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To Evaluate the Efficacy of Ultrasound Therapy with Maitland Mobilization against Shortwave Diathermy with Maitland Mobilization in Treatment of Periarthritis Shoulder

Tanishq Monga[1*], Lalit Arora[1*], Reena Arora[1] and Anu Monga[2]

[1]*Baba Farid University of Health Sciences, Faridkot, Punjab, India*
[2]*Monga Physiotherapy Clinic, Moga, Punjab-142001, India.*

[*]tanishqmonga666@gmail.com (Corresponding Author)

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ABSTRACT

Background: A clinical condition of uncertain etiology characterized by substantial restriction of both active and passive shoulder motion, initially affecting external rota-tion and later shoulder abduction. The main pain factor is ROM restriction and in-flammation. The initial stage is challenging, with the majority of the discomfort oc-curring at night.

Purpose: The initial stage is challenging to treat, with the majority of the discomfort occurring at night, and hence we need to compare the treatment approaches.

Methods: 60 subjects were included as per inclusion and exclusion criteria diagnosed with frozen shoulder of age group between 40-70 years. The subjects were randomly divided into 3 groups. Group A (n=20) were treated with ultrasound therapy with Maitland mobilization; Group B (n=20) were treated with shortwave diathermy with Maitland mobilization; Group C (n=20) were treated with hot packs and exercises. Patients were evaluated for pain by using VAS. ROM of shoulder joint was measured using a goniometer. The duration of the study was 6 weeks. The patients were assessed on the 0th day and at the end of the 3rd and 6th weeks.

Results: After statistical analysis, significantly higher improvement was seen in the mean of VAS and ROM in Group B.

Conclusion: It was determined that Maitland mobilization in combination with shortwave diathermy is superior to both other modalities of therapy.

1. Introduction

The shoulder joint is one of the most rewarding and functional joints involved in daily routines, including performances, occupational, and recreational activities. Operation of this joint facilitates stability and mobility, which often mutually co-exist between the upper and lower limb movements during skilled and powerful activities of the hands. The joints in the human body get affected by different disabilities, of which arthritis represents a major one (Brue *et al.*, 2007). Arthritis of the shoulder joint has been reported since 1872, described as 'Humero Scapular Periarthritis'. The ailment was renamed as 'Frozen Shoulder' in 1934 by Codman and later described as 'Adhesive Capsulitis' by Neviarerin in 1945, who reported the occurrence of this ailment amongst 7% to 21% of the population (Neviaser, 1945). The condition is characterized by a painful, stiff shoulder. The shoulder is a complex joint that plays a crucial role in many activities of daily living (Tiwari *et al.*, 2017).

Adhesive capsulitis is defined as a painful and disabling condition in which the capsule and the connective tissue surrounding the glenohumeral (GH) joint become inflamed, leading to restriction of range of motion in the joint. Adhesive capsulitis is associated with a global dysfunction of the involved extremity. The functional limitations/ disabilities seen in subjects with adhesive capsulitis are the inability to reach overhead, behind the head, out to the side, and behind the back, thus having difficulty in dressing in men and women according to its severity. Patients with frozen shoulder present with gradual and progressive onset of pain and loss of active and passive shoulder motion in both elevation and rotation. Frozen shoulder is marked by the presence of multiregional synovitis, consistent with inflammation. There are commonly 3 stages of periarthritis of the shoulder: The painful stage, in which there is pain in both active and passive motion that is diffuse and lasts one to two months. The frozen stage: gradual loss of range of motion that persists from several months to years with

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minimal pain throughout the range except at the end range of motion. The Thawing stage: improvement in range of motion (ROM) over several months to years (Guler-Uysal *et al*., 2004).

The rationale for achieving therapeutic goals through heating is to alter the viscoelastic properties of connective tissue. Shortwave diathermy (SWD) can heat up a larger treatment area and volume of tissue than is possible with ultrasound, while ultrasound can produce some mechanical effects in addition to the heating effect. Hot pack is the most traditional method of providing superficial heating. Shortwave diathermy (SWD) is a deep tissue heating electrotherapeutic modality that produces an oscillating electromagnetic field in the frequency range of 27.12 MHz and a wavelength of 11 m. It has been suggested that deep heating agents could produce a greater increase in tissue extensibility than superficial heating. Additionally, the deep heating effect also induces an anti-inflammatory response, stimulates connective tissue repair, reduces joint stiffness, and muscle spasm, and prepares tissue for passive stretching. Therapeutic effects of these oscillations are proven in their ability to decrease tissue viscosity and with these muscular and tendinous contractures (Anthonia *et al*., 2020). Ultrasound is a commonly used electrotherapeutic modality for impingement as well as other forms of tendinitis and muscle injury. Therapeutic ultrasound is a modality commonly used by physiotherapists. Ultrasound therapy works by driving alternating compression and rarefaction of sound waves with a frequency of more than 20,000 cycles per second. Therapeutic ultrasound may have two types of benefits, namely thermal effects and non-thermal effects. Thermal effects aid in pain relief, whereas non-thermal effects enhance cell-repair effects of the inflammatory response (Fiore *et al*., 2011). Reduction in pain and induced tissue repair helps in regaining the reduced range of motion due to shoulder impingement syndrome (Dogru *et al*., 2008).

Maitland mobilization is a widely used therapeutic technique used to treat various intra-articular and periarticular disorders. According to G.D. Maitland, passive oscillatory movements, two or three per second, of small or large amplitude can be applied anywhere in a range of motion for treating joint dysfunction. The International Maitland Teachers Association (IMTA) defines the Maitland concept as a process of examination, assessment, and treatment of musculoskeletal disorders by manipulative therapy. This concept uses oscillations given to the joint within the physiological range. Grades I and II of Maitland mobilization techniques are primarily used for treating joints limited by pain. The oscillations may have an inhibitory effect on the perception of painful stimuli by repetitively stimulating mechanoreceptors that block nociceptive pathways at the spinal cord or brain stem levels. These nonstretch motions help move synovial fluid to improve nutrition to the cartilage, whereas Grades III and IV are primarily used as stretching maneuvers. Appropriate selection of mobilization technique for treatment can only take place after a thorough assessment and examination (Kumar *et al*., 2012).

2. Methodology

2.1. Study Design

Quasi-Experimental Study

2.2. Duration of the Study

September 2021 to April 2022

2.3. Objectives of the Study

The major objectives of the study were to:

- Evaluate the effectiveness of ultrasound therapy coupled with Maitland mobilization to improve the shoulder function of patients with periarthritis shoulder.
- Evaluate the effectiveness of shortwave diathermy coupled with Maitland mobilization to improve the shoulder function of patients with periarthritis shoulder.
- Evaluate the effectiveness of conventional physiotherapy to improve the shoulder function of patients with periarthritis shoulder.
- Compare the effectiveness of shortwave diathermy coupled with Maitland mobilization and ultrasound therapy coupled with Maitland mobilization to improve shoulder function in patients among periarthritic shoulder subjects.
- Compare the effectiveness of conventional physiotherapy over shortwave diathermy coupled with Maitland mobilization and ultrasound therapy coupled with Maitland mobilization to improve the shoulder function of patients among periarthritic shoulder subjects.

2.4. Participants

A total of 60 patients, aged 40-70 years, both males and females, clinically diagnosed with periarthritis shoulder by an orthopaedician or a physiotherapist, with unilateral periarthritis and patients with diabetes mellitus, were included in the study. Exclusion criteria were patients with any fracture around the shoulder, any severe skin infection or malignancy, dislocation of the shoulder, spastic biceps muscle, coronary artery bypass surgery, neurological deficits

such as cervicogenic pain, stroke patients, and a history of any major trauma or surgery.

2.5. Study Procedures

A total of 60 subjects (20 in each group) were included in the study with the age group of 40-70 years, both males and females with confirmed diagnosis of periarthritis of the shoulder based on inclusion and exclusion criteria. They were divided into three equal groups by a simple random sampling procedure: Group A, Group B, and Group C. Patients were assessed on day 0 before giving treatment, and reassessment of patients was done at the end of the 6th week after completing the treatment for comparison. The effectiveness of VAS (Visual Analogue Scale) and goniometer was checked out before and after the treatment.

2.6. Intervention

Experimental Group A: 20 subjects in group A were treated with ultrasound therapy with Maitland mobilization for a period of six successive weeks. The patient was positioned comfortably to receive therapeutic ultrasound with parametric settings of 1 MHz in frequency, continuous mode, and 1.5 W/cm² of intensity with a 5 cm² sized transducer for a 10-minute treatment duration. After coating the treatment area with aquasonic gel, ultrasound was delivered by moving the treatment head around the shoulder joint in slow, circular, and overlapping fashion (Brue *et al.,* 2007; Bridgman, 1972). Pre- and post-measures of the Visual Analogue Scale and shoulder range of motion with a goniometer were taken. Application of Maitland Mobilization: The glides were given as anteroposterior glides for improving flexion and internal rotation in the supine lying position of the patient. Postero-anterior glide for improving extension and external rotation in the prone lying position of the patient. Caudal glide for improving abduction at the gleno-humeral joint in supine lying of the patient, distraction or lateral glide at the gleno-humeral joint at the rate of 2-3 glides per second for 30 seconds for 3 sets. Pre- and post-measurements of the Visual Analogue Scale (VAS) and shoulder range of motion with a goniometer were done.

Experimental Group B: 20 subjects in group B were treated with shortwave diathermy with Maitland mobilization for a period of six successive weeks. The patient was positioned in a supine lying position, and shortwave diathermy pads were applied in the contraplanar (AP) method for 15 minutes on the affected shoulder. Pre- and post-measures of the Visual Analogue Scale and shoulder range of motion with a goniometer were taken (Figure 1).

Experimental Group C (Control group): 20 subjects in group C were treated with a hot moist pack and a supervised exercise regimen for 6 weeks. Pre- and post-measures of the Visual Analogue Scale and shoulder range of motion with a goniometer were taken.

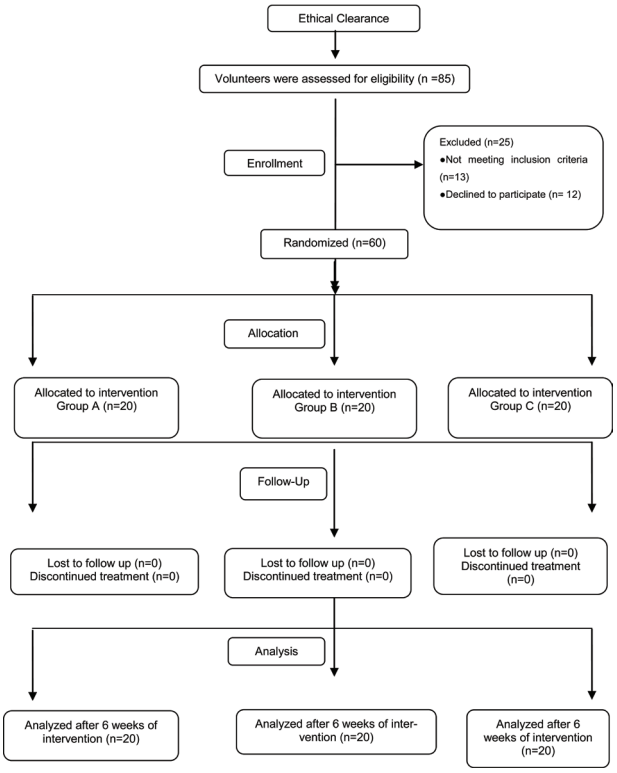

Figure 1: Consort Flow Diagram

2.7. Outcome Measures

Before the beginning of the study and after the 6 weeks of treatment, all the patients were evaluated in the following outcome measures: Visual Analogue Scale (VAS) & goniometer.

2.8. Data Analysis

Data was analyzed using SPSS software version 20. A paired t-test was used for comparison of the 0th week to the 6th week score measurement of VAS and ROM.

3. Results

Among the 85 patients who were screened for the study, 12 participants withdrew from the study due to losing interest in participation, and 60 met the eligibility criteria and were randomized into three groups: 20 in the experimental Group A, 20 in the experimental Group B, and 20 in the

control Group C. The total number of patients was 20 in Group A, out of which 12 were males (60%) and 8 were females (40%), with a mean age of 51.55 and an S.D. of 8.15. A total of 20 patients were taken in Group B also, out of which 11 were male (55%) and 9 were females (45%) with a mean age of 54.0 and S.D. of 6.89. Similarly, a total number of 20 patients were studied in Group C, out of which 14 were males (70%) and 6 were females (30%), with the mean age of 55.4 and S.D. of 5.20. A paired t-test was done between the 0th week, 3rd week, and 6th week values within groups A, B, and C to analyze the changes within the pain intensity and range of motion. An ANOVA test was performed between the 0th week, 3rd week, and 6th week values between group A, group B, and group C to find out the significance of the difference in pain intensity and range of motion in all the groups. Comparing the Visual Analog Scale (VAS) level by using an ANOVA test for Group A, Group B, and Group C, the value of the VAS level did not decrease significantly ($p > 0.05$) at the 3rd week as compared to the 0th week. However, at the 6th week, it decreased (improved) significantly ($p < 0.05$) as compared to both the 0th week and the 3rd week (Tables 1 to 3).

Comparing the range of motion (ROM) level by using an ANOVA test for Group A, Group B, and Group C, the value of flexion, abduction, ER, and IR level did not increase significantly ($p > 0.05$) at the 3rd week as compared to the 0th week. However, at the 6th week, it increased (improved) significantly ($p < 0.05$) as compared to both the 0th week and the 3rd week. Group B shows a highly significant improvement compared to Group A and Group C in VAS, with mean values at the 6th week of 5.2 (Group A), 4.1 (Group B), and 5.0 (Group C). Group B shows a highly significant improvement compared to Group A and Group C in ROM for flexion, abduction, internal rotation, and external rotation, with mean values at the 6th week of 146.2, 131.6, 60.25, and 57.75 (Group A); 166.25, 162.25, 64.75, and 59.65 (Group B); and 154.25, 151, 53, and 50.35 (Group C), as shown in Figure 2 and Tables 4 to 6.

Table 1: Paired Sample Test Results of VAS of Group A from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t- value	Df
VAS	VAS A – 0 WK	5.2	1.0025	0.228	13.28	38
GROUP A	VAS A – 6 WK					

Table 2: Paired Sample Test Results of ROM of Group A from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t-value	Df
ROM GROUP A	Flexion	146.25	8.86	1.98	10.32	38
	Abd	131.6	12.59	2.81	5.79	38
	ER	60.25	8.025	1.79	6.72	38
	IR	57.75	7.79	1.71	8.63	38

Table 3: Paired Sample Test Results of VAS of Group B from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t- value	Df
VAS	VAS B – 0 WK	4.1	0.71	0.16	18.71	38
GROUP B	VAS B – 6 WK					

Table 4: Paired Sample Test Results of ROM of Group B from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t- Value	Df
ROM GROUP B	Flexion	160.25	6.58	1.47	12.50	38
	Abd	162.25	6.97	1.55	13.57	38
	ER	64.74	4.12	0.92	18.75	38
	IR	59.65	5.50	1.23	19.54	38

Table 5: Paired Sample Test Results of VAS of Group C from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t- value	Df
VAS GROUP C	VAS C – 0 WK	5	0.72	0.16	14.62	38
	VAS C – 6WK					

Table 6: Paired Sample Test Results of ROM of Group C from 0 Weeks to 6 Weeks

Variables	Comparison Between	Mean	Std Deviation	Std. Error Mean	t- value	Df
ROM GROUP C	Flexion	154.2	5.68	1.27	11.51	38
	Abd	151	9.67	2.16	11.73	38
	ER	53	6.15	1.37	9.29	38
	IR	50.35	6.35	1.42	10.71	38

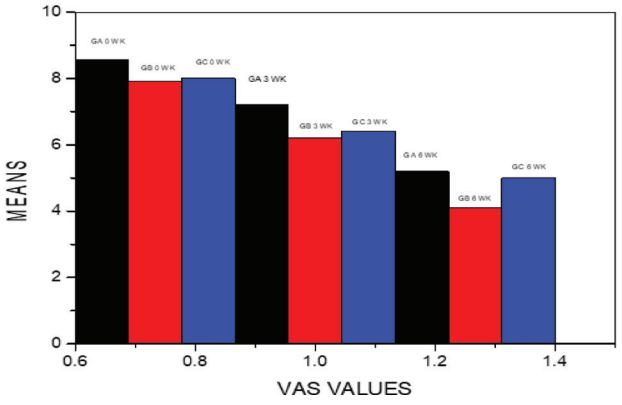

Figure 2: Intergroup Comparison at 0 Week, after 3rd Week, and 6th Week Mean Scores of VAS of Group A, Group B, and Group C

4. Discussion

The results of this study are similar to a recent study conducted by Anthonia *et al.* (2020) on a 54-year-old woman who was diagnosed with (L) frozen shoulder, whose range of motion of the (L) shoulder was limited in all directions on examination. Shortwave diathermy and supervised active exercises were introduced after thorough examination. After six weeks of shortwave diathermy and supervised active exercises, the patient recorded a remarkable improvement in pain and range of motion of the (L) shoulder (Anthonia *et al.,* 2020). The result of short-wave diathermy is also supported by a study conducted by Tiwari *et al.* (2015) on 40 patients with a confirmed diagnosis of periarthritis shoulder. Two groups of 20 patients each were made. Group A received SWD and exercise therapy, whereas Group B received TENS and exercise therapy. Pain improved significantly in both groups, with more pain relief seen in group B as compared to group A. The functionality, which was calculated using the Likert scale, showed significant improvement in both groups, with slightly more increase in the functionality in group A as compared to group B. Also, long-term benefits were better achieved with the SWD as compared to the TENS, whereas immediate pain relief is achieved with TENS much better than the SWD (Tiwari *et al.,* 2015).

5. Conclusion

This study concluded that both ultrasound therapy combined with Maitland mobilization as well as shortwave diathermy combined with Maitland mobilization & moist hot pack with supervised exercise regimes were also effective in reducing pain and improving range of motion in patients with periarthritis of the shoulder. However, statistically it was concluded that shortwave diathermy combined with Maitland mobilization is better than both other forms of treatment. The limitations of the study are that the sample size for each group was small, the study period was short, and there is no longer follow-up of the study. The future scope of the study includes: a study can be done on a large sample size in each group; further studies could include long follow-up; the study could include a non-diabetic population also; different outcome measures could be included.

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Authorship Contribution

All the authors have equally contributed to conceptualization, data interpretation, and methodology.

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Conflict of Interest

Authors declare that there is no conflict of interest.

Ethical Approvals

No ethical approvals were required for this study.

Declaration

It is an original article and has been neither sent elsewhere nor published anywhere.

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Chitkara University, Saraswati Kendra, SCO 160-161, Sector 9-C, Chandigarh, 160009, India

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