EFFECTIVENESS OF MOVEMENT WITH MOBILIZATION TO IMPROVE ROM AMONG ADHESIVE CAPSULITIS PATIENTS ATTENDED AT CRP

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EFFECTIVENESS OF MOVEMENT WITH MOBILIZATION TO IMPROVE ROM AMONG ADHESIVE CAPSULITIS PATIENTS ATTENDED AT CRP

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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 same any publication, presentation or dissemination of information of the study. I would bind to take written consent of my supervisor and Head of the Physiotherapy department, Bangladesh Health Profession Institute (BHPI).

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Acronyms

BHPI	Bangladesh Health Professions Institute
BMRC	Bangladesh Medical Research Council
CRP	Centre for the Rehabilitation of the Paralysed
IRB	Institution Review Board
MS	Musculo-skeletal
MWM	Movement with Mobilization
NSAID's	Non-Steroidal Anti-inflammatory Drugs
PT	Physiotherapy
RCT	Randomized Control Trail
ROM	Range of Movement
TENS	Transcutaneous Electrical Nerve Stimulation
UST	Ultrasound Therapy
VAS	Visual Analogue Scale
WHO	World Health Organization

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Abstract

Purpose: The purpose of the study was to explore the effectiveness of movement mobilization with conventional physiotherapy compare to only conventional physiotherapy for Adhesive capsulitis patient. Objectives: To evaluate the effect of pain after introducing Movement with Mobilization for Adhesive capsulitis, to measure the severity of pain by using Visual Analogue Scale(VAS), to measure the ROM by using Goniometer, to explore the socio-demography of the participants. Methodology: Fourteen patients with adhesive Capsulitis were randomly selected from outdoor musculo-skeletal unit, CRP and then 7 patients with Adhesive Capsulitis were randomly assigned to movement with mobilization with conventional physiotherapy group and 7 patients to the only conventional physiotherapy group for this randomize control trial study. Visual Analogue Scale was used to measure pain intensity in different functional position and Goniometer to measure ROM. Unrelated "t" test was used to compare the result in ROM analysis and Pain was analysed by Calculating mean difference between two groups and unrelated "t" test. Results: By using an unrelated t test on the data the results were found to be significant in case of resting pain ($p < 0.05$), pain during abduction ($p < 0.05$), pain during lateral rotation ($p < 0.05$) but not statistically significant in case of pain during medial rotation ($p < 0.05$), pain during sleeping in affected side ($p < 0.05$).The study also found significant Improvement of ROM In case of Abduction ($p<.05$). A small but not statistically significant improvement has been found in Medial rotation and lateral rotation of Shoulder. Conclusion: This experimental study shows that movement with mobilization with conventional physiotherapy is more effective than conventional physiotherapy alone for patients with Adhesive Capsulitis.

Key words: Adhesive Capsulitis, Movement with mobilization, Conventional physiotherapy

CHAPTER – I INTRODUCTION

1.1Background

Adhesive capsulitis, also known as frozen shoulder, is a condition characterized by pain and significant loss of both active range of motion (AROM) and passive range of motion (PROM) of the shoulder (Nath, 2015). Adhesive capsulitis is the most common disease among those musculoskeletal disease (Yang et al., 2007).

Adhesive capsulitis is a common but poorly understood syndrome of painful shoulder stiffness. Frozen shoulder syndrome was first described by Duplay in1872. He used the term peri-arthritis scapulo-humerale and believed that manipulation under anesthesia had a role in its treatment.

In 2009, Captuli used the term frozen shoulder to describe this condition. Adhesive capsulitis a term is an orthopaedic condition that is commonly encountered in general practice. It is characterized by an insidious and progressive loss of active and passive mobility in the glenohumeral joint presumably due to capsular Contracture. He stated that most cases resolved in about two years without treatment.

More recently, Zuckerman and Cuomo defined frozen shoulder or idiopathic adhesive capsulitis, as a condition of uncertain etiology 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., 2010).

Adhesive capsulitis is a common cause of shoulder pain and disability. It is characterized by spontaneous onset of shoulder pain accompanied by progressive limitation of both active and passive glenohumeral movement (Carette et al., 2005).

Adhesive capsulitis (frozen shoulder) 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 stiffness. For this condition, the pain and stiffness can limit the ability to do simple everyday activities like getting dressed, brushing hair or reaching into a cabinet.

Frozen shoulder usually affects patients aged 40-70, with females affected more than males, and no predilection for race. In Bangladesh, Adhesive capsulitis is one of the common disabling disease affecting both elderly male and female (Arshad et al., 2015).

In 6-17% of patients, the other shoulder becomes affected, usually within five years, and after the first has resolved (Nath, 2015). The occurrence of one side frozen shoulder have the chance to the risk of contralateral shoulder involvement by 5% to 34% and simultaneously bilateral shoulder involvement occurs often 14% of the time (Ludewig & Reynolds, 2009).

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.

Frozen shoulder typically lasts 12 to 18 months with a cycle of 3 clinical stages. There are freezing, frozen and thawing stages: Stage I is mainly characterized by pain usually lasting 2–9 months. In Stage II (frozen stage): pain gradually subsides but stiffness is marked lasting4–12 months. In Stage III (thawing phase): pain resolves and improvement in range of motion (ROM) appears (Guler & Kozanoglu, 2005).

Adhesive capsulitis of the shoulder is a common affliction, affecting 2–5% of the general adult population 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).

Statistics by country Adhesive Capsulitis (2005) claimed that in Bangladesh 3 to 5% people were affected by Adhesive Capsulitis .The prevalence of Adhesive Capsulitis is rapidly increasing day by day.

In western countries approximately 7-2% of the population suffers from a painful or stiff shoulder. The annual incidence of the shoulder disorders in general practice is noted between 7-13% in 1000 patients per years and 30% of all patients with new episodes of shoulders pain in Dutch primary care are referred for physiotherapy (Lin et al., 2009).

The most common in the co-morbid condition of diabetes mellitus with an incidence of 10-34% are estimated in the England (Griggs et al., 2010).
According to Center for the Disease Control and Prevention about 13.7 million people in the United States sought medical care in 2003 for shoulder problem (Thomas et al., 2007). The period 1987-1995, the state of Washington (USA) each year accepted over 6000 work disability claims related to shoulder problems (Goyal et al., 2013).

Adhesive capsulitis is a clinical diagnosis made from a history of the gradual onset of severe shoulder pain with the progressive limitation of active and passive glenohumeral movement. The most significant loss of movement is in the external rotation of the joint (Kisner & Colby, 2006).
The condition is widely reported as a disease of middle and is characterized by three phases. A painful phase, lasting between 3 and 8 months is followed by a phase of progressive stiffness or “adhesive phase", typically lasting 4–6 months. Final resolution phase of gradual return of motion usually lasts 5–24 months (Shah & Lewis, 2007).

It is assumed that 3% of people in Europe develop the condition in their lifetime. There is no known racial preference; however, adhesive capsulitis is associated with certain conditions, particularly insulin-dependent diabetes. Some people with frozen shoulder may get better over a period of 18-24 months. In other cases, symptoms can persist for several years. Studies suggest that about 50% of people with frozen shoulder continue to experience symptoms up to seven years after the condition starts. However, with appropriate treatment it is possible to shorten the period of disability (Captuli, 2009).

Many treatments have been employed in the management of shoulder disorders; few have been proven to be effective in randomized controlled trials. 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 can be listed among the most common non-surgical approaches to treatment in adhesive capsulitis. Physical therapy is often the first line of management for Frozen Shoulder (Griggs et al., 2010).

As physiotherapy Intervention the traditional principles of treatment of adhesive capsulitis are to relieve pain, maintain range of motion, and ultimately to restore function. The treatment of adhesive capsulitis by means of physiotherapy all along consists of different modalities (e.g., exercises, electrotherapy or massage) which may be applied side by side. Relief of pain may be achieved by massage, deep heat, ice, ultrasound, TENS (transcutaneous electrical nerve stimulation), and LASER (light amplification by stimulated emission of radiations) as described in our standard text books and other literature concerning the treatment of adhesive capsulitis. However, they probably offer little benefit. Mostly these applications are adjunct to other treatment modalities like mobilization techniques or home exercise program. Although adhesive capsulitis is generally considered to be a self-limiting condition that can be treated with physical therapy, 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 has been recommended.

Grades I and II of Maitland mobilization techniques are primarily used for treating joints limited by pain. Grades III and IV are primarily used as stretching maneuvers. Appropriate selection of mobilization technique for treatment can only take place after a thorough assessment and examination (Arslan & Celiker, 2011).There are many research reports advocating good effects of mobilization with movement techniques. The most reported effect is immediate reduction in pain and improved shoulder function (Arshad et al., 2015).Exercise protocol of rotator cuff and scapular retractors believe to restore the normal kinematics of gleno-humeral and scapulo-thoracic motion that plays an important role on Adhesive capsulitis or such conditions limiting normal shoulder kinesiology (Michener et al., 2008).

1.2 Rationale

The aim of the study was to find out the effectiveness of movement with mobilization exercise for Adhesive capsulitis. Literature shows that, Patients with frozen shoulder exhibit significant deficits in shoulder kinematics, including increased elevation and upward scapular rotation. Jewell and colleagues Pt (2010), suggested in their meta-analysis of physical therapy interventions for frozen shoulder syndrome that joint mobilization and exercise were the most effective interventions. In the field of research in physiotherapy, hasn't encoded any research on effectiveness of movement with mobilization exercise for Adhesive capsulitis. There are some achievements in overall Physiotherapy intervention in Adhesive capsulitis but experts suggests that movement with mobilization exercise is one of the important interventions for this condition.

The purpose of this study is to compare the effectiveness of movement with mobilization exercise with conventional physiotherapy and conventional physiotherapy alone for the patient with Adhesive capsulitis. There were some research articles published about physiotherapy intervention for patient with Adhesive capsulitis, but movement with mobilization exercise for Adhesive capsulitis is not so focused among them. So, in this study "Effectiveness of movement with mobilization exercise in Combination with Conventional Physiotherapy for Adhesive Capsulitis" will give the evidence for effectiveness of movement with mobilization exercise for patient with Adhesive capsulitis. However, research helps to improve the knowledge of health professionals, as well as develops the profession. The results of the study may help to guide physiotherapists to give evidence based treatment in patient with Adhesive capsulitis, which will be beneficial for both the patient with Adhesive Capsulitis and for developing the field of physiotherapy profession.

1.3 Aim

The aim of this study is to find out the Effectiveness movement with mobilization exercise in Combination with Conventional Physiotherapy for Adhesive Capsulitis.

1.4 Objectives

General objective

To identify the effectiveness of Movement with mobilization in Adhesive Capsulitis patient**.**

Specific objective

1. To explore socio-demographic (age, gender, marital status, family type, living area, educational status) characteristics of patients with Adhesive capsulitis.
2. To find out the activity limitation for patients with Adhesive capsulitis.
3. To evaluate severity of pain after introducing Movement with Mobilization for patients with Adhesive capsulitis.
4. To measure Improvement of Range of Movement (ROM) for patients with Adhesive capsulitis.

1.5 Hypothesis

Movement with mobilization with conventional physiotherapy is more effective than conventional physiotherapy alone for the treatment of patient with Adhesive capsulitis ($H_A > H_O$).

1.6 Null hypothesis

Movement with mobilization with conventional physiotherapy is no more effective than conventional physiotherapy alone for the treatment of patient with Adhesive capsulitis ($H_O \neq H_A$).

$$H_0: \mu_1 = \mu_2$$

Where,

H_0 = the null hypothesis,
μ_1 = the mean of population 1 and
μ_2 = the mean of population 2

$H_0: \mu_1 - \mu_2 = 0$, against
$H_0: \mu_1 \neq \mu_2$

1.7 Operational Definition

1.7.1 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. In this study the cases were identified as per diagnosis at BIHS.

1.7.2 Conventional physiotherapy

Physiotherapeutic 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.. Capsular stretching, Accessory movements, pendulum exercise, pulley exercise, Infra-red radiation and Ultrasound were the most commonly used interventions, the frequency of use was 100%, Movement with mobilization and oral NSAID were the second most commonly used interventions and the frequency was 75-99% and corticosteroid injection were the partially used interventions and the frequency of use was 25-49%.

1.7.3 Movement with mobilization exercise

The use of MWM for peripheral joints was developed by Mulligan. This technique combines a sustained application of a manual technique "gliding" force to a joint with concurrent physiologic (osteo-kinematic) motion of the joint, either actively performed by the subject or passively performed by the therapist. The manual force, or mobilization, is theoretically intended to cause repositioning of bone positional faults. The intent of MWM is to restore pain-free motion at joints that have painful limitation of range of movement.

CHAPTER– II LITERATURE REVIEW

Adhesive capsulitis is a condition of uncertain etiology characterized by a progressive loss of both active and passive shoulder motion (Yang et al., 2007). Adhesive capsulitis is characterized by pain, stiffness, and limited function of the glenohumeral joint, which adversely affects the entire upper extremity. Patients typically describe onset of shoulder pain followed by a loss of motion.The most common limitations in range of motion are flexion, abduction, and external rotation. Approximately 70% of frozen shoulder patients are women; however, males with frozen shoulder are at greater risk for longer recovery and greater disability. Although the exact pathophysiologic cause of this pathology remains elusive, there are two types identified in the literature: idiopathic and secondary adhesive capsulitis. Idiopathic ("primary") adhesive capsulitis occurs spontaneously without a specific precipitating event. Primary adhesive capsulitis results from a 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 surgery, or may be associated with another condition such as diabetes, rotator cuff injury, cerebrovascular accident (CVA) or cardiovascular disease, which may prolong recovery and limit outcomes (Kirkley et al., 2005).

In a profile study of 32 patients with adhesive capsulitis, heart disease and diabetes were more prevalent in those suffering from adhesive capsulitis than a control group (McNeely et al., 2005).

In a study, 19% of older diabetic patients had adhesive capsulitis; however, recent estimates place the incidence as high as 71% when patients with pre-diabetes (metabolic syndrome) are included. Both Type I and Type II diabetics are susceptible to frozen shoulder; unfortunately, diabetics have worse functional outcomes as measured by disability and quality of life questionnaires compared to non-diabetics with frozen Shoulder (Laska & Hanning, 2010).Frozen shoulder is also a common complication following stroke, occurring in 25% of patients within 6 months in USA (Riley et al., 2006).

Three stages of frozen shoulder have been described in the literature: painful stage, stiffness or "frozen" stage, and recovery or "thawing" stage, with the average length of symptoms lasting 30 months.The average range of motion in frozen-stage shoulder patients is 98° of abduction, 117° of flexion, 33° external rotation and 18° of internal rotation with the shoulder abducted to 90°. While the "stiffness stage" is the longest of the stages, adhesive capsulitis is thought to be reversible in the acute pain stage. In addition to limited range of motion, shoulder complex muscle imbalances lead to altered shoulder motion. The upper trapezius tends to be more activated than the lower trapezius, creating an imbalance of the scapular stabilizers leading to increased elevation and upward rotation of the scapula during elevation of the glenohumeral joint in both the frontal and sagittal planes. Patients with adhesive capsulitis have higher EMG ratios of upper trapezius to lower trapezius during arm elevation when compared to asymptomatic subjects, indicating a muscular imbalance (Thomas et al., 2007).

The literature reports that adhesive capsulitis progresses through three overlapping clinical phases:
Acute/freezing/painful phase- gradual onset of shoulder pain at rest with sharp pain at extremes of motion, and pain at night with sleep interruption which may last anywhere from 3-9 months. Adhesive/frozen/stiffening phase- Pain starts to subside, progressive loss of glenohumeral motion in capsular pattern. Pain is apparent only at extremes of movement. This phase may occur at around 4 months and last till about 12 months. Resolution/thawing phase-Spontaneous, progressive improvement in functional range of motion which can last anywhere from 1 to 3.5 years (Wirth et al., 2011).

Patients with frozen shoulder exhibit significant deficits in shoulder kinematics, including increased elevation and upward scapular rotation. Eventually, patients with adhesive capsulitis develop the characteristic "shrug sign" during glenohumeral joint elevation, where the scapula migrates upward prior to 60 degrees of abduction.
This indicates compensation due to lack of capsular extensibility as well as a change in the central nervous system motor patterning due to maladaptive movement (Morrison et al., 2005).

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).

The contracture of the 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 capsular and 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 interventions for frozen shoulder syndrome are joint mobilization and exercise. Physical therapy is the most effective interventions. Non-aggressive physical therapy interventions are generally more effective than aggressive or intensive interventions (Roubal et al., 2012). Physical therapy interventions used with patients with frozen shoulder frequently include modalities, manual techniques, and therapeutic exercise. While some of these interventions have been studied in patients with adhesive capsulitis, it is important to remember that not all clinical interventions have evidence to support their use in specific patient populations. Recall that evidence-based practice is best defined as the use of the best evidence available along with clinical experience while taking into consideration the unique needs of an individual patient (Bunker & Anthony, 2005).

The rationale 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., 2006).Because adhesive capsulitis involves fibrotic changes to the capsuloligamentous structures, continuous passive motion or dynamic splinting are thought to help elongate collagen fibers. Continuous passive motion (CPM) was recently compared with conventional PT 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).

Dynamic splinting was also recently evaluated in patients with Stage 2 ("frozen stage") adhesive capsulitis.The experts noted better outcomes when physical therapy was combined with the protocol, although there was no statistically significant difference between standard physical therapy or the Dynasplint alone. The concept of total end-range time (TERT) has also been described in the treatment of patients with adhesive capsulitis, suggesting maintenance of a stretch in the maximally lengthened range of motion for a total of 60 minutes per day (Bunker, 2011). As stated previously, joint mobilization is an effective intervention for adhesive capsulitis. Several studies have demonstrated the effectiveness of joint mobilization in adhesive capsulitis patients.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., 2006).

Chang (2008), randomly assigned 20 consecutive adhesive capsulitis patients to physical therapy interventions including 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. In addition, high-grade joint mobilization techniques were more effective than low-grade mobilization in improving glenohumeral mobility and reducing disability in a recent randomized controlled trial of treatment of patients with adhesive capsulitis (Sattar & Luqman, 2007).

Myofascial trigger points, focal areas of increased tension within a muscle, may be present in the musculature around the shoulder complex in patients with adhesive capsulitis. In Travel and Simons' classic textbook, the authors describe how the subscapularis muscle in particular is referred to as the “Frozen Shoulder” muscle because trigger points in the subscapularis cause limitations in shoulder elevation and external rotation. The Spray and Stretch technique for the subscapularis and latissimusdorsi muscle may be effective at reducing trigger point irritation, pain, and helping to gradually lengthen tight muscles (Critchley et al., 2005).

Soft tissue mobilization and deep friction massage may benefit adhesive capsulitis patients. Deep friction massage using the Cyriax method was shown to be superior to superficial heat and diathermy in treatment of patients with adhesive capsulitis (McNeely et al., 2008).
Recently, instrument-assisted soft tissue mobilization (IASTM) as used in such interventions as Graston Technique, ASTYM, or guasha has become increasingly popular in physical therapy practice. IASTM reportedly provides strong afferent stimulation and reorganization of collagen, as well as in increase in microcirculation. The inferior glenohumeral capsule and pectoral fascia are often restricted, as well as the insertion of the latissimusdorsi and subscapularis. IASTM may help improve fibroblast proliferation and promote normal collagen alignment,although no studies have evaluated outcomes of the use of IASTM on patients with adhesive capsulitis (Bulgen et al., 2006).

Probably 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, 2009).

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).

Resistive exercises typically include strengthening of the scapular stabilizers and rotator cuff, when range of motion has progressed enough for strengthening to be an appropriate intervention. Muscles prone to weakness in a variety of shoulder dysfunctions include the lower trapezius, serratus anterior, and infraspinatus. Patients with adhesive capsulitis have significantly weaker lower trapezius muscles compared to asymptomatic controls. It is important that treating therapists facilitate normal movement patterns rather than allowing pathological adaptive patterns to prevail during movement for the sake of completing an exercise (Jobe, 2012).

If a patient demonstrates a „shrug sign" while performing resisted abduction, the exercise should be stopped and modified with less resistance or be attempted in an altered position, while cuing of the patient for proper movement patterns. The "Shoulder Sling" exercise can be used to help re-train the initial setting phase of the rotator cuff when initiating abduction. The Shoulder Sling exercise for a "rotator cuff set" is considered analogous to a "quad set" exercise in the lower extremity. The elastic band creates an "upward and inward" vector of resistance that the patient must push against in a "down and out" vector.This movement simulates the initiation of abduction as well as the depression and stabilization functions of the rotator cuff, which occur prior to and during abduction. Anecdotally, this exercise helps reduce early activation of the upper trapezius during abduction in patients demonstrating a shrug sign (Andersen et al., 2005).

Although no studies have been published on the efficacy of taping (such as rigid strapping tape or kinesiological taping [KT]) with patients who have adhesive capsulitis, taping may be helpful in reducing pain and providing tactile cues through proprioceptive and afferent mechanisms. The mechanisms and efficacy of taping applications remain unclear. Because adhesive capsulitis patients often exhibit poor posture and scapular mechanics, KT may provide postural cues and assist with promoting proper scapular motion (Hazleman, 2009).

Non-operative treatment may also include injections directly into the glenohumeral joint joint. These injections often 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).
In their systematic review, Blanchard et al. suggested that 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.They 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., 2014).

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 (Pt, 2010).

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 abd 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 (Pt, 2010).

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
- Sidelying dumbells IR, ER 3 sets of 10 - 12 (1 - 2 lbs) (Pt, 2010).

CHAPTER – III METHODOLOGY

3.1 Study design

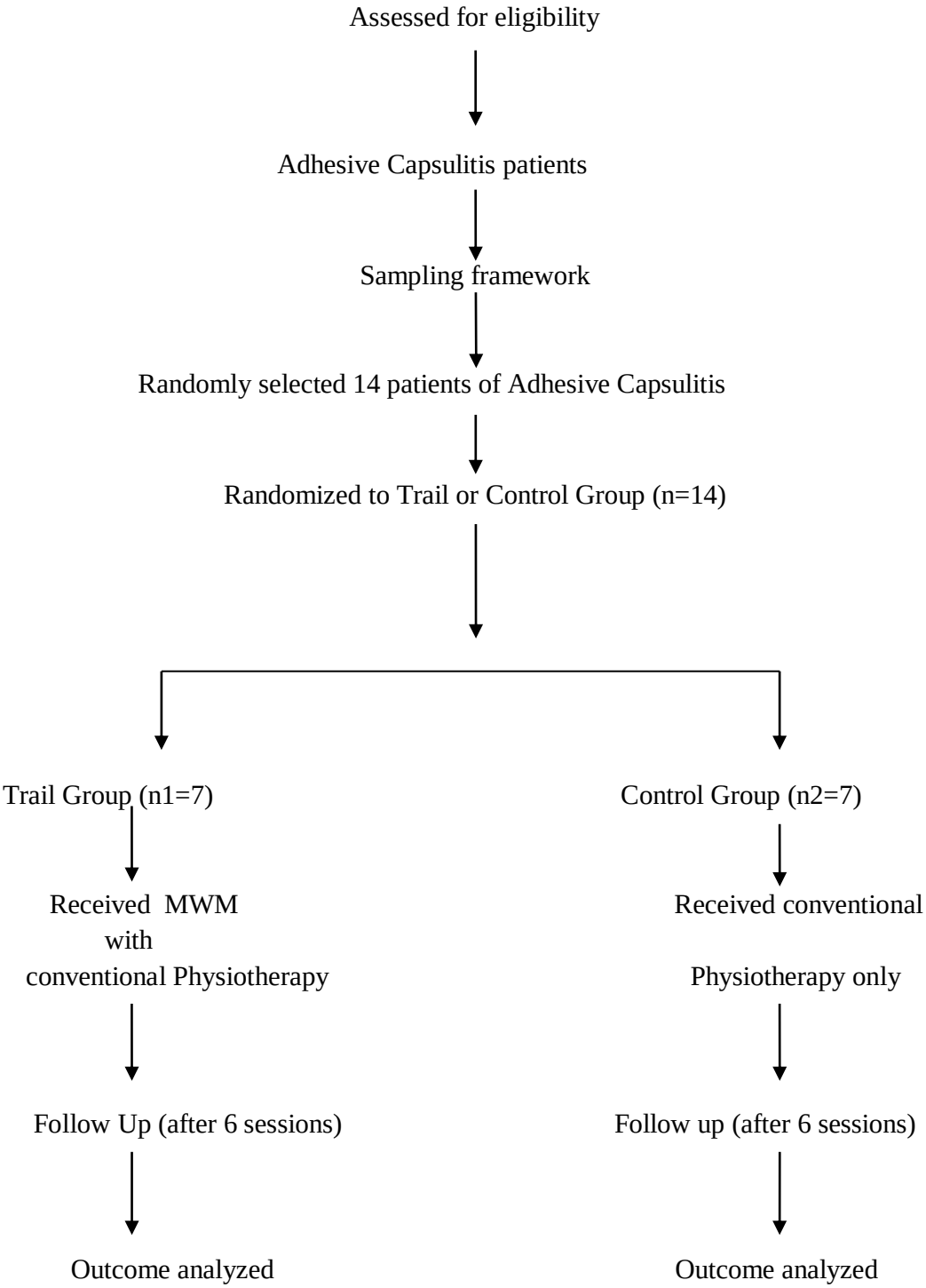
The study was designed using an experimental design quantitative research. According to DePoy & Gitlin (2013) the design could be shown by:

Experimental Group	:	R	O_1	X	O_2
Control Group	:	R	O_1		O_2

The study is an experimental between two subject designs. Conventional physiotherapy with movement with mobilization will be applied to the experimental group and Conventional physiotherapy only will be applied to the control group.

A pre-test (before intervention) and post-test (after intervention) will be administered with each subject of both groups to compare the pain effects and ROM before and after the treatment.

Flowchart of the phases of randomized controlled trial



A flowchart for a randomized controlled trial of a treatment program including conventional physiotherapy with movement with mobilization for patient Adhesive Capsulitis.

3.2 Study site

Outdoor Physiotherapy, Musculoskeletal Unit-2, Department of Physiotherapy, CRP, Savar, Dhaka- 1343.

3.3 Study Population

A population refers to the entire group of people with adhesive capsulitis that meet the criteria set by the researcher. The populations of this study were the Adhesive capsulitis Patients.

3.4 Study duration

4 months (May to August)

3.5 Sample selection

Subjects, who met the inclusion criteria, were taken as sample in this study. Fourteen patients with Adhesive capsulitis were selected from outdoor musculoskeletal physiotherapy department of CRP (Savar) and then 7 patients with Adhesive Capsulitis were randomly assigned to MWM with conventional physiotherapy group and 7 patients to the only conventional physiotherapy group for this simple randomize control trial 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 C1, C2, C3 etc for the control and E1, E2, E3 etc for experimental group. Total 14 samples included in this study, among them 7 patients were selected for the experimental group (received MWM with conventional physiotherapy) and rest 7 patients were selected for control group (conventional physiotherapy only).

3.6 Inclusion criteria

Age between 30 to 70 years

Male and female both are included.

Unilateral Adhesive capsulitis &greater than 50% loss of passive movement.

Subject who having decrease shoulder function.

Clearly diagnosis from qualified physiotherapist.

Included those who showed willingness to participants.

3.7 Exclusion criteria

Age less than 30 years and more than 70 years

Subject who are not willing to participate.

Other condition involving shoulder such as rheumatoid arthritis, osteoarthritis, osteoporosis or malignancy

Those who will not fulfill the criteria will be excluded.

Other disability with musculoskeletal complain.

Surgery to the shoulder.

3.8 Sample Size

Sample size was 14 participants. 7 participants was in experimental group and 7 participants in control group.

3.9 Method of data collection

3.9.1 Data Collection Tools

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

3.9.2 Questionnaire

The questionnaire was developed under the advice and permission of the supervisor following certain guidelines. There were eight close ended questions with visual analogue scale (VAS) with some objective questions which were measured by examiner and each question was formulated to find out the change of pain with each activity.

Social demographic criteria included age, gender, marital status, family type, living area, education. Positional criteria included resting pain, pain during abduction, pain during lateral rotation, pain during medial rotation, pain during sleep. Movement criteria included passive abduction, passive lateral rotation, passive medial rotation.

3.10 Measurement tool

3.10.1 Visual Analogue Scale (VAS)-In this study researcher used visual analogue scale for measuring the intensity of pain. The VAS is a simple and accurate way of subjectively assessing pain along a continuous visual spectrum. VAS 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 and 10 representing the worst pain ever experienced. According to Myles (1999), the visual analog scale (VAS) is a tool widely used to measure pain and a change in the visual analog scale score represents a relative change in the magnitude of pain sensation.

3.10.2 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.

3.11 Data collection procedure

The study procedure was conducted through assessing the patient, initial recording, treatment and final recording. After screening the patient at department, the patients were assessed by qualified physiotherapist. Six sessions of treatment was provided for every subject. Fourteen subjects were chosen for data collection according to the inclusion criteria. The researcher divide all participants into two groups and coded C1 (7) for control group and E1 (7) for experimental group. Experimental group received conventional physiotherapy with MWM and control group received only conventional physiotherapy.

Data was gathered through a pre-test, intervention and post-test and the data was 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 VAS score and degrees on questionnaire form. The same procedure was performed to take post-test at the end of six session of treatment. Researcher 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 VAS according to their intensity of pain.

The researcher collected the data both in experimental and control group in front of the qualified physiotherapist in order to reduce the biasness. At the end of the study, specific test was performed for statistical analysis.

3.12 Intervention

A common intervention program was executed for both groups as conventional physiotherapy, it includes- .

- Capsular stretching
- Accessory movements
- Soft tissue mobilization
- Pendulum exercise
- pulley exercise
- Infra-red radiation
- Ultrasound

which are the most frequently, used interventions. In this study, the experimental group was treated with MWM with conventional physiotherapy. Clinical physiotherapist applied the MWM and the conventional physiotherapies. Each group got 6 sessions of treatment. There is no evidence of exact repetition for MWM, but in practice expert opinion suggests that 6 sessions is minimal enough for patients with adhesive Capsulitis to get more effectiveness.

3.13 Data analysis

Statistical analysis was performed by using Microsoft Excel 2013 and Scientific Calculator.

3.14 Statistical Test

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 code according to group to maintain participant's confidentiality. All subjects of both experimental and control group score their pain intensity on visual analogue scale before starting treatment and after completing treatment. Reduction of pain intensity for both groups and improvement of ROM of different movements of shoulder are 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 and had unmatched groups of different subjects, who was randomly assigned to conventional physiotherapy with MWM and only conventional physiotherapy group and the measurement of the outcome came from ROM by Gonoiometer, 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

$\overline{x}_1$ = mean of scores from trial group.

$\overline{x}_2$ = mean of scores from control group.

$(x_1)^2$= the square of the each individual score from trial 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 trial 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

Analysis of Resting Pain Reduction

Subject	X_1	X_1^2	Subject	X_2	X_2^2
C1	3	9	E1	1	1
C2	4	16	E2	2	4
C3	2	4	E3	4	16
C4	3	9	E4	3	9
C5	3	9	E5	1	1
C6	2	4	E6	1	1
C7	3	9	E7	1	1
	$\sum X_1$ = 20	$\sum X_1^2$ = 60		$\sum X_2$ = 13	$\sum X_2^2$ = 33

$(\sum X_1)^2$ = 400

$(\sum X_2)^2$ = 169

n_1 = 7

n_2 = 7

$\bar{x}_1 = \frac{20}{7}$ = 2.857

$\bar{x}_2 = \frac{13}{7}$ = 1.857

Calculating the degree of freedom from the formula-

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

Now according to *t* formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{2.857 - 1.857}{\sqrt{\frac{\left(60 - \frac{400}{7}\right) + \left(33 - \frac{169}{7}\right)}{12}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}}$$

$$t = \frac{1}{\sqrt{\frac{2.857 + 8.857}{12}} \times \sqrt{0.286}}$$

$$t = \frac{1}{\sqrt{0.976} \times 0.535}$$

$$t = \frac{1}{0.988 \times 0.535}$$

$$t = \frac{1}{0.529}$$

$$t = 1.890$$

In same way pain variable in different position, t value has been calculated as below

Variables	df	Level of Significance for one-tailed test at probability of 0.05		*t* value	probability level	Comments
Resting Pain	12	1.782	2.179	1.89	$p < 0.05$	Significant
Pain during Abduction	11	1.796	2.201	1.812	$p< 0.05$	Significant
Pain during Lateral Rotation	12	1.782	2.179	1.869	*p < 0.05*	Significant
Pain during Medial Rotation	12	1.782	2.179	1.683	*p < 0.05*	Not significant
Pain during sleep	12	1.782	2.179	2.610	*p < 0.05*	Not significant

Table 1- Pain variables in different position and t value

Range of Movement in Passive Abduction- MWM with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in passive Abduction were differences between pre-test and post-test pain scores.

Conventional physiotherapy with MWM exercise group			**Only Conventional physiotherapy group**		
Subjects	ROM in Passive Abduction (X_1)	X_1^2	Subjects	ROM in passive Abduction (X_2)	X_2^2
E_1	20	400	C_1	10	100
E_2	10	100	C_2	10	100
E_3	10	100	C_3	10	100
E4	20	400	C4	10	100
E_5	20	400	C_5	0	0
E_6	15	225	C_6	10	100
E_7	15	225	C_7	20	400
	$\sum X_1$ =110	$\sum X_1^2$=1850		$\sum X_2$= 70	$\sum X_2^2$= 900

$\bar{X}_1$= 15.72

$\sum X_1^2$= 1850

$(\sum X_1)^2$= 12100

n_1=7

$\bar{X}_2$= 10.0

$\sum X_2^2$=900

$(\sum X_2)^2$= 4900

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-

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

$$t = \frac{15.72 - 10.0}{\left[\sqrt{\frac{1850 - \frac{12100}{7} + 900 - \frac{4900}{7}}{(7-1)+(7-1)}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}\right]}$$

t= 2.06

In same way ROM variables in different movement, t value has been calculated as below

Variables	df	Level of Significance for one-tailed test at probability of 0.05		*t* value	Probability level	Comments
ROM in passive Abduction	12	1.782	2.179	2.06	$p < 0.05$	Significant
ROM in passive Lateral Rotation	12	1.782	2.179	1.14	$p< 0.05$	Not significant
ROM in passive Medial Rotation	12	1.782	2.179	1.14	$p < 0.05$	Not significant

Table 2- ROM variables in different movement and t value

3.15 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.

3.16 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 patient's age, history of taking recent physiotherapy intervention, oral NSAID, steroid injection or other treatment which could influence the result of the study. Researcher found no significant difference between the mean age of two groups and the mean age of control group was 45years and mean age of trial group was 48 years, so there was no effect of age which can influence the result. To control the confounding variables, researcher set the inclusion criteria as to include only those subjects who have no history of taking recent physiotherapy intervention, oral NSAID, steroid injection or other treatment.

3.17 Ethical consideration

The whole process of this research project was done by following the Bangladesh Medical Research Council (BMRC) guidelines, Institution Review Board (IRB) and World Health Organization (WHO) Research guidelines. The proposal of the dissertation including methodology was approved by Institutional Review Board and obtained permission from the concerned authority of ethical committee of Bangladesh Health Professions Institute (BHPI). Again before the beginning of the data collection, the researcher obtained the permission ensuring the safety of the participants from the concerned authorities of the clinical setting and was allotted with a witness from the authority for the verification of the collected data. The researcher strictly maintained the confidentiality regarding participant's condition and treatment.

CHAPTER – IV RESULTS

Mean Age of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them Experimental group mean age 45 years and control group mean age 39 years.

Experimental Group Subjects	Age (Years)	Control Group Subjects	Age (Years)
E1	30	C1	32
E2	50	C2	50
E3	60	C3	45
E4	45	C4	30
E5	45	C5	30
E6	50	C6	40
E7	40	C7	50
Mean Age	45 years	Mean Age	39 years

Table 3-Mean Age of Participants

Age Range

The majority of the participants 50% (n=7) were in “41-50” years of age followed by 21% (n=3) were in “31-40” years, 22% (n=3) were in “21-30”years and 7% (n=1) were in “51-60” years of age range group.

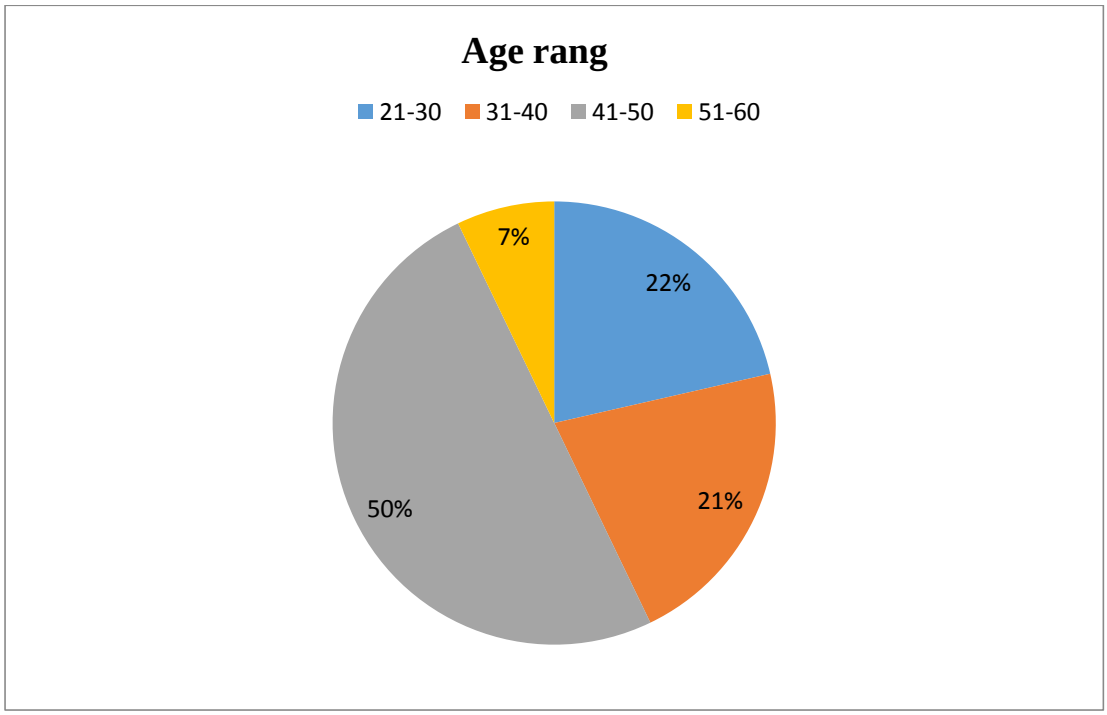
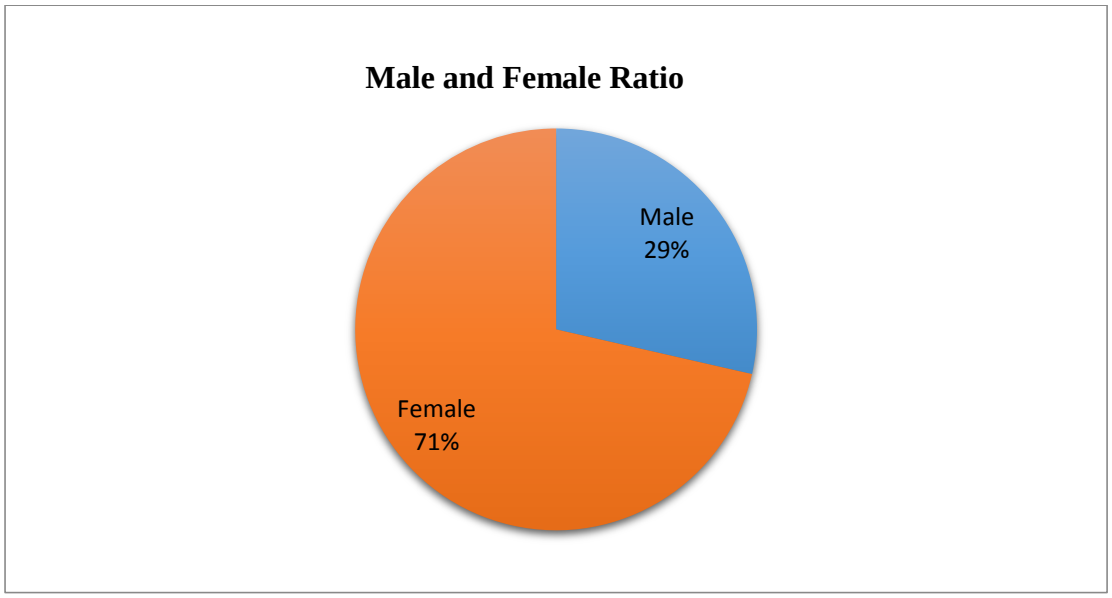


Figure 1- Age Range

Sex of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them almost 29% (n=4) were male and about 71% (n=10) were female. On the other hand, In Experimental Group 21% (n=3) were Male and 29% (n=4) were Female and in Control Group 7% (n=1) were Male and 43% (n=6) were Female.



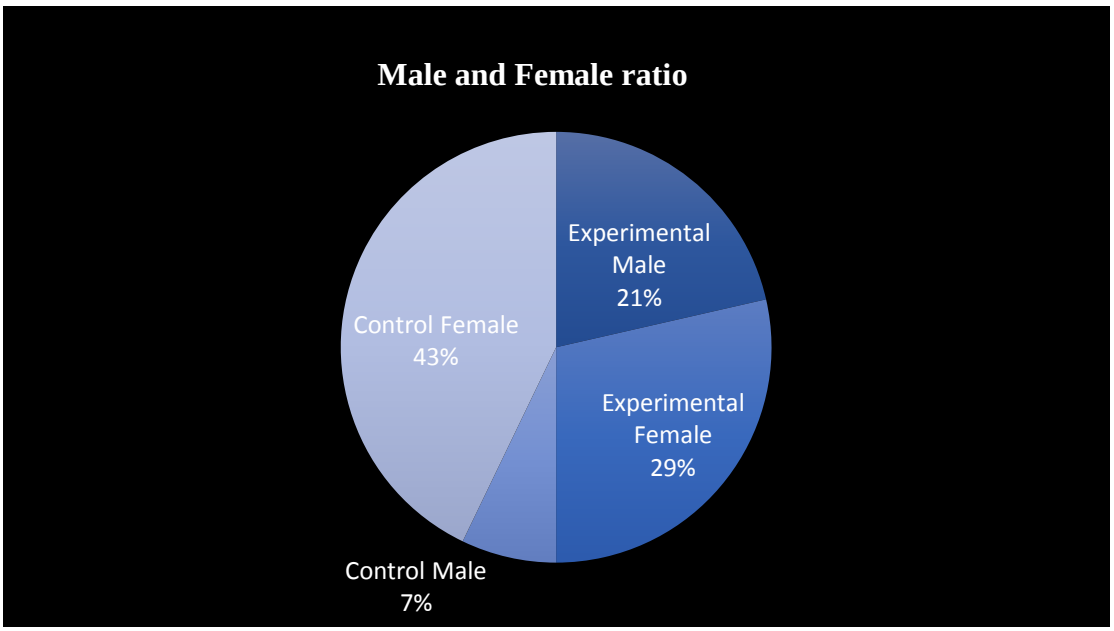
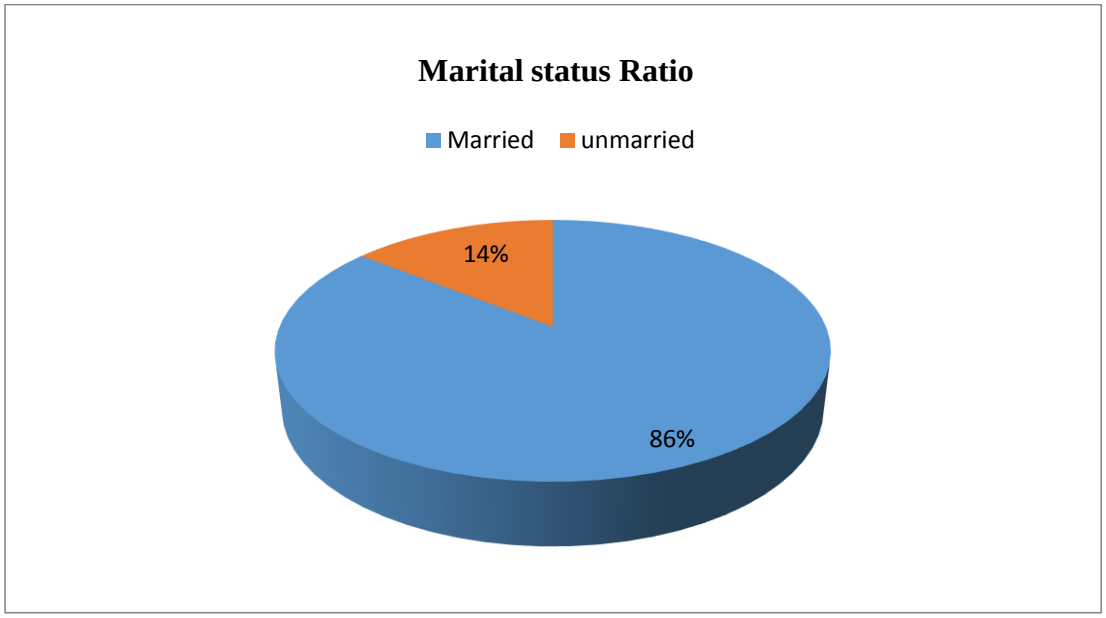


Figure 2- Gender Distribution

Marital status of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them almost 14 % (n=2) were unmarried, about 86 % (n=12) were married. On the other hand, In Experimental Group 7% (n=1) were unmarried and 43% (n=6) were married and in Control Group 7% (n=1) were unmarried and 43% (n=6) were married.



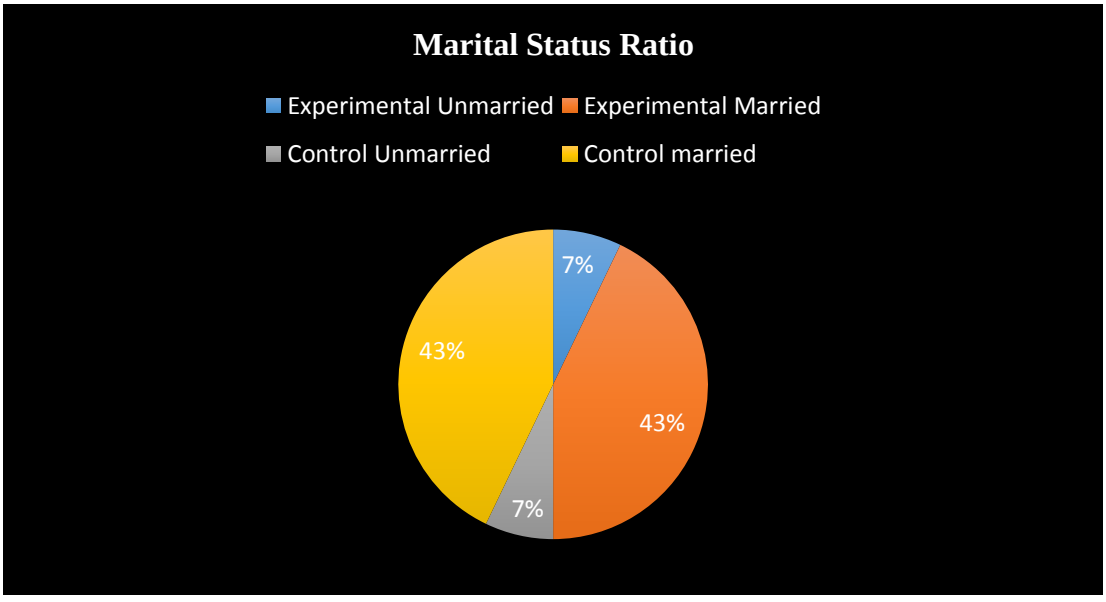
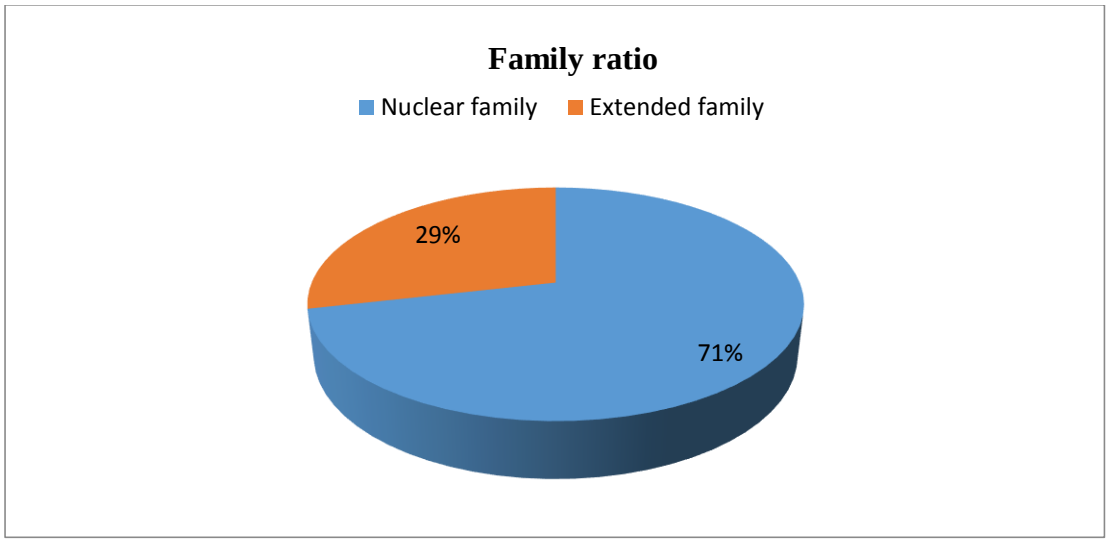


Figure 3- Marital status Distribution

Family type of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them almost 71% (n=10) were nuclear family, about29 % (n=4) were extended family. On the other hand, In Experimental Group 14% (n=2) were extended family and 36% (n=5) were nuclear family and in Control Group 14% (n=2) were extended family and 36% (n=5) were nuclear family.



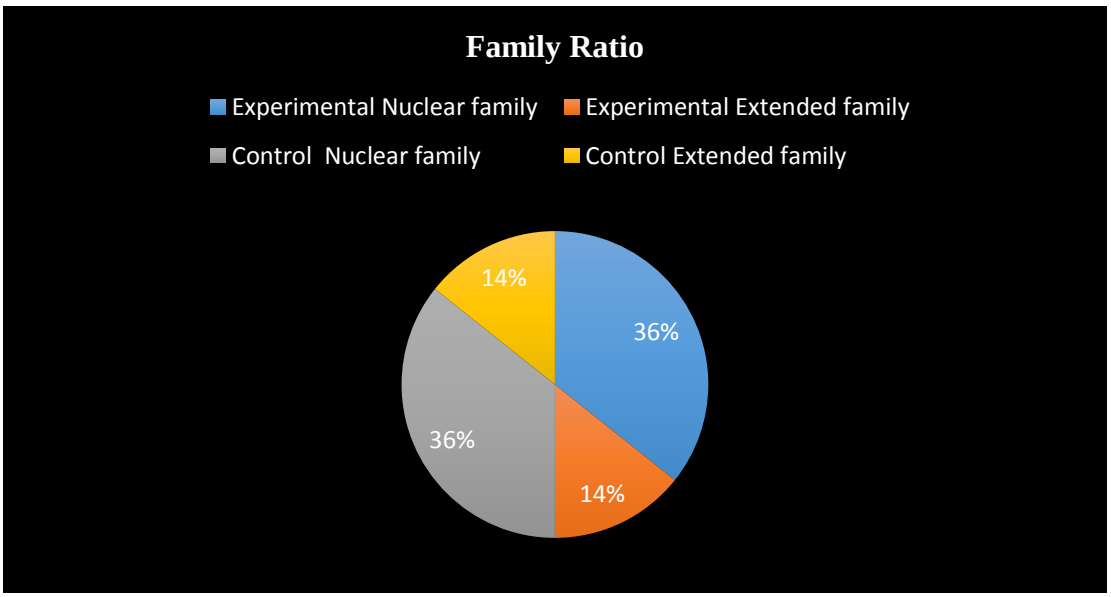
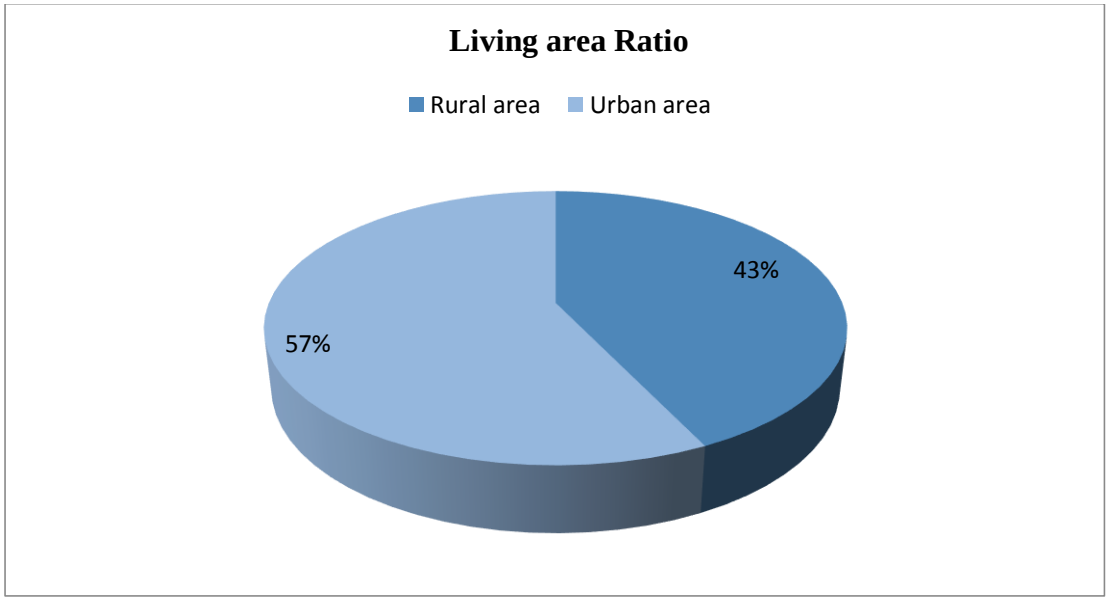


Figure 4- Family Distribution

Living area of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them almost 43% (n=6) were rural area, about 57 % (n=8) were urban area. On the other hand, In Experimental Group 29% (n=4) were rural area and 21% (n=3) were urban area and in Control Group 14% (n=2) were rural area and 36% (n=5) were urban area.



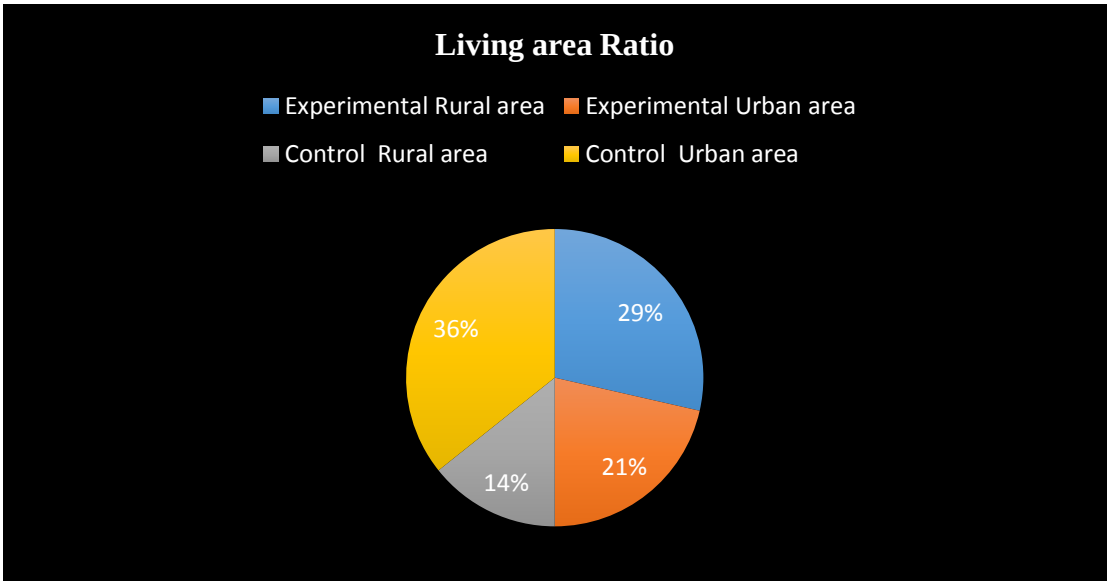
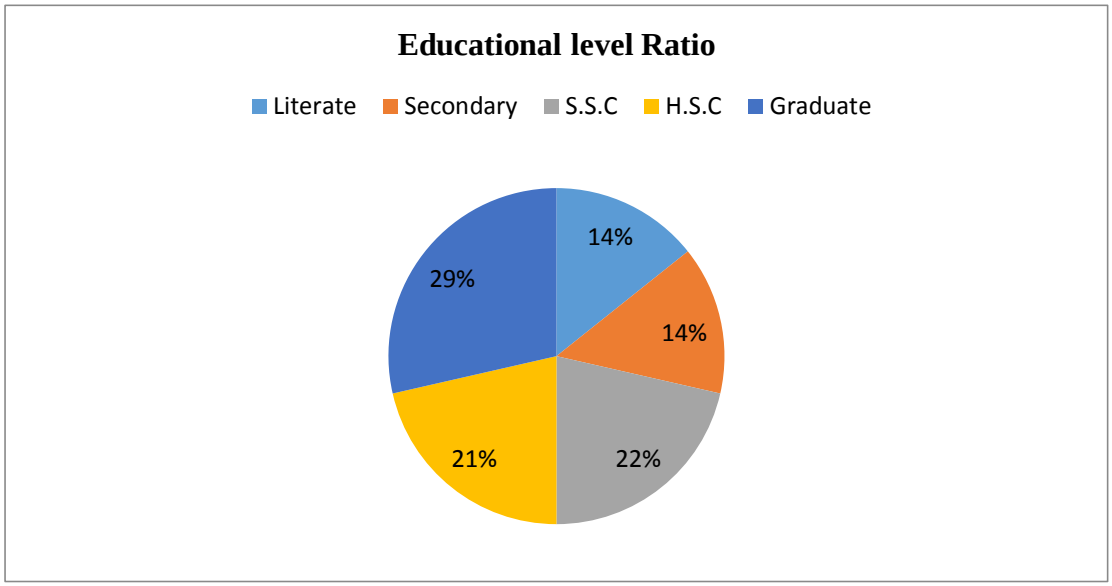


Figure 5- Living area Distribution

Educational level of the Participants

14 Patients with adhesive Capsulitis were included as sample of the study, among them almost 14% (n=2) were literate, about 14 % (n=2) were Secondary, about 22% (n=3) were S.S.C ,about 21% (n=3) were H.S.C. and about 29%(n=4) were Graduate.



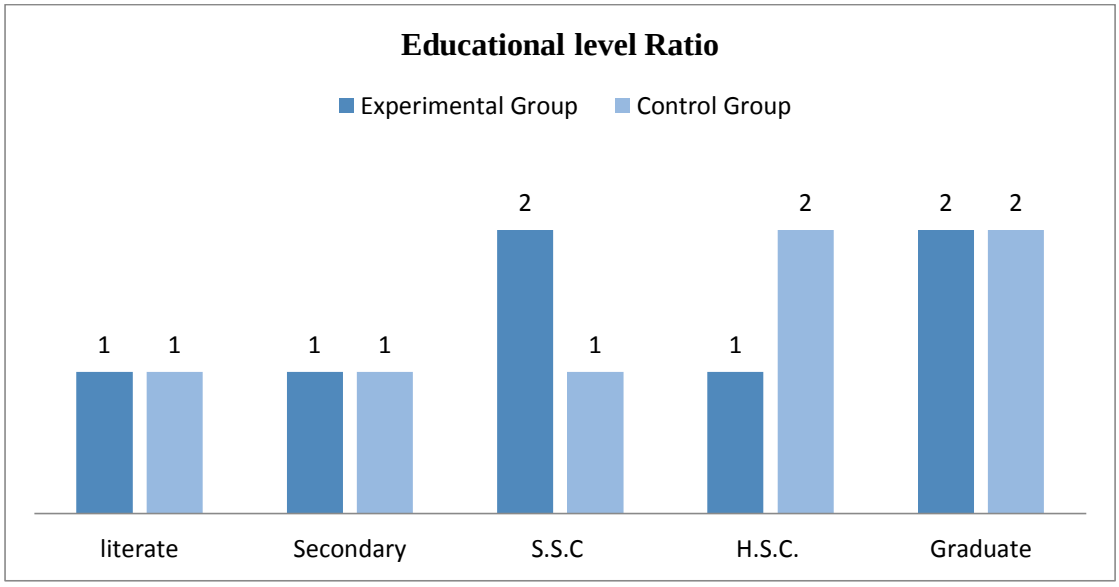


Figure 6- Educational level Distribution

Results of Pain in different position

Resting pain

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of reduction of pain intensity in resting between control and experimental group was 1.43.Using unrelated "t" test on the data of resting pain($t=1.89$, $df=12$) and p value is < 0.05, the result was found to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed significant improvement in case of resting pain.

Pain during Abduction (raising hand sideways)

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of reduction of pain intensity during abduction between control and experimental group was 1.52.Using unrelated "t" test on the data of pain during abduction ($t=1.812$, $df=11$) and p value is < 0.05, the result was found to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed significant improvement in case of pain during abduction.

Pain during Lateral Rotation (Combing hair)

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of reduction of pain intensity during lateral rotation between control and experimental group was 1.15. Using unrelated "t" test on the data of pain during lateral rotation ($t=1.869$, $df=12$) and p value is < 0.05, the result was found to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed significant improvement in case of pain during lateral rotation.

Pain during Medial Rotation (Scratching lower back)

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of reduction of pain intensity during medial rotation between control and experimental group was 1.43. Using unrelated "t" test on the data of pain during medial rotation (t=1.683, df=12) and p value is < 0.05, the result was found not to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed no significant improvement in case of pain during medial rotation.

Pain during sleeping in affected side

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of reduction of pain intensity during sleeping between control and experimental group was 1.35. Using unrelated "t" test on the data of pain during sleeping (t=2.610, df=12) and p value is < 0.05, the result was found not to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed no significant improvement in case of pain during sleeping.

Results of ROM in different movement

ROM in passive Abduction

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of ROM in passive abduction between control and experimental group was 5.72. Using unrelated "t" test on the data of ROM in passive abduction (t=2.06, df=12) and p value is < 0.05, the result was found to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed significant improvement in case of ROM in passive abduction.

ROM in passive Lateral Rotation

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of ROM in passive lateral rotation between control and experimental group was 1.43. Using unrelated "t" test on the data of ROM in passive lateral rotation (t=1.14, df=12) and p value is < 0.05, the result was found not to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed no significant improvement in case of ROM in passive lateral rotation.

ROM in passive Medial Rotation

14 patients were enrolled and 7 patients among them were control group and 7 patients among them were experimental group. Mean difference of ROM in passive medial rotation between control and experimental group was 1.43. Using unrelated "t" test on the data of ROM in passive medial rotation (t=1.14, df=12) and p value is < 0.05, the result was found not to be significant for one tailed hypothesis. So this result suggests that following application of treatment the experimental group showed no significant improvement in case of ROM in passive medial rotation.

CHAPTER – V DISCUSSION

The purpose of the study was to evaluate the effectiveness of movement with mobilization exercises with conventional physiotherapy compare to only conventional physiotherapy for Adhesive capsulitis.

The experimental design employed in this study is mainly suitable for a comprehensive investigation of the management of participating subjects (Kumar, 2010). 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 movement with 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 in the physiotherapy outdoor department of CRP Savar in order to demonstrate the improvement. The outcome was measured by using visual analogue scale for pain intensity in different functional position, and goniometer for measuring ROM.

In this study, the mean age of the participants was 45 years in Experimental group and 39 years in Control group. Among them almost 29% (n=4) were male and about 71% (n=10) were female. Frozen shoulder usually affects patients aged 30-70, with females affected more than males, and no predilection for race (Arshad et al., 2015).

The mean difference of pain reduction from both experimental and control group shows that the study was effective in reducing pain intensity and proves clinically significant. The researcher found significant improvement of pain. In Experimental group, Mean difference of reduction of resting pain was 5.17 which were 1.43 more than Mean difference in control group. Also there was significant improvement of pain in Abduction, Lateral rotation; medial rotation and pain during lying in affected side, as the mean difference were consecutively 1.52, 1.15, 1.43, and 1.35 more than control group.

The analysis of significance was carried out by using unrelated *t* test to compare the effectiveness of movement with mobilization with conventional physiotherapy compare to only conventional physiotherapy for Adhesive capsulitis.

By using an unrelated *t* test on the data the results were found to be significant in case of resting pain (p <0.05), pain during abduction (p <0.05), pain during lateral rotation (p <0.05) but not statistically significant in case of pain during medial rotation (p <0.05), pain during sleeping in affected side (p <0.05).
Researcher also found significant Improvement of ROM in case of Abduction (p<.05). A small but not statistically significant improvement has been found in Medial rotation and lateral rotation of Shoulder.

A quasi experimental study showed that among the 100 participants, control group was received conventional physiotherapy and experimental group was received MWM for 2 months to improve range of motion that result concluded that in trail group, significant Improvement of ROM in case of Abduction (p<.05) and Medial rotation (p<.05) but improvement of lateral rotation was same in control group (Arshad et al., 2015).

Shrivastava et al. (2011) showed that his study, statistically significant in Movement With Mobilization group and conventional physiotherapy group separately. The Mean percentage improved of pain for conventional physiotherapy with MWM group from 5.85% to 3.6% in two weeks and p value <0.05.This study also found significant Improvement of ROM in case of Abduction (p<.05), lateral rotation (p<.05), and not statistically significant Medial rotation (p<.05).

In this Research, Researcher found improvement of ROM in both conventional physiotherapy and movement with mobilization group. But the comparison of both improvements shows that, shoulder abduction had significant improvement in movement with mobilization group than conventional physiotherapy group. Lateral rotation and medial rotation has shown almost same improvement rate.

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. It is limited by the fact daily activities of the subject were not monitored which could have influenced. Researcher only explored the effect of MWM after 6 weeks, so the long term effect of MWM was not explored in this study.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 – VI CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The result of this experimental study have find out the effectiveness of conventional physiotherapy with MWM are better treatment than the conventional physiotherapy alone for reducing pain and disability in Adhesive Capsulitis patient. Participants in the conventional physiotherapy with MWM group showed a greater benefit than those in the only conventional physiotherapy group, which indicate that the conventional physiotherapy with MWM can be an effective therapeutic approach for patient with Adhesive capsulitis. From this research the researcher wishes to explore the effectiveness of MWM 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. Adhesive Capsulitis is a global gleno-humeral disease that just not affects a specific joint but the entire complex. The manifestations are not only pain but also limitation in movements and restriction to activities of daily living. From this research, researcher also concluded the specific variables and comparison of their improvement rates. This will aid the professionals to decide the specific evidence based protocol for applying interventions in Adhesive capsulitis.

6.2 Recommendation

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

Double blinding procedure.

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.

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APPENDIX 1: CONSENT FORM (English)

Verbal Consent Statement

(Please read out to the participants)

Assalamualaikum/Namasker,

My name is Tandra saha, I am conducting this study as a part of my academic work of B. Sc. in Physiotherapy under Bangladesh Health Professions Institute (BHPI), which is affiliated to University of Dhaka. My study title is "Effectiveness of Movement with Mobilization to improve range of motion among Adhesive capsulitis patient attended at CRP". I would like to know about some personal and other related information regarding Adhesive capsulitis. You will need to answer some questions which are mentioned in this form. It will take approximately 20-25 minutes.

I would like to inform you that this is a purely academic study and will not be used for any other purpose. All information provided by you will keep in a locker as confidential and in the event of any report or publication it will be ensured that the source of information remains anonymous and also all information will be destroyed after completion of the study.

Your participation in this study is voluntary and you may withdraw yourself at any time during this study without any negative consequences. You also have the right not to answer a particular question that you don't like or do not want to answer during interview.

If you have any query about the study or your right as a participant, you may contact with me and/or Mohammad Anwar Hossain, Associate Professor of Physiotherapy, Bangladesh Health Professions Institute (BHPI), Savar, Dhaka.

Do you have any questions before I start? Yes / No

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

Yes ☐

No ☐

Signature of the Participant _____

Signature of the Interviewer _____

মৌখিক অনুমতিপত্র/সম্মতিপত্র

(অংশগ্রহনকারী কে পড়ে শোনাতে হবে)

আসসালামুআলাইকুম/ নমস্কার,
আমার নাম তন্দ্রা সাহা,আমি এই গবেষণা প্রকল্পটি বাংলাদেশ হেলথ্ প্রফেশনস ইনষ্টিটিউট (বিএইচপিআই)-এ পরিচালনা করছি যা আমার ৪র্থ বর্ষ বি এসসি ইন ফিজিওথেরাপী কোর্সের অধিভুক্ত। আমার গবেষণার শিরোনাম হল- **"এডহেসিব ক্যাপসুলাটিস এর কাধের অস্তি সন্ধি মোভমেন্ড এর সাথে মোভিলাইজেসন এর কার্যকরীতা"**। আমি এক্ষেত্রে আপনাকে কিছু ব্যক্তিগত এবং আনুষঙ্গিক প্রশ্ন এডহেসিব ক্যাপসুলাটিস সম্পর্কে করতে চাচ্ছি। এতে আনুমানিক ২০-৩০ মিনিট সময় নিবো।

আমি আপনাকে অনুগত করছি যে, এটা আমার অধ্যয়নের অংশ এবং যা অন্য কোন উদ্দেশ্যে ব্যবহৃত হবে না। আপনি যে সব তথ্য প্রদান করবেন তার গোপনীয়তা বজায় থাকবে এবং আপনার প্রতিবেদনের ঘটনাপ্রবাহে এটা নিশ্চিত করা হবে যে এই তথ্যের উৎস অপ্রকাশিত থাকবে।

এই অধ্যয়নে আপনার অংশগ্রহণ স্বেচ্ছা প্রণোদীত এবং আপনি যে কোন সময় এই অধ্যয়ন থেকে কোন নেতি বাচক ফলাফল ছাড়াই নিজেকে প্রত্যাহার করতে পারবেন। এছাড়াও কোন নির্দিষ্ট প্রশ্ন অপছন্দ হলে উত্তর না দেয়ার এবং সাক্ষাৎকারের সময় কোন উত্তর না দিতে চাওয়ার অধিকারও আপনার আছে।

এই অধ্যয়নে অংশগ্রহণকারী হিসেবে যদি আপনার কোন প্রশ্ন থাকে তাহলে আপনি আমাকে অথবা/এবং মোঃ আনোয়ার হোসেন ,সহযোগী অধ্যাপক, ফিজিওথেরাপি বিভাগ, সি আর পি, সাভার, ঢাকা-১৩৪৩-তে যোগাযোগ করতে পারেন।
সাক্ষাৎকার শুরু করার আগে আপনার কি কোন প্রশ্ন আছে?
আমি আপনার অনুমতি নিয়ে এই সাক্ষাৎকার শুরু করতে যাচ্ছি।

হ্যাঁ ☐

না ☐

১। অংশগ্রহনকারীর সাক্ষর.....

২। সাক্ষাৎগ্রহনকারীর সাক্ষর.....

APPENDIX II: Questioner (English)

Questioner (English)

Code no :

This questionnaire is developed for the patient with Adhesive Capsulitis.

Personal details

Name of participant:

Address:

Village/house no……..

Post office……

Thana……

District…….

Contact number/mobile number:

Date of interview: DD/MM/YY……

Code no:

This questionnaire is developed for the patient with adhesive capsulitis.

1. Socio demographic information:

1.1. Age……..years

1.2. Sex:

1= male 2= female

1.3. Occupation :

1= Farmer 2= Day laborer 3= Service holder

4= Garments/ Factory worker 5= Driver 6= Rickshaw puller

7= Businessman 8= Unemployed 9= Housewife 10= Teacher 11= Student

11= Other (Specify)……..

1.4.Monthly family income:……..taka

1.5. Marital status:

1= Married 2= Unmarried 3 = Widow

4 = Divorce 5= Single

1.6.Family type:

1= Nuclear family 2= Extended family

1.7.Living area:

1= Rural 2= Urban

1.8.Educational level:

1 = Illiterate 2=literate 3= Primary 4=Secondary

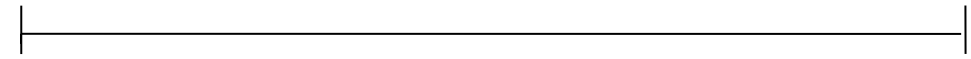
5 = S.S.C 6=H.S.C. 7= Graduate 8= Post Graduate

This questionnaire is designed for Adhesive Capsulitis patients. There are some questions (QN 1- QN 10) and with each question there is a long line. The line represents pain situation. The left hand end represents no pain and right hand end represents severe pain. Please a mark on the line where you feel it shows how much pain you have. The Answer of other questions(QN 11- QN 13) will be enlisted by examiner by using some measurement tools.

(A Zero (0) means no pain and Ten (10) means extreme pain)

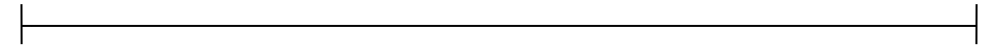
1. How severe your pain is at resting position?

Pre test



0 10

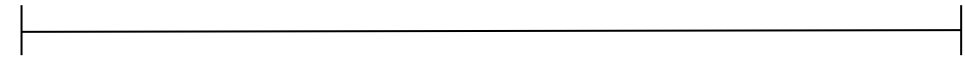
Post test



0 10

2. How severe is your pain during rising arm sideways (Abduction)?

Pre test



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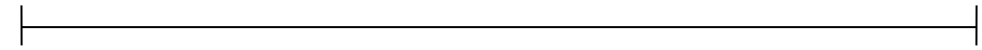
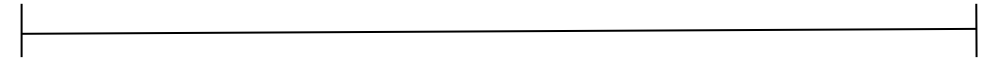
Post test



0 10

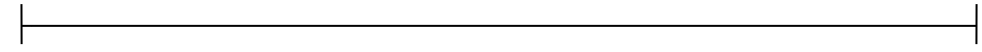
3. How severe is your pain during combing hair (Lateral Rotation)?

Pre test



0 10

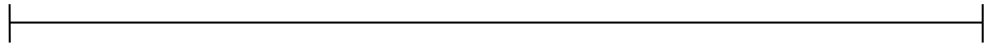
Post test



0 10

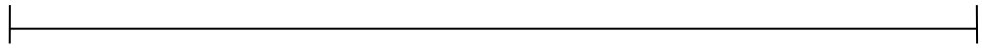
4. How severe is your pain during Scratching Lower back (Medial rotation)?

Pre test



0 10

Post test

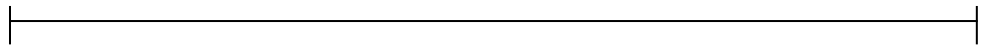


0

10

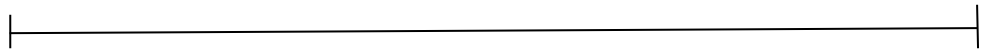
5. How severe is your pain during lying in affected side?

Pre test



0 10

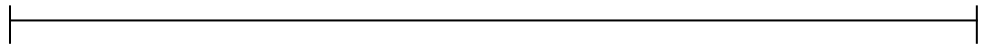
Post test



0 10

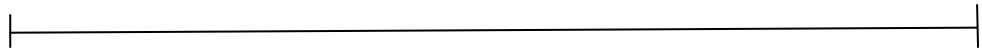
6. How severe is your pain during working hour in your job place?

Pre test



0 10

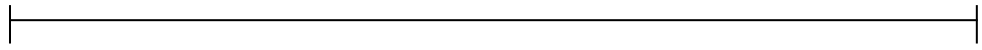
Post test



0 10

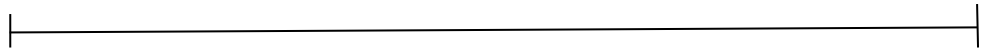
7. How severe is your pain during carrying weight in affected side?

Pre test



0 10

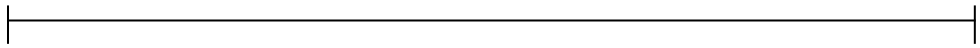
Post test



0 10

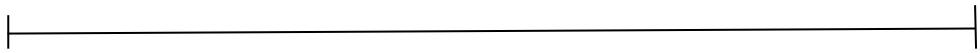
8. How severe is your pain during wearing your cloth?

Pre test



0 10

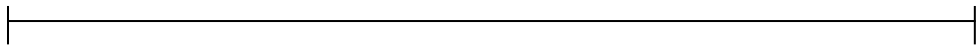
Post test



0 10

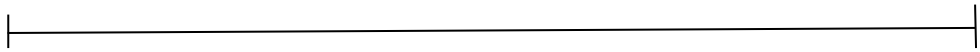
9. How severe is your pain during off your cloth?

Pre test



0 10

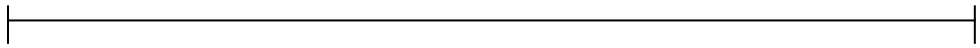
Post test



0 10

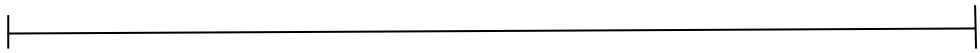
10. How severe is your pain during bathing?

Pre test



0 10

Post test



0 10

11. Passive ROM of Abduction of Affected Shoulder (Measured by examiner)
Pre- treatment …….. Degrees
Post- treatment …….. Degrees

12. Passive ROM of Lateral Rotation of Affected Shoulder (Measured by examiner)
Pre- treatment …….. Degrees
Post- treatment …….. Degrees

13. Passive ROM of medial rotation of Affected Shoulder (Measured by examiner)
Pre- treatment …….. Degrees
Post- treatment …….. Degrees

Tandra saha
B Sc in Physiotherapy
Researcher

প্রশ্নাবলী

এই প্রশ্নপত্র এডহেসিভ ক্যাপসুলাইটিস রোগীর জন্য প্রণীত **পরিচিতি নং.....**

ব্যক্তিগত তথ্যাবলী

অংশগ্রহনকারীর নামঃ

ঠিকানাঃ

গ্রাম/বাসা নম্বর.....

পোস্ট অফিস.....

থানা.....

জেলা.....

মোবাইল নম্বরঃ

সাক্ষাৎকার গ্রহনের তারিখ.....

এই প্রশ্নপত্র এডহেসিভ ক্যাপসুলাইটিস রোগীর জন্য প্রণীত **পরিচিতি নং.....**

১। আর্থ-সামাজিক তথ্যাবলী

বয়সঃ.....বৎসর।

লিঙ্গঃ

১= পুরুষ **২= মহিলা**

পেশাঃ

১= কৃষক **২= দিন মজুর** **৩= চাকরিজীবী**

৪= গার্মেন্টস/কারখানা শ্রমিক **৫= গাড়ি চালক** **৬= ব্যবসায়ী**

৮= বেকার **৯= গৃহিণী** **১০= ছাত্র**

১১= অন্যান্য.....

বৈবাহিক অবস্থাঃ

১= অবিবাহিত **২= বিবাহিত** **৩= বিধবা**

৪= বিপত্নীক **৫= তালাক প্রাপ্ত** **৬= আলাদা থাকেন**

পরিবারের ধরনঃ

১= একক পরিবার **২= যৌথ পরিবার**

বসবাসের এলাকাঃ

১= গ্রাম **২= শহর**

শিক্ষাগত যোগ্যতাঃ

১= নিরক্ষর **২= স্বাক্ষর করতে পারে** **৩= প্রাথমিক**

৪= মাধ্যমিক **৫= এস এস সি** **৬= এইচ এস সি**

৭= স্নাতক **৮= স্নাতকোত্তর**

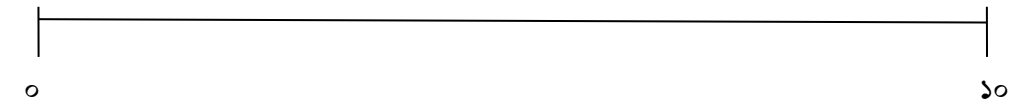
পরিবারের মাসিক আয়ঃ.....টাকা।

এই প্রশ্নপত্র এডহেসিভ ক্যাপসুলাইটিস রোগীর জন্য প্রণীত। ১ নং থেকে ১০ নং প্রশ্ন রোগীর ব্যাথা নির্দেশ করে, প্রতিটি প্রশ্নের শেষে এ একটি লম্বা লাইন আছে, আপনার হাতের বাম পাশ নির্দেশ করে কোন ব্যাথা নেই আর ডান পাশ নির্দেশ করে তীব্র ব্যাথা। আপনি যতটুকু ব্যাথা অনুভব করেন তা চিহ্নিত করুন। ১১ নং থেকে ১৩ নং প্রশ্নের উত্তর পরিক্ষক লিপিবদ্ধ করবেন।

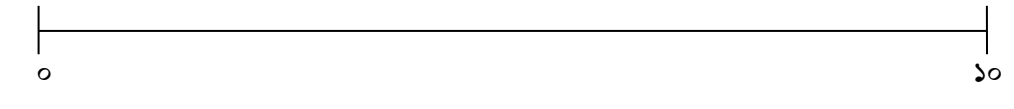
(এখানে ০ মানে কোন ব্যাথা নেই, ১০ মানে তীব্র ব্যাথা)

১।বিশ্রামরত অবস্থায় আপনার ব্যাথার পরিমাণ কত ?

চিকিৎসার পূর্বে:

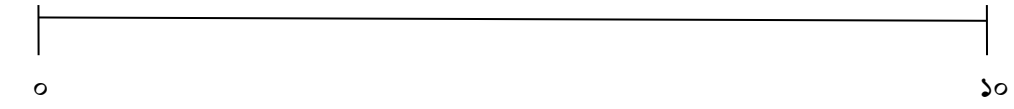


চিকিৎসার পরে:



২।পাশাপাশি হাত তুলতে আপনার ব্যাথার পরিমাণ কত ?

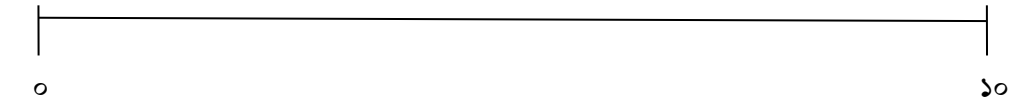
চিকিৎসার পূর্বে:



চিকিৎসার পরে:

৩।চুল আঁচড়াইতে আপনি কেমন ব্যাথা পান ?

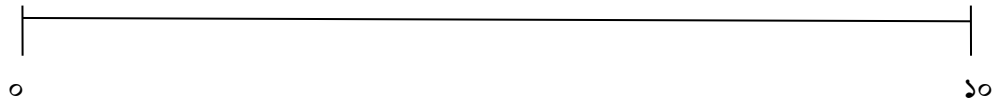
চিকিৎসার পূর্বে:



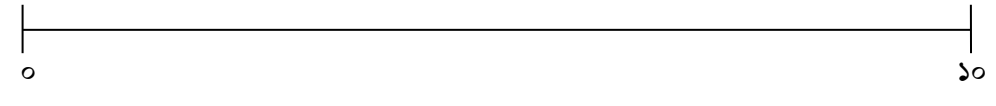
চিকিৎসার পরে:

৪। হাত পিছনে নিয়ে আপনার চুলকাতে আপনার কেমন ব্যাথা লাগে?

চিকিৎসার পূর্বে:

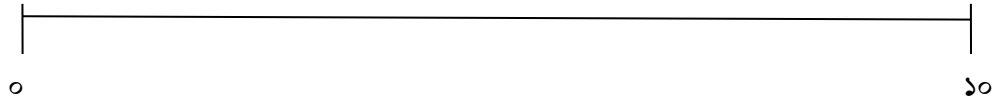


চিকিৎসার পরে:



৫। আক্রান্ত পাশে ঘুমাতে আপনার কত ব্যাথা হয়?

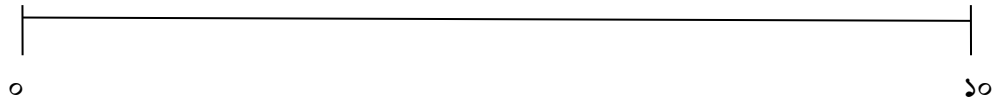
চিকিৎসার পূর্বে:



চিকিৎসার পরে:

৬। কর্মক্ষেত্রে কাজের সময় আপনার ব্যাথার পরিমাণ কত?

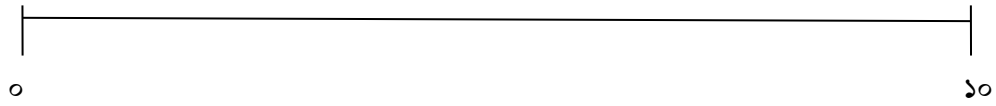
চিকিৎসার পূর্বে:



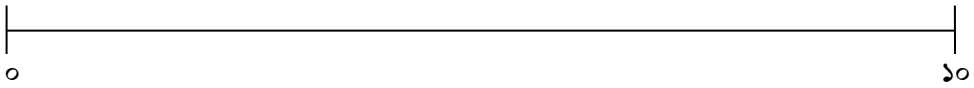
চিকিৎসার পরে:

৭। আক্রান্ত পাশে ভারী জিনিস উত্তোলনের সময় আপনার ব্যাথার পরিমাণ কত?

চিকিৎসার পূর্বে:

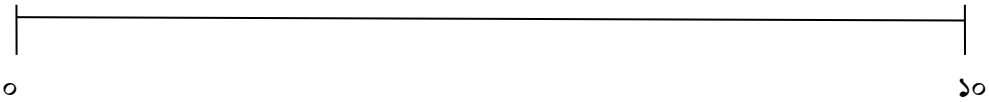


চিকিৎসার পরে:

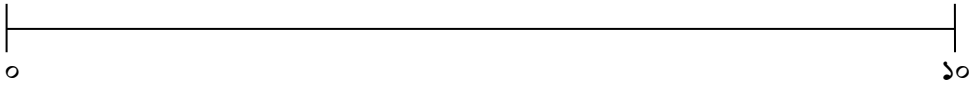


৮। জামা পরার সময় আপনার ব্যাথার পরিমাণ কত?

চিকিৎসার পূর্বে:

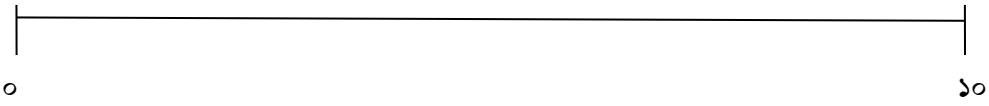


চিকিৎসার পরে:

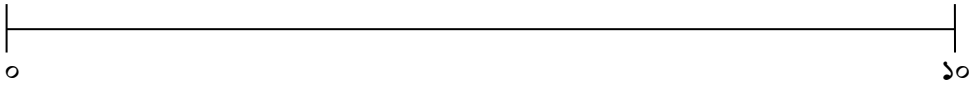


৯। জামা খোলার সময় আপনার ব্যাথার পরিমাণ কত?

চিকিৎসার পূর্বে:

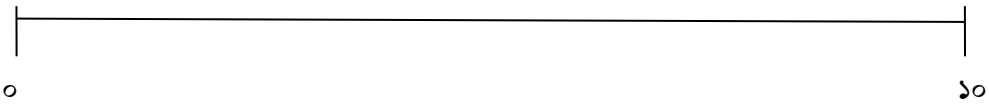


চিকিৎসার পরে:

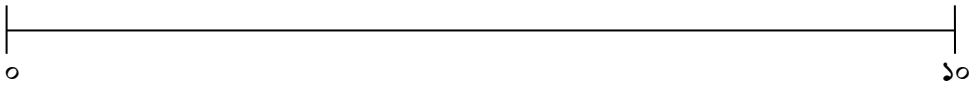


১০। গোসল করার সময় আপনার ব্যাথার পরিমাণ কত?

চিকিৎসার পূর্বে:



চিকিৎসার পরে:



১১। আক্রান্ত কাঁধের পেসিভ এবডাকসন (পরিক্ষক পরিমাপ করবেন)।

চিকিৎসার পূর্বে..... ডিগ্রি

চিকিৎসার পরে..... ডিগ্রি

১২। আক্রান্ত কাঁধের পেসিভ লেটারাল রোটেশন (পরিক্ষক পরিমাপ করবেন)।

চিকিৎসার পূর্বে..... ডিগ্রি

চিকিৎসার পরে..... ডিগ্রি

১৩। আক্রান্ত কাঁধের পেসিভ মিডিয়াল রোটেশন(পরিক্ষক পরিমাপ করবেন)।

চিকিৎসার পূর্বে..... ডিগ্রি

চিকিৎসার পরে..... ডিগ্রি

তন্দ্রা সাহা

বি এস সি ইন ফিজিওথেরাপী

গবেষক

APPENDIX III: Statistical Analysis

Analysis of Reduction of pain in Abduction

Subject	X_1	X_1^2	Subject	X_2	X_2^2
C1	2	4	E1	0	0
C2	3	9	E2	3	9
C3	4	16	E3	4	16
C4	3	9	E4	3	9
C5	5	25	E5	1	1
C6	4	16	E6	2	4
C7	3	9	E7	1	1
	$\sum X_1$ = 24	$\sum X_1^2$ = 88		$\sum X_2$ = 14	$\sum X_2^2$ = 40

$(\sum X_1)^2$ = 576

$(\sum X_2)^2$ = 196

n_1 = 7

n_2 = 6

$\bar{x}_1 = \frac{24}{7}$ = 3.428

$\bar{x}_2 = \frac{14}{6}$ = 2.333

Calculating the degree of freedom from the formula-

$$df = (n_1 - 1) + (n_2 - 1) = (7 - 1) + (6 - 1) = 11$$

Now according to *t* formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{3.428 - 2.333}{\sqrt{\frac{\left(88 - \frac{576}{7}\right) + \left(40 - \frac{196}{6}\right)}{11}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{6}\right)}}$$

$$t = \frac{1.095}{\sqrt{\frac{5.714 + 7.333}{11}} \times \sqrt{0.309}}$$

$$t = \frac{1.095}{\sqrt{1.186} \times 0.555}$$

$$t = \frac{1.095}{1.089 \times 0.555}$$

$$t = \frac{1.095}{0.604}$$

$$t = 1.812$$

Analysis of Reduction of pain in Lateral Rotation

Subject	X_1	X_1^2	Subject	X_2	X_2^2
C1	2	4	E1	2	4
C2	3	9	E2	2	4
C3	4	16	E3	3	9
C4	2	4	E4	1	1
C5	2	4	E5	2	4
C6	4	16	E6	3	9
C7	4	16	E7	2	4
	$\sum X_1$ = 21	$\sum X_1^2$ = 69		$\sum X_2$ = 15	$\sum X_2^2$ = 35

$(\sum X_1)^2$ = 441

$(\sum X_2)^2$ = 225

n_1 = 7

n_2 = 7

$\bar{x}_1 = \frac{21}{7} = 3$

$\bar{x}_2 = \frac{15}{7} = 2.142$

Calculating the degree of freedom from the formula-

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

Now according to *t* formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{3 - 2.142}{\sqrt{\frac{\left(69 - \frac{441}{7}\right) + \left(35 - \frac{225}{7}\right)}{12}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}}$$

$$t = \frac{0.858}{\sqrt{\frac{6 + 2.858}{12}} \times \sqrt{0.286}}$$

$$t = \frac{0.858}{\sqrt{o.738} \times o.534}$$

$$t = \frac{0.858}{0.859 \times 0.534}$$

$$t = \frac{o.858}{0.459}$$

$$t = 1.869$$

Analysis of Reduction of pain in Medial Rotation

Subject	X_1	X_1^2	Subject	X_2	X_2^2
C1	4	16	E1	3	9
C2	5	25	E2	4	16
C3	3	9	E3	2	4
C4	3	9	E4	2	4
C5	2	4	E5	1	1
C6	2	4	E6	1	1
C7	4	16	E7	3	9
	$\sum X_1$ = 23	$\sum X_1^2$ = 83		$\sum X_2$ = 16	$\sum X_2^2$ = 44

$(\sum X_1)^2$ = 529

n_1 = 7

$\bar{x}_1 = \frac{23}{7}$ = 3.285

$(\sum X_2)^2$ = 256

n_2 = 7

$\bar{x}_2 = \frac{15}{7}$ = 2.285

Calculating the degree of freedom from the formula-

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

Now according to *t* formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{3.285 - 2.285}{\sqrt{\frac{\left(83 - \frac{529}{7}\right) + \left(44 - \frac{256}{7}\right)}{12}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}}$$

$$t = \frac{1}{\sqrt{\frac{7.429 + 7.429}{12}} \times \sqrt{0.286}}$$

$$t = \frac{1}{\sqrt{1.238} \times o.534}$$

$$t = \frac{1}{1.112 \times 0.534}$$

$$t = \frac{1}{0.594}$$

$$t = 1.683$$

Analysis of Reduction of pain at sleeping in affected side

Subject	X_1	X_1^2	Subject	X_2	X_2^2
C1	3	9	E1	2	4
C2	2	4	E2	1	1
C3	3	9	E3	2	4
C4	4	16	E4	3	9
C5	2	4	E5	1	1
C6	3	9	E6	2	4
C7	3	9	E7	2	4
	$\sum X_1$ = 20	$\sum X_1^2$ = 60		$\sum X_2$ = 13	$\sum X_2^2$ = 27

$(\sum X_1)^2$ = 400

n_1 = 7

$\bar{x}_1 = \frac{2o}{7}$ = 2.857

$(\sum X_2)^2$ = 169

n_2 = 7

$\bar{x}_2 = \frac{13}{7}$ = 1.857

Calculating the degree of freedom from the formula-

df = (n_1 - 1) + (n_2 - 1) = (7 - 1) + (7 - 1) = 12

Now according to *t* formula-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{\left(\sum X_1^2 - \frac{(\sum X_1)^2}{n_1}\right) + \left(\sum X_2^2 - \frac{(\sum X_2)^2}{n_2}\right)}{(n_1 - 1) + (n_2 - 1)}} \times \sqrt{\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}}$$

$$t = \frac{2.857 - 1.857}{\sqrt{\frac{\left(60 - \frac{400}{7}\right) + \left(27 - \frac{169}{7}\right)}{12}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}}$$

$$t = \frac{1}{\sqrt{\frac{2.858 + 2.858}{12}} \times \sqrt{0.286}}$$

$$t = \frac{1}{\sqrt{0.476} \times \ o.534}$$

$$t = \frac{1}{0.689 \times \ 0.534}$$

$$t = \frac{1}{0.368}$$

$$t = 2.610$$

Range of Movement in Passive Lateral Rotation-MWM with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in passive Lateral Rotation were differences between pre-test and post-test pain scores.

Conventional physiotherapy with MWM exercise group			**Only Conventional physiotherapy group**		
Subjects	ROM in Passive Lateral Rotation (X_1)	X_1^2	Subjects	ROM in passive Lateral Rotation ($X_{2)}$	X_2^2
E_1	5	25	C_1	5	25
E_2	5	25	C_2	5	25
E_3	0	0	C_3	0	0
E4	5	25	C4	5	25
E_5	5	25	C_5	0	0
E_6	5	25	C_6	0	0
E_7	5	25	C_7	5	25
	$\sum X_1 = 30$	$\sum X_1^2 = 150$		$\sum X_2 = 20$	$\sum X_2^2 = 100$

$\bar{X}_1 = 4.29$

$\sum X_1^2 = 150$

$(\sum X_1)^2 = 900$

$n_1 = 7$

$\bar{X}_2 = 2.86$

$\sum X_2^2 = 100$

$(\sum X_2)^2 = 400$

$n_2 = 7$

Calculating the degree of freedom from the formula

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

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

Now ‘t’ formula-

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

$$t = \frac{4.29 - 2.86}{\left[\sqrt{\frac{150 - \frac{900}{7} + 100 - \frac{400}{7}}{(7-1)+(7-1)}} \times \sqrt{\left(\frac{1}{7}+\frac{1}{7}\right)}\right]}$$

t= 1.14

Range of Movement in Passive Medial Rotation- MWM with conventional physiotherapy treatment group and only conventional physiotherapy treatment group for Improvement of ROM in passive Medial Rotation were differences between pre-test and post-test pain scores.

Conventional physiotherapy with MWM exercise group			**Only Conventional physiotherapy group**		
Subjects	ROM in Passive Medial Rotation (X_1)	X_1^2	Subjects	ROM in passive Medial Rotation ($X_{2)}$	X_2^2
E_1	5	25	C_1	0	0
E_2	o	0	C_2	0	0
E_3	5	25	C_3	5	25
E4	5	25	C4	5	25
E_5	5	25	C_5	5	25
E_6	5	25	C_6	0	0
E_7	5	25	C_7	5	25
	$\sum X_1 = 30$	$\sum X_1^2 = 150$		$\sum X_2 = 20$	$\sum X_2^2 = 100$

$\bar{X}_1 = 4.29$

$\sum X_1^2 = 150$

$(\sum X_1)^2 = 900$

$n_1 = 7$

$\bar{X}_2 = 2.86$

$\sum X_2^2 = 100$

$(\sum X_2)^2 = 400$

$n_2 = 7$

Calculating the degree of freedom from the formula

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

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

Now ‘t’ formula-

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

$$t = \frac{4.29 - 2.86}{\left[\sqrt{\frac{150 - \frac{900}{7} + 100 - \frac{400}{7}}{(7-1)+(7-1)}} \times \sqrt{\left(\frac{1}{7} + \frac{1}{7}\right)}\right]}$$

t= 1.14

Permission letter

The Head of the Department
Department of Physiotherapy
Center for the Rehabilitation of the Paralyzed (CRP),
Savar, Dhaka -1343.

Subject: Application for permission of data collection to conduct a research study.

Sir,

I respectfully state that I am Tandra saha, a student of fourth year B. Sc in Physiotherapy at Bangladesh Health Professions Institute (BHPI). In to do fourth year course curriculum we have to conduct a research project. I have chosen a research title that is "*Effectiveness of Movement with Mobilization to improve range of motion among Adhesive capsulitis patient attended at CRP*". For this reason, I need permission to collect data from patient with Adhesive capsulitis attended at CRP.

May I therefore, pray and hope that you would be kind enough to grant my application and give me the permission to collect data from patient with Adhesive capsulitis and oblige thereby.

Yours faithfully
Tandra Saha

Tandra saha
4th year B.Sc in Physiotherapy
Session: 20010-2011
BHPI, CRP, Savar, Dhaka-1343

Date:

Allowed for data collection. Ms. Farhana Banu is the counterpart of the data collection process

2/09/15
Mohammad Delwar Hossain
Associate Professor &
Head of Physiotherapy Dept.
CRP, Chapain, Savar, Dhaka-1343