 22.30	10.83 ± 11.97	
External rotation	Mobilization	30.33 ± 19.52	43.33 ± 20.94	13.00 ± 9.34	0.0002
External rotation	SWD	26.67 ± 14.16	31.83 ± 14.88	5.17 ± 5.80	
Internal rotation	Mobilization	39.83 ± 17.49	49.83 ± 16.79	10.00 ± 7.66	0.12
Internal rotation	SWD	47.33 ± 19.15	53.83 ± 18.79	6.50 ± 9.57	

Figure 1. Mean improvements in shoulder ROM



Mean improvements in shoulder ROM (flexion, abduction, external rotation, internal rotation) in mobilization and SWD groups after 4 weeks. Mobilization showed significantly greater gains in abduction and external rotation.

Summary of Findings:

- Both groups showed significant improvement in all shoulder movements after 4 weeks.
- Mobilization with stretching produced better gains in abduction and external rotation, which were statistically significant.
- Improvements in flexion and internal rotation were not significantly different between groups.

DISCUSSION

- The present study compared the effectiveness of high-grade mobilization with stretching and shortwave diathermy with stretching on shoulder range of motion in subjects with stage II adhesive capsulitis. The results showed that both interventions produced significant improvements in shoulder flexion, abduction, external rotation and internal rotation after four weeks of treatment. However, mobilization with stretching showed greater improvements in abduction and external rotation compared to shortwave diathermy with stretching, and these differences were statistically significant.
- Adhesive capsulitis is known for progressive loss of both active and passive movements of the shoulder joint, with external rotation being the most severely affected, followed by abduction and internal rotation[14]. Limitation of these movements leads to major functional difficulties in daily activities such as combing hair, overhead reaching and dressing. Therefore, regaining shoulder ROM is an important goal of physiotherapy treatment in this condition.
- In this study, high-grade mobilization produced better gains in abduction and external rotation. These findings are supported by previous reports that mobilization, particularly at end ranges, helps in stretching the contracted capsule and improves glenohumeral joint mobility[17],[19]. High-grade techniques involve oscillatory movements at the end of the available range, which provide a mechanical stretch to the tight capsuloligamentous structures. This leads to increased extensibility and improved range of motion[17]. Vermeulen et al. reported that high-grade mobilization resulted in significantly greater improvements in shoulder ROM compared to low-grade mobilization[19]. Nicholson also observed beneficial effects of passive joint mobilization in improving hypomobility associated with adhesive capsulitis[17].

- Mobilization also has a neurophysiological effect. It stimulates joint mechanoreceptors and inhibits nociceptors, which leads to reduced pain and muscle guarding and helps to increase mobility[17]. This may have contributed to the greater gains in abduction and external rotation seen in the mobilization group in this study.
- Shortwave diathermy, on the other hand, works by producing deep heating of the periarticular tissues. The thermal effect increases the extensibility of collagen and reduces stiffness, which facilitates stretching[15]. SWD when combined with stretching has been shown to improve tissue extensibility more effectively than superficial heating[16]. In the present study, SWD with stretching also produced significant improvements in ROM in all directions after four weeks, but the magnitude of change was lower compared to mobilization, especially for abduction and external rotation.
- The greater improvement with mobilization may be because SWD alone does not provide a mechanical stretching effect to the joint capsule. While it helps in reducing tissue viscosity and prepares the tissues for stretching, the actual capsular restrictions may be better addressed through mobilization. This explains why mobilization with stretching was more effective in improving abduction and external rotation.
- External rotation and abduction are usually the most restricted and also the most functionally important movements in adhesive capsulitis[14]. Better improvement in these movements indicates better capsular extensibility and joint play, which is important for functional recovery.
- The findings of this study are similar to previous studies which have shown significant improvements in ROM with mobilization techniques in adhesive capsulitis[17],[19]. The improvement seen in both groups also suggests that both interventions are beneficial, but mobilization provides additional advantage in restoring key movements.

CONCLUSION

- Both high-grade mobilization with stretching and shortwave diathermy with stretching were effective in improving shoulder range of motion in subjects with stage II adhesive capsulitis after four weeks of treatment. However, mobilization with stretching showed significantly greater improvements in abduction and external rotation compared to shortwave diathermy with stretching.
- Since these are the most restricted and functionally important movements in adhesive capsulitis, high-grade mobilization with stretching can be considered more effective in restoring mobility during the frozen stage. Shortwave diathermy may be useful as an adjunct to stretching, but mobilization remains the better option for improving shoulder ROM.

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