EFFECTIVENESS OF END RANGE MOBILIZATION (ERM) IN PATIENTS WITH ADHESIVE CAPSULITIS OF SHOULDER JOINT

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Bachelor of Science in Physiotherapy (B. Sc. PT)

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EFFECTIVENESS OF END RANGE MOBILIZATION (ERM) IN PATIENTS WITH ADHESIVE CAPSULITIS OF SHOULDER JOINT

Submitted by **Md. Al-Zamin Islam** for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B. Sc. PT).

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DECLERATION

I declare that the work presented here is my own. All sources used have been cited appropriately. Any mistakes or inaccuracies are my own. I also decline that for any publication, presentation or dissemination of information of the study, I would be bound to take written consent of my supervisor.

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Acronyms

BHPI	Bangladesh Health Professions Institute
CRP	Centre for the Rehabilitation of the Paralysed
CONSORTR	Consolidated Standards of Reporting Trials
MS	Musculo-skeletal
MWM	Movement with Mobilization
NSAID's	Non-Steroidal Anti-inflammatory Drugs
PT	Physiotherapy/ Physical Therapy
RCT	Randomized Control trail
ROM	Range of Movement
WHO	World Health Organization
AAROM	Active-Assisted Range of Motion
CPM	Continuous Passive Motion
MUA	Manipulation Under Anesthesia
MRM	Mid-Range Mobilization
NPRS	Numerical Pain Rating Scale
CHL	Coraco Humeral Ligament
PNF	Proprioceptive Neuromuscular Facilitation

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Abstract

Purpose: The purpose of the study was to evaluate the effectiveness of end range mobilization (ERM) with conventional physiotherapy compare to the conventional physiotherapy for adhesive capsulitis of shoulder. *Objectives*: To compare pain intensity at rest, Abduction, Lateral rotation, Medial rotation, lying in affected side and ROM in Abduction, Lateral rotation, Medial rotation before and after end range mobilization with conventional physiotherapy and conventional physiotherapy alone in patients with adhesive capsulitis. *Methodology*: Fourteen patients with adhesive capsulitis were randomly selected from outdoor musculo-skeletal unit, CRP. Among them 7 patients with adhesive capsulitis were randomly selected for the end range mobilization with conventional physiotherapy group and 7 patients selected for the conventional physiotherapy group for this randomize control trial. The study was a single blinded study which has been conducted at musculoskeletal department of CRP, savar. Numerical pain rating scale (NPRS) was used to measure pain and Goniometer to measure range of motion (ROM) in different functional position. ROM was analyzed by using Unrelated "t" test and Pain was analyzed by using Mann Whitney 'U' test. *Results:* In experimental group, mean difference of reduction of resting pain, Abduction, Lateral rotation, Medial rotation and pain during lying on affected side were 4.57, 4.71, 4.43, 4.57, and 5 which were 2.28, 2.72, 2.44, 2.72, and 2.43 in control group. After analysis the study found that the experimental group showed a significant improvement in case of resting pain ($p<.05$), pain at Abduction ($p<0.05$), pain at Lateral rotation ($p<0.05$), pain at Medial rotation ($p<0.05$), pain during lying ($p<0.05$). The study also found significant improvement of ROM in case of Abduction ($p<0.05$) and Medial rotation ($p<0.05$). A small but not statistically significant improvement has been found in Lateral rotation of shoulder. *Conclusion:* This research showed that end range mobilization with conventional physiotherapy was more effective than conventional physiotherapy alone for patients with adhesive capsulitis.

Key words: Adhesive Capsulitis, End Range Mobilization, Conventional Physiotherapy

CHAPTER- I INTRODUCTION

1.1 Background

Musculoskeletal problems were one of the most common reasons for seeking primary care, with an estimate of up to 20% of adults consulting their general practitioner with a musculoskeletal problem over the course of a year (Jordan et al., 2010). The shoulder joint is one of the unique anatomical structures which have an extraordinary range of motion (ROM) that allows us to interact with our environment. A loss of mobility of this joint will cause significant morbidity (Manske et al., 2008). Adhesive capsulitis is a common syndrome of painful shoulder stiffness. Frozen shoulder syndrome was first described by Duplay. He used the term peri-arthritis scapulo-humerale and believed that manipulation under anesthesia had a role in its treatment. Codman used the term 'Frozen Shoulder' to describe this condition. He described that most cases of adhesive capsulitis resolved in about two years without treatment. Neviaser coined the term adhesive capsulitis to reflect his findings during surgery on patients who had been treated for a painful, stiff shoulder. More recently, Zuckerman and Cuomo defined frozen shoulder or idiopathic adhesive capsulitis, as a condition with unknown cause characterized by substantial restriction of both active and passive shoulder motion that occurs in the absence of a known intrinsic shoulder disorder (Griggs et al., 2000). Adhesive capsulitis is a poorly understood musculoskeletal often disabling condition which is diagnosed by various physical characteristics which includes a thickening of the synovial capsule, adhesions within the subacromial or subdeltoid bursa, adhesions to the biceps tendon, and/or obliteration of the axillary fold secondary to adhesions. Since Duplay initially described a case report of adhesive capsulitis almost 130 years ago, this condition remains an enigmatic shoulder disorder that causes pain and restricted ROM at the glenohumeral joint (Manske et al., 2008).

Adhesive capsulitis is one of the common causes of shoulder pain and disability. It is characterized by the regular onset of shoulder pain accompanied by progressive limitation of both active and passive glenohumeral movement (Carette et al., 2003). It occurs in the general population with an incidence of approximately 2%, and of these 20 to 30% develops the condition bilaterally (Goyal et al., 2013). It is more common

in females, aged between 40-60 years (Khan et al., 2009). In 2007 Shah and Lewis state that adhesive capsulitis of the shoulder is a common disorder, affecting 2–5% of the general adult population in England and up to 20% of patients with diabetes. An average general practice list of 6250 patients in England would expect to see 15 to 16 new cases each year (Shah & Lewis, 2007). The annual incidence of adhesive capsulitis in the world is 3% to 5% in the general population and up to 20% in people with diabetes and the etiology and pathology of this syndrome remains enigmatic (Vermeulen et al., 2006).The condition is widely reported as a disease with three phases. First stage is termed as painful phase, lasting between 3 to 8 months. This is followed by a phase of progressive stiffness or 'adhesive phase', typically lasting 4 to 6 months. The final resolution phase of gradual return of motion usually lasts 5 to 24 months. Physiotherapy is most effective in the middle phase (Shah & Lewis, 2007).Many non-surgical treatments have been used in the management of shoulder disorders including adhesive capsulitis, but few have been proven to be effective in randomized controlled trials. The treatments used include non-steroidal anti-inflammatory drugs, local anesthetic and corticosteroid injections into the glenohumeral joint, calcitonin and antidepressants, distension arthrography, closed manipulation, physical therapy modalities and stretching exercises. Physical therapy is often the first line of management for frozen shoulder (Griggs et al., 2000). To relieve pain, maintain range of motion, and ultimately to restore function. The treatment of adhesive capsulitis by means of physiotherapy consists of different modalities (e.g., exercises, electrotherapy or massage). These may be applied side by side. Some of our standard text books and other literature concerning the treatment of adhesive capsulitis, state that relief of pain may be achieved by different intervention like massage, deep heat, ice, ultrasound, TENS (transcutaneous electrical nerve stimulation), and LASER (light amplification by stimulated emission of radiations). However, these treatments probably offer little benefit. But mostly these applications are adjunct to other treatment modalities, like mobilization techniques or home exercise programs. Although adhesive capsulitis is generally considered to be a self-limiting condition that can be treated with physical therapy, in order to regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion by means of mobilization techniques, that has been mostly recommended. 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 non-stretch motions help to move synovial fluid to improve nutrition to the cartilage, whereas Grades III and IV are primarily used as stretching maneuvers. The appropriate selection of mobilization techniques for treatment can only take place after a thorough assessment and examination (Arslan & Celiker, 2001). Grade III-IV mobilization techniques of Maitland concept is termed as an end range mobilization technique (EMT). These are used for increasing the range of motion (Lin et al., 2008).To regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion by means of end-range mobilization techniques (EMTs) has been recommended (Vermeulen et al., 2000).

1.2 Rationale

The aim of the study was to find out the effectiveness of end range mobilization in adhesive capsulitis. The literature shows that patients with frozen shoulder exhibit significant deficits in shoulder kinematics, including increased elevation and upward scapular rotation. Jewell and colleagues, suggested in their meta-analysis of physical therapy interventions for frozen shoulder syndrome, that joint mobilization and exercise were the most effective interventions (Bang, 2000). End-range mobilization techniques are recommended for the treatment of patients with hypo mobile joints (Lin et al., 2008). The field of physiotherapy research has not included any research on the effectiveness of end-range mobilization techniques in adhesive capsulitis. There are some achievements in overall physiotherapy interventions in adhesive capsulitis but experts suggest that End-range mobilization techniques are one of the important interventions for this condition.The purpose of this study was to compare the effectiveness for the patient with adhesive capsulitis, of end-range mobilization techniques given alongside conventional physiotherapy, with conventional physiotherapy alone. There have been some research articles published about physiotherapy interventions for patients with Adhesive capsulitis, but End-range mobilization techniques is not so prominent among them. The effectiveness of end-range mobilization techniques in patient with adhesive capsulitis of shoulder joint aim to provide the evidence to prove that this is the case. However, research is essential to improve the knowledge of health professionals, as well as to develop the profession. The results of this study will guide physiotherapists to give evidence-based treatment to patients with adhesive capsulitis, which will be beneficial for both the patient with adhesive capsulitis and for developing the field of the physiotherapy profession.

1.3 Aim

The aim of the study was to compare the effectiveness of end-range mobilization techniques in combination with Conventional Physiotherapy for adhesive capsulitis.

1.4 Study objectives

1.4.1 General objectives

- To identify the effectiveness of end range mobilization in adhesive capsulitis.

1.4.2 Specific objectives

- To measure the range of motion in different positions
- To quantify the pain at numeric pain rating scale at the different positions.

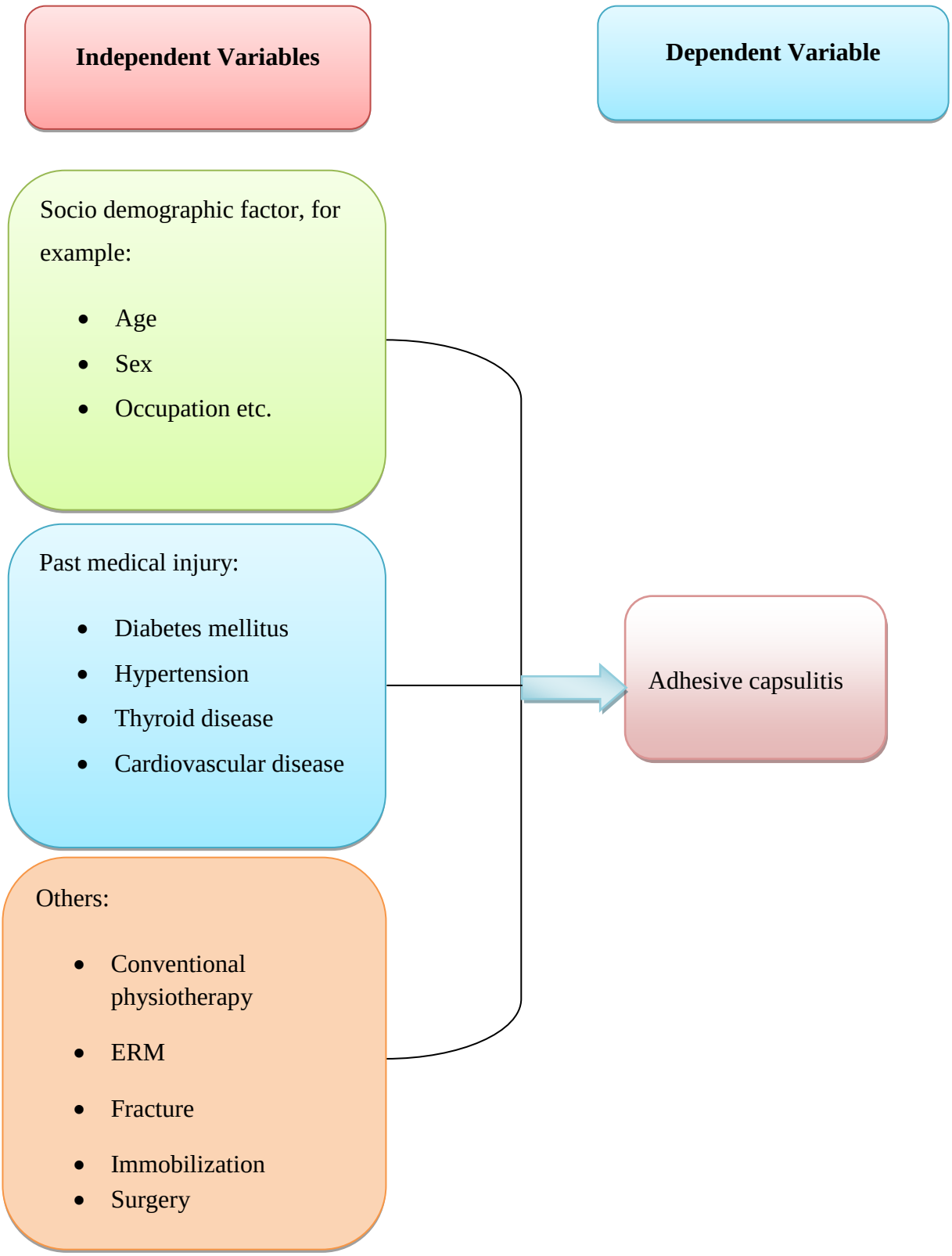
1.5 Hypothesis

End – range mobilization techniques with conventional physiotherapy are more effective than conventional physiotherapy for the treatment of patient with adhesive capsulitis.

1.6 Null hypothesis

End – range mobilization techniques with conventional physiotherapy are no more effective than conventional physiotherapy for the treatment of patient with adhesive capsulitis.

1.7 List of variables



1.8 Operational Definition

1.8.1 Adhesive Capsulitis

Adhesive capsulitis is a common, painful condition of the shoulder that is associated with loss of range of motion in the glenohumeral joint. It results from contraction of the glenohumeral joint capsule and adherence to the humeral head. The term ‘frozen shoulder’ commonly used to describe adhesive capsulitis and other conditions associated with loss of range of motion at the joint. Although adhesive capsulitis is often self-limited, it can persist for years and may never fully resolve.

1.8.2 Conventional physiotherapy

Physiotherapy interventions that are widely accepted and commonly practiced by medical community. The researcher formulated a list of evidence based physiotherapy interventions of adhesive capsulitis and provided those to the physiotherapist to mark the interventions commonly used as conventional physiotherapy for Adhesive capsulitis.

1.8.3 End-range mobilization

End-range mobilization techniques is a mobilization technique which is applied passively at the end range of the movement of a specific joint to regain the normal extensibility of the shoulder capsule, passive stretching of the shoulder capsule in all planes of motion and increasing the joint range of motion.

CHAPTER- II LITERATURE REVIEW

Musculoskeletal problem are becoming one of the important problem of the health care profession and the pain and disability associated with these problem represent a significant increasing health burden in worldwide (Spearing et al., 2005). Adhesive capsulitis is a condition that is characterized by a painful, gradual loss of both active and passive glenohumeral movement resulting from progressive fibrosis and ultimate contracture of the glenohumeral joint capsule and the patient is suffering from this condition face months to years of pain and disability (Neviaser & Hannafin, 2010). Nearby 70% of frozen shoulder patients are women; however, males with frozen shoulder are at greater risk for longer recovery and greater disability, the exact pathophysiologic cause is unknown, there are two types identified in the literature: one is idiopathic and another is secondary adhesive capsulitis, Idiopathic (primary) adhesive capsulitis occurs spontaneously without a specific cause and primary adhesive capsulitis results from a chronic inflammatory response with fibroblastic proliferation, which may actually be an abnormal response from the immune system and the secondary adhesive capsulitis occurs after a shoulder injury or surgery, or may be associated with another condition such as rotator cuff injury, diabetes, cerebrovascular accident (CVA) or cardiovascular disease, which may delay the recovery and limit outcomes (Kirkley et al., 1999). In a profile study of 32 patients with adhesive capsulitis has shown that, heart disease and diabetes were more prevalent in those suffering from adhesive capsulitis than a control group (McNeely et al., 2004). Adhesive capsulitis is an insidious painful condition with gradual restriction of all planes of movement in the shoulder. It is the main cause of shoulder pain and dysfunction in middle aged and elderly populations. Adhesive capsulitis can be due to idiopathic or post-traumatic causes but the term adhesive capsulitis should be reserved for the idiopathic type of shoulder stiffness. Factors associated with adhesive capsulitis include female gender, age older than 40 years, trauma, immobilization, diabetes, thyroid disease, stroke, myocardial infarction, and the presence of autoimmune diseases, cervical spine disorders and reflex sympathetic dystrophy syndrome. Idiopathic (primary) adhesive capsulitis is characterized by fibrosis of the capsule resulting with progressive, painful loss of active and passive shoulder motion. There are three stages of the disease: Stage I (painful stage) is

mainly characterized by pain usually lasting 2–9 months. In Stage II (frozen stage) pain gradually subsides but stiffness is marked lasting 4–12 months. In Stage III (thawing phase) pain resolves and improvement in range of motion (ROM) appears (Guler & Kozanoglu, 2004). Patients with adhesive capsulitis may also 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 (Ludewig & Reynolds, 2009). Shoulder ligaments actually decreases the volume of the capsule, thus limiting range of motion. It is likely that limitations in range of motion and the pain associated with frozen shoulder are not only related to ligamentous tightness, but also fascia restrictions, muscular tightness, and trigger points within the muscles. Physical therapists can address impairments and limitations associated each of these contributors to the pathology of adhesive capsulitis with a variety of treatment methods (Thomas et al., 2007).

Physical Therapy in Adhesive capsulitis

Treatment for adhesive capsulitis, as is true for any condition, should report the underlying pathology. Non-operative methods include pharmacological treatment of the synovitis and inflammatory mediators and also physical modalities to prevent or modify capsular contracture. Surgery can address both the inflammatory component via synovectomy and the capsular contracture through capsular release and manipulation under anesthesia. Optimizing treatment depends on recognition of the clinical stage at presentation because the condition progresses through a predictable sequence (Neviaser & Hannafin, 2010).

Modalities

The basis for using modalities in patients with adhesive capsulitis includes pain relief and affecting scar tissue (collagen). However, the use of modalities such as ultrasound, massage, iontophoresis, and phonophoresis has not been proven to be beneficial in treatment of patients with adhesive capsulitis (Bal et al., 2008).

Interestingly, transcutaneous electrical stimulation (TENS) has been shown to significantly increase range of motion more than heat combined with exercise and manipulation. Research also suggests that low-power laser therapy is more effective than a placebo for treatment of patients with adhesive capsulitis. Recently, deep heating through diathermy combined with stretching was shown to be more effective than superficial heating for treating frozen shoulder patients (Vermeulen et al., 2002).

Manual Techniques

Mobilization techniques improve the normal extensibility of the shoulder capsule and stretch the tightened soft tissues to induce beneficial effects (Yang et al., 2007). Joint mobilization is an effective intervention for adhesive capsulitis. In particular, posterior glide mobilization was determined to be more effective than anterior glide for improving external rotation range of motion in patients with adhesive capsulitis (Mantone et al., 2000). Chang (2004), randomly assigned 20 consecutive adhesive capsulitis patients to physical therapy interventions includes grade III stretch mobilization with distraction at end range of abduction and external rotation using either an anterior or posterior directed linear translation. After 3 sessions, the posterior mobilization group had significantly improved their external rotation range of motion by 31 degrees versus only 3 degrees in the anterior mobilization group. Manual therapy is effective in the treatment of musculoskeletal pain (Bialosky et al., 2009).

Soft Tissue Mobilization

Soft tissue mobilization and deep friction massage is benefited adhesive capsulitis patients. Deep friction massage using the Cyriax method was shown to be greater than superficial heat and diathermy in treatment of patients with adhesive capsulitis (McNeely et al., 2008).

Passive Motion

Adhesive capsulitis involves fibrotic changes to the capsule-ligamentous structures, continuous passive motion or dynamic splinting help to elongate collagen fibers. Continuous passive motion (CPM) was recently compared with conventional physiotherapy in 57 patients with adhesive capsulitis. Both groups improved after 4

weeks of treatment; while there was no significant difference between the groups, the CPM patients had greater reduction in pain levels (McHardy et al., 2008).

Therapeutic Exercise

The most commonly prescribed therapeutic exercises for adhesive capsulitis are active-assisted range of motion (AAROM) exercises. These typically involve the patient using the uninvolved arm, or using equipment such as rope-and-pulley, wand/T-bar, or exercise balls. Generally, these exercises are performed for flexion, abduction and external rotation ranges of motion which are frequently the most limited (Kazemi, 2000).

Griggs and colleagues found that physical therapy including 4 self-stretches (passive flexion, horizontal adduction, internal rotation behind the back with the unaffected arm, and external rotation at 0° using a cane) performed at least twice a day produced a satisfactory outcome in 90 percent of stage 2 adhesive capsulitis patients. These patients significantly improved in pain, range of motion, and shoulder function; however, the study did not compare the intervention to other types of treatment. Despite this limitation, the authors suggested that more aggressive treatments such as manipulation are rarely necessary (Ludewig & Braman, 2011).

Rigid and Kinesiological Taping

Frozen Shoulder is treated by using physical interventions like modalities, passive motion, and manual techniques, soft tissue mobilization, therapeutic exercise, rigid & kinesiotaping. Because adhesive capsulitis patients often exhibit poor posture and scapular mechanics, kinesiological may provide postural cues and assist with promoting proper scapular motion. Maitland mobilization and kinesiological taping together has a better effect than maitland mobilization alone (Labbe, 2012).

Additional Interventions

Non-operative treatment also included injections directly into the glenohumeral joint. These injections contain both a corticosteroid and an anesthetic, and can also include saline to distend the capsule, stretching the fibers. When saline is used to distend the capsule, it is known as “distension arthrography” or “hydroplasty”. Corticosteroid

injections have been shown to be as effective as exercise for treating frozen shoulder, particularly when provided in the early stages of the pathology (Manske & Prohaska, 2010). Corticosteroid injections have a greater effect when compared to physical therapy when utilized within the first 6 weeks of treatment, although these differences diminished over time. Researcher noted a moderate effect of corticosteroid injections on pain, external rotation ROM, and disability at 6 weeks, and only small effects after 12 weeks (Trampas & Kitsios, 2006).

Distension arthrography is often successfully combined with physical therapy. In fact, therapeutic exercise including physical therapy is more effective when combined with a corticosteroid injection (Lin et al., 2009).Adhesive capsulitis patients not responding to physical therapy are often treated with manipulation under anesthesia (MUA), where the shoulder is forcefully moved by the physician into the full ranges of motion, breaking the adhesions located within of the shoulder capsule. In addition to increased risk of complications from anesthesia, MUA can cause severe damage including labral tears, tendon tears, fractures, and ruptures of the shoulder ligaments. Most recently, steroid injections with distention arthrography have been shown to be as effective as MUA and are therefore the recommended course of treatment because of the risks associated with MUA (Dodenhoff et al., 2000).

Rehabilitation Protocol for Adhesive capsulitis

Phase I

1. Patient education:
    - emphasize full ROM may never be recovered
    - spontaneous resolution & reduction of stiffness
    - avoid painful activity/activity modification
2. Upper body cycle ergometer: 50 r.p.m, 8 minute warm - up
3. Modalities: 10 - 15 minutes, before, during, or after exercise
    - moist heat
    - cold pack
4. ROM exercise/stretches: low intensity, short duration, 1-5 seconds, 2-3 times per day, pain-free, passive, AAROM

- pendulums (1 min clockwise, 1 min counter-clockwise)
- internal rotation in standing
- horizontal adduction in standing
- pulley for elevation in sitting or standing
- forward flexion in supine using own hand
- external rotation using pipe/stick in supine
- extension in standing using pipe/stick in supine

5. Manual Techniques:
    - Low - grade mobilization (Grade I or II)
    - Positional stretching of CHL: 5 minutes-> progress to 15 minutes
6. Strengthening:
    - Isometric in all planes, 5 second holds, 1 set of 10 each direction, against wall (Bang, 2000).

Phase II

1. Patient education:
    - moderate irritability
    - activity modifications/basic functional activities

2. Upper body cycle ergometer: 50 r.p.m, 8 minute - warm up
3. Modalities: 10 - 15 minutes, before, during, or after exercise
    - moist heat
    - cold pack
4. ROM exercise/stretches: 5 - 15 seconds, passive AAROM to AROM, low load, prolonged
    - Same as in Phase I, but increase duration and length of stretch
5. Manual Techniques:
    - Same as Phase I for abduction and flexion, instead End-Range in varying degrees of elevation and rotation, 10 - 15 repetitions
    - Mobilization with Movement 3 sets of 10 repetitions with 1 minute rest in between
    - Last 3 minutes, passive PNF if needed to increase ROM

- Low - to - High Grade Mobilizations

6. Strengthening:
    - Theraband: 5 directions, 3 sets of 12 reps, progress with colors of band (Bang, 2000).

Phase III

1. Patient education:
    - increase activities/high demand activities
    - pain decreased
2. ROM exercises/stretches:
    - same as phase II, but increase duration, past end - range
    - end range/lower pressure, increased duration, cyclic loading
    - can use stick or cane in standing over table for prolonged elevation & external rotation
3. Manual Techniques:
    - High Grade Mobilization/Sustained (HGMT) - Grades III & IV
    - Distraction, posterior glides > anterior glides (perform before HGMT) 3 sets of 30 seconds (End-range posterior mobilizations hold 1 minute x 15 times)
    - Abduction & External rotation
    - Last 3 minutes passive PNF, if needed to increase ROM
4. Strengthening:
    - Low - to - high resistance end range dumbell in sitting: flexion, abduction, extension 1 - 2 lbs to begin with, 2 - 3 sets of 10
    - Side lying dumbbells, 3 sets of 10 - 12 rep (1 - 2 lbs) (Bang, 2000).

End range mobilization technique

In addition to the MRM technique, ERM has been recommended. The intent of ERM was not only to restore joint play but also to stretch contracted periarticular structures. Researcher used the techniques described by Vermeulen and Maitland as follows. At the start of each intervention session, the physical therapist examined the subject's ROM to obtain information about the end-range position and the end-feel of the glenohumeral joint. Then, the therapist's hands were placed close to the glenohumeral joint, and the humerus was brought into a position of maximal range in different directions. Ten to 15 repetitions of intensive mobilization techniques, varying the plane of elevation or varying the degree of rotation in the end-range position, were applied (Zaky, 2012).

CHAPTER-III METHODOLOGY

This research was conducted to evaluate the effect of end range mobilization in patients with adhesive capsulitis. To identify the effectiveness of this treatment approach, it is essential to measure the pain intensity and ROM in several functional positions.

3.1 Study design

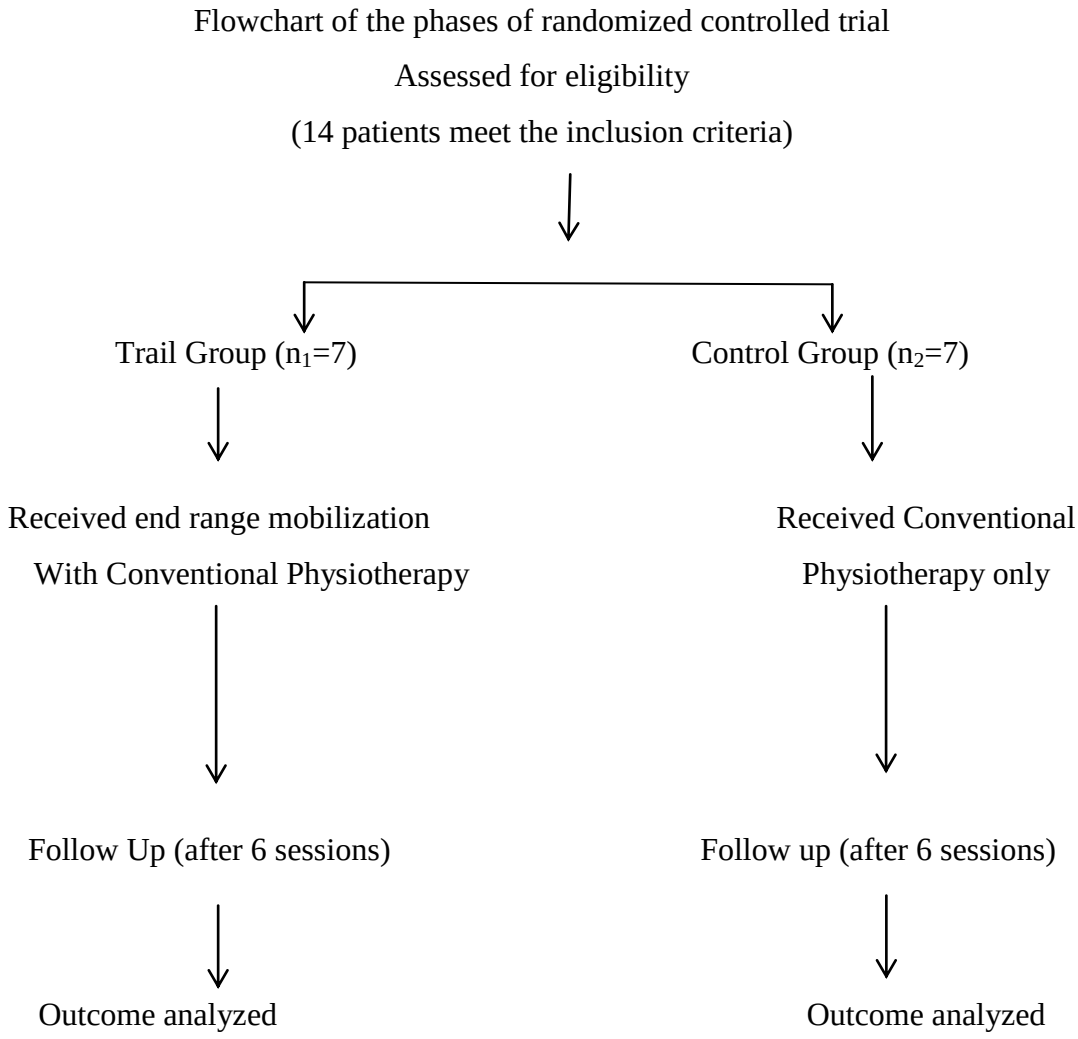
The study was conducted by Randomized Control Trail (RCT).

From the outdoor patients with adhesive capsulitis, 14 patients was selected by simple random sampling from outdoor musculo-skeletal unit, CRP and then 7 patients with adhesive capsulitis were randomly assigned to end range mobilization with conventional physiotherapy group and 7 patients to the only conventional physiotherapy group for this randomize control trial study.

A pre test (before intervention) and post test (after intervention) was administered with each subject of both groups to compare the pain effects before and after the treatment. The design could be shown by-

r O_1 X_1 O_2 (experimental group)

r O_3 X_2 O_4 (control group)



CONSORT flowchart for a randomized controlled trial of a treatment program including conventional physiotherapy with end range mobilization for patient with adhesive capsulitis.

3.2 Study area

Outdoor Physiotherapy, Musculoskeletal Unit, Department of Physiotherapy, CRP, Savar, Dhaka- 1343.

3.3 Sample size

The equation of sample size calculation given below-

$$n = \left\{ \frac{Z\left(1 - \frac{\alpha}{2}\right)}{d} \right\}^2 \times pq$$

Here,

$Z\left(1 - \frac{\alpha}{2}\right)$ = 1.96

P = 0.72

q = 1- p

= 1- 0.72

= 0.37

d = 0.05

According to this equation the sample should be more than 398 people but due to lack of opportunity the study was conducted with 14 patients attending at the musculoskeletal department of physiotherapy in CRP.

3.4 Study Population

A population refers to the entire group of people or items that meet the criteria set by the researcher. The populations of this study were the adhesive capsulitis patients.

3.5 Sample selection

Subjects, who met the inclusion criteria, were included as sample in this study. Fourteen patients with adhesive capsulitis were selected from outdoor musculoskeletal physiotherapy department of CRP, Savar. From the outdoor patients

with adhesive capsulitis, 14 patients randomly selected from outdoor musculo-skeletal unit, CRP and then 7 patients with adhesive capsulitis were randomly assigned to End range mobilization with conventional physiotherapy group and 7 patients to the only conventional physiotherapy group for this randomize control trial study. The study was a single blinded study. When the samples were collected, the researcher randomly assigned the participants into experimental and control group, because it improves internal validity of experimental research. The samples were given numerical number C_1, C_2, C_3 etc for the control and E_1, E_2, E_3 etc for experimental group. Total 14 samples included in this study, among them 7 patients were selected for the experimental group (received End range mobilization with conventional physiotherapy) and rest of 7 patients were selected for control group (received conventional physiotherapy only).

3.5.1 Inclusion criteria

- ✓ The participants were those individuals who was diagnosed previously as adhesive capsulitis or recently diagnosed by physiotherapist.
- ✓ Age group: Participants age range is 40-65 years including both sexes (Neviaser & Hannafin, 2010).
- ✓ Patient who were at the 2^{nd} and 3^{rd} stage of adhesive capsulitis.

3.5.2 Exclusion criteria

- ✓ Subject who had history of taking oral NSAID (3 days) or corticosteroid injection (2 hours) recently.
- ✓ Patient who were at the 1^{st} stage (painful stage) of adhesive capsulitis.
- ✓ Presence of cervical problem causing radiating pain to shoulder.

3.6 Method of data collection

3.6.1 Data collection tools

A written questionnaire, pen, paper and a goniometer were used as data collection tools in this study.

3.6.2 Questionnaire

The questionnaire was developed under the advice and permission of the supervisor following certain guidelines. There were eight close ended questions with Numerical pain rating scale with some objective questions which were measured by examiner and each question was formulated to identify the change of pain and ROM with each activity.

3.7 Measurement tool

3.7.1 Numerical pain rating scale – In this study researcher used Numerical pain rating scale for measuring the intensity of pain. The Numerical pain rating scale is a simple and accurate way of subjectively assessing pain along a continuous visual spectrum. It consists of a straight line on which the individual being assessed marks the level of pain. The ends of the straight line are the extreme limits of pain with 0 representing no pain, 1 – 3 mild pain, 4 – 6 moderate pain and 7 – 10 representing the worst pain ever experienced. .

3.7.2 Goniometer – In this study researcher used goniometer for measuring the Range of Movement (ROM) of shoulder Abduction, Lateral rotation and Medial rotation. The Goniometer is a simple and accurate way of objective assessment of ROM.

3.8 Data collection procedure

The data collection procedure was conducted through assessing the patient, initial recording and final recording. After screening the patient at department, the patients were assessed by graduate physiotherapist. Six sessions of treatment was provided for every subject. 14 subjects were selected for data collection according to the inclusion criteria. The researcher divided all participants into two groups and coded C_1, C_2, C_3, C_4, C_5, C_6, C_7 for control group and E_1, E_2, E_3, E_4, E_5, E_6, E_7 for experimental group. Experimental group received conventional physiotherapy with end range mobilization and control group received only conventional physiotherapy.

Data was collected through a pre-test and post-test and the data were collected by using a written questionnaire form which was formatted by the researcher. Pre test was performed before beginning the treatment and the intensity of pain and ROM of

shoulder movements were noted with Numerical pain rating scale score and ROM by universal Goniometer. The same procedure was performed to take post-test at the end of six session of treatment. Data collector gave the assessment form to each subject before starting treatment and after six session of treatment and instructed to put mark on the line of Numerical pain rating scale according to their intensity of pain. At the end of the study 't' test and 'u' test were performed for statistical analysis.

3.9 Intervention

A common intervention program was executed for both groups as conventional physiotherapy, it includes - Capsular stretching, Accessory movements, pendulum exercise, pulley exercise, Infra-red radiation and Ultrasound, which are the most frequently, used interventions. In this study, the experimental group was treated with end range mobilization exercise in addition with conventional physiotherapy. Graduate physiotherapist applied the end range mobilization and the conventional physiotherapies. Each group got 6 sessions of treatment.

3.10 Ethical consideration

Research proposal was submitted for approval to the administrative bodies of ethical committee of BHPI. Again before beginning the data collection, researcher took written permission (Appendix-1) the permission from the concerned authorities ensuring the safety of the participants. In order to eliminate ethical claims, the participants were set free to receive treatment for other purposes as usual. Each participant was informed about the study before beginning and given written consent.

3.11 Informed Consent

The researcher obtained consent to participate from every subject. A signed informed consent form was received from each participant. The participants were informed that they have the right to meet with outdoor doctor if they think that the treatment is not enough to control the condition or if the condition become worsen. The participants were also informed that they were completely free to decline answering any question during the study and were free to withdraw their consent and terminate participation at any time. Withdrawal of participation from the study would not affect their treatment in the physiotherapy department and they would still get the same facilities.

Every subject had the opportunity to discuss their problem with the senior authority or administration of CRP and have any questioned answer to their satisfaction

3.12 Data analysis

In order to ensure that the research have some values, the meaning of collected data has to be presented in ways that other research workers can understand. In other words the researcher has to make sense of the results. As the result came from an experiment in this research, data analysis was done with statistical analysis.

All participants were coded according to group to maintain participant's confidentiality. All subjects of both experimental and control group score their pain intensity on Numerical pain rating scale before starting treatment and after completing treatment. Reduction of pain intensity for both groups and improvement of ROM of different movements of shoulder were the differences between pre-test and post-test score.

Experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is interval or ratio should be analyzed with unrelated "t" test. As it was experimental study and unmatched groups of different subjects, who was randomly assigned to conventional physiotherapy with End range mobilization and only conventional physiotherapy group and the measurement of the outcome came from ROM by goniometer, with considering interval or ratio data, so the parametric unrelated "t" test was used in this study to calculate the level of significance. Unrelated "t" test and mean difference was calculated to test the hypothesis on the basis of following assumptions-

- ✓ Data were ratio
- ✓ Two different set of subjects in two conditions

The "t" formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\left[\sqrt{\frac{\left(\sum {x_1}^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum {x_2}^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}\right]}$$

Where

$\bar{X}_1$= mean of scores from treatment group.

$\bar{X}_2$ = mean of scores from control group.

$(x_1)^2$= the square of the each individual score from treatment group totaled.

$(x_2)^2$=the square of the each individual score from control group totaled.

$(\sum x_1)^2$= the total of the individual score from treatment group squared.

$(\sum x_2)^2$= the total of the individual score from control group squared.

n_1= number of subjects from treatment group.

n_2= number of subjects from control group.

The U test was done for the analysis of the pain after six session treatment of both control and experimental groups. Experimental studies with the different subject design where two groups are used and each tested in two different conditions and the data is ordinal should be analyzed with Mann-Whitney U test.

Mann-Whitney U test is a non-parametric test that is simply compares the result obtained from the each group to see if they differ significantly. This test can only be used with ordinal or interval/ ratio data.

The formula of Mann-Whitney U test:

$$U = n_1 n_2 + \frac{n_x(n+1)}{2} - T_x$$

Here,

n_1 = the number of the subjects in trail group

n_2= the number of the subject in control group.

T_x= the larger rank total.

n_x= the number of the subjects of the group with larger rank total.

3.13 Significant level

In order to find out the significance of the study, the researcher calculated the "p" value. The p values refer the probability of the results for experimental study. The word probability refers to the accuracy of the findings. A p value is called level of significance for an experiment and a p value of <0.05 was accepted as significant result for health service research. If the p value is equal or smaller than the significant levels, the results are said to be significant.

Calculating the degree of freedom from the formula:

Degrees of freedom (df) = $(n_1-1) + (n_2-1) = (7-1) + (7-1) = 12$

df	.1	.05	.025	.01	.005	.0005
12	1.356	1.782	2.179	2.681	3.055	4.318

Table-1: Level of significance for one tailed hypothesis

3.14 Elimination of confounding variables

Confounding variable has an effect on the study variables which can affect the result of the study. There were some confounding variables in this study such as recent history of taking oral NSAID (3 days before the physiotherapy intervention because the plasma half-life of NSAID is 3 days) and steroid injection (2 hours) which could influence the result of the study. To control the confounding variables, researcher set the inclusion criteria as to include only those subjects who have no history of taking recent oral NSAID, steroid injection.

3.15 Limitations

- ✓ The main limitation of this study was its short duration.
- ✓ The study was conducted with 14 patients of Adhesive Capsulitis, which was a very small number of samples in both groups and was not sufficient enough for the study to generalize the wider population of this condition.
- ✓ There was no available research done in this area in Bangladesh. So, relevant information about adhesive capsulitis patient with specific intervention for Bangladesh was very limited in this study.

CHAPTER- IV RESULTS

Mean Age of the Participants:

Experimental Group		Control Group	
Subjects	**Age (Years)**	**Subjects**	**Age (Years)**
E1	58	C1	50
E2	52	C2	48
E3	45	C3	38
E4	48	C4	40
E5	47	C5	65
E6	62	C6	65
E7	60	C7	50
Mean Age	**53 years**	**Mean Age**	**51 years**

Table 2: Mean Age of Participants

Sex of the Participants: 14 Patients with adhesive capsulitis were included as sample of the study, among them almost 71% (n=10) were female and about 29% (n=4) were male.

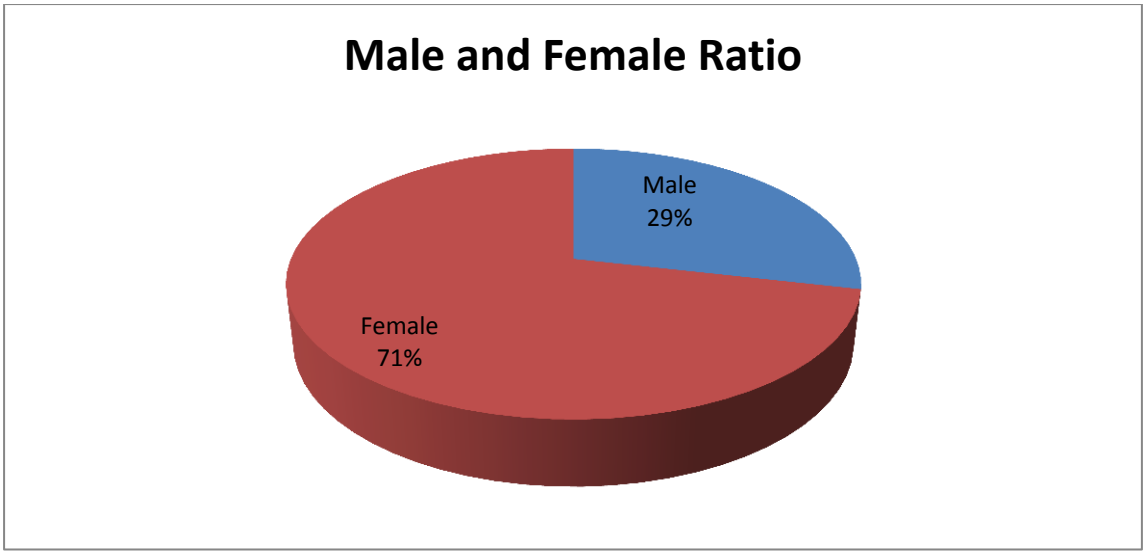


Figure 1: Gender Distribution

14 patients with adhesive capsulitis were enrolled in the study. 7 in the end range mobilization with conventional physiotherapy treatment group (experimental group) and 7 in the only conventional physiotherapy treatment group (control group). The all subjects of both experimental and control group scored their pain on numerical pain rating scale before and after completing treatment.

Resting pain: Reduction of pain scores at Rest in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for pain at rest were differences between pre-test and post-test pain scores.

Only Conventional physiotherapy group (Control Group)											
Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							1 Person (14%)	4 Persons (57%)	2 Persons (29%)		
Post-test				2 Person (28%)		4 Persons (44%)	1 Person (14%)				

Conventional physiotherapy with end range mobilization (Experimental Group)											
Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test								2 Persons (28%)	5 Persons (72%)		
Post-test			2 Persons (28%)	3 Persons (44%)	2 Persons (28%)						

Table 3: Reduction of Resting Pain

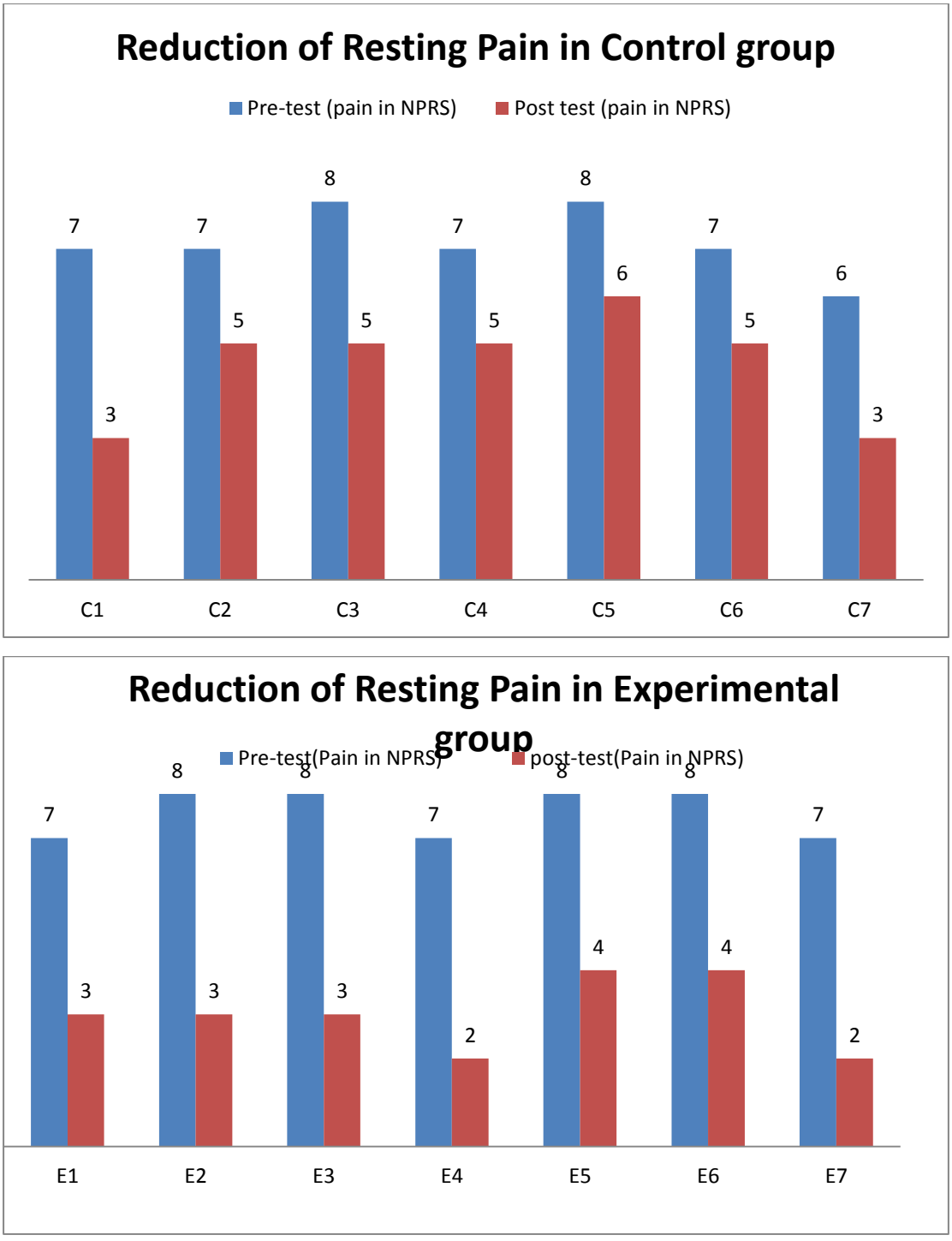


Fig 2: Reduction of Resting Pain in different Subjects

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	3	5	C_1	3	5
E_2	3	5	C_2	5	11.5
E_3	3	5	C_3	5	11.5
E_4	2	1.5	C_4	5	11.5
E_5	4	8.5	C_5	6	14
E_6	4	8.5	C_6	5	11.5
E_7	2	1.5	C_7	3	5
total	21	35		32	70

Table-4: Reduction of resting pain in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 7

n_2 = the number of the subject in control group = 7

T_x = the larger rank total = 70

n_x = the number of the subjects in the condition with larger rank total .That is control group = 7

Now U formula:

$$U = n_1 n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

$= 7 \times 7 + \frac{7(7+1)}{2} - 70$

$= 49 + 28 - 70$

$= 77 - 70$

$= 7$

The U-value is 7. The critical value of U at $p \leq 0.05$ is 11. Therefore, the result is significant at $p \leq 0.05$.

Pain in Abduction (raising hand sideways): Reduction of pain scores in abduction in Adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for pain in abduction were differences between pre-test and post-test pain scores.

Only Conventional physiotherapy group (Control Group)											
Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							1 Person (14%)	4 Persons (57%)	2 Persons (29%)		
Post-test				2 Person (28%)	1 person (14%)	3 Persons (44%)	1 Person (14%)				

Conventional physiotherapy with end range mobilization (Experimental Group)											
Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							3 Persons (28%)	4 Persons (72%)			
Post-test			4 Persons (57%)		3 Persons (43%)						

Table 5: Reduction of Pain in abduction

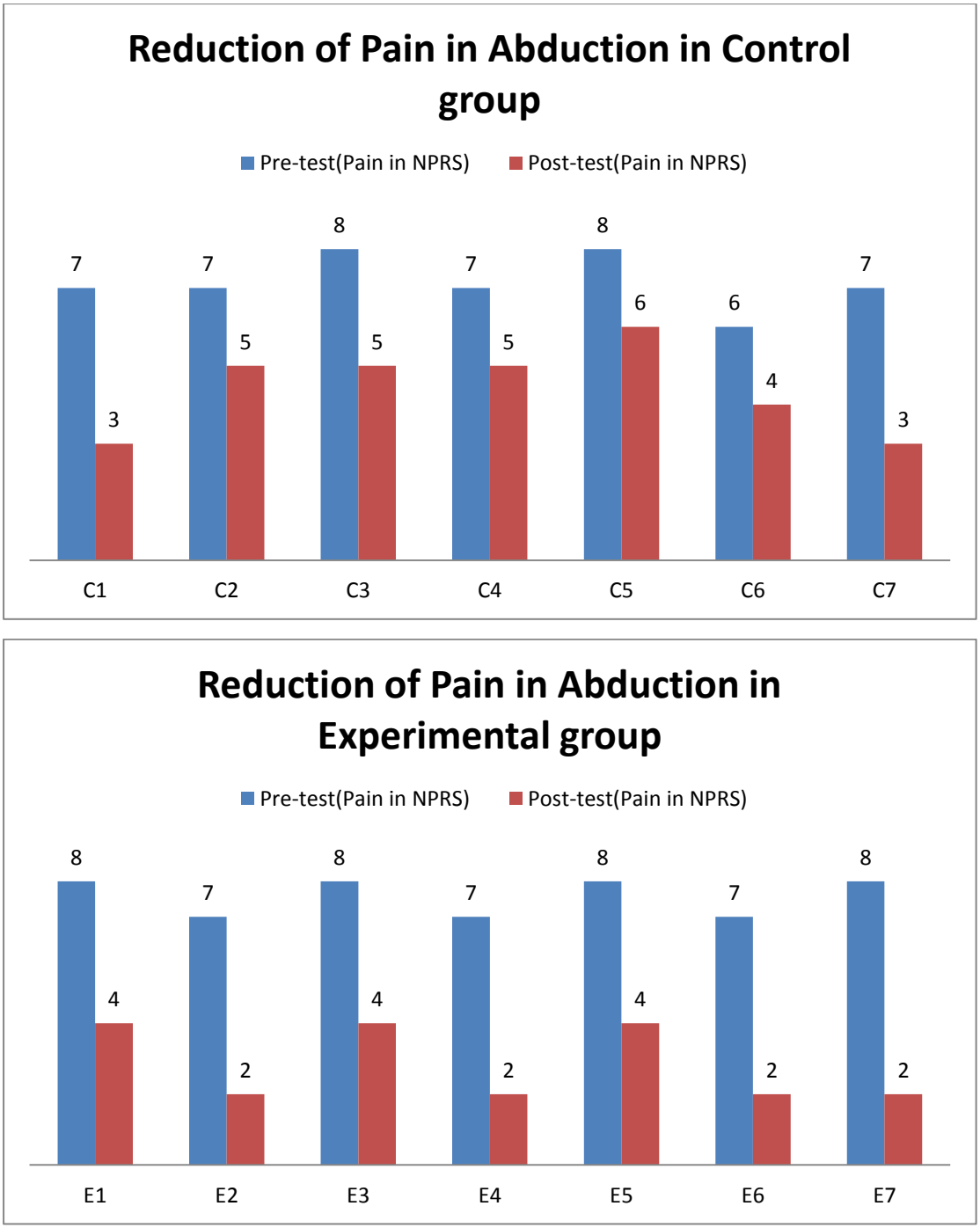


Fig 3: Reduction of Pain in Abduction

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	4	8.5	C_1	3	5.5
E_2	2	2.5	C_2	5	12
E_3	4	8.5	C_3	5	12
E_4	2	2.5	C_4	5	12
E_5	4	8.5	C_5	6	14
E_6	2	2.5	C_6	4	8.5
E_7	2	2.5	C_7	3	5.5
total	20	35.5		31	69.5

Table-6: Reduction of Pain in abduction in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 7

n_2 = the number of the subject in control group = 7

T_x = the larger rank total = 69.5

n_x = the number of the subjects in the condition with larger rank total .That is control group = 7

Now U formula:

$$U = n_1 n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

$= 7 \times 7 + \frac{7(7+1)}{2} - 69.5$

$= 49 + 28 - 69.5$

$= 77 - 69.5$

$= 7.5$

The U-value is 7.5. The critical value of U at $p \leq 0.05$ is 11. Therefore, the result is significant at $p \leq 0.05$.

Pain at Lateral Rotation (Combing hair): Reduction of pain scores at lateral rotation in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for pain at lateral rotation were differences between pre-test and post-test pain scores.

Only Conventional physiotherapy group (Control Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							3 Persons (46%)	2 Persons (28%)	2 Persons (28%)		
Post-test					5 persons (72%)	1 Person (14%)	1 Person (14%)				

Conventional physiotherapy with end range mobilization (Experimental Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							1 person (14%)	4 Persons (58%)	2 Persons (28%)		
Post-test			3 Persons (43%)	3 Persons (43%)	1 Person (14%)						

Table 7: Reduction of Pain in Lateral rotation

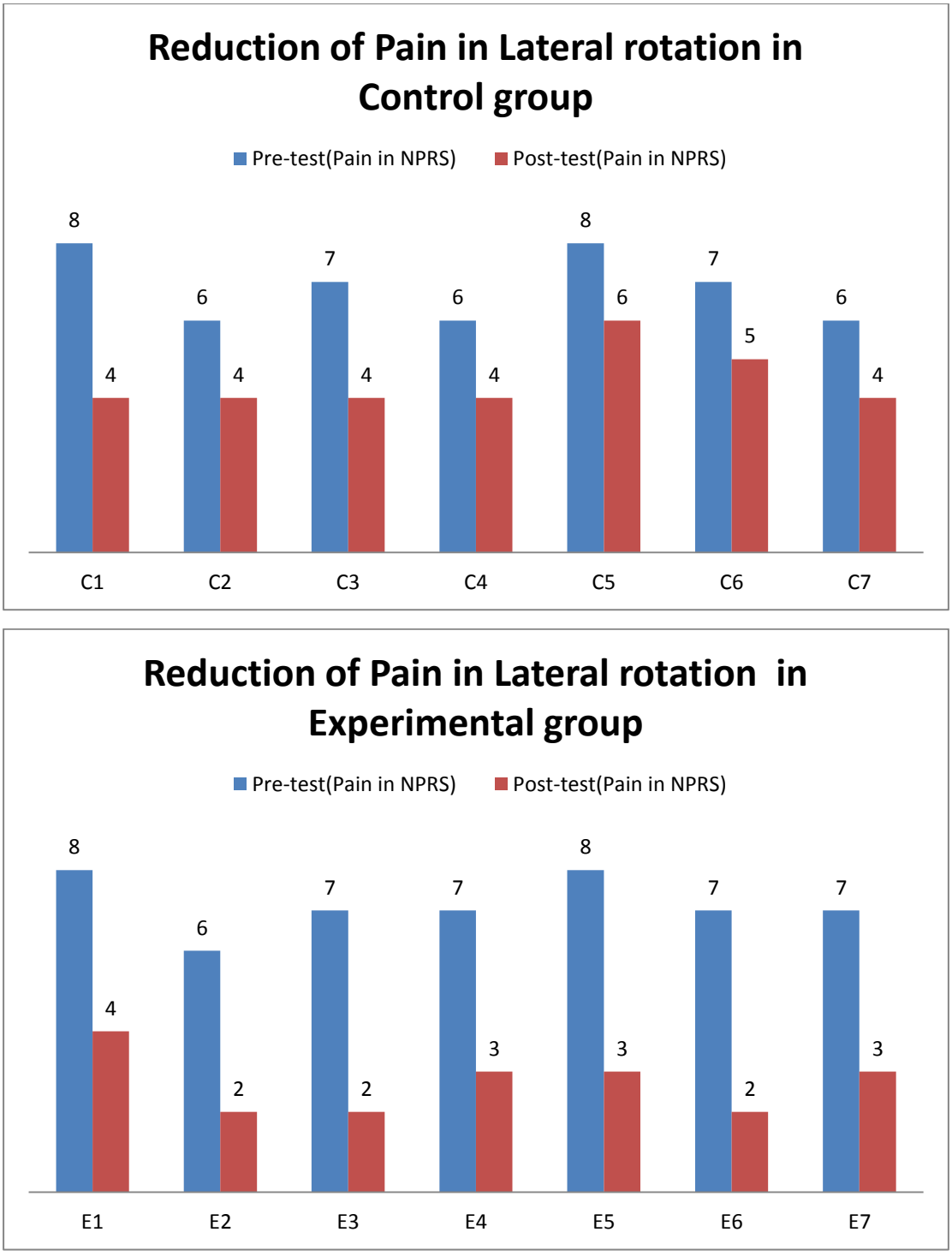


Fig 4: Reduction of Pain in Lateral rotation

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	4	9.5	C_1	4	9.5
E_2	2	2	C_2	4	9.5
E_3	2	2	C_3	4	9.5
E_4	3	5	C_4	4	9.5
E_5	3	5	C_5	6	14
E_6	2	2	C_6	5	13
E_7	3	5	C_7	4	9.5
total	19	30.5		31	74.5

Table-8: Reduction of Pain in Lateral rotation in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 7

n_2 = the number of the subject in control group = 7

T_x = the larger rank total = 74.5

n_x = the number of the subjects in the condition with larger rank total .That is control group = 7

Now U formula:

$$U = n_1 n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

$= 7 \times 7 + \frac{7(7+1)}{2} - 74.5$

$= 49 + 28 - 74.5$

$= 77 - 74.5$

$= 2.5$

The U-value is 2.5. The critical value of U at $p \leq 0.05$ is 11. Therefore, the result is significant at $p \leq 0.05$.

Pain at Medial Rotation (Scratching lower back): Reduction of pain scores at medial rotation in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for pain in medial rotation were differences between pre-test and post-test pain scores.

Only Conventional physiotherapy group (Control Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							2 Persons (28%)	3 Persons (46%)	1 Person (14%)	1 Person (14%)	
Post-test				2 Persons (28%)	1 person (14%)	3 Persons (44%)	1 Persons (14%)				

Conventional physiotherapy with end range mobilization (Experimental Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test							1 person (14%)	4 Persons (58%)	2 Persons (28%)		
Post-test			3 Persons (43%)	3 Persons (43%)	1 Person (14%)						

Table 9: Reduction of Pain in Medial rotation

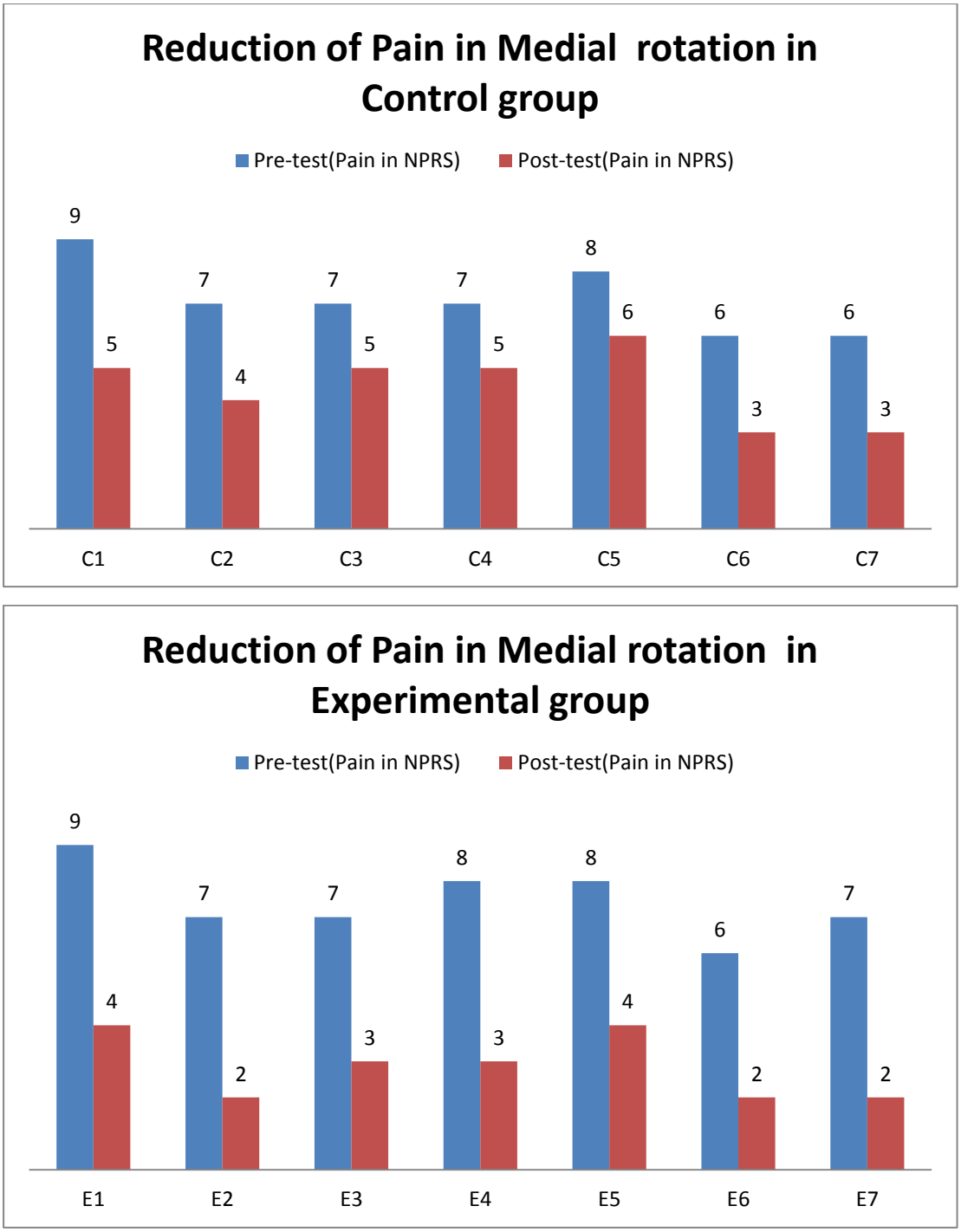


Fig 5: Reduction of Pain in Medial rotation

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	4	9	C_1	5	12
E_2	2	2	C_2	4	9
E_3	3	5.5	C_3	5	12
E_4	3	5.5	C_4	5	12
E_5	4	9	C_5	6	14
E_6	2	2	C_6	3	5.5
E_7	2	2	C_7	3	5.5
total	20	38		31	70

Table-10: Reduction of Pain in Medial rotation in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 7

n_2 = the number of the subject in control group = 7

T_x = the larger rank total = 70

n_x = the number of the subjects in the condition with larger rank total .That is control group = 7

Now U formula:

$$U = n_1 n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

$= 7 \times 7 + \frac{7(7+1)}{2} - 70$

$= 49 + 28 - 70$

$= 77 - 70$

$= 7$

The U-value is 7. The critical value of U at $p \leq 0.05$ is 11. Therefore, the result is significant at $p \leq 0.05$.

Pain during sleeping in affected side: Reduction of pain scores in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for pain during sleeping in affected side were differences between pre-test and post-test pain scores.

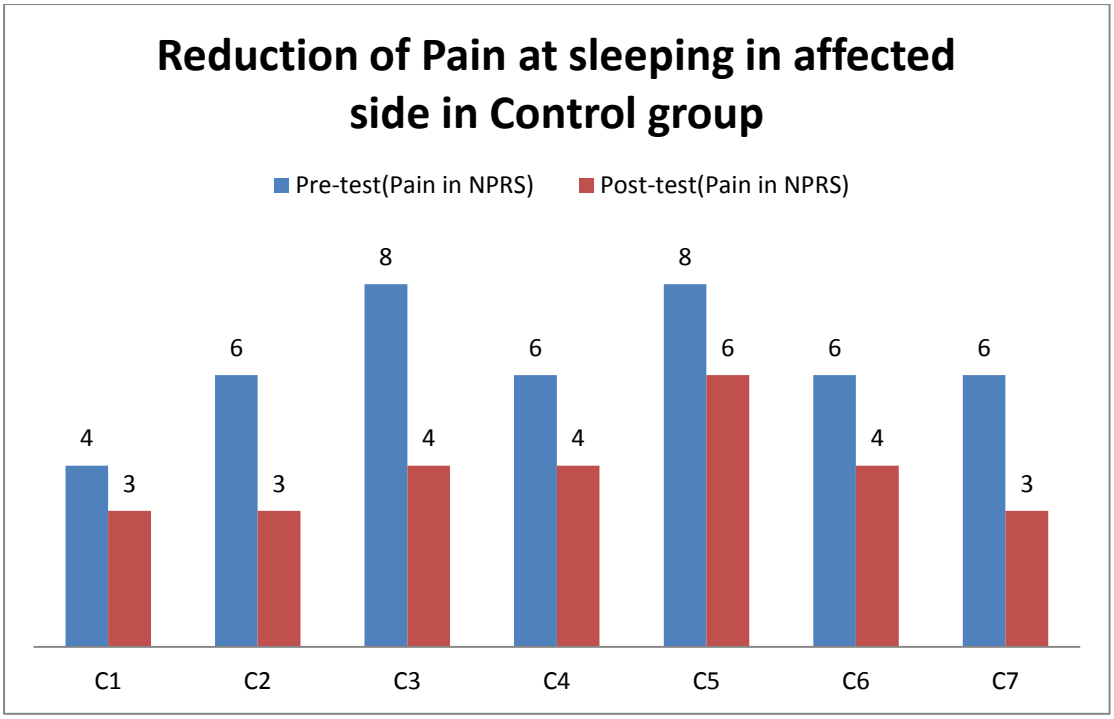
Only Conventional physiotherapy group (Control Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test					1 Person (14%)		4 Persons (58%)		2 Persons (28%)		
Post-test				3 Persons (43%)	3 persons (43%)		1 Person (14%)				

Conventional physiotherapy with end range mobilization (Experimental Group)

Pain in NPRS	0	1	2	3	4	5	6	7	8	9	10
Pre-test						1 Person (14%)	2 persons (28%)	2 Persons (29%)	2 Persons (29%)		
Post-test		3 Persons (43%)	3 Persons (43%)	1 Person (14%)							

Table 11: Reduction of Pain during sleeping in affected side



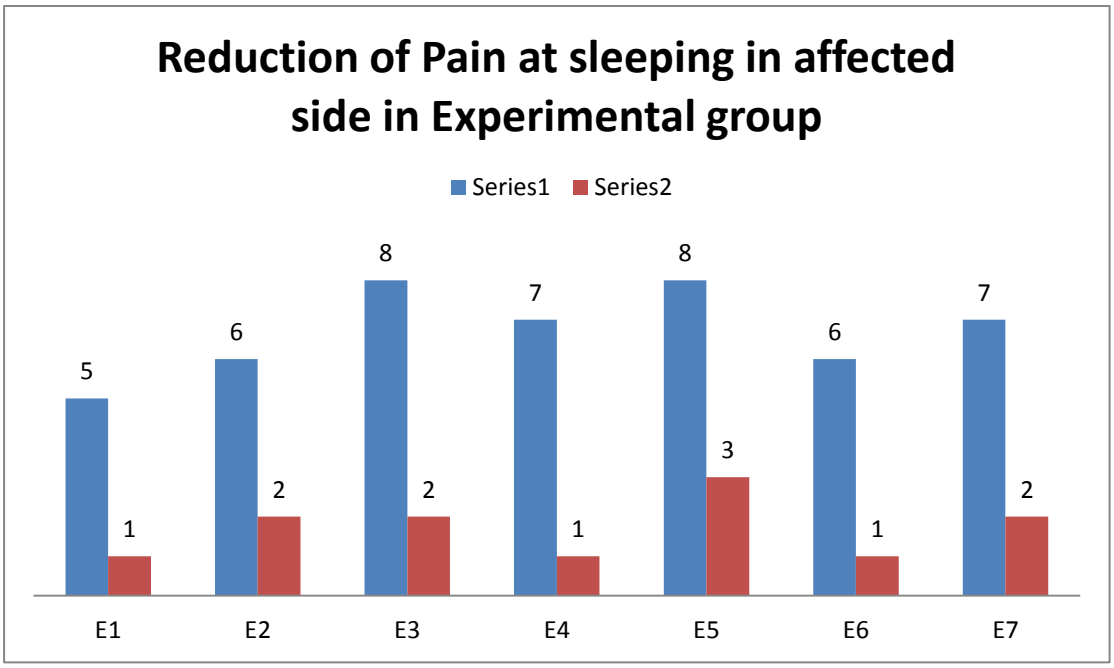


Fig 6: Reduction of pain in lying affected side

Experimental group			Control group		
Subjects	Post-test pain score	Rank	Subjects	Post-test pain score	Rank
E_1	1	2	C_1	3	8.5
E_2	2	5	C_2	3	8.5
E_3	2	5	C_3	4	12
E_4	1	2	C_4	4	12
E_5	3	8.5	C_5	6	14
E_6	1	2	C_6	4	12
E_7	2	5	C_7	3	8.5
total	12	75.5		27	29.5

Table-12: Reduction of pain in lying affected side in experimental and control group with rank

Here,

n_1 = the number of the subjects experimental group = 7

n_2 = the number of the subject in control group = 7

T_x = the larger rank total = 75.5

n_x = the number of the subjects in the condition with larger rank total .That is control group = 7

Now U formula:

$$U = n_1 n_2 + \frac{n_x(n_x+1)}{2} - T_x$$

$= 7 \times 7 + \frac{7(7+1)}{2} - 75.5$

$= 49 + 28 - 75.5$

$= 77 - 75.5$

$= 1.5$

The U-value is 1.5. The critical value of U at $p \leq 0.05$ is 11. Therefore, the result is significant at $p \leq 0.05$.

Variables in the study statistically significant or not significant at the following level of significance:

No.	Variables Calculated	Observed 'U' value	The critical value of U at $p \leq 0.05$ is	Significant or not significant
1.	Resting pain	7	11	Significant
2.	Pain in Abduction	7.5	11	Significant
3.	Pain in Lateral rotation	2.5	11	Significant
4.	Pain in Medial rotation	7	11	Significant
5.	Pain during Sleeping in affected side	1.5	11	Significant

Table-13: Variables in this study with level of significance

To be significant at one of these levels, the 'U' value must be equal to or smaller than the value at the intersection point.

Subjects	**Mean Difference of Pain Reduction in Control group**									
	Rest		Abduction		Lateral rotation		Medial rotation		Sleeping in affected side	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
C1	7	3	7	3	8	4	9	5	4	3
C2	7	5	7	5	6	4	7	4	6	3
C3	8	5	8	5	7	4	7	5	8	4
C4	7	5	7	5	6	4	7	5	6	4
C5	8	6	8	6	8	6	8	6	8	6
C6	7	5	6	4	7	5	6	3	6	4
C7	6	3	7	3	6	4	6	3	6	3
Total	50	32	50	31	48	31	50	31	44	27
Mean	7.14	4.57	7.14	4.42	6.86	4.42	7.14	4.42	6.29	3.86
Mean difference	**2.57**		**2.72**		**2.44**		**2.72**		**2.43**	

Subjects	**Mean Difference of Pain Reduction in Experimental group**									
	Rest		Abduction		Lateral rotation		Medial rotation		Sleeping in affected side	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
E1	7	3	8	4	8	4	9	4	5	1
E2	8	3	7	2	6	2	7	2	6	2
E3	8	3	8	4	7	2	7	3	8	2
E4	7	2	7	2	7	3	8	3	7	1
E5	8	4	8	4	8	3	8	4	8	3
E6	8	4	7	2	7	2	6	2	6	1
E7	7	2	8	2	7	3	7	2	7	2
Total	53	21	53	20	50	19	52	20	47	12
Mean	7.57	3.00	7.57	2.86	7.14	2.71	7.43	2.86	6.71	1.71
Mean difference	**4.57**		**4.71**		**4.43**		**4.57**		**5.00**	

Name of the variables	Experimental Group (Mean Pain reduction)	Control group (Mean Pain reduction)
Pain at rest	4.57	2.57
Pain at abduction (Raising hand sideways)	4.71	2.72
Pain at lateral rotation (Combing Hair)	4.43	2.44
Pain at medial rotation (Scratch Lower Back)	4.57	2.72
Pain at sleeping in affected side	5.00	2.43

Table 14: Comparison of mean difference of pain reduction in both groups

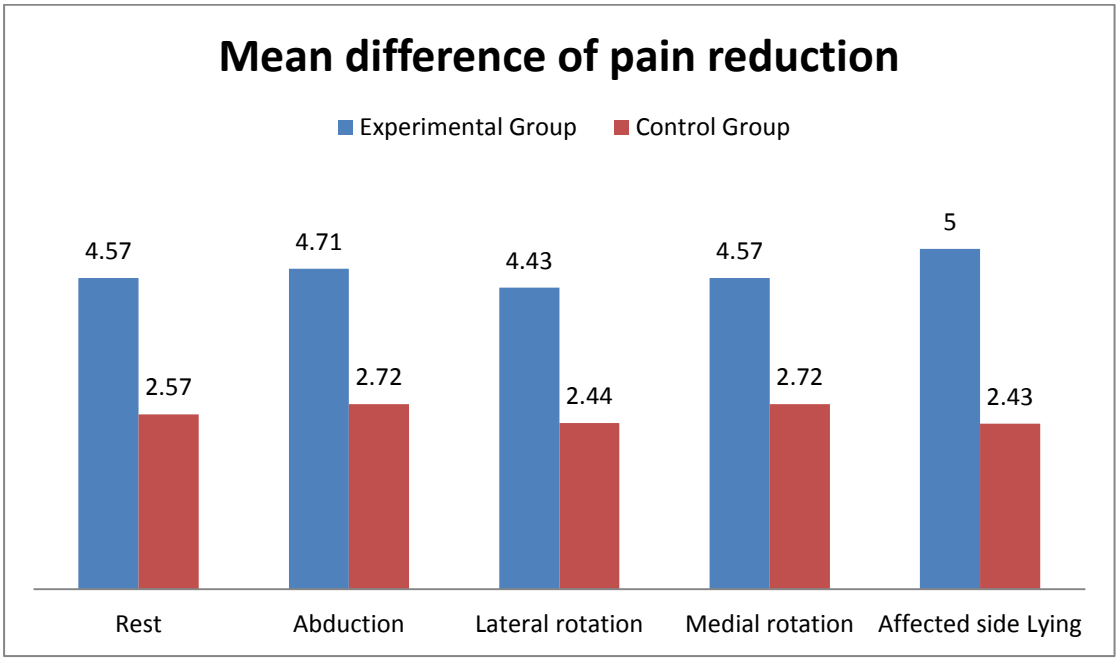


Fig 7: Mean difference of pain reduction

Improvement of ROM

Mean difference of Improvement of Range of motion between pre-test and post-test in conventional physiotherapy with end range mobilization and only conventional physiotherapy group.

Name of the variables	Conventional physiotherapy with end range mobilization group	Only conventional physiotherapy group
Abduction	17.14	11.42
Lateral Rotation	8.75	6.42
Medial Rotation	11.42	5.71

Table 15: Mean difference of Improvement of ROM between pre-test and post-test in experimental and control group

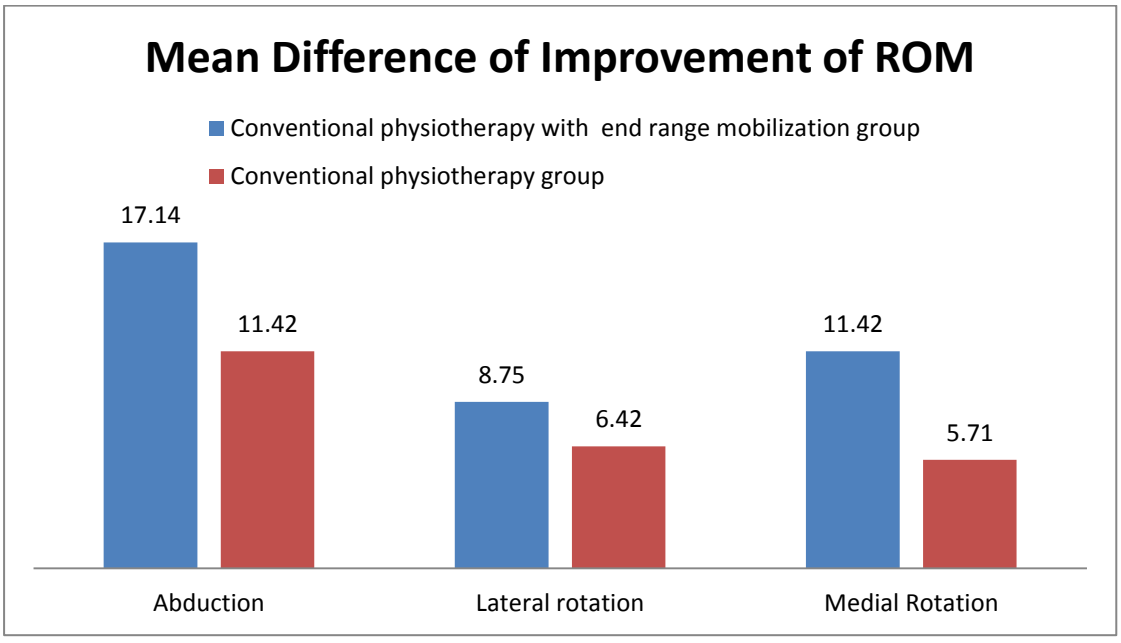


Figure 8: Mean difference of Improvement of ROM between pre-test and post- test in experimental and control group.

Range of Movement in Abduction: Improvement of ROM in Abduction in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in Abduction was differences between pre-test and post-test pain scores.

Conventional physiotherapy with end range mobilization group			**Only Conventional physiotherapy group**		
Subjects	ROM in Abduction (X_1)	X_1^2	Subjects	ROM in Abduction ($X_{2)}$	X_2^2
E_1	20	400	C_1	10	100
E_2	15	225	C_2	20	400
E_3	15	225	C_3	10	100
E4	20	400	C4	10	100
E_5	15	225	C_5	5	25
E_6	15	225	C_6	10	100
E_7	20	400	C_7	15	225
	$\sum X_1$=120	$\sum X_1^2$=2100		$\sum X_2$= 80	$\sum X_2^2$= 1050

$\bar{X}_1$= 17.14

$\sum X_1^2$= 2100

$(\sum X_1)^2$= 14400

n_1=7

$\bar{X}_2$= 11.42

$\sum X_2^2$=1050

$(\sum X_2)^2$= 6400

n_2=7

Calculating the degree of freedom from the formula

df = (n_1-1) + (n_2-1)

= (7 -1) + (7 - 1) =12

Now ‘t’ formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\left[\sqrt{\frac{\left(\sum x_1{}^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2{}^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}\right]}$$

$$t = \frac{17.14 - 11.42}{\left[\sqrt{\frac{2100 - \frac{14400}{7} + 1050 - \frac{6400}{7}}{(7-1) + (7-1)}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}\right]}$$

t= 2.8

Range of Movement in Lateral rotation: Improvement of ROM in Lateral Rotation in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in Lateral rotation was differences between pre-test and post-test pain scores.

Conventional physiotherapy with end range mobilization group			**Only Conventional physiotherapy group**		
Subjects	ROM in Lateral rotation (X_1)	X_1^2	Subjects	ROM in Lateral rotation ($X_{2)}$	X_2^2
E_1	10	100	C_1	5	25
E_2	10	100	C_2	5	25
E_3	10	100	C_3	10	100
E4	5	25	C4	5	25
E_5	10	100	C_5	5	25
E_6	5	25	C_6	5	25
E_7	10	100	C_7	10	100
	$\sum X_1$= 60	$\sum X_1^2$= 550		$\sum X_2$= 45	$\sum X_2^2$= 325

$\bar{X}_1$= 8.57

$\sum X_1^2$= 550

$(\sum X_1)^2$= 3600 n_1=7

$\bar{X}_2$= 6.42

$\sum X_2^2$=325

$(\sum X_2)^2$= 2025 n_2=7

Calculating the degree of freedom from the formula

df = (n_1-1) + (n_2-1)

= (7 -1) + (7 - 1) =12

Now ‘t’ formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\left[\sqrt{\frac{\left(\sum x_1{}^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum x_2{}^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}\right]}$$

$$t = \frac{8.57 - 6.42}{\left[\sqrt{\frac{550 - \frac{3600}{7} + 325 - \frac{2025}{7}}{(7-1) + (7-1)}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}\right]}$$

t= 1.65

Range of Movement in Medial Rotation: Improvement of ROM in Medial Rotation in adhesive capsulitis, end range mobilization with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in Medial rotation was differences between pre-test and post-test pain scores.

Conventional physiotherapy with end range mobilization group			**Only Conventional physiotherapy group**		
Subjects	ROM in Medial Rotation (X_1)	X_1^2	Subjects	ROM in Medial Rotation ($X_{2)}$	X_2^2
E_1	10	100	C_1	5	25
E_2	10	100	C_2	5	25
E_3	10	100	C_3	10	100
E4	10	100	C4	5	25
E_5	15	225	C_5	10	100
E_6	10	100	C_6	5	25
E_7	15	225	C_7	10	100
	$\sum X_1$=80	$\sum X_1^2$=950		$\sum X_2$= 40	$\sum X_2^2$= 400

$\bar{X}_1$= 11.42

$\sum X_1^2$= 950

$(\sum X_1)^2$= 6400

n_1=7

$\bar{X}_2$= 5.71

$\sum X_2^2$=400

$(\sum X_2)^2$= 1600

n_2=7

Calculating the degree of freedom from the formula

df = (n_1-1) + (n_2-1)

= (7 -1) + (7 - 1) =12

Now ‘t’ formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\left[\sqrt{\frac{\left(\sum {x_1}^2 - \frac{(\sum x_1)^2}{n_1}\right) + \left(\sum {x_2}^2 - \frac{(\sum x_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}\right]}$$

$$t = \frac{11.42 - 5.71}{\left[\sqrt{\frac{950 - \frac{6400}{7} + 400 - \frac{1600}{7}}{(7-1) + (7-1)}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}\right]}$$

t= 2.60

Variables in the study statistically significance at the following level of significance:

NO	**Variables**	**Observed ‘t’ value**	**Tabulated ‘t’ value**	**Observed P value**	
1	ROM in abduction	2.80	2.681	<.01	Significant
2	ROM in lateral rotation	1..65	1.356	<.10	Not Significant
3	ROM in medial rotation	2.60	2.179	<.025	Significant

Table 16: Level of significance in different variables

CHAPTER- V DISCUSSION

The purpose of this study was to evaluate the effectiveness of end range mobilization with conventional physiotherapy compare to only conventional physiotherapy for adhesive capsulitis. In this experimental study 14 patients with adhesive capsulitis were randomly assigned to the experimental group and to the control group. Among these 14 patients, 7 patients were included in the experimental group who received end range mobilization with conventional physiotherapy and the rest of the 7 patients were included in the control group, who received conventional physiotherapy only. Each group attended for 6 sessions of treatment within two weeks in the physiotherapy outdoor department of CRP Savar in order to demonstrate the improvement. The outcome was measured by using numerical pain rating sclae for pain intensity in different functional position, and goniometer for measuring ROM in Abduction Medial rotation and Lateral rotation.

In experimental group, mean difference of reduction of resting pain, Abduction, Lateral rotation, Medial rotation and pain during lying were 4.57, 4.71, 4.43, 4.57, and 5 which were 2.28, 2.72, 2.44, 2.72, and 2.43 in control group. Following treatment the study found that the experimental group showed a significant improvement in case of resting pain ($p<.05$), pain at Abduction ($p<0.05$), pain at Lateral rotation ($p<0.05$), pain at Medial rotation ($p<0.05$), pain during lying ($p<0.05$). The study also found significant improvement of ROM in case of Abduction and Medial rotation ($p<0.05$). A small but not statistically significant improvement has been found in Lateral rotation of shoulder. In a series of 7 patients with adhesive capsulitis were observed after 3 months of treatment with EMTs. After finishing the treatments, five patients reported no pain in the affected shoulder (Vermeulen et al., 2000). In this study according to ‘U’ test analysis, reduction of pain at lateral rotation is significant but in case of ‘t’ test analysis the ROM of lateral rotation is not significant because adhesive capsulitis is a global restriction of shoulder joint.

CHAPTER- VI CONCLUSION AND RECOMMANDATIONS

6.1 Conclusion

The result of this experimental study is identified the effectiveness of end range mobilization in adhesive capsulitis patient. Participants in the conventional physiotherapy with end range mobilization group showed a greater benefit than those in the only conventional physiotherapy group, which indicate that the conventional physiotherapy with end range mobilization is an effective therapeutic approach for patient with adhesive capsulitis.

From this research the researcher explore the effectiveness of end range mobilization along with conventional physiotherapy to reduce the features of patient with adhesive capsulitis, which will be helpful to facilitate their rehabilitation and to enhance functional activities.

The manifestations are not only pain but also limitation in movements and restriction to activities of daily living. From this research, researcher concluded the specific variables and comparison of their improvement. This will aid the professionals to decide the specific and effective treatment protocol for adhesive capsulitis patients.

6.2 Recommendations

As a consequence of this researcher it is recommended to do further study including comparison of the conventional physiotherapy and end range mobilization with conventional physiotherapy alone to assess the effectiveness of these interventions with-

- It is recommended to do further study with more number of subjects and with a longer time frame.
- It is also recommended to include the functional outcome assessment of patient and to identify the average number of sessions that are needed to be discharged from treatment to validate the treatment technique.
- Double blinding procedure.

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সম্মতিপত্র

আসসালামুআলাইকুম/ নমস্কার। আমার নাম সুরাইয়া সালেক, বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট এর ফিজিওথেরাপী চতুথ বষের ছাত্রি। আমি এই গবেষণাটি ব্যাচেলর অব সায়েন্স ইন ফিজিওথেরাপী ডিগ্রির পরিপূণতার জন্য করছি। আমার গবেষণার নাম - এডহেসিব ক্যাপসুলাইটিসে শেষ পরিসীমা সংহতি এর কাযকারীতা।

এই গবেষণার মাধ্যমে আমি জানতে পারব - এডহেসিব ক্যাপসুলাইটিসে শেষ পরিসীমা সংহতি এর কাযকারীতা। এই জন্য আমার এডহেসিব ক্যাপসুলাইটিস রোগী থেকে প্রয়োজনীয় তথ্য জানতে হবে ।

গবেষণার ক্ষেত্রে অনুযায়ী, আপনি এই গবেষণায় অন্তভুক্তির যোগ্যতা অর্জন করেছেন । আমি আপনাকে এই গবেষণায় অংশ গ্রহনের আমন্ত্রন জানাচ্ছি, আমার একটি নিদিষ্ট ফলাফলের চেষ্টা করছি - এডহেসিব ক্যাপসুলাইটিসে শেষ পরিসীমা সংহতি এর কাযকারীতা " যে সব চিকিৎসা পদ্ধতি আপনার উপর প্রয়োগ করা হবে তা সম্পূর্ণ নিরাপদ এবং নিশ্চিত যে কোন ক্ষতি সাধন করবে না ।

আমি আপনার সাথে বেশ কয়েকবার দেখা করব। আমার অংশ গ্রহন হবে ঐচ্ছিক । এই গবেষণায় যে কোন মুহূর্তে আপনি আপনার সম্মতি নিতে পারেন কিংবা অংশ গ্রহন থেকে বিরত থাকতে পারেন ।

আপনার যদি এ গবেষণা সম্পকে কোন জিজ্ঞাসা থাকে তবে অনুগ্রহপূবক যোগাযোগ করতে গবেষক মো: আল-জামিন ইসলাম অথবা মো. সফিকুল ইসলাম, সহকারী অধ্যাপক, ফিজিওথেরাপী বিভাগ, বি এইচ পি আই, সিআরপি, সাভার, ঢাকা-১৩৪৩ ।

শুরু করার পূর্বে আপনার কি কোন প্রশ্ন আছে?

আমি কি শুরু করতে পারি?

☐ হ্যাঁ ☐ না

প্রশ্নকর্তার স্বাক্ষর .....

আমি ..... এই সম্মতি পত্রটি পড়েছি ও বুঝেছি। আমি স্বেচ্ছায় এই গবেষণায় অন্তর্ভুক্ত হচ্ছি ।

অংশগ্রহণকারীর স্বাক্ষর .....

১ নং সাক্ষীর স্বাক্ষর .....

২ নং সাক্ষীর স্বাক্ষর .....

APPENDIX 1: CONSENT FORM (English)

Consent Form (English)

Assalamu-alaikum/ Namasker. My name is Md. Al-Zamin Islam, student of B.Sc in physiotherapy at Bangladesh Health Professions Institute (BHPI), CRP. I am conducting a study for partial fulfillment of Bachelor of Science in Physiotherapy degree, titled, "Effectiveness of end range mobilization (ERM) in patient with adhesive capsulitis of shoulder joint".

Through this research, I will see the efficacy of end range mobilization (ERM) along with existing physiotherapy for the case of adhesive capsulitis. For this regard, I would need to collect data from the patient having adhesive capsulitis.

Considering the area of research, you have met the inclusion criteria and i would like to invite you as a subject of my study. If you participate in this study, I will evaluate for a particular intervention (end range mobilization (ERM) in Combination with Conventional Physiotherapy) for frozen shoulder. The interventions that would be given are safe and will not cause any harm.

I want to meet you a few couple of sessions during your as usual therapy. Your participation will be voluntary. You have the right to withdraw consent and discontinue participation at any time.

If you have any query about the study or your right as a participant, you may contact with, researcher Md. Al-Zamin Islam or Md. Shofiqul Islam, Assistant Professor Department of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343.

Do you have any questions before I start?

So may I have your consent to proceed with the interview?

Yes: ☐ No: ☐

Signature of the Interviewer _____

I …….have read and understand the contents of the form. I agree to participant in the research without any force.

Signature of the participant _____

প্রশ্নপত্র (বাংলা)

কোড নং-

এই প্রশ্নপত্র এডহেসিব ক্যাপসুলাইটিস রোগীর জন্য প্রণীত।

রোগীর নামঃ পেশাঃ বয়সঃ লিঙ্গঃ

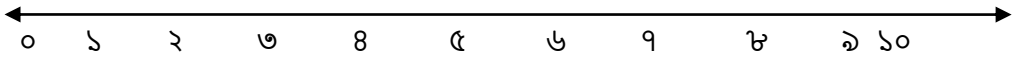
তারিখঃ

ঠিকানাঃ

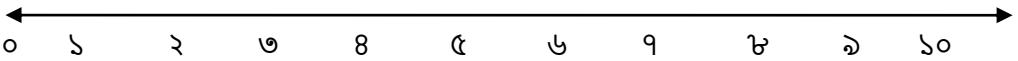
এই প্রশ্নপত্র এডহেসিব ক্যাপসুলাইটিস রোগীর জন্য প্রণীত। ১ নং থেকে ৫ নং প্রশ্ন রোগীর ব্যথা নির্দেশ করে, প্রতিটি প্রশ্নের শেষ এ একটি লম্বা লাইন আছে, আপনার হাতের বাম পাশ নির্দেশ করে কোন ব্যথা নেই আর ডান পাশ নির্দেশ করে তীব্র ব্যথা। আপনি যতটুকু ব্যথা অনুভব করেন তা চিহ্নিত করুন। ৬ নং থেকে ৮ নং প্রশ্নের উত্তর পরীক্ষক লিপিবদ্ধ করবেন।

১. বিশ্রামরত অবস্থায় আপনার ব্যথার পরিমান কত (পরীক্ষক পরিমাপ করবেন সংখ্যাসূচক ব্যথা নির্ধারণ স্কেল দিয়ে)?

চিকিৎসার পূর্বে



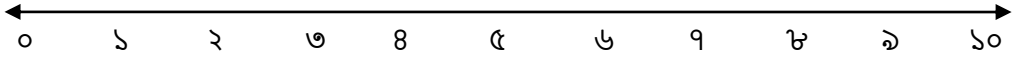
চিকিৎসার পরে



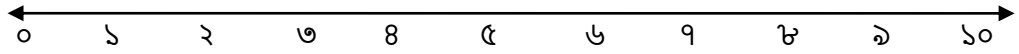
এখানে ০ মানে কোন ব্যথা নেই,১-৩ সামান্য ব্যথা,৪-৬ মাঝারি ব্যথা,৭- ১০ মানে তীব্র ব্যথা।

২) পাশাপাশি হাত তুলতে আপনার ব্যথার পরিমাণ কত (পরীক্ষক পরিমাপ করবেন সংখ্যাসূচক ব্যথা নির্ধারণ স্কেল দিয়ে)?

চিকিৎসার পূর্বে



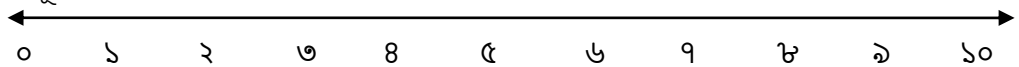
চিকিৎসার পরে



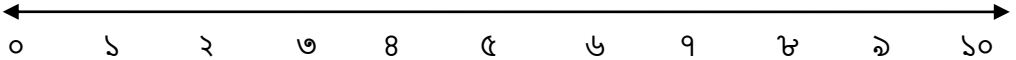
এখানে ০ মানে কোন ব্যথা নেই,১-৩ সামান্য ব্যথা,৪-৬ মাঝারি ব্যথা,৭- ১০ মানে তীব্র ব্যথা।

৩) চুল আঁচড়াতে আপনি কেমন ব্যথা পান(পরীক্ষক পরিমাপ করবেন সংখ্যাসূচক ব্যথা নির্ধারণ স্কেল দিয়ে)?

চিকিৎসার পূর্বে



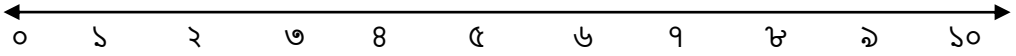
চিকিৎসার পরে



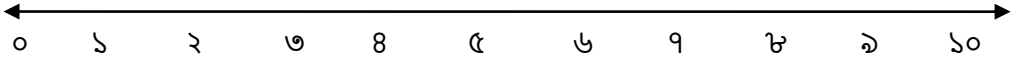
এখানে ০ মানে কোন ব্যথা নেই,১-৩ সামান্য ব্যথা,৪-৬ মাঝারি ব্যথা,৭- ১০ মানে তীব্র ব্যথা।

৪) হাত পিছনে নিয়ে পিঠ চুলকাতে আপনার কেমন ব্যথা লাগে(পরীক্ষক পরিমাপ করবেন সংখ্যাসূচক ব্যথা নির্ধারণ স্কেল দিয়ে)?

চিকিৎসার পূর্বে



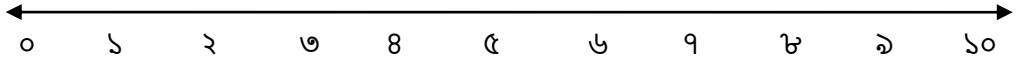
চিকিৎসার পরে



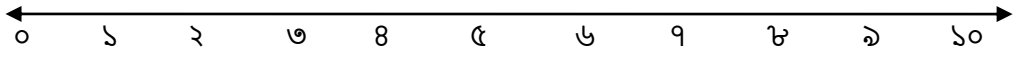
এখানে ০ মানে কোন ব্যথা নেই,১-৩ সামান্য ব্যথা,৪-৬ মাঝারি ব্যথা,৭- ১০ মানে তীব্র ব্যথা।

৫) আক্রান্ত পাশে ঘুমাতে আপনার কত ব্যথা হয়(পরীক্ষক পরিমাপ করবেন সংখ্যাসূচক ব্যথা নির্ধারণ স্কেল দিয়ে)?

চিকিৎসার পূর্বে



চিকিৎসার পরে



এখানে ০ মানে কোন ব্যথা নেই,১-৩ সামান্য ব্যথা,৪-৬ মাঝারি ব্যথা,৭- ১০ মানে তীব্র ব্যথা।

৬) আক্রান্ত কাঁধের পেসিভ এবডাকসন (পরীক্ষক পরিমাপ করবেন গনিও মিটার দিয়ে)

চিকিৎসার পূর্বে ..... ডিগ্রি

চিকিৎসার পরে ..... ডিগ্রি

৭) আক্রান্ত কাঁধের পেসিভ লেটারাল রোটেশন (পরীক্ষক পরিমাপ করবেন গনিও মিটার দিয়ে)

চিকিৎসার পূর্বে ..... ডিগ্রি

চিকিৎসার পরে ..... ডিগ্রি

৮) আক্রান্ত কাঁধের পেসিভ মিডিয়াল রোটেশন (পরীক্ষক পরিমাপ করবেন গনিও মিটার দিয়ে)

চিকিৎসার পূর্বে ..... ডিগ্রি

চিকিৎসার পরে ..... ডিগ্রি

মোঃ আল-জামিন ইসলাম

৪র্থ বর্ষ বিএসসি ইন ফিজিওথেরাপি

গবেষক

APPENDIX II: Questioner (English)

Questioner (English)

Code No.

This questionnaire is developed for the patient with Adhesive Capsulitis.

Patient's name: Occupation: Age: Sex:

Address: Date:

This questionnaire is designed for adhesive capsulitis patients. There are some questions (QN 1- QN 5) and with each question there is a long line. The line represents pain situation. The left hand end indicates no pain at all and right hand end indicates worse pain imaginable. Please a mark on the line where you feel it shows how much pain you have. The Answer of other questions (QN 6- QN 8) will be enlisted by examiner by using some measurement tools.

1. How severe your pain is at resting position (Measured by examiner by using Numerical pain rating scale)?

Pre test

0 1 2 3 4 5 6 7 8 9 10

Post test

0 1 2 3 4 5 6 7 8 9 10

(A Zero (0) representing no pain, 1-3 mild pain, 4-6 moderate pain and 7-10 representing the worst pain ever experienced)

2. How severe is your pain during rising arm sideways (Abduction) (Measured by examiner by using Numerical pain rating scale)?

Pre test

0 1 2 3 4 5 6 7 8 9 10

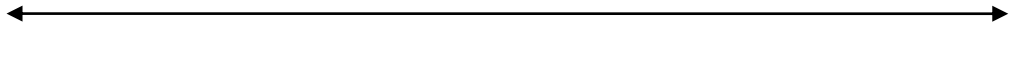
Post test

0 1 2 3 4 5 6 7 8 9 10

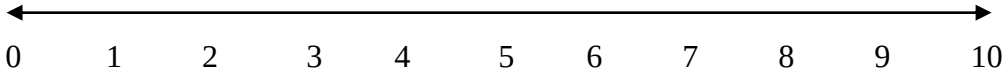
(A Zero (0) representing no pain, 1-3 mild pain, 4-6 moderate pain and 7-10 representing the worst pain ever experienced)

3. How severe is your pain during combing hair (Lateral Rotation) (Measured by examiner by using Numerical pain rating scale)?

Pre test



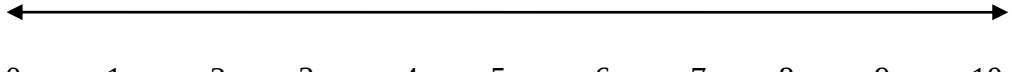
Post test



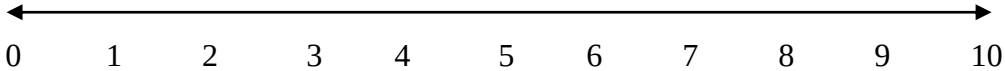
(A Zero (0) representing no pain, 1-3 mild pain, 4-6 moderate pain and 7-10 representing the worst pain ever experienced)

4. How severe is your pain during Scratching Lower back (Medial rotation) (Measured by examiner by using Numerical pain rating scale)?

Pre test



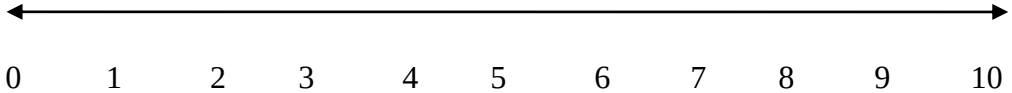
Post test



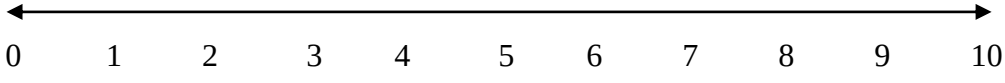
(A Zero (0) representing no pain, 1-3 mild pain, 4-6 moderate pain and 7-10 representing the worst pain ever experienced)

5. How severe is your pain during lying in affected side (Measured by examiner by using Numerical pain rating scale)?

Pre test



Post test



(A Zero (0) representing no pain, 1-3 mild pain, 4-6 moderate pain and 7-10 representing the worst pain ever experienced)

6. Passive ROM of Abduction of Affected Shoulder (Measured by examiner by using Goniometer).

Pre- treatment …….. Degrees

Post- treatment …….. Degrees

7. Passive ROM of Lateral Rotation of Affected Shoulder (Measured by examiner by using Goniometer).

Pre- treatment …….. Degrees

Post- treatment …….. Degrees

8. Passive ROM of medial rotation of Affected Shoulder (Measured by examiner by using Goniometer).

Pre- treatment …….. Degrees

Post- treatment …….. Degrees

Md.Al-Zamin Islam

BSc in Physiotherapy

Researcher

February 23, 2015

Head

Department of Physiotherapy,

Centre for the Rehabilitation of the Paralysed (CRP)

Chapain,Savar, Dhaka-1343.

Through: Head, Department of Physiotherapy, BHPI.

Subject: Seeking permission for data collection to conduct research Project.

Sir,

With due respect and humble submission to state that I am MD.Al-Zamin Islam, student of 4th year B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: "Effectiveness of end range mobilization (ERM) in patient with adhesive capsulitis of shoulder joint."under the supervision of Md.Shofiqul Islam, Assistant professor Department of Physiotherapy.I want to collect data for my research project from the Department of physiotherapy at CRP. So I need permission for data collection from the musculoskeletal unit of Physiotherapy Department at CRP, Savar. I would like to assure that anything of the study will not be harmful for the participants.

I, therefore, pray and hope that you would be kind enough to grant my application and give me the permission for data collection and oblige thereby.

Yours faithfully

MD. Al-Zamin Islam
23-02-2015

MD.Al-Zamin Islam

4th Professional B.Sc. in Physiotherapy

Class Roll: 27, Session: 2009-2010

Bangladesh Health Professions Institute (BHPI)

(An academic Institution of CRP)

CRP-Chapain, Savar, Dhaka-1343.

Seen
Shofiq
23/2/2015

Forwarded for Approval
23/02/15

Md. Obaidul Haque
Associate Professor & Head of the Department
Department of Physiotherapy
Bangladesh Health Professions Institute (BHPI)
CRP, Chapain, Savar, Dhaka-1343

Given permission for data collection please contact with my concern part Mr. Shofiqul Islam
23/02/15