A COMPARATIVE STUDY BETWEEN COMBINATION OF ACTIVE EXERCISES WITH ULTRASOUND AND MUSCLE ENERGY TECHNIQUE WITH ULTRASOUND IN THE MANAGEMENT OF ADHESIVE CAPSULITIS

A dissertation submitted in partial fulfillment of the requirement for the degree of

MASTER OF PHYSIOTHERAPY

(ELECTIVE – PHYSIOTHERAPY IN ORTHOPAEDICS)

To

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(Affiliated to the Tamil Nadu Dr. M.G.R Medical University, Chennai – 32)

SULUR, COIMBATORE – 641 402

TAMIL NADU, INDIA

CERTIFICATE

Certified that this is the bonafide work of Mr. Kenneth G. Hebick of R.V.S. College of Physiotherapy, Sulur, Coimbatore submitted in partial fulfillment of the requirements for Master of Physiotherapy Degree course from The Tamil Nadu Dr M.G.R Medical University under the Registration No: 27111023.

ADVISOR

PROF. MRS. L. MAHALAKSHMI, MPT, (PhD.),

PROFESSOR,

RVS COLLEGE OF PHYSIOTHERAPY

SULUR, COIMBATORE.

PRINCIPAL

PROF. MRS. R. NAGARANI, MPT, MA, SRP (Lon), (Ph.D.),

RVS COLLEGE OF PHYSIOTHERAPY,

SULUR, COIMBATORE.

Place:

Date:

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INTERNAL EXAMINER:

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EXTERNAL EXAMINER:

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SUBMITTED IN THE PARTIAL FULFILLMENT OF THE REQUIREMENT

FOR DEGREE OF "MASTER OF PHYSIOTHERAPY"

AT

THE TAMIL NADU DR. M.G.R. MEDICAL UNIVERSITY,

CHENNAI

APRIL 2013

DECLARATION

I hereby declare and present my thesis work entitled "**A COMPARATIVE STUDY BETWEEN COMBINATION OF ACTIVE EXERCISES WITH ULTRASOUND AND MUSCLE ENERGY TECHNIQUE WITH ULTRASOUND IN THE MANAGEMENT OF ADHESIVE CAPSULITIS.**"

The outcome of the original research work undertaken and carried out by me, under the guidance of **PROF. MRS. L. MAHALAKSHMI, MPT, (PhD.), RVS COLLEGE OF PHYSIOTHERAPY,** Sulur, Coimbatore.

I also declare that the material of this project work has not formed in any way the basis for the award of any other degree previously from the Tamil Nadu Dr. M.G.R Medical University.

Date :

Place :

SIGNATURE

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I give my thanks to **Almighty GOD** for providing me the wisdom and knowledge to complete my study successfully.

This study will be an incomplete one without my gratitude towards my **Respected Parents, beloved Wife, and loving Children**.

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INTRODUCTION

The upper limbs of the human body constitute slightly less than 10 percent of the total body weight. The small segment of body mass, however, contains one of the principal physical features separating from the rest of the animal world, the human hand. The intricate gross and skilled functions performed by the hand are dependent on mobile yet strong base provided by the shoulder complex. Each of the upper limb of the human body constitutes only 2.5 percent of the total body weight. The shoulder complex comprises fully one half the weight of entire upper limb. It is very essential for upper limb functions. The complex is connected to the axial skeleton by a single joint and is suspended by muscles that secure the shoulder girdle to the rest of the body. The joint is affected by many pathological conditions. Among them, the most important is Adhesive Capsulitis. It usually occurs between the ages of 40 and 60 years. It occurs unilaterally in most of the cases and bilateral involvement occurs in 10 to 40 percent.

The joint capsule has twice the volume of humeral head approximately and helps movement of the arm through considerable range. The glenoid labrum increases 75% of the contact area. The prime abductors of the gleno-humeral joint are deltoid and supraspinatus and these two are called prime movers. To highlight the stabilization needs of the gleno-humeral joint in elevation activities, the general line of action of the deltoid muscle can be traced. Deltoid is a strong muscle of the upper limb, the force of contraction of the muscle is used to translate the humeral head superiorly. Only a small portion of force causes rotation of the humerus. The superior translatory force of deltoid if unopposed would cause the humeral head to impact the coraco-acromial arch before much abduction has occurred. Once the inferiorly directed force of coraco-acromial arch

is introduced by humeral head contact, rotation of humeral head could theoretically continue against the leverage provided by the arch. The result and force of the deltoid always exceeds that of gravity before any rotation can occur. Thus, the inferior translator pull of the gravity cannot set off. The structures that overlie the subacromial bursa (acromian and coraco-acromial ligament) are together known as the coraco-acromial joint. The arch acts as a protection to sensitive muscles, tendons and bursa, which come between humeral head and structures lying above head.

Most of the movements of the shoulder involve humerus and scapula simultaneously, but not successively. The scapular contribution to maximum humero elevation is sighted as 60 degrees from the vertical plane, while the gleno-humeral contribution is 120 degrees from a line drawn parallel to the vertebral border of the scapula. This results in maximum range of elevation of 18 degrees and in an overall ratio of 2 degrees of gleno-humeral to 1 degree thoracic motion.

Frozen shoulder clinically known as adhesive capsulitis, is a painful and debilitating condition affecting up to 5% of the population. The fibrosis of the gleno-humeral joint capsule with a chronic inflammatory response is called adhesive capsulitis. There is pain, limited range of motion, and disability generally lasting anywhere from 1 to 24 months. It was originally thought to be "periarthritis" until frozen shoulder was properly diagnosed. ***Nevasier*** was the first to identify the pathology through histological and surgical examination of frozen shoulder patients. He distinguished between frozen shoulder and periarthritis. He concluded that frozen shoulder was not periarthritis, but a thickening and contraction of the capsule, which becomes adherent to the humeral head that he termed "adhesive capsulitis." Adhesive capsulitis is characterized by pain,

stiffness and limited function of gleno-humeral joint, which adversely affects the entire upper extremity. Initially, the patients complain of pain followed by loss of motion. The most commonly affected movements are flexion, abduction and external rotation. About 70% of frozen shoulder patients are women. However, males are at greater risk for longer recovery and greater disability with frozen shoulder.

Two types of adhesive capsulitis are identified:

1. Primary or idiopathic adhesive capsulitis.
2. Secondary adhesive capsulitis.

Primary or idiopathic adhesive capsulitis results from chronic inflammatory response with fibroblastic proliferation, which may actually be an abnormal response from the immune system. Secondary adhesive capsulitis occurs after a shoulder injury or may be associated with other conditions such as diabetes, rotator cuff injury, cerebrovascular accident (CVA), cardiovascular disease, which may prolong recovery and limit outcomes. However, recent estimates place the incidence as high as 71% when the patients were prediabetics. Both type 1 and type 2 diabetes are susceptible to frozen shoulder. Diabetics have worst functional outcomes compared to nondiabetics. Frozen shoulder is also a common complication following stroke, occurring in 25% of the patients within 6 months. It is very essential to have an accurate differential diagnosis to rule out other pathologies. For example, chronic regional pain syndrome (CRPS formerly known as reflex sympathetic dystrophy) may cause severe limitation in shoulder range of motion similar to those seen with a frozen shoulder. Anyways, CRPS is associated with swelling and other trophic skin changes in the extremity. Shoulder girdle tumors,

although rare, may also mimic the symptoms of frozen shoulder. The average length of symptoms lasts for 30 months.

Stages of frozen shoulder:

1. Painful stage.
2. Stiffness or frozen stage.
3. Recovery or thawing stage.

Painful stage is characterized by the onset of an aching pain in the shoulder. The pain is usually more severe at night and with activities associated with the sense of discomfort that radiates down the arm. There are fewer arm positions that are comfortable. Most patients will position the arm in adduction and internal rotation. This position represent the “neutral isometric” position of relaxed tension for the, inflamed gleno-humeral capsule, biceps and rotator cuff.

The second stage is the progressive stiffness or frozen stage. Pain at rest usually diminishes during this stage, leaving the patient with shoulder that has restricted motion in all planes. The patients usually complain about their inability to reach into the back pocket, fasten the bra, comb the hair, or wash the opposite shoulder. When performing these activities, a sharp acute discomfort can occur as the patient reaches the restraint of the tight capsule.

The final stage is a resolution stage or “thawing stage” characterized by a slow recovery of motion. Aggressive treatment with physiotherapy, closed manipulation or surgical release may accelerate recovery, moving the patient from frozen phase into thawing phase.

Average range of motion in frozen shoulder patient is 98° of abduction, 117° of flexion, 33° external rotation and 18° of internal rotation with the shoulder abducted to 90°.

The stiffness stage is the longest of stages in adhesive capsulitis. Adhesive capsulitis is reversible in the acute pain stage. There is an imbalance of shoulder complex muscles, which leads to the altered shoulder motions along with limited range of motions. There is an increased imbalance of scapular stabilizers leading to increased elevation and upward rotation of the scapula during elevation of the gleno-humeral joint in both frontal and sagittal planes. Upper trapezius being more activated than the lower trapezius. EMG studies show a higher ratio of upper trapezius to lower trapezius during arm elevation when compared to asymptomatic subjects indicating a muscular imbalance. The patients with frozen shoulder develop a characteristic “shrug sign” during gleno-humeral joint elevation where the scapula migrates upwards prior to 60 degrees of abduction, which indicates deficit in shoulder kinematics. This further indicates compensation due to lack of capsular extensibility, as well as a change in the central nervous system motor patterning due to maladaptive movement. Further, the patient may develop adaptive postural deviations such as anterior shoulders or increased thoracic kyphosis, as the function of the shoulder complex remains limited and painful. Adhesive capsulitis is generally related to a shortening and fibrosis of the joint capsule (ligaments) surrounding the shoulder joint.

Nevasier was among the first to report thickening and contraction of the shoulder capsule as well as inflammatory changes through histologic analysis. The limitation of the joint range of motion is due to decrease in the volume of the capsule, which

eventually happens because of the contraction of the shoulder ligament. It is likely that limitation in the range of motion, pain associated with adhesive capsulitis is not related to capsular and ligamentous tightness, but also fascial restrictions, muscular tightness, and trigger points within the muscles.

Shoulder conditions that demonstrate similar restricted motion to the adhesive capsulitis (e.g., bursitis, tendonitis), inflammatory diseases, diabetes, especially type 1 diabetes, hyperthyroidism, and dyslipidemia. Precisely, why pain precedes stiffening and loss of motion is unclear leading to the belief that the condition does not stem solely from mechanical defects within the gleno-humeral joint itself.

Neurologic factors may contribute to the generation of pain, (e.g., sympathetic autonomic hyperactivity, alpha-adrenoreceptor hyper-responsiveness and central nervous system factors). Inadequate blood supply (ischemia) to soft tissue identical to that found in Dupuytren's contracture is also found in adhesive capsulitis, indicating a possible microvascular connection between neurologically mediated pain and connective tissue contracture, as well as a link between frozen shoulder and the microvascular aspects of diabetes.

Management for adhesive capsulitis is usually nonoperative (conservative) and begins with patient education regarding the condition. Non-steroidal anti-inflammatory drugs (NSAIDs) often are helpful for relief of pain and inflammation. Narcotic analgesics may be used for individuals intolerant to NSAIDs and for those with severe pain. However, the mainstay of treatment is physical therapy, initiated promptly upon diagnosis, focusing on stretching and then strengthening exercises. The exercises are initially supervised by a physical therapist, but later can be performed on a self-directed

basis with periodic therapist and/or physician monitoring. Modalities such as ice, heat, and ultrasound also may be used to relieve pain. If pain limits participation in therapy, a combination of local anesthetic and a corticosteroid drug can be injected into the shoulder joint. In such a combination, the anesthetic provides short-term pain relief, while the corticosteroid provides longer-term reduction of inflammation and associated discomfort, ideally permitting more aggressive therapy. If injections are used, it may be advisable to use a relatively large volume in order to distend the contracted shoulder capsule. Suprascapular nerve block sometimes may be employed, injecting bupivacaine into the supraspinous fossa. This is a simple, steroid-free procedure with no notable complications except tenderness at the injection site. Use of slings or other types of immobilization is typically avoided.

MUSCLE ENERGY TECHNIQUE:

Muscle Energy Techniques are soft tissue manipulative methods in which the patient, on request, actively uses her muscles from a controlled position, in a specific direction, with mild effort against a precise counter force. The counter force can match the patient's effort (isometrically) or fail to match it (isotonically) or overcome it isolytically, depending upon the therapeutic effect required. Depending upon the relative acuteness of the situation, the contraction will be commenced from or short of a previously ascertained barrier of resistance. Leon Chaitow (2009)

During isometric contraction a load is placed on the golgi tendon organs which, on cessation of effort, results in phenomenon known as postisometric relaxation (PIR). This is a period of relative hypotonicity, lasting is excess of 15 seconds, during which a stretch of the tissues involved will be more easily achieved than before contraction.

During and following an isometric contraction of a muscle, its antagonist(s) will be reciprocally inhibited(RI) allowing tissues involved to be more easily stretched. Contractions are kept light in MET methodology (15-20% of available strength) as clinical experience indicates this is as effective as a strong contraction in achieving the desired effects (PIR or RI). Light contractions are also easier to control and far less likely to provoke pain or cramping.

1.1 NEED OF THE STUDY

There are many treatment protocols in the management of the Adhesive Capsulitis, but which of them are practically effective is not properly reported.

The need of this study is to validate and compare the effectiveness of Muscle Energy Technique and Active Exercises as a useful intervention in the management of Adhesive Capsulitis. This study serves as an initial step in a research process that would explore new Manual Therapy Techniques as useful addition to other interventions**.**

1.2 OBJECTIVES OF THE STUDY

- To determine the efficacy of physiotherapeutic techniques in the treatment of Adhesive Capsulitis.
- To systematically compare the efficacy of Muscle Energy Technique and Active Exercise in the treatment of Adhesive Capsulitis.

1.3 SIGNIFICANCE OF THE STUDY

- The study will create a wide spread awareness on Adhesive Capsulitis and its implications as a barrier to an individual in the day-to-day activities at home and the efficiency at workplace.
- The study will create awareness among physiotherapists about the new treatment combinations and the different choices of interventions available in treating Adhesive Capsulitis.

1.4 STATEMENT OF THE PROBLEM

A Comparative Study Between Combinations Of Active Exercise Therapy With Ultrasound And Muscle Energy Technique With Ultrasound In The Management Of Adhesive Capsulitis**.**

1.5 HYPOTHESES

The following hypotheses are framed for this study:

1. There may not be any significant difference following Ultrasound therapy with Active Exercise in reducing pain and improving shoulder Function among people having Adhesive Capsulitis.

2. There may not be any significant difference following Ultrasound therapy with Muscle Energy Technique in reducing pain and improving shoulder Function among people having Adhesive Capsulitis.

3. There may not be any significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in reducing pain among people having Adhesive Capsulitis.

4. There may not be any significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in improving shoulder function among people having Adhesive Capsulitis.

1.6. OPERATIONAL DEFINITIONS

Ultrasound Therapy: Ultrasound is a type of sound, and all types of sound consist of waves that transmit energy by alternating compressing and rarefying material. It is sound with frequency greater than 20 KHz. Therapeutic Ultrasound has a frequency between 0.7 and 3.3 MHz to maximize energy absorption at a depth of 2 to 5 cm of soft tissue. *(Michelle Cameron, 2009)*

Muscle Energy Technique: Muscle Energy Techniques are soft tissue manipulative methods in which the patient, on request, actively uses her muscles from a controlled position, in a specific direction, with mild effort against a precise counter force. The counter force can match the patient's effort (isometrically) or fail to match it (isotonically) or overcome it isolytically, depending upon the therapeutic effect required. (*Leon Chaitow., 2009).*

Adhesive Capsulitis: It is thickening and contraction of the capsule, which becomes adherent to the humeral head, characterized by pain, stiffness and limited function of gleno-humeral joint, which adversely affects the entire upper extremity. *Nevasier (1939).*

Active exercises: Movement within the unrestricted range of motion for a segment that is produced by an active contraction of the muscles crossing the joint (Kisner and Colby, 1995).

REVIEW OF RELATED LITERATURE

One of the very important early steps in a research project is performing the review of literature. This is also one of the most humbling experiences we are likely to have. Why? Because we are likely to find out that any important idea we have, has been thought of before, at least to some extent. A literature review is always performed to identify related studies, to set the current project within the conceptual and theoretical context. When looked at that way, almost no topic is so new or unique that you can't locate relevant and informative related studies. Here are some steps about conducting the review of literature.

First, concentrate on the scientifically designed literature. Try to identify what the most authentic research journals are in the related area and start with those. Give more importance to research journals that use a blind or juried review system. In a blind or juried review, authors submit potential articles to a journal editor who solicits several reviewers who agree to give a critical review of the paper. The paper is sent to these reviewers without any identification of the author so that there will be no bias (either for or against the author). Based on their recommendations, the editor can accept, reject it, or recommend that the author revise and resubmit the article. Articles in journals with blind review system are likely to have a fairly high level of credibility.

Second, do the review as early as possible in the research process. We will surely learn a lot in the literature review that will help us determine what the necessary things are. After all, previous researchers also had to face tradeoff decisions.

In the literature review we can find the following things;

First, we might be able to find a study that is quite similar to the one we are thinking of doing. Since all authentic and credible research studies have to review the literature themselves, we can verify their literature review to get started on our own study.

Second, prior research will help ensure that we include all of the important relevant constructs in our study. We may find that other similar studies routinely look at an outcome that we might not have included. Our study would not be judged properly if it ignored a major construct.

Third, the literature review will help us to find and select appropriate measurement instruments/tools. We will readily see what measurement instruments/tools those researchers used themselves in contexts similar to ours.

In the following study the review of literature have been studied under the following sections.

2.1. Section A: Studies on effectiveness of ultrasound on soft tissues.

2.2. Section B: Studies on effectiveness of active exercises in management ofadhesive capsulitis.

2.3. Section C: Studies on effectiveness of muscle energy technique in management of adhesive capsulitis.

2.4. Section D: Studies on reliability of The Oxford Shoulder Score in measuring functional ability in adhesive capsulitis.

2.5 Section E: Studies on the reliability of visual analog scale in measuring pain.

2.1. Studies on effectiveness of ultrasound on soft tissues.

Dogru H, et al, (2007) assessed the effectiveness of therapeutic ultrasound in the treatment of adhesive capsulitis. They randomized 25 patients with ultrasound and 24 patients with Sham ultrasound for 2 weeks. SPADI was assessed and it was concluded that effectiveness of ultrasound might be marked by worse pre-treatment values of the ultrasound group and higher exercise compliance of the Sham US group.

Pribicevic M and Pollard H, (2004) conducted a study on patients with diversified manipulation and exercises outcomes included pain measurement, ROM and return to normal daily work for 4 to 12 weeks including phonophorosis. It was concluded at the end of treatment protocol patients where symptoms free.

Jane Fedorczyk (1997) presented an article on the use of physical agents in modulating pain associated the hand and upper extremity musculoskeletal conditions. Physical agents included superficial heating agents, cryotherapy, ultrasound and TNS and concluded the need of further research needed to determine the specific selection of individual treatment modality for benefits

Draper and Richard, (1995), determined that when therapeutic ultrasound vigorously heats connective tissue, it can be effective in increasing extensibility of soft tissue. They conducted study on 20 subjects with 23-gauge hypodermic needle microprobe inserted 1.2 cm deep into the medial aspect of their anesthetized triceps surae muscle to determine the rate of temperature decay following 3 MHz ultrasound and the

time period of optimal stretching they concluded that under circumstances where tissue temperature is raised 5° stretching will be effective on average for 3.3 minutes following ultrasound treatment and also suggested that stretching be applied during and immediately after ultrasound application.

2.2. Studies on effectiveness of active exercises in management of adhesive capsulitis.

Marilyn Elias (2012), studied effects of active exercises in managing chronic pain in patients with low back ache and other musculoskeletal problems and concluded that *breaking a sweat can bring relief of pain in special of life script.*

Mior and Silavno D.C. (2001) determined the effectiveness of exercise is in the treatment of chronic pain the study included three systemic reviews, three randomized controlled trails addressing of effectiveness of exercise for the management of chronic low back pain, one systematic reviews and three randomized controlled trails addressing upper extremity paired and three randomized controlled trails addressing fibromyalgia and concluded that exercises are effective in management of chronic low backache up to 1 year after treatment and up to 6 months. They concluded that exercise program is effective for chronic low back pain after. For chronic neck pain and for chronic soft tissue shoulder disorders and chronic lateral epicondylitis effectiveness of exercise is limited.

2.3. Studies on effectiveness of muscle energy technique in management of adhesive capsulitis.

Naik Prashant, et al (2010), studied the effectiveness of MET and positional release therapy in acute low back pain and disability on 60 randomly assigned participants with outcome measures like pain, ROM and disability level and he concluded MET and positional release can be an effective treatment regime in participants within acute low back pain.

Akbari A, et al (2009), compared MET and low level laser on reducing neck and shoulder pain. This double-blinded randomized controlled trial was performed with 30 patients with trigger points in neck and shoulder and participants were randomly assigned to one of the 3 groups in equal number results concluded that low level laser and MET are both equally effective in decreases pain in neck and shoulder pain.

F Ghiasi, et al (2008), examined MET and ultrasound on management of trigger points in upper trapezius on 45 patients in randomized control trial randomly assigning one of the 3 groups. A 10-session treatment program, which lasted 2 weeks was performed or interventional groups, and followup was done 3 months after treatment outcome based on self-reported pain of neck, shoulder pain disability questionnaire, range of motion and concluded that MET has more long benefit effect than ultrasound therapy.

Lee KM, et al, (2000), studied the effectiveness of MET in adhesive capsulitis of shoulder 12 patients were treated with MET of Greenman in MMT, and treatment repeated 6 times of each subject. Outcomes for pain, range of motion before and after the treatment and concluded than MET (MMT) is an effective tolerable and noninvasive treatment method of adhesive capsulitis of shoulder.

2.4 . Studies on reliability of The Oxford Shoulder Score in measuring functional ability in adhesive capsulitis.

Lars Henrik Frich, et al (2011), conducted study on 102 consecutive patients referred to as shoulder patients. They established psychometric properties of the scoring system. Again another 32 patients were invited for test-retest reliability to complete another OSS 72 hours after the first test. Bland-Attman plot was used to show absolute differences between test and retest. They concluded that OSS showed good validity and reliability and recommended for the evaluation of patients.

Wilson J, et al(2009), studied 50 patients undergoing shoulder surgery completed on OSS before surgery the study showed when applied to a large group, recollection of shoulder symptoms as assessed by the OSS was not subject to recall bias. Therefore, possible to use the mean value of recollected scores, within a population to assess the impact of an intervention.

L.M. Olley and A.J. Carr (2008), conducted a study on 24 patients aiming to assess whether a patient based questionnaire (OSS) could be effectively used to audit

outcome from shoulder surgery and the patient had completed pre-operative OSS questionnaire and had undergone rotator cuff repair participants were assessed postoperatively at regular intervals using OSS. The study concluded that OSS was observed to be a robust tool for the qualitative assessment and tracking of patient outcomes.

2.5. Studies on the reliability of Visual-Analog Scale in measuring pain.

Anne M Boonstra, et al (2008), conducted a reliability and validity study for disability as a single item instrument measuring disability in chronic pain. The study population consisted of patients over 18 years of age with chronic musculoskeletal pain, 52 patietns were in reliability study, 344 patients in the validity study. The conclusion of the study was that the reliability of the VAS in moderate to good and validity questionable.

Bijur PE, et al (2001), studied the reliability of the VAS for measurement of acute pain and found that the paired measurement were more reproducible at the extremes of pain intensity than at moderate levels of pain and concluded by the data that was sufficient suggesting that VAS in completely reliable to be used to assess acute pain.

Bijur, (2001), an observation al prospective cohart design was used to assess the reliability of VAS pain measurement. The study was approved by institutional review boards of 2 hospitals who provided patients aged 18 years and above. The reliability was assessed following classic measurement theory. Interclass correlation co-efficient (ICCE) were used and concluded an excellent reliability.

METHODOLOGY

3.1 Study Design:

Pre-Test Post-Test Experimental Design, comparative in nature.

3.2 Study setting:

Dept of Physiotherapy, Santosh Hospital, Bangalore.

Sampling Procedure:

Random Sampling Procedure.

3.3 Study Duration:

20 subjects were studied for 21 days.

3.4 Selection of Subjects:

20 subjects will be selected from the population, who fulfill the inclusive criteria.

3.5 Criteria for Selection:

Inclusion Criteria:

- Age group between 45 yrs and 60 yrs.
- Both sex involved.
- Unilateral Adhesive Capsulitis.

Exclusion Criteria:

- Patients with Diabetes, Bypass and Open Heart Surgery.
- Other Related disorders like Cervical Spondylosis, Bicipital tendinitis, rotator cuff, injuries, Supraspinatus tendinitis, etc.
- Patients with fractures around shoulder.
- Patients with recurrent Shoulder Dislocation.
- Surgeries around Shoulder.
- Uncooperative Patients.

3.6 Variables of Study:

Dependent Variable:

- Pain.
- Functional Ability.

Independent Variable:

- Active Exercises.
- Muscle energy technique (MET).
- Ultra sound

3.7 Measurement tools:

- Visual Analog Scale for pain.
- Oxford Shoulder Score for Functional ability.

3.8. PROCEDURE

Treatment procedure for Group A

Ultrasound therapy procedure

Fig. 3.8 Ultra sound therapy being administered to the patient

1 MHz pulsed ultra sound was given on the shoulder region with 1.0 watts/cm2 for 6 minutes.

Ultrasound therapy is a common treatment for both patients of Group – A and Group - B

Exercises for Shoulder

(1) Pendulum: Lean forward with support. Let arm hang down, swing arm.

(a) Forward and back.

(b) Side to side.

(c) Around the circle (both ways).

Repeat 5-10 times each movement.

Fig. 3.9 Pendulum exercises

(2) Twisting outwards: Sitting holding a stick, keep elbow into your side throughout, push with unaffected arm, so hand of problem is moving away from mid line. Repeat 5-10 times.

(3) Arm over head, lying on your back, support problem arm at wrist and lift it up. Over head can start with elbow bend. Repeat 5-10 times.

Fig. 3.10 Twisting outwards /arm overhead

(4) Twisting outwards/arm overhead: Lying on your back, knees bend and feet flat, place your hand behind your neck or head, elbow up to ceiling, let elbow fall.

(5) Hand behind back: Standing with arm by side. Grasp wrist of problem arm.

(a) Gently stretch hand towards your opposite buttock.

(b) Slide your arm up your back, can progress and use a towel.

(6) Kneeling on all four: Keep your hands still and gently sit back towards your heels. To progress take your knees further away from your hands. Repeat 5-10 times.

(7) Stretching the back of the shoulder: Take hand of your problem shoulder across body towards opposite shoulder. Give gentle stretch by pulling your uninvolved arm at the elbow. Repeat 5 times.

(8) Sit or stand: Try and set up a pulley system with pulley or ring above you, pull down with your better arm to help the stiff arm up. Repeat 10 times.

Treatment procedure for group B

Ultrasound therapy procedure

1 MHz pulsed ultra sound was given on the shoulder region with 1.0 watts/cm^2 for 6 minutes.

Muscle Energy Technique for Shoulder Flexion Restriction

Patient position : Side lying position

Procedure : The therapist's cephalad hand cups the shoulder of the side lying patient firmly compressing the scapula and clavicle to the thorax, while the patient's flexed elbow is held by the therapist's caudal hand. The therapist's slowly introduces shoulder flexion in the horizontal plane as range of motion to 180° is assessed. At the position of very first indication of restriction in movement, the patient is instructed to pull the elbow towards the feet or posterior or to push further towards the direction of flexion, utilizing more than 20% of their strength, and building up force slowly. This effort is firmly resisted and after 7 to 10 seconds, the patient is instructed to slowly cease the efforts simultaneously with the therapist. After complete relaxation and on an exhalation, the therapist moves the arm to take the shoulder in to further flexion to the next restriction barrier, where the MET procedure was repeated.

Fig. 3.11 Muscle Energy Technique for Shoulder Flexion Restriction

Muscle Energy Technique for Abduction Restriction:

Patient position : Side lying position

Procedure : The patient is in side lying. Therapist cups the patients shoulder and compress the scapula and clavicle to the thorax with the cephalad hand while cupping flexed elbow with the caudal hand. The patient hand is supported on the therapists cephalad forearm/wrist to stabilize the arm. The elbow is abducted towards the patient's head, as the range of motion is assessed. At the position of very first indication of resistance of movement, the patient is instructed to pull the elbow towards the waist or to push further towards the direction of abduction, utilizing not more than 20% of their strength, building up force slowly.

Muscle Energy Technique for External Rotation:

Patient position : Supine Position

Procedure : The patient lying is in supine position and ensures that his/her shoulder remains in contact with the table throughout the procedure. The head turned to the left; the patient flexes, adducts and externally rotates the arm fully maintaining the elbow in

extension (palm facing ceiling). The therapist stands at the head of table and supports the patients arm at proximal forearm and elbow. The patient is asked to begin process of returning the arm to his/her side, in stages against resistance. The first instruction is to pronate and internally rotate the arm followed by abduction and then extension. The amount of force used by the patient should not exceed 25% of their strength potential.

On complete relaxation, the therapist with patients assistance takes the arm further in to flexion, abduction and external rotation, stretching these muscles in to new barrier.

Muscle Energy Technique for Internal Rotation Restriction:

Patient position : Side lying Position

Procedure : The patient is in side lying. The patients flexed arm is placed behind his back to evaluate whether the dorsum of the hand can be painlessly placed against the dorsal surface of the ipsilateral lumbar area. This arm position is maintained throughout the procedure. The practitioner stands facing the side lying and cups the patient's shoulder and compresses the scapula and clavicle to the thorax with cephalad hand while cupping the flexed elbow with the caudal hand. The practitioner slowly brings the patients elbow (ventrally) towards his body, notes any sign of restriction as this movement, which increases internal rotation, is performed.

At this position of first indication of resistance to this movement, the patient is instructed to pull his elbow away from the practitioner, either posteriorly or medially or both simultaneously using not more than 20% of his strength, building up force slowly. This effort is firmly resisted, after 7 to 10 seconds the patient is instructed to slowly cease the effort simultaneously with the practitioner. After complete relaxation the elbow is

moved to take the shoulder further in to abduction and internal rotation, to the next restriction barrier, where the MET procedure was repeated.

Both group patients were given home exercise program (including mainly Codman's exercises and finger ladder exercises) on the 1st day of treatment session patient were advised to do each exercise 2-3 times a day for 10-15 repetitions.

The subjects in both groups were assessed for same parameters (VAS and OSS) at the end of 10th sitting of the treatment session.

DATA ANALYSIS AND RESULTS

4.1 Data Analysis and Interpretation

The data collected from 20 subjects were evaluated statistically. Descriptive analytical study was done by using Paired 't' test and Unpaired 't' test.

a) **Paired 't' test** $\bar{d} = \frac{\sum d}{n}$

$$s = \frac{\sqrt{\sum d^2 - \frac{\sum (d)^2}{n}}}{n-1}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where,

d – Difference between pre test and post test values

$\bar{d} = \frac{\sum d}{n}$ – Mean of difference between pre test and post test values

n – Total number of subjects

s – Standard deviation

b) Un paired 't' test $s = \sqrt{\frac{\sum (x_{1-} \bar{x}_2)^2 + \sum (x_{2-} \bar{x}_2)^2}{n_1 + n_2 - 2}}$

$$T = \frac{\bar{x}_{1-} \bar{x}_2}{s} \sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

S = Standard deviation

n_1 = Number of subjects in Group A

n_2 = Number of subjects in Group B

$\bar{x}_1$ = Mean of the difference in values between pre-test and post-test in Group-A

$\bar{x}_2$ = Mean of the difference in values between pre-test and post-test in Group-B

Table 1: Paired 'T' value, Mean value, Mean Difference, Standard Deviation between pre and post score of pain among group A patient

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre-test	7.2	5.15	0.37	43.98
Post-test	2.05			

Analysis of Dependent Variable Pain in Group A: The Calculated Paired 't' value is 43.98 at 0.05 level of significance and the Paired Table 't' value is 1.83 at 0.05 level of significance. Hence, the calculated 't' value is greater than the Table 't' value.

Graph 1

Bar diagram showing the pre and post test mean values of Pain on Visual Analog Scale among Group A.

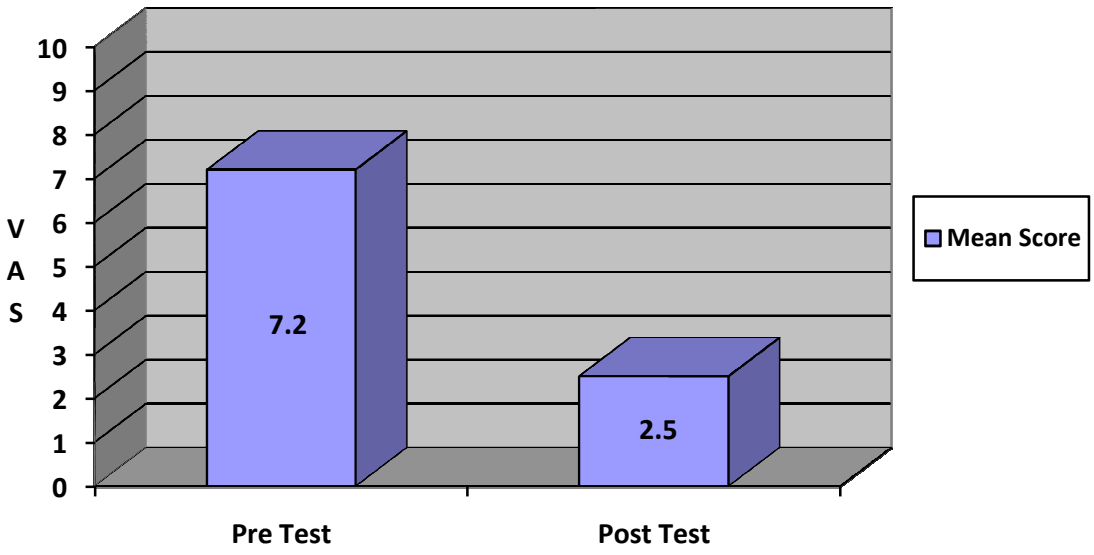


Table 2:

Paired 'T' value, Mean value, Mean Difference, Standard Deviation between pre and post score of pain among group B patients.

Measurement	Mean	Mean difference	Standard deviation	Paired 't' value
Pre test	6.4	4.5	0.31	45.87
post test	1.9			

Analysis of Dependent Variable Pain in Group B: The Calculated Paired't' value is 45.87 at 0.05 level of significance and the Paired Table 't' value is 1.83 at 0.05 level of significance. Hence, the calculated't' value is greater than the Table't' value.

Graph 2

Bar diagram showing the pre and post test mean values of Pain on Visual Analog Scale among Group B.

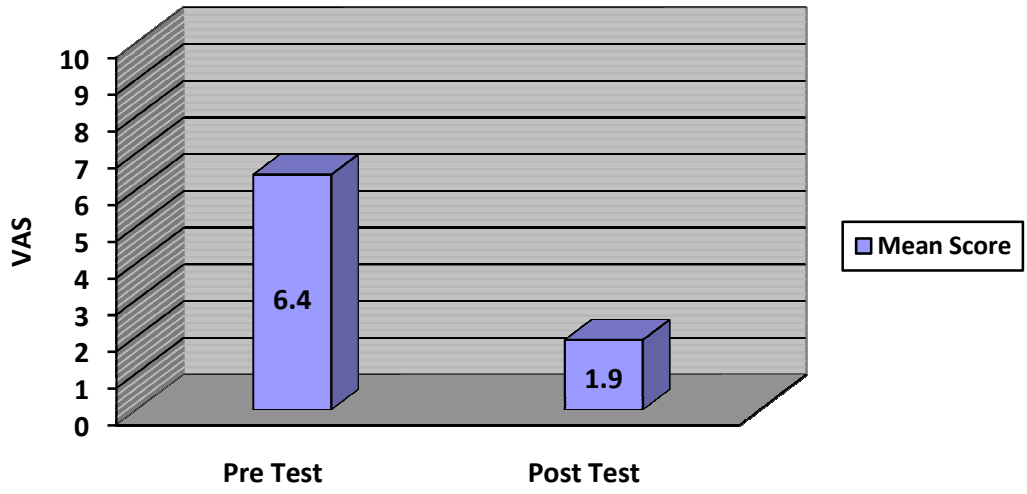


Table 3: Comparison of Pain between Group A and Group B

Showing Mean value, Mean Difference, Standard Deviation, and Unpaired‘t’ Value scores between Group A and Group B.

S.no	Groups	Improvement		Standard deviation	Unpaired ‘t’ Test
		Mean	Mean Difference		
1	GROUP-A	5.15	0.65	0.27	5.35
2	GROUP-B	4.5			

Analysis of Dependent Variable Pain between Group A and Group B: The calculated Unpaired’t’ value is 5.35 at 0.05 level of significance and the Unpaired Table ‘t’ value is 1.73 at 0.05 level of significance. Hence, the calculated‘t’ value is greater than Table‘t’ value.

Graph 3

Bar diagram showing Mean values of Pain on Visual Analog Scale in Group A and Group B.

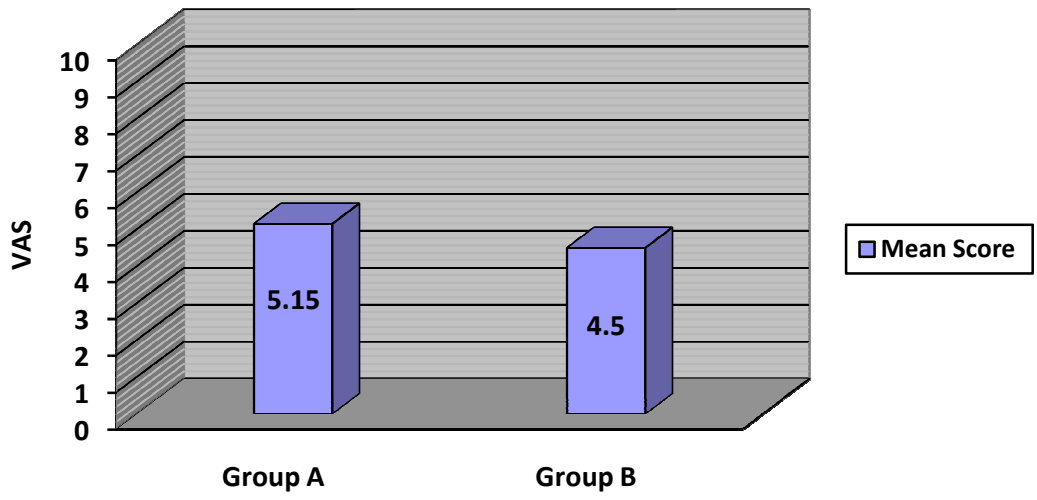


Table 4: Shoulder Function in Group A

Showing Mean value, Mean Difference, Standard Deviation and Paired 't' value between pre and post test scores of Shoulder Function among Group A.

Measurement	Mean	Mean difference	Standard deviation	Paired 't' value
Pretest	25.3	15.4	1.57	30.99
post test	9.9			

Analysis of Dependent Variable Shoulder Function in Group A: The Calculated Paired 't' value is 30.99at 0.05 level of significance and the Paired Table 't' value is 1.83 at 0.05 level of significance. Hence, the calculated 't' value is greater than the table 't' value.

Graph 4

Bar diagram showing the pre and post test mean values of Shoulder Function on The Oxford Shoulder Score among Group A.

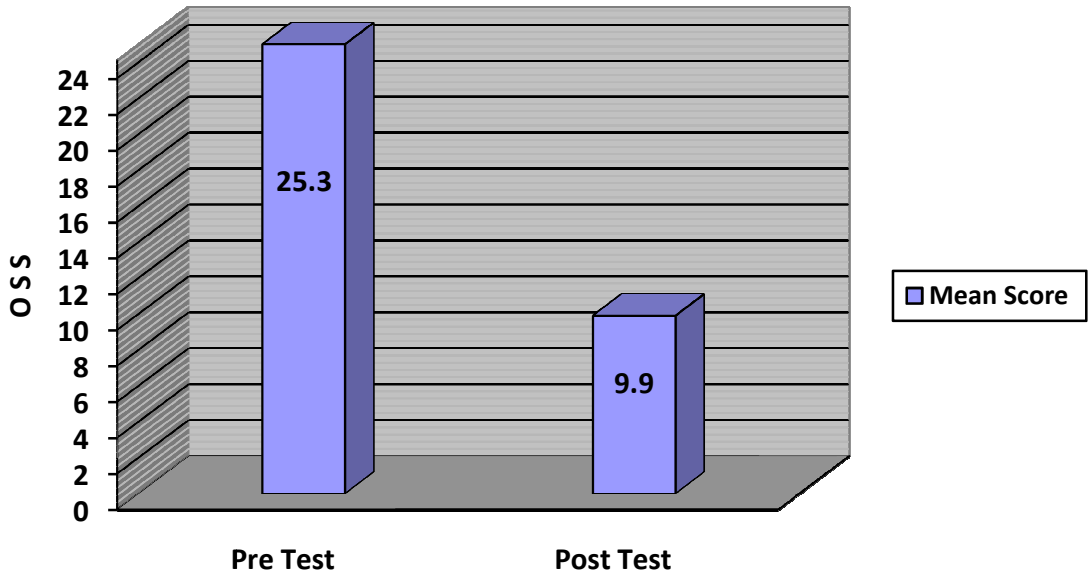


Table 5: Shoulder Function in Group B

Showing Mean value, Mean Difference, Standard Deviation and Paired 't' value between pre and post test scores of Shoulder Function among Group B.

Measurement	Mean	Mean Difference	Standard Deviation	Paired 't' value
Pre test	21.3	13.0	2.01	20.43
post test	8.3			

Analysis of Dependent Variable Shoulder Function in Group B: The Calculated Paired't' value is 20.43 at 0.05 level of significance and the Paired Table 't' value is 1.83 at 0.05 level of significance. Hence, the calculated't' value is greater than the Table't' value.

Graph 5

Bar diagram showing the pre and post test mean values of Shoulder Function on The Oxford Shoulder Score among Group B.

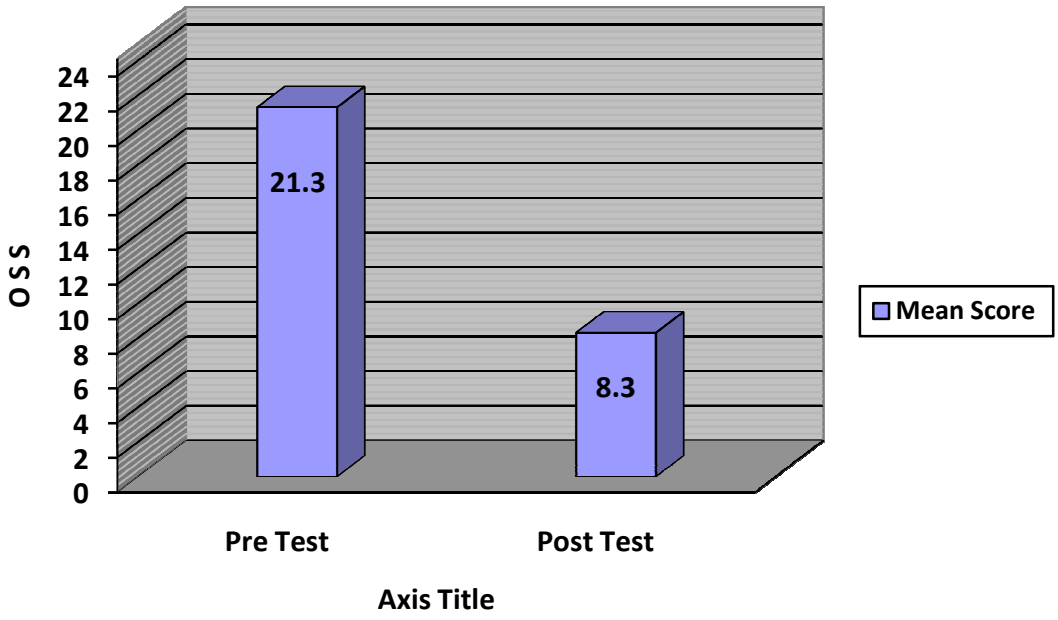


Table 6: Comparison of Shoulder Function between Group A and Group B

Showing Mean value, Mean Difference, Standard Deviation, and Unpaired 't' Value scores between Group A and Group B.

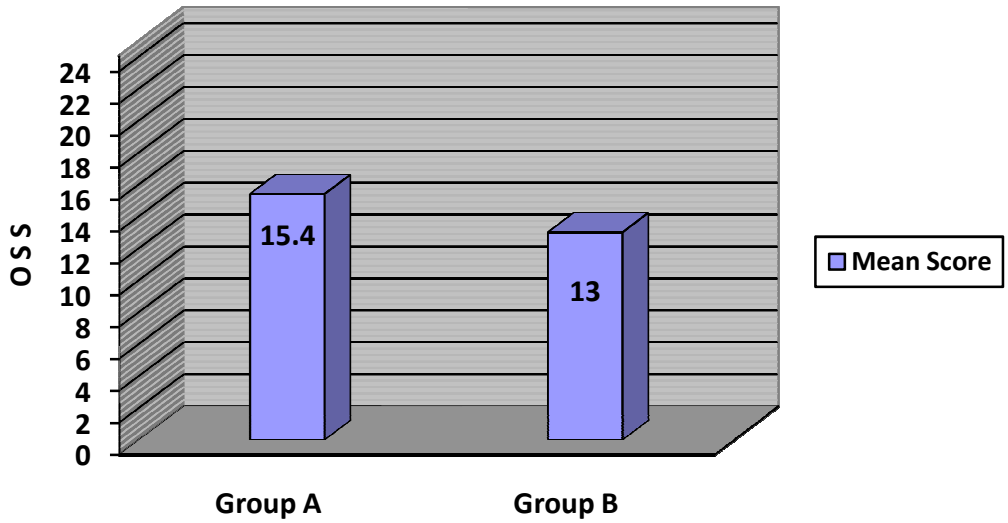
S.No	Groups	Improvement		Standard deviation	Unpaired "t" Test
		Mean	Mean Difference		
1	GROUP-A	15.4	2.4	0.47	11.37
2	GROUP-B	13.0			

Analysis of Dependent Variable Shoulder Function between Group A and Group B:

The calculated Unpaired't' value is 11.37 at 0.05 level of significance and the Unpaired Table 't' value is 1.73 at 0.05 level of significance. Hence, the calculated't' value is greater than Table't' value.

Graph 6

Bar diagram showing Mean values of Shoulder Function on The Oxford Shoulder Score in Group A and Group B.



Discussion

Hypothesis 1 states that there is no significant difference following Ultrasound therapy with Active Exercise in reducing Pain and improving Shoulder Function among people having Adhesive Capsulitis.

This study shows that there is significant difference in reducing Pain and improving Shoulder Function among people having Adhesive Capsulitis. Therefore we reject Hypothesis 1.

Hypothesis 2 states that there is no significant difference following Ultrasound therapy with Muscle Energy Technique in reducing Pain and improving Shoulder Function among people having Adhesive Capsulitis.

This study shows that there is significant difference following Ultrasound therapy with Muscle Energy Technique in reducing Pain and improving Shoulder Function among people having Adhesive Capsulitis. Therefore we reject Hypothesis 2.

Hypothesis 3 states that there may not be any significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in reducing pain among people having Adhesive Capsulitis.

This study shows that there is significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in reducing pain among people having Adhesive Capsulitis. Therefore we reject Hypothesis 3.

Hypothesis 4 states that there may not be any significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in improving shoulder function among people having Adhesive Capsulitis.

This study shows that there is significant difference between Ultrasound therapy with Active Exercise and Ultrasound therapy with Muscle Energy Technique in improving shoulder function among people having Adhesive Capsulitis. Therefore we reject Hypothesis 4.

V. SUMMARY AND CONCLUSION

5.1 Summary

A Pre-test Post-test Experimental study was conducted to compare the effectiveness of Active Exercises and Muscle Energy Technique in reducing pain and improving shoulder function among patients with Adhesive Capsulitis.

Twenty subjects with shoulder pain were included in this study by purposive sampling and randomly assigned to two groups A and B with each group consisting of 10 subjects.

Group A was treated with Ultrasound Therapy with Active Exercises and Group B was treated with Ultrasound Therapy with Muscle Energy Technique. Pain and Shoulder Function were assessed before and after the intervention by Visual-Analog scale and The Oxford Shoulder Score respectively.

The statistical result shows that there is improvement in both the groups, but when comparing both it was found that Active Exercises and Ultrasound Therapy are more effective than combination of Muscle Energy Technique and Ultrasound Therapy.

5.2 Conclusion

- It was concluded that there is an effective reduction of pain among patients with Adhesive Capsulitis by Ultrasound Therapy and active Exercise.
- It was concluded that there is improvement in Shoulder function among patients with shoulder pain treated with Ultrasound Therapy and Active Exercise.
- It was concluded that there is reduction of pain among patients with Adhesive Capsulitis treated with Ultrasound Therapy and Muscle Energy Technique for their shoulder pain.
- It was concluded that there is improvement also in shoulder function among patients with Adhesive Capsulitis treated with Ultrasound Therapy and Muscle Energy Technique.
- It was concluded that combination of Ultrasound Therapy with Active Exercise training group showed statistically significant improvement in pain and shoulder function than the other group.

5.3 Limitations

- The study was conducted with a sample size of 20 patient,
- The age group of the sample being 45 to 60 years.
- With treatment duration of 21 days.

5.4 Recommendation

- Future research can be conducted with a larger sample size,
- The study can be conducted with a wider age group
- The study can be conducted using different variables
- The study can be conducted with more consistent outcome measures
- The study can be done using different treatment durations.

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ANNEXURE-1

ASSESSMENT CHART

Physical Therapy Assessment Chart

Name

Age

Gender

Occupation

Chief complaints

Medical history

- Past
- Present

Family history

Social history

Associated problems

On observation

- Body Built
- Posture
- Attitude of limbs
- Muscle wasting
- Edema
- Involuntary movement
- Gait

- Deformity

On palpation

- Tenderness
- Swelling
- Muscle tightness
- Warmth
- Other if any

Pain assessment

- Side
- Site
- Duration
- Nature
- Aggravating factor
- Relieving factor
- Other if any

On examination

- Vital signs
- Motor Assessment
    - Range Of Motion
    - End Feels
    - Manual Muscle Testing
- Sensory Assessment
    - Superficial Sensations
    - Deep Sensations
    - Combined
- Reflexes
    - Superficial
    - Deep
    - Clonus

Dermatomes and Myotomes

- Limb Length Discrepancies
- Special Tests
- Functional Assessments
- Gait Assessments
- Posture

Investigations

Clinical Impression

Differential Diagnosis

Provisional Diagnosis

Treatment Goals

- Short Term Goals
- Long Term Goals

Treatment Plan

- Electrotherapy Modalities
- Manipulations
- Therapeutic Exercises
- Splints and Assistive Devices

Home Programme

Prognosis Evaluation

ANNEXURE-2

Table: 7 Pre and post-test Visual Analog Scale values of Pain among Group A

Sl. No:	Pre-test	Post-test	Difference (d)	Difference Squared(d^2)
1	9	2	7	49
2	6	1	5	25
3	8	1	7	49
4	7	1	6	36
5	9	4	5	25
6	6.5	2	4.5	20.25
7	6	1.5	4.5	20.25
8	9	5	4	1.6
9	5	0.5	4.5	20.25
10	6.5	2.5	4	16

Table: 8 Pre and post-test Visual Analog Scale values of Pain among Group B

Sl. No:	Pre-test	Post-test	Difference (d)	Difference Squared(d^2)
1	9	4	5	25
2	6	1.5	4.5	20.25
3	7	2.5	4.5	20.25
4	6	1	5	25
5	6	1	5	25
6	5	1	4	16
7	9	4	5	25
8	7.5	2.5	5	25
9	2.5	0.5	2	4
10	6	1	5	25

Table: 9 Pre and post-test values of The Oxford Shoulder Score among Group A

Sl. No:	Pre-test	Post-test	Difference (d)	Difference Squared(d^2)
1	30	7	23	529
2	18	6	12	144
3	34	17	17	289
4	22	4	18	324
5	39	19	20	400
6	17	9	8	64
7	16	5	11	121
8	42	23	19	361
9	13	1	12	144
10	22	8	14	196

Table: 10 Pre and post-test Values of The Oxford Shoulder Score among Group B

Sl. No:	Pre-test	Post-test	Difference (d)	Difference Squared(d^2)
1	36	20	16	256
2	16	4	12	144
3	31	14	17	289
4	19	6	13	169
5	15	3	12	144
6	6	4	2	4
7	42	17	25	625
8	24	10	14	196
9	8	1	7	49
10	16	4	12	144

ANNEXURE-3

Visual Analog Scale

The Visual analog scale (VAS) is a measurement tool that measures a characteristic or attitude which ranges across a continuum of values and cannot easily be directly measured. Operationally VAS is a horizontal line, 10 cm in length, anchored by word descriptors at each end, as illustrated in Fig: 1. The subject marks on the line a point that they feel which represents their perception of their current state of pain. The VAS score is determined by measuring in millimeters from the left hand end of the line to the point that the subject marks.

Fig: 1 Visual Analog Scale for pain- VAS (not to actual scale)

No Pain Severe Pain

Oxford Shoulder Score

Oxford Shoulder Score is a 12-item patient-reported PRO specifically designed and developed for assessing the shoulder surgery outcomes. It measures the impact of problems like arthritis, rotator cuff problems, frozen shoulder, on the quality of life along with shoulder surgeries like replacement and reverse shoulder replacement.

ANNEXURE - 4

THE OXFORD SHOULDER SCORE

Oxford Shoulder Score **Date of completion**

Clinician's name (or ref) **Patient's name (or ref)**

Please answer the following 12 multiple choice questions.

During the past 4 weeks.....

1. How would you describe the worst pain you had from your shoulder?	**7.Could you brush/comb your hair with the affected arm?**
☐ None	☐ Yes, easily
☐ mild	☐ With little difficulty
☐ Moderate	☐ With moderate difficulty
☐ Severe	☐ With extreme difficulty
☐ Unbearable	☐ No, impossible

2. Have you had any trouble dressing yourself because of your shoulder?	**8. How would you describe the pain you usually had from your shoulder?**
☐ No trouble at all	☐ None
☐ Little trouble	☐ Very mild
☐ Moderate trouble	☐ Mild
☐ Extreme difficulty	☐ Moderate
☐ Impossible to do	☐ Severe

3. Have you had any trouble getting in and out of a car or using public transport because of your shoulder?	**9. Could you hang your clothes up in a wardrobe, using the affected arm? (whichever you tend to use)**
☐ No trouble at all	☐ Yes, easily
☐ Very little trouble	☐ With little difficulty
☐ Moderate trouble	☐ With moderate difficulty

☐ Extreme difficulty	☐ With great difficulty
☐ Impossible to do	☐ No, impossible

4. Have you been able to use a knife and fork at the same time?	**10. Have you been able to wash and dry yourself under both arms?**
☐ Yes, easily	☐ Yes, easily
☐ With little difficulty	☐ With little difficulty
☐ With moderate difficulty	☐ With moderate difficulty
☐ With extreme difficulty	☐ With extreme difficulty
☐ No, impossible	☐ No, impossible

5. Could you do the household shopping on your own?	**11. How much has pain from your shoulder interfered with your usual work (including housework)?**
☐ Yes, easily	☐ Not at all
☐ With little difficulty	☐ A little bit
☐ With moderate difficulty	☐ Moderately
☐ With extreme difficulty	☐ Greatly
☐ No, impossible	☐ Totally

6. Could you carry a tray containing a plate of food across a room?	**12. Have you been troubled by pain from your shoulder in bed at night?**
☐ Yes, easily	☐ No nights
☐ With little difficulty	☐ Only 1 or 2 nights
☐ With moderate difficulty	☐ Some nights
☐ With extreme difficulty	☐ Most nights
☐ No, impossible	☐ Every night

The Oxford Shoulder Score is: ☐

Interpreting the Oxford Shoulder Score

Score 0 to 19	May indicate severe shoulder arthritis. It is highly likely that you may well require some form of surgical intervention, contact your family physician for a consult with an Orthopaedic Surgeon.
Score 20 to 29	May indicate moderate to severe shoulder arthritis. See your family physician for an assessment and x-ray. Consider a consult with an Orthopaedic Surgeon.
Score 30 to 39	May indicate mild to moderate shoulder arthritis. Consider seeing you family physician for an assessment and possible x-ray. You may benefit from non-surgical treatment, such as exercise, weight loss, and /or anti-inflammatory medication
Score 40 to 48	May indicate satisfactory joint function. May not require any formal treatment.

ANNEXURE-5

CONSENT FORM

I ……..……aged……..…yrs,

voluntarily consent to participate in the research named **"A comparative study between combination of active exercise therapy with ultrasound and muscle energy technique with ultrasound in the management of adhesive capsulitis."**

The researcher has explained me the treatment approach in detail, risk of participation and has answered all the questions pertaining to the study to my satisfaction.

Signature of Subject **Signature of Researcher**

Signature of Witness

Annexure 6

Flow chart