BIOMECHANICAL CHANGES AT SHOULDER GIRDLE AMONG THE FROZEN SHOULDER PATIENT ATTENDED AT CRP

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We the under sign certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for the acceptance of this dissertation entitled

BIOMECHANICAL CHANGES AT SHOULDER GIRDLE AMONG THE FROZEN SHOULDER PATIENT ATTENDED AT CRP

Submitted by **Md. Shakil Ahmed Adil**, for the partial fulfilment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT)

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CONTENTS

Declaration

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

Signature: **Date:**

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Abbreviations

ADL's:	Activities of Daily Livings.
BHPI:	Bangladesh Health Professions Institute.
CRP:	Centre for the Rehabilitation of the Paralyzed.
NSAID:	Non-Steroidal Anti Inflammatory Drug.
ROM:	Range of Motion.
SCI:	Spinal Cord Injury.
SPSS:	Statistical Package for Social Sciences.
TENS:	Transcutaneous Electrical Nerve Stimulation.
WHO:	World Health Organization.

List of figures

Abstract

Purpose: The purpose of the study was to explore the biomechanical changes at the shoulder girdle among the frozen shoulder patient attended in CRP. *Objectives*: To find out the variation of active range of motion among the patient with frozen shoulder, to evaluate changes of muscle contraction, to check out the severity of muscle wasting, to distinguish any alteration of bony alignmentand to identify any alteration in gleno-humeral rhythm. *Methodology*: A quantitative research model in the form of a cross sectional type survey in design is used also with a simple random sampling technique. *Results:* Most (60%) of the participants (n=18) with frozen shoulder had 67% loss of active shoulder lateral rotation, 80% participants (n=24) had 33% loss of active shoulder abduction, 70% participants (n=21) had 33% loss of active shoulder medial rotation and about 57% participants (n=17) had 33% loss of active shoulder flexion. About 87% participants (n=26) had Grade-4 muscle contraction in their shoulder lateral rotator. Another muscles- shoulder abductor, medial rotator and flexor had normal Grade-5 muscle contraction. 7% participants (n=2) had mild (less than 5mm) abductor muscle wasting and muscle wasting occurred due to inactivity or in case of chronic frozen shoulder patient. Left shoulder elevation (13%, n=4) was more common than right shoulder (7%, n=2). Left shoulder was rounded in most of the participants (10%, n=3) than right shoulder (3%, n=1). Left side scapular elevation (14%, n=4) was more common than right side (3%, n=1). Chance of Subluxation or dislocation is less in frozen shoulder patient, only 13% participants (n=4) had positive anterior apprehension test. Moderate (1.5:1) glenohumeral alteration found in maximum (80%, n=24) case. *Conclusion*: From this study some things can be concluded that- frozen shoulder patient have variation in active range of motion, changes occur in muscle power, sometimes muscle wasting is also seen in shoulder abductor group, bony alteration also common and alteration of gleno-humeral rhythm also seen.

Key Wards : Biomechanical, Shoulder girdle, Frozen shoulder.

CHAPTER-I INTRODUCTION

1.1 Introduction

The shoulder girdle also called pectoral girdle and which is an arrangement of bones that connect the axial skeleton (head-neck, trunk) with the upper limb.The shoulder girdle is very important for proper movement and function of the upper limb. The main components of the shoulder girdle are bones, joints, ligaments and muscles. The efficient function of the arm is possible due to combined and coordinated movements of three joints and one articulation (glenohumeral, acromioclavicular, sternoclavicular and scapulothoracic) (Nordin & Frankel, 1989).

Forces on the shoulder girdle, either indirect (e.g. fall onto outstretched hand) or direct (e.g. blow to upper shoulder) transmits their force throughout the girdle. Shoulder girdle consists of some bones- scapula, humerus, clavicle and humerus. Among these bones, scapular fracture rarely occurs but shaft of clavicle and humerus fractures are common.

The shoulder girdle is stabilized and supported by some muscles. These muscles are rotator cuff (supraspinatus, infraspinatus, teres minor and subscapularis), trapezius, rhomboid major, rhomboid minor, levator scapulae, serratus anterior, pectoralis major and minor and subclavious. If serratus anterior is paralysed (e.g. injury of the long thoracic nerve), then scapula is pulled outwards by the force of the pectoral muscles. This condition is called winging of scapula.

Two types of movement occurs in the shoulder girdle- osteokinematics (movement that occurs around a joint axis e.g. abduction, flexion) and arthrokinematics (specific movements of joint surfaces, sometimes called joint play motions or component motionse.g. rolling, gliding) movement.

There are some internal mechanical (e.g. Impingement syndrome) and some pathological conditions (e.g. Frozen shoulder) are commonly seen in the clinical setting which are treated in different ways. Often these impairment leads to pain, compensations (with resultant pain and problems occurring in the kinetic chain),

limited ability to perform various activities and limitations of functional performance. About 23% of family practice, physicians are involved for the treatment of musculoskeletal problems.

1.2 Rationale

Biomechanical changes across the shoulder girdle include decrease range of movement, decrease muscle power, reduction of cross sectional area of muscle. Shoulder girdle is an important area for performing upper limb activities and ADL's using hands. Any problem which involve the shoulder girdle, basically hampers, upper limb activities. Frozen shoulder may lead to decrease joint range of motion but greater decrease of joint range of motion has been explained among those who are physically inactive. Normal range of movement in shoulder decreases with pain but the decrease has been shown to be significantly smaller in physically active persons. The effect of inactivity after having pain and associated decrease of range of motion will lead to atrophy of muscle and then decrease muscle power. If muscle wasting and alteration of range of motion occurs then some other hazardous changes may occur. All of these factors are responsible for alteration of gleno-humeral rhythm. So, it is a most important area for performing daily activities. On the other hand, there is no adequate biomechanical information or literature about this area. After this study, everybody will be able to know some biomechanical alteration, When occur and their level of alteration in the shoulder girdle, occurred due to frozen shoulder. So, this study is very important to warn general people about frozen shoulder and its view of alteration in the shoulder girdle.

1.3 Research question

What are the biomechanical changes at shoulder girdle among the frozen shoulder patient attended at CRP?

1.4 Objectives of the study

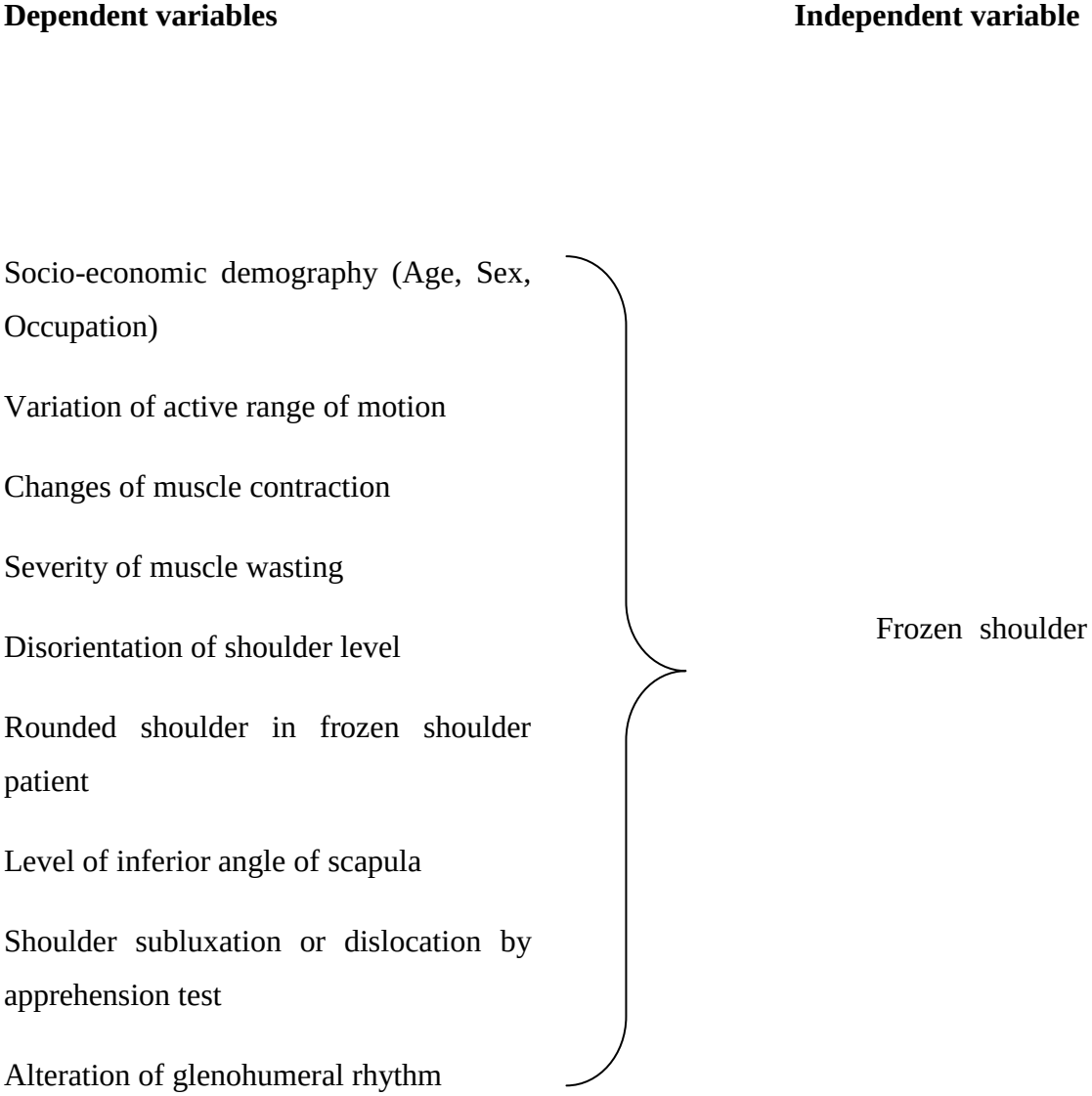
1.4.1 General objective

To determine the biomechanical changes at shoulder girdle among the frozen shoulder patient attended at CRP.

1.4.2 Specific objectives

- To find out the variation of active range of motion among the patient with frozen shoulder
- To evaluate changes of muscle contraction
- To check out the severity of muscle wasting
- To distinguish any alteration of bony alignment
- To identify any alteration in gleno-humeral rhythm

1.5 Conceptual Framework



1.6 Operational definitions

Biomechanical changes: It is the biomechanical alteration. It includes-cheek for variation in active movements in different direction, changes in muscle power, associated muscle wasting, symmetry or asymmetry, rounded or not or presence of any other subluxation or dislocation.

Shoulder girdle: It consists of gleno-humeral joint, acromio-clavicular joint, sterno-clavicular joint and scapula-thoracic articulation.

Frozen shoulder: It is a disease condition of the shoulder joint which may affect upper limb activities.

CHAPTER-II LITERATURE REVIEW

Shoulder joint is a multi-axial ball and socket type of synovial joint and possesses three degrees of freedom of movement (Datta, 2000). Here three degree of freedom means, shoulder joint movement can occur in three planes-coronal, sagittal and horizontal.

Shoulder joint maintains its static joint stability by the joint surfaces and the capsulolabral complex, and dynamic stability by the rotator cuff muscles and the scapular rotators.

The rotator cuff is composed of four muscles: the supraspinatus, infraspinatus, teres minor and subscapularis. The subscapularis facilitates internal rotation, and the infraspinatus and teres minor muscles assist in external rotation. The rotator cuff muscles depress the humeral head against the glenoid. Excessive elevation of the humeral head may also occur as a result of imbalance between the elevators of the humeral head (deltoid) and the humeral head stabilizers (rotator cuff muscles). This imbalance may lead to the humeral head moving superiorly with deltoid contraction. With a poorly functioning (torn) rotator cuff, the humeral head can move upward within the joint because of an opposite action of the deltoid muscle (Reza, 2002).

Scapular stability is maintained by trapezius, serratus anterior and rhomboid muscles. The levator scapulae and upper trapezius muscles support posture, the trapezius and the serratus anterior muscles help to rotate the scapula upward and the trapezius and the rhomboids for normal scapular rotation (Chaurasia, 2002). Simultaneous synchronous movements of the four shoulder articulations provide the normal appearance of shoulder girdle-

The glenohumeral joint is a synovial joint between the humeral head and the glenoid fossa of the scapula. The diameter of the humeral articular surface ranges from 37 to 55 mm.

The humeral head makes about 135 degrees of angle with the humeral shaft. The glenoid fossa consists of a cartilage which is small and pear shaped, covered bony

depression that measures about 41 mm longitudinally and about 25 mm in the transverse direction. The surface area of the glenoid fossa is only one third to one fourth that of the humeral head. The longitudinal diameter of the glenoid fossa is about 75%, and its transverse diameter approximately 60%, of that of the humeral head (Nordin & Frankel, 1989). Saha (1971) found that 75% of 50 normal subjects had a posteriorly tilted glenoid face, the tilt averaging 7.4 degrees. Several factors are important for stability of the glenohumeral joint-

Adequate size of the glenoid fossa: if the longitudinal diameter of the glenoid fossa was less than 75% and the transverse diameter less than 57% of that of the humeral head, the glenoid was relatively hypo plastic and the joint was more likely to be unstable.

Posterior tilting of the glenoid fossa: anteriorly tilted glenoid fossa in 80% of 21 unstable shoulders, while the incidence of this finding in 50 normal shoulders was 27%. Retroversion of the humeral head.

Intact capsule and glenoidlabrum. Young patients with anterior shoulder instability are likely to have a detached labrum, whereas older patients with this condition are likely to have a stretched capsule.

Functions of the muscles that control the anteroposterior position of the humeral head (subscapularis, infraspinatus, and upper part of teres minor) (Saha, 1971).

According to Nordin & Frankel (1989) humeral ball excursion on the glenoid face during shoulder elevation in the plane of the scapula in 12 normal subjects. From zero to 30 degrees of elevation, and often from 30 to 60 degrees, the humeral ball moved upward on the glenoid fossa by approximately 3mm, indicating rolling and/ or gliding. With each additional 30 degree interval of elevation, the humeral head moved only 1±0.5mm up or down, indicating almost pure rotation.

The acromioclavicular joint is a small synovial articulation between the distal clavicle and the proximal acromion of the scapula. Joint stability is provided mainly by the two parts of the coracoclavicular ligament, the conoid and the trapezoid. These ligaments permit the scapula to move on the clavicle about three axes:

The conoid ligament, serves as a longitudinal axis for scapular rotation (scapular protraction and retraction). The trapezoid ligament, acts as a hinge for scapular motion about a transverse axis in the frontal plane.

Scapular motion is also possible through the acromioclavicular joint itself. Inman and associates (1944) have proposed that when the scapula rotates posteriorly relative to the clavicle, a relative lengthening of the coracoclavicular ligament results rotation of scapula in transverse axis andin sagittal plane.

A 30 degree rotation occurs for the coronoid ligament, a 60 degree arc for the trapezoid ligament, and a 30 degree arc for the transverse axis in the sagittal plane through the acromioclavicular joint (Nordin & Frankel, 1989). Inman and coworkers (1944) found that during shoulder abduction and forward flexion the total range of clavicular elevation at the acromioclavicular joint is 20 degrees, occurring primarily in the first 30 and the last 45 degrees of arm elevation.

The sternoclavicular joint is the synovial articulation between the manubrium of the sternum and the proximal clavicle. The principle stabilizing structure of this joint, the costoclavicular ligament securely attaches the clavicle to the first rib. Inman and associates (1944) noted a range of about 40 degrees during arm elevation in both the frontal and sagittal planes; 4 degrees of clavicular elevation occurred for each 10 degrees of arm elevation through the first 90 degrees, and beyond 90 degrees clavicular motion at this joint is almost negligible. Rotation about the long axis of the clavicle was approximately 40 degrees.

The scapulothoracic articulation, is formed by bone-muscle-bone articulation. Scapular motion is enhanced by the scapulothoracic articulation. The serratus anterior holds the scapula closely to the chest wall throughout large ranges of scapular motion and prevents scapular winging.

Several investigators have attempted to relate glenohumeral and scapulothoracic motion during arm elevation in various planes (Inman et al, 1944; Saha, 1973).

Inman’s group (1944) examined arm elevation in the frontal and sagittal planes (abduction and forward flexion) and found that about two thirds of the motion (approximately 120 degrees) took place at the glenohumeral joint and one third

(approximately 60 degrees) at the scapulothoracic articulation. During the first 30 to 60 degrees of arm elevation, scapular motion becomes highly irregular. Still then, the 2 to 1 ratio of glenohumeral to scapulothoracic motion remained quite constant. The investigators stated that the 60 degrees of scapular motion at the scapulothoracic articulation is possible only due to an equal amount of rotation takes place at the clavicular joints (20 degrees at the acromioclavicular joint and 40 degrees at the sternoclavicular joint).

Nordin & Frankel (1989) found a 1.35 to 1 (3 to 2) ratio for the range from zero to 135 degrees, with an increase of glenohumeral motion in the last stage of arm elevation.

Frozen shoulder patients who have some pain and limited range of motion, may be go through three sequential stages. Frozen shoulder syndrome (or adhesive capsulitis) has been reported to go through a natural history of freezing, frozen and thawing stages, which take many months to resolve (Grubbs, 1993 and Wadsworth, 1986). Freezing phage: Here gradual onset of diffuse shoulder pain, gradual loss of gleno-humeral motion. Frozen phase: Shoulder movement often restricted in characteristic pattern, with loss of external rotation, internal rotation and adduction. Thawing phase: Gradual regaining of shoulder motion.

We think that pain and decreased ROM are due to selective hypomobilities. These selective hypomobilities can involve the joint capsule/ligaments (innert structure) or the musculotendinous unit (contractile structure). Besides that, muscle power decreased and bony alignment alteration also seen. Harryman et al (1990) told that the reaction of the joint when the joint capsule becomes asymmetrically tight. Nordin & Frankel, (1989) measured humeral head translations with active and passive glenohumeral joint internal and external rotation. They reported posterior humeral head translation with external rotation and anterior humeral head translation with internal rotation. These studies (Gerber & Ganz, 1984) report glenohumeral joint arthrokinematics that represent a departure from the traditional ball and socket movements of a convex humeral head moving on a concave glenoid fossa.

Frozen shoulder patients biomechanical changes can be described by some features: The major symptom is a tight stiff shoulder (Hilt & Cogburn 1980). Here patient

comes with instability to lift the arm upward, difficulty to reach the things on the shelf, inability to manage his own hair.

The common sequence of events of frozen shoulder is one of pain, pain and loss of movement, relief from pain, then slow recovery of movement. It may sometimes be accompanied by severe pain and systematic disturbances (Nordin & Frankel, 1989).

A stiff shoulder in which active and passive movements are restricted primarily at the glenohumeral joint. Lateral rotation and elevation are the most marked limitations, followed by limitation of medial rotation (Hall & Brody, 1999).

The essential features of frozen shoulder are an inflamed capsule of the glenohumeral joint, which eventually shrinks and thickens, thus restricting movement.

The range of motion is defined as the amount of motion that is available at a joint. According to Norkin & White, (1998) the starting position for measuring all ROM, except rotations in the transverse plane, is the anatomical position. Three rotation systems have been used to define ROM: the 0-to 180-degree system, the 180-to 0-degree system, and the 360-degree system.

In the 0-to 180-degree rotation system, the upper and lower extremity joints are at 0-degrees for flexion-extension and abduction-adduction when the body is in anatomical position.

The 180-to 0-degree rotation system defines anatomical position as 180-degrees (Clark, 1920). A ROM begins at 180-degrees and proceeds toward 0-degrees.

The 360-degree rotation system also defines anatomical position as 180 degrees (West, 1945).The motion of flexion and abduction begin at 180-degrees and proceed toward 0-degrees. The motions of extension and abduction begin at 180-degrees and proceed toward 360-degrees.Measurement of ROM is specifically done by goniometer.

There is no standard treatment regimen for frozen shoulder. The goals of treatment are pain relief and restoration of range of motion of the shoulder joint. The main aim of treatment is to improve the range of movements in the shoulder, and continuation of shoulder exercises are the mainstay of treatment (McRae, 1988). Treatments are based

on clinical findings and the stage of disease. More importantly, management should be considered in relation to its natural history (Corrigan & Maitland, 1983).Many different therapeutic regimens and no single methods of treatment cure this condition. Different approaches which are used, includes- analgesic, corticosteroid injections, mobilization techniques and exercises of various forms, manipulation under anesthetia (Kesson & Atkins, 1998).

Non-steroidal anti-inflammatory drugs (NSAIDs) help to relief pain and inflammation. Analgesics are indicated when NSAIDs are contraindicated. Muscle relaxants are helpful in the early stages of the diseases when spasm is predominant. Low dose anti-depressant medications (e.g., 10mg of amitriptyline taken at night) may help to avoid sleep disturbance leading to a chronic pain syndrome and fibromyalgia.

Intra-articular corticosteroid injections are used in affected patients to relieve severe pain and to improve joint mobility. The usual dose is 15 to 40mg of triamcinolone acetonide (kenalog) or another depot steroid with 1ml of 1 percent lidocaine.

Severe shoulder pain is associated with complete loss of all shoulder movements, including rotation. Then, a high dose of NSAIDs and intra-articular injection of corticosteroids are helpful. Once the pain becomes tolerable then a manipulation under anesthetia is also used. When untreated, it recovers in 1-2 years.

Surgical interventions should be considered when physical therapy and injections fail (if no improvement after three months of therapy).

There are some aims of physiotherapy in the treatment of frozen shoulder: Prevent hypertrophic scarring, Maintain joint range of movement and prevent contracture and deformities, Maintain muscle strength, Regain maximum function of the patient, Help the patient return to an active lifestyle within society, Pain control through exercise, mobilizing modalities.

The best physiotherapy approach for frozen shoulder is preventative. Local treatment (heat, active exercises, maintain good posture, while sleeping with extra pillow, self-stretching, exercise with pulley, supporting to the affected arm against a wall and climbing up the wall with the fingers etc.) for frozen shoulder requires patients active participation. The patient must be able and willing to co-operate with the physical

therapist and deal with psychological barrier (Hall & Brody, 1999).The aim of physiotherapy treatments is to prevent any further stiffness and regain range of motion (McRae, 1988). A new osteopathic treatment called 'The Niel-Asher technique' used for the recovery of frozen shoulder. There is also a self-help programme available for this method. According to Niel-Asher technique the self-help programme are: keeping adhesive capsulitis warm, sleeping with an extra pillow, massage helps in, frozen shoulder, dietary supplements for frozen shoulder, borrowing a TENS machine, straping or support the arm from time to time, consider short term medication to improve sleep (Sandor, 2000).

For stage one and stage two-

Stage one (when pain and restriction of movement are not yet marked) treatment may consists of rest from excessive use of the shoulder. In stage two, pain is usually severe. Rest is obtained with a sling, which needs to be worn continuously (Corrigan & Maitland, 1983). Simple exercises given in these two stages.

Ice may also be used to control pain but heat to the shoulder is usually of no benefit; exercises, massage and forceful movements are contraindicated (Corrigan & Maitland 1983).

If mobilization is used, it will be very slow after pain has reduced in the shoulder and may be manipulated gently under anesthesia (Adams, 1976).

For stage three and four-

In the third and fourth stages of frozen shoulder, pain is not the major problem, but the shoulder is now stiff. Routine physical methods used to increase the joint range include mobilization techniques, stretching and exercises. Heat or ice may be applied to the shoulder before use of physical methods. Rarely, a manipulation under anesthetic may be indicated (Corrigan & Maitland, 1983).

Commonly used treatments for frozen shoulder patients in CRP are as follows- mobilization is applied to the non-irritable joint only. The aim is to relieve pain and to increase the range of motion. Heat is used to assist the mobilization technique. The condition, prognosis and treatment are explained carefully to the patient and also that

recovery time may be prolonged over many months or even years (Keson & Atkins, 1998). Longitudinal, posteroanterior accessory movements are used as small-amplitude movements at the limit of the available range. Treatments should not provoke any excessive pain and are carried out for approximately 3 minutes.

Active exercise is used to stretch the adhesions and improve the blood supply to the area. The frozen shoulder patient should follow the following exercises in stage three and four-

Pendullar exercises and hot packs or bath to warm up for stretching exercises; concentrate on passive forward elevation and end of range motion. Perform end range stretch with the arm at the side and the elbow flexed at 90 degrees. Pendullar mobilization exercises are anti-gravity exercises with the patient flexed forward at the hips so that the arm hangs freely down. A weight is carried in the hand to produce traction on the gleno-humeral joints, so stretching the capsule. By moving the trunk the shoulder can be moved so that there is no muscular activity around the glenohumeral joint. The arm then can be moved like a pendulum in a forwards and backwards, lateral or circumduction plane.

PNF stretching: These consists first of flexion-abduction, lateral rotation patterns, followed later by extension-abduction, medial rotation patterns, in which the patient contracts and then relaxes the agonist and then antagonist muscles.

Active assisted exercises may be given, using either a pulley or a rotation disc in the treatment of frozen shoulder.

Scapulohumeral mobilization: It is a rhythmical mobilization technique.

Gapping mobilization: It is used with belt or without belt in the gleno-humeral joint.

Movement with mobilization (MOA): It is also performed in the treatment of frozen shoulder.

Isometric exercise: The therapist fully resist the patients attempt to move the arm towards flexion, abduction, lateral rotation and medial rotation.

Strengthening exercises of rotator cuff: Strengthening practice with forward elevation and progressed when 10 repetitions are done without difficulty. Using supine position first, lifting up 3kg then using sitting position with weight dropped to 250gm and slowly progress to 10kg as tolerated.

The patient may also force the movements (flexion and abduction) by supporting the affected arm against a wall and climbing up the wall with the finger.

It is essential to practice the exercise programme regularly and revise it with the patient. There are various ways to progress exercises, including: changing the starting position, changing the length of the liver, changing the speed of the exercise, altering the range through which the movement is performed, applying resistance as discussed by Porter in 2002.

CHAPTER-III METHODOLOGY

3.1 Study design

The study was aimed to determine biomechanical changes at shoulder girdle among the frozen shoulder patient attended at CRP. For this reason a quantitative research model in the form of a cross sectional type survey in design is used.

3.2 Study area

Study area was musculoskeletal unit of physiotherapy department at Center for the Rehabilitation of the Paralyzed. This area were selected as, patient from all of the Bangladesh came here for treatment purpose.

3.3 Study site

Center for the Rehabilitation of the Paralyzed, which is a specialized rehabilitation center, situated 25 km away from the Dhaka City and it is Savar.

3.4 Study population and sample

All frozen shoulder patient of Bangladesh were considered as the study population. 30 samples had been selected randomly from the population for this study from musculoskeletal unit of CRP Savar.

3.5 Sampling

The researcher used simple random sampling procedure to collect the samples. Simple random sampling is a type of probability sampling in which the researcher consciously selects samples; each and every number of the population has equal opportunity to be the sample.

3.6 Inclusion criteria of the study

- Only frozen shoulder patients were included for this research

3.7 Exclusion criteria of the study

- Except frozen shoulder, all patient were excluded from this research

3.8 Sample size of the study

According to the prevalence of frozen shoulder patient in Musculoskeletal Unit of CRP Savar, estimated sample size was 30, by the following procedure-

$n=\left\{\frac{z\left(1-\frac{\alpha}{2}\right)}{d}\right\}^2 \times pq$,{where, $z(1-\alpha/2)$) = 1.96; p = 0.02; q = (1-p) = 0.98; d = 0.05}

$=\left\{\frac{1.96}{0.05}\right\}^2 \times 0.02 \times (1-0.02)$

$=\frac{3.8416}{0.0025} \times 0.02 \times 0.98$

=30.118144 (30)

3.9 Data collection method

Data were collected by observation, inspection, palpation, measurement and checking boney alignment. In this study, data had been collected by both structured and semi-structured mixed type questionnaire. Mixed type questionnaire included both open and close ended questions. Following that, the investigator had gone to the patient to take permission that, are they interested in this study or not. Firstly, the investigator was introduced him and the research project as well its purpose. For data collection, the investigator used Bengali type of questionnaire and lastly researcher had collected the questionnaire. Then data were analyzed by Microsoft Office Excel 2007 using a SPSS 16 version software program.

3.10 Data collection tools

- **Goniometer**: Measurement of ROM done by goniometer. The term goniometry is derived from two Greek words, gonia, meaning angle, and metron, meaning measure.

  Therefore, goniometry refers to the measurement of angles, in particular the measurement of angles created at human joints by the bones of the body. When using a universal goniometer, the examiner had obtained these measurements by placing the parts of the measuring instrument along the bones immediately proximal and distal to the joint being evaluated.

  Goniometry used to determine both a particular joint position and the total amount of motion available at a joint. The performance of active joint motions by the subject during the evaluation allowed the examiner to screen for abnormal movements and gain information about the subject's willingness to move.

  In case of abnormal active motions the examiner performed passive joint motions in an attempt to determine reasons for joint limitation and joint end feels.

  Goniometry used to measure and document the amount of available active and passive joint motion. Goniometry used to accurately describe abnormal fixed joint positions.

- **The tap**: It used to measure muscle wasting by measuring width.

3.11 Data analysis

The result of this research consisted of quantitative data. The collected data were illustrated with bar graphs and pie graphs. By this research a lot of information was collected. All these results had given a basic idea about biomechanical changes in frozen shoulder patient. The result was calculated in percentages and descriptive statistics. Other statistical tests were not used, as samples were small in number. Generally descriptive statistics are often used in conjunction with survey methods.

3.12 Informed Consent

The aims and objectives of this study were informed to the subjects verbally. The researcher had given the consent form to the subject and explained them. The subjects had the right to withdraw themselves from the research at any time. He/she was assured that his/her name and/or address would not be used for any harmful activity. Information's of the subject might be published in any normal presentation or seminar or writing but would not be identified. The participant was informed or given notice that the research result would not be harmful for them. It would be kept confidential. The researcher was ensured about confidentiality of participant's information, sharing information only with the research supervisor.

3.13 Ethical consideration

i. The researcher had taken permission from the research supervisor, Physiotherapy Department.
ii. The study followed WHO guidelines.
iii. All the participant and authority were informed about the purpose of the study, the process of the study and their written consent were obtained.
iv. All the interviews had been taken in a confidential to maximize the participant's comfort and feelings of security.
v. The researcher ensured confidentiality of participant's information, sharing information only with the research supervisor.

3.14 Limitation of the study

There were some situational limitations and barriers while considering the study. Those are as follows:

- This study conducted among frozen shoulder patient in musculoskeletal department only, but it is a common complication of stroke patient in neurology department and different spinal cord injury patient in SCI department. So, it may affect the result of the study to generalize for wider population.

- Few amount of literatures are found about this study, so researcher had to use own idea.
- This type of research is done by two or three people in BHPI, CRP so local resources about documentation were not available for comparison.
- Although some international literatures were found in this field on the internet accessing this study was not always possible for comparison with the findings of this study.
- As the study was conducted at Centre for the Rehabilitation of the Paralyzed (CRP) which may not represent the whole country.

CHAPTER-IV RESULTS

Variation of active shoulder lateral rotation

Active shoulder lateral rotation range is divided into 3 groups (0°-30°, 31°-60°, 61°-90°). Graph shows that, 18 participants (60%) among 30 participants had a range of motion between 0°-30°, and about 67% loss. Remaining 12 participants (40%) had a range of motion between 31°-60°, and about 33% loss. But no participants had a range of motion between 61°-90°. So, result indicates that- most of the frozen shoulder patient possesses their active shoulder lateral rotation less than 31° or within the range between 0°-30° (Figure-1).

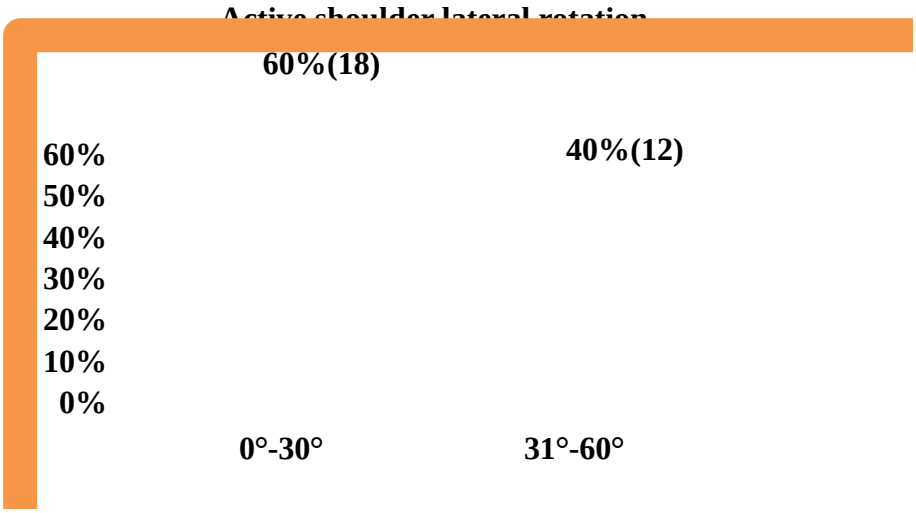


Figure 1: Variation in active shoulder lateral rotation.

Variation of active shoulder abduction

Active shoulder abduction range also divided into 3 groups (0°-60°, 61°-120°, 121°-180°). Graph shows that, only 1 participant (3%) among 30 participants had a range of motion between 0°-60°, and about 67% loss. Remaining 24 participants (80%) had a range of motion between 61°-120°, and 33% loss. And resting 5 participants (17%) had a range of motion between 121°-180°. So, result indicates that- most of the frozen shoulder patient possesses their active shoulder abduction range less than 121° or within the range between 6°-120° (Figure-2).

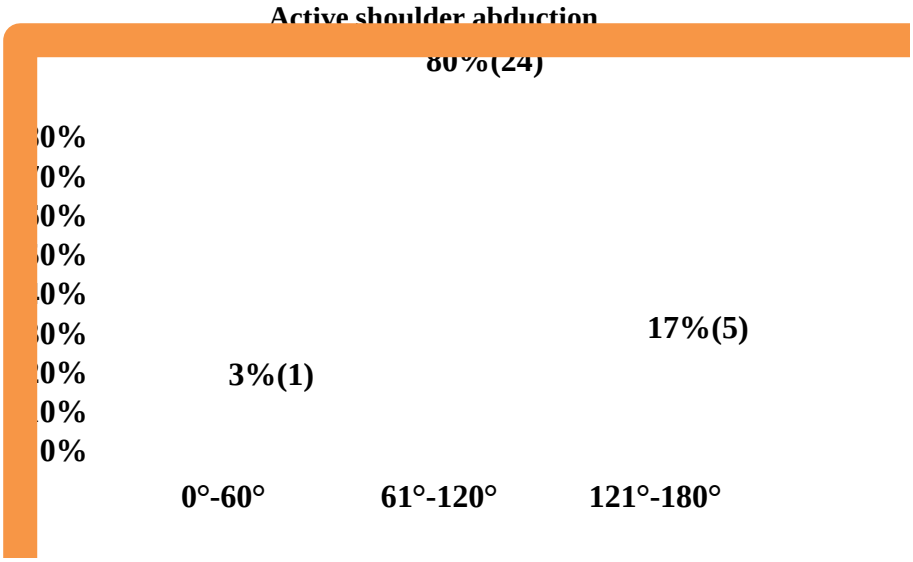


Figure 2: Variation in active shoulder abduction.

Variation of active shoulder medial rotation

Active shoulder medial rotation range is divided into 3 groups (0°-30°, 31°-60°, 61°-90°). Graph shows that, 9 participants (30%) among 30 participants had a range of motion between 0°-30°, and about 67% loss. Remaining 21 participants (70%) had a range of motion between 31°-60°, and 33% loss. But no participants had a range of motion between 61°-90°. So, result indicates that- most of the frozen shoulder patient possesses their active shoulder medial rotation range less than 61° or within the range between 31°-60° (Figure-3).

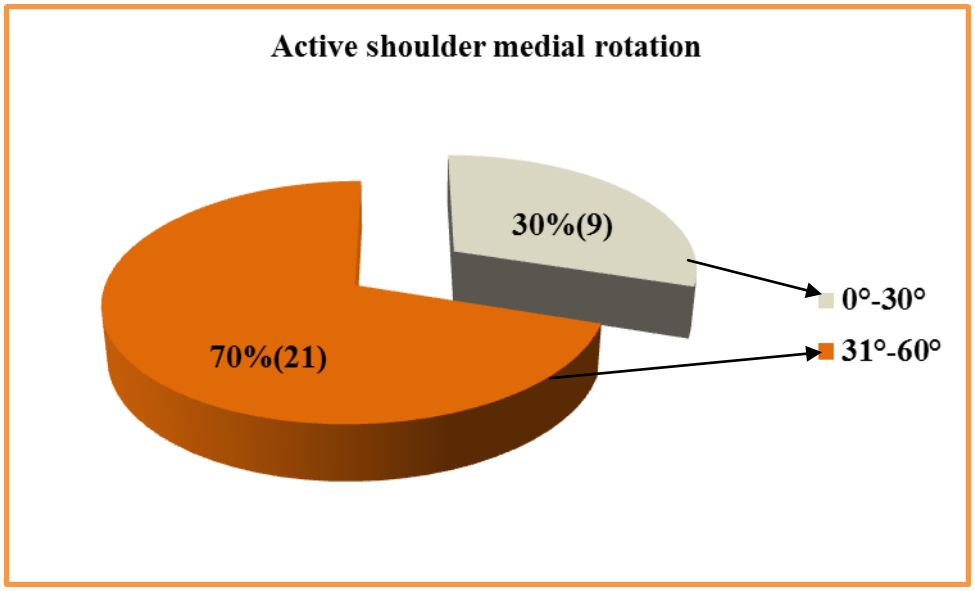


Figure 3: Variation in active shoulder medial rotation.

Variation of active shoulder flexion

Active shoulder flexion range also divided into 3 groups (0°-60°, 61°-120°, 121°-180°). Graph shows that, only 1 participant (3%) among 30 participants had a range of motion between 0°-60°, and about 67% loss. Remaining 17 participants (57%) had a range of motion between 61°-120°, and 33% loss. And resting 12 participants had a range of motion between 121°-180°. So, result indicates that- most of the frozen shoulder patient possesses their active shoulder abduction range less than 121° or within the range between 61°-120° (Figure-4).

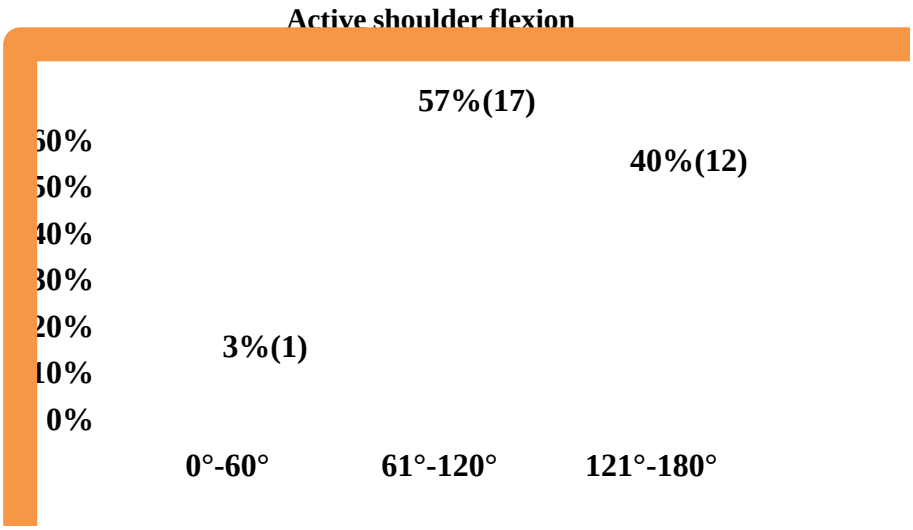


Figure 4: Variation in active shoulder flexion range.

Changes of muscle contraction

Every participant of this research had muscle contraction Grade-4 or Grade-5 in their shoulder girdle muscles and nobody had muscle contraction Grade-1, Grade-2 or Grade-3.

26 participants (87%) within 30 had Grade-4 muscle contraction in their shoulder lateral rotator muscle and remaining 4 participants (13%) had Grade-5 muscle contraction in their shoulder lateral rotator muscle. So, result indicates that- in maximum case shoulder lateral rotator muscle possesses Grade-4 muscle contraction (Figure 5).

6 participants (20%) within 30 had Grade-4 muscle contraction in their shoulder abductor muscle and remaining 24 participants (80%) had Grade-5 muscle contraction in their shoulder abductor muscle. So, result indicates that- in maximum case shoulder abductor muscle possesses Grade-5 muscle contraction (Figure 5).

1 participant (3%) within 30 had Grade-4 muscle contraction in their shoulder medial rotator muscle and remaining 29 participants (97%) had Grade-5 muscle contraction in their shoulder medial rotator muscle. So, result indicates that- in maximum case shoulder medial rotator muscle possesses Grade-5 muscle contraction (Figure 5).

2 participants (7%) within 30 had Grade-4 musclecontraction in their shoulder flexor muscle and remaining 28 participants (93%) had Grade-5 muscle contraction in their shoulder flexor muscle. So, result indicates that- in maximum case shoulder flexor muscle possesses Grade-5 muscle contraction (Figure 5).

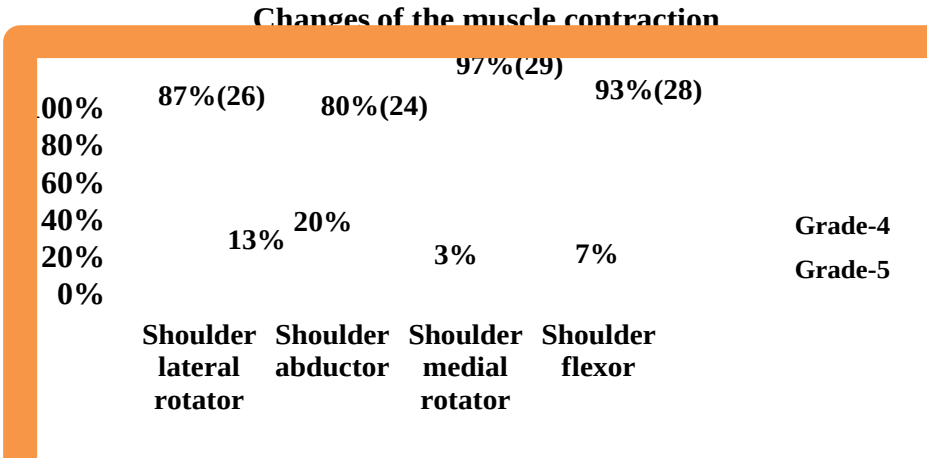


Figure 5: Changes of the muscle contraction in frozen shoulder patients.

Checkout the severity of muscle wasting

The pie chart below showing that- 2 participants (7%) had mild muscle wasting (less than 5mm) in their abductor muscle and remaining 28 participants (93%) had no muscle wasting in their abductor muscle. So, result reveals that most of the frozen shoulder patient possesses mild abductor muscle wasting (less than 5mm) (Figure 6).

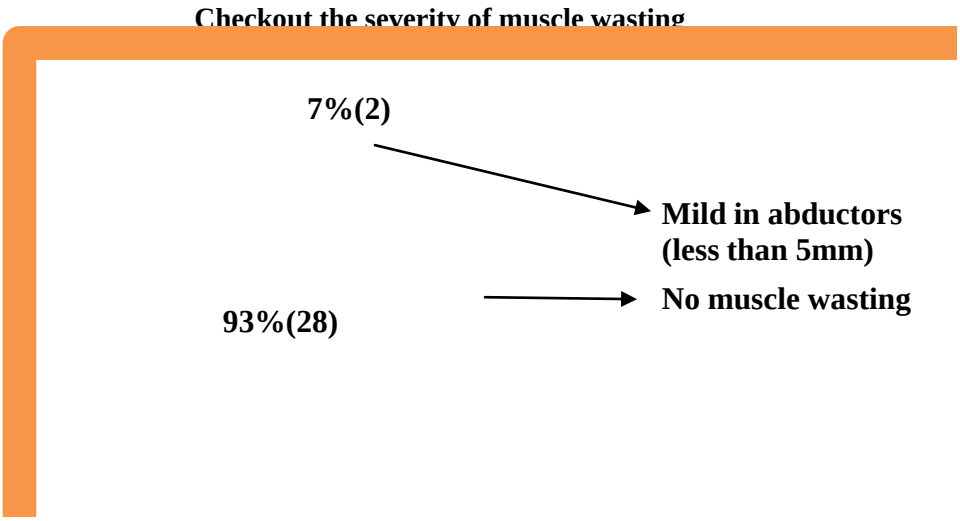


Figure 6: Shoulder girdle muscle wasting.

Alteration of bony alignment

Alteration of bony alignment in the shoulder girdle can be identified by knowing some points- identify percentages of shoulder level, rounded shoulder, inferior angle of scapula, gleno-humeral rhythm, winging of scapula and anterior apprehension test for shoulder subluxation or dislocation. Within these points, result of gleno-humeral rhythm represents 100% alteration and result of winging of scapula represents 100% absence of this. Other points with their results, are described below-

Disorientation of shoulder level

24 participants (80%) within 30 had equal shoulder level, 2 of the remaining (7%) had right shoulder slightly elevated and last 4 participants (13%) had left shoulder elevated. So, result shows that maximum frozen shoulder patient does not have any alteration in shoulder level. And rest of the part of the result shows that left shoulder elevation is common than right shoulder (Figure 7).

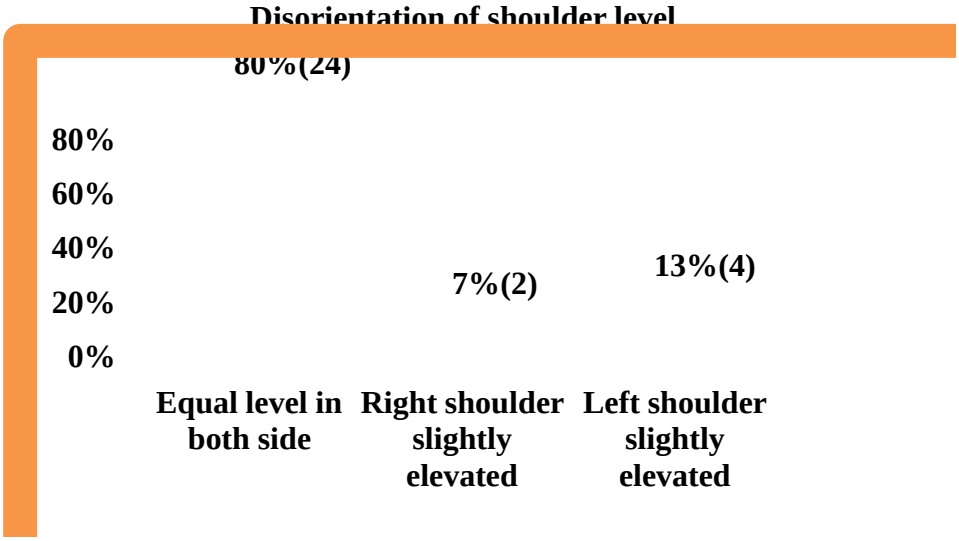


Figure 7: Disorientation of shoulder level.

Rounded shoulder in frozen shoulder patients

Among 30 participants, 26 (87%) had no rounded shoulder, 1 participant (3%) had right shoulder slightly rounded anteriorly and remaining 3 participants (10%) had left shoulder slightly rounded anteriorly. So, result shows that, rounded shoulder does not found in most of the frozen shoulder cases and percentage of rounded shoulder to the left side is more than right side (Figure 8).

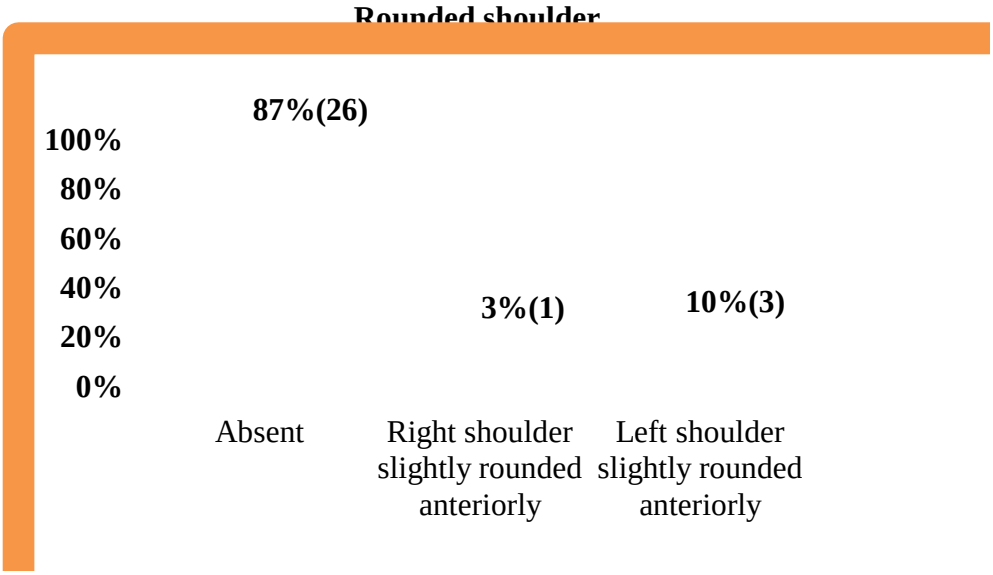


Figure 8: Rounded shoulder in frozen shoulder patients.

Identification of inferior angle of scapula

Among 30 participants 25 (83%) had equal level of inferior angle of scapula. 4 of the resting participants (14%) had left side slightly elevated and remaining 1 participant (3%) had right side slightly elevated. So, result shows that in maximum case both side inferior angle of scapula remain in equal level. And percentage of left side elevation is more than right side elevation (Figure 9).

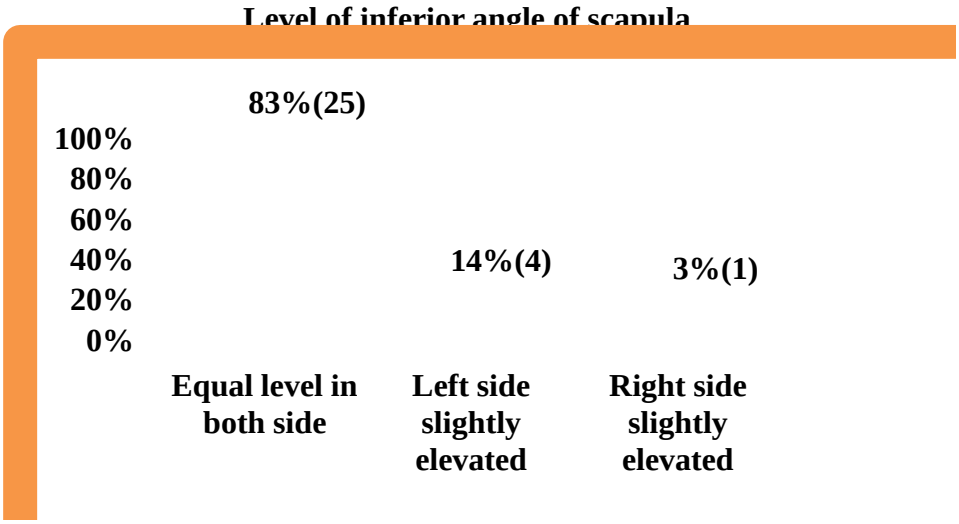


Figure 9: Level of inferior angle of scapula.

Apprehension test:

Subluxation or dislocation can be determined by anterior apprehension test. Result shows that, negative result is 86.7% and positive result is 13.3%. So, it can be said that, in case of frozen shoulder patient chance of subluxation or dislocation is less (Figure 10).

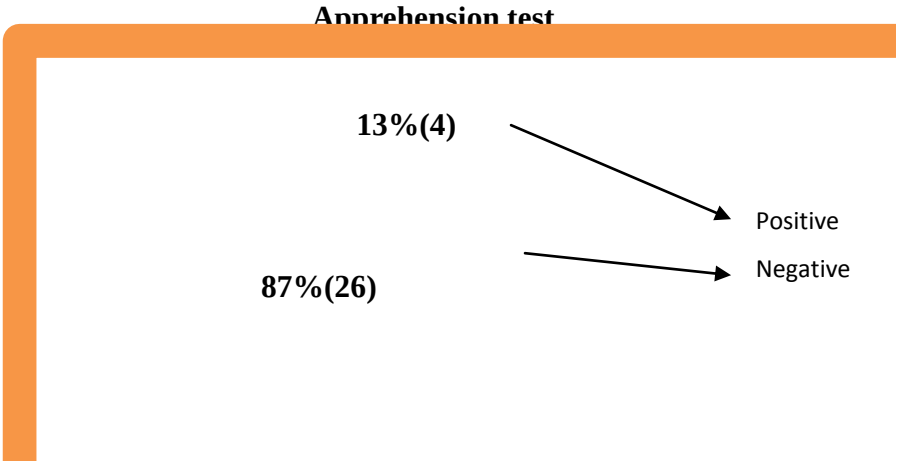


Figure 10: Subluxation or dislocation in frozen shoulder patient.

Gleno-humeral alteration

Among 30 participants, 6 participants (20%) had severe (1:1) glenohumeral alteration and resting 24 participants (80%) had moderate (1.5:1) glenohumeral alteration. So, result shows that, moderate glenohumeral alteration found in maximum case (Figure 11).

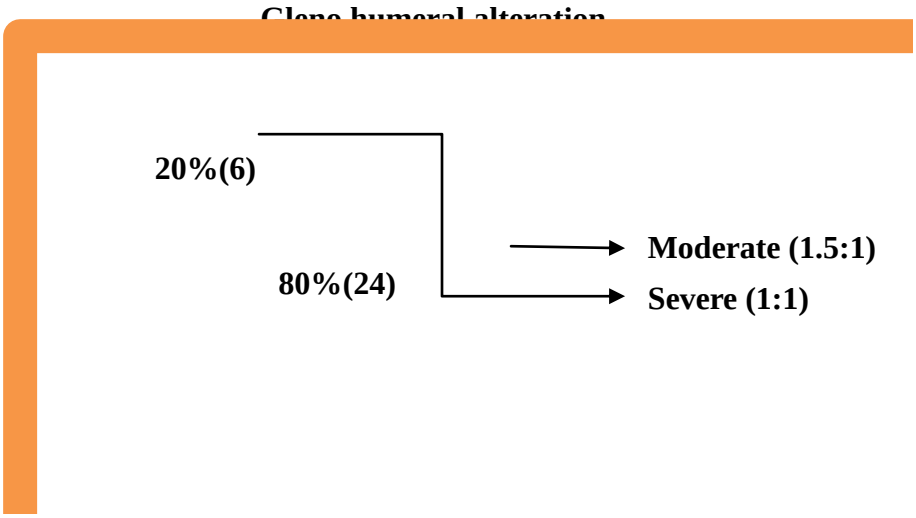


Figure 11: Gleno-humeral alteration in frozen shoulder patient.

CHAPTER-V DISCUSSION

Thirty participants had participated in this study. The study was done under the cross-sectional survey design. The first point of view of this study was to find out the variation of active range of motion among the patient with frozen shoulder. Four active range of motion has been studied- active lateral rotation range, active abduction range, active medial rotation range and active flexion range. In case of active lateral rotation range, 18 participants (60%) had a range of motion between 0°-30°. Remaining 12 participants (40%) had a range of motion between 31°-60°. But no participants had a range of motion between 61°-90°. In a study of California, 62 participants had been participated. Among those 29 participants had restricted lateral rotation range and the researcher had been selected an average range which was 65° (Shaffer et al, 1992). Comparison of these results explore that, his study does not support this study because there are some variation in environment, participants etc.

In case of active abduction range, 1 participant (3.30%) had a range of motion between 0°-60°. Remaining 24 participants (80%) had a range of motion between 61°-120°. And resting 5 participants had a range of motion between 121°-180°. Another study by Shaffer et al, (1992) in California showed that 17 participants among 62 participants had restricted abduction and selected average range was 149°. Result comparison showed that, his study supports this study.

In case of active medial rotation range, 9 participants (30%) had a range of motion between 0°-30°. Remaining 21 participants (70%) had a range of motion between 31°-60°. But no participants had a range of motion between 61°-90°. Shaffer et al. (1992) in California showed that, 10 participants among 62 participants had restricted medial rotation and it was fifth thoracic spinous process level as he measured this movement by comparing with thoracic spinous process level. Comparison of both result showed that, his study is not similar to this study.

In case of active flexion range, 1 participant (3.30%) had a range of motion between 0°-60°. Remaining 17 participants (56.70%) had a range of motion between 61°-120°. And resting 12 participants had a range of motion between 121°-180°. Another study

done by Shaffer et al, (1992) in California showed that, 10 participants among 62 participants had restricted flexion and selected average range was 161°. Comparison of these results reveals that, his study supports this study.

The second point of view was to evaluate changes of muscle contraction. 26 participants (86.7%) had Grade-4 muscle contraction and remaining 4 participants (13.3%) had Grade-5 muscle contraction in their shoulder lateral rotator muscle.

6 participants (20%) had Grade-4 muscle contraction and remaining 24 participants (80%) had Grade-5 muscle power in their shoulder abductor muscle.

1 participant (3.3%) had Grade-4 muscle contraction and remaining 29 participants (96.7%) had Grade-5 muscle contraction in their shoulder medial rotator muscle.

2 participants (6.7%) had Grade-4 muscle power and remaining 28 participants (93.3%) had Grade-5 muscle contraction in their shoulder flexor muscle.

No associated study or research is found, which support this study or similar to this study.

The third point of view was to check out the severity of muscle wasting. In this study, 2 participants (7%) had mild muscle wasting (less than 5mm) in their abductor muscle and remaining 28 participants (93%) had no muscle wasting in their abductor muscle. Another study done by Wong PLK at Nuffield Orthopaedic Centre in United Kingdom had 22 sample of frozen shoulder patient and study said that mild level of unuse atrophy occur in second stage of frozen shoulder.

The fourth point of view was to distinguish any alteration of bony alignment. Here, bony alignment includes-determination of shoulder level, rounded shoulder, inferior angle of scapula, subluxation or dislocation of gleno-humeral joint. In case of determination of shoulder level, 24 participants (80%) had equal shoulder level, 2 of the remaining (6.7%) had right shoulder slightly elevated and last 4 participants (13.3%) had left shoulder elevated. No associated study or research is found which support this study.

In case of rounded shoulder, 26 (86.7%) had no rounded shoulder, 1 participant (3.3%) had right shoulder slightly rounded anteriorly and remaining 3 participants (10%) had left shoulder slightly rounded anteriorly. Another study by Grubbs in 1993, states that patients with frozen shoulder syndrome often present with a stooped posture and rounded shoulders with the involved shoulder elevated in a protective manner.

In case of determination of inferior angle of scapula, 25 (83.3%) had equal level of inferior angle of scapula. 4 of the resting participants (13.3%) had left side slightly elevated and remaining 1 participant (3.3%) had right side slightly elevated. Another study in Indianapolis, Randquist studied with 17 participants and state that the involved scapulae were significantly more upwardly rotated (7.7°, $P<0.01$) than the noninvolved scapulae at peak involved side scapular plane elevation.

In case of subluxation or dislocation of gleno-humeral joint, negative appresion test result is 86.7% and positive apprehension test result is 13.3, as dislocation or subluxation can be determined by anterior apprehension test. Using the Bristow-Latariet procedure, Hovelius et al, were able to correlate arthritic condition and subluxation-arthritis rate of 35% in mild and 14% in moderate and severe cases.

The fifth point of view was to detect gleno-humeral alteration, 20% had severe (1:1) glenohumeral alteration and resting 80% had moderate (1.5:1) glenohumeral alteration is found. Another study by Scibec in 2012 with 13 participants and with the help of digital inclinometer showed that- scapulohumeral rhythm for the entire arc of shoulder elevation was equal to a ratio of 2.34:1 and ranged from 40.01:1 to 0.90:1 when assessed across the different increments of humeral elevation.

CHAPTER-VI CONCLUSION

The researcher explores the biomechanical changes at the shoulder girdle among the frozen shoulder patient attended in CRP with 30 participants. Objectives were to find out the variation of active range of motion among the patient with frozen shoulder, to evaluate changes of muscle contraction, to check out the severity of muscle wasting, to distinguish any alteration of bony alignment and to identify any alteration in gleno-humeral rhythm. From this study some things can be concluded that- in case of frozen shoulder patient, lateral rotation of the affected shoulder mostly hampered than abduction, medial rotation, and flexion. Early intervention can prevent this movement restriction. Most cases weakness found in the shoulder lateral rotator muscles, which can be minimized by normal functional exercises and muscle strengthening exercises. Abductor muscle wasting had been found which was due to inactivity or in case of chronic frozen shoulder patient. Practice of activities of daily livings may solve this problem. Left shoulder elevation was more common than right shoulder. Left shoulder was rounded in most of the participants than right shoulder. Left side scapular elevation was more common than right side. All these problems can be solved by different physiotherapy techniques. Chances of subluxation or dislocation are less in frozen shoulder patients.

Recommendations proposed by the researcher are- conduct the research in different places with different types of patient, using other sampling procedure, taking sample from different types of patient and from different departments, different correlational study.

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APPENDIX

Appendix-01 (English)

Permission Latter

June 26, 2012

To

Head of the Department

Department of Physiotherapy

Center for the Rehabilitation of the Paralyzed (C.R.P.),

Savar, Dhaka-1343.

Subject: Prayer for permission of data collection for research.

Sir,

I beg most respectfully to state that, I am Md.Shakil Ahmed Adil student of fourth year B.Sc in physiotherapy at Bangladesh Health Professions Institute (BHPI). In fourth year course curriculum we have to do research project. I have chosen a research title that "Biomechanical changes at shoulder girdle among the frozen shoulder patient attended at C.R.P."- under supervision of Nasirul Islam, Assistant Professor, BHPI. For this reason, I need permission for collection of data from the C.R.P. Musculoskeletal unit at Savar.

So, I therefore pray and hope that you would be kind enough to grant my application and give me the permission for collection of data from C.R.P.Musculoskeletal unit at Savar.

Yours obediently,

Md. Shakil Ahmed Adil

Md, Shakil Ahmed Adil

4th year B.Sc in Physiotherapy

Session: 2006-2007, Roll: 15

BHPI, C.R.P. Savar, Dhaka-1343.

Accepted

Md. Sohrab Hossain
Physiotherapy, BHPI
Physiotherapy Department, CRP

Appendix-02 (A) (Bengali)

মৌখিকঅনুমতি পত্র

(অংশগ্রহনকারীকে পড়ে শোনাতে হবে)

আস্সালামুওয়ালাইকুম/ নমস্কার। আমি মো: শাকিল আহমেদ আদিল বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট, সি, আর, পি-তে বি. এস.ইন ফিজি ওথেরাপী-র একজন ছাএ। এই ইনস্টিটিউট-টি ঢাকা ইউনিভার্সিটির মেডিকেল ফ্যাকালটির অধীভূক্ত।

যা হোক, আমার পড়াশোনা শেষ করতে আমাকে একটি গবেষণা করতে হবে। তাই, আমি একটা গবেষণা করছি-যে সকল ফ্রুজেন সোল্ডার রুগী সি.আর.পি-তে আসে তাদের কাধেঁর বায়োমেকানিকাল পরিবর্তনসমূহ। এই গবেষণাটি করার জন্য আমাকে ফ্রুজেন সোল্ডার রুগীদের কাছ থেকে তথ্য সংগ্রহ করতে হবে এবং জয়েন্টের অ্যাকটিভ মোভমেন্টে, চারদিকের মাংসপেশির শক্তি, মাংসপেশির শুকিয়ে যাওয়া এবং কাধেঁর হাড়ের অ্যাবনরমালিটি সম্নধ্যে জানতে হবে।

আপনি এই গবেষণার জন্য উপযুক্ত হওয়াই আমি আপনাকে অংশগ্রহন করার জন্য আমন্ত্রন জানাচ্ছি। জয়েন্টের অ্যাকটিভ মোভমেন্টে, ইন্সপেকশন এবং মাংসপেশির শক্তি পরীক্ষা করা নিরাপদ এবং আমি বিশ্বাস করি আপনার কোন ক্ষতি হবে না। এটা ২০-৩০ মিনিট সময় নিবে।

এই গবেষণায় আপনার অংশগ্রহন হবে সম্পূর্ণ ঐচ্ছিক এবং আপনি যে কোন সময় নিজেকে গবেষণা থেকে প্রত্যাহার করে নিতে পারবেন। আপনি যদি কোন প্রশ্ন পছন্দ না করেন অথবা কোন প্রশ্নের উত্তর দিতে না চান তা-ও আপনি পারবেন।

একজন অংশগ্রহনকারী হিসাবে আপনার যদি কিছু জানার থাকে তাহলে আপনি গবেষক মোঃ শাকিলআহমেদ আদিলে-র সাথে বি.এইচ.পি.আই.,সি. আর.পি.,সাভার, ঢাকা-১৩৪৩-র সাথে যোগাযোগ করতে পারেন।

আলোচনা শুরু করার আগে আপনার কি কোন প্রশ্ন করার আছে?

আলোচনার জন্য আমি কি আপনার অনুমতি পেতে পারি? হ্যা...../না.....

সাক্ষাৎকারগ্রহনকারীর সাক্ষর: .....তারিখ:

অংশগ্রহনকারীর সাক্ষর:.....তারিখ:

Appendix-02(B) (English)

VERBAL CONSENT STATEMENT

(Please read out to the participant)

Assalamu-alaikum/Namasker. I am Md. Shakil Ahmed Adil, a student of B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI), CRP. The institute is affiliated with the faculty of Medicine, University of Dhaka.

However, to the fulfillment of my degree, I shall have to conduct a research. That is why, I am going to conduct a research with the entitled "Biomechanical changes at shoulder girdle among the frozen shoulder patient attended at CRP". To carry out the research, I need to collect data from patients with frozen shoulder about active range of movement, muscle power, muscle wasting and any alteration in bony alignment.

Considering the area of my research, you have been met the inclusion criteria of the research, therefore I would like to invite you as a subject of the study. Measuring range of motion, inspection or checking muscle powers are safe intervention for frozen shoulder through which, I believe there will be no harm. It will take 20-30 minutes.

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 do not like or do not want answer during interview.

If you have any query about the study or your right as a participant, you may contact with researcher Md. Shakil Ahmed Adil, BHPI, CRP, Savar, Dhaka-1343.

Do you have any question before I start?

So may I have your consent to proceed with the interview? YES……../ NO……...

Signature of the Interviewer : Date:

Signature of the participant : Date:

Appendix-03 (A) (Bengali)

প্রশ্নপএ

যে সকল ফ্রুজেন সোল্ডার রুগী সি.আর.পি-তে আসে তাদের কাধেঁর বায়োমেকানিকাল পরিবর্তনসমূহ।

রুগীর নাম্বার: তারিখ:

বয়স:

পুরুষ/মহিলা:

পেশা:

রোগ:

A) চেক্‌লিস্ট:

ক) আক্রান্ত কাধঁ: ১) ডান ২) বাম

খ) কাধেঁর ব্যাঁথা: ১) আছে ২) নাই

গ) ব্যাঁথার তীব্রতা: ১) কম ২) মাঝারি ৩) তীব্র

ঘ) বাঁথার ধরন: ১) সবসময় ২) থেমে থেমে

ঙ) যা করলে ব্যাঁথা বাড়ে: .....

চ) যা করলে বাঁথা কমে: .....

B) রেন্‌জ অফ মোশন:

মোভমেন্ট	অ্যাকটিভ রেন্‌জ অফ মোশন	প্যাসিভ রেন্‌জ অফ মোশন	এন্ড ফিল
	ব্যাঁথাসহ / ব্যাঁথাছাড়া রেন্‌জ	ব্যাঁথাসহ / ব্যাঁথাছাড়া রেন্‌জ	
১) কাধেঁর ল্যাটারাল রোটেশন			
২) কাধেঁর অ্যাবডাকশন			
৩) কাধেঁর মিডিয়াল রোটেশন			
৪) কাধেঁর ফ্লেক্‌শন			

C) ক্যাপসোলারপ্যাটার্ন: ১) পজিটিভ ২) নেগেটিভ

D) রেজিস্টেট টেষ্টস:

ক) ল্যাটারাল রোটেশন	আইসোমেট্রিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
খ) অ্যাবডাকশন	আইসোমেট্রিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
গ) মিডিয়াল রোটেশন	আইসোমেট্রিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
ঘ) ফ্লেক্শন	আইসোমেট্রিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
ঙ) ল্যাটারাল রোটেশন	আইসোটনিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
চ) অ্যাবডাকশন	আইসোটনিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
ছ) মিডিয়াল রোটেশন	আইসোটনিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল
জ) ফ্লেক্শন	আইসোটনিক	১) ব্যাথাসহ শক্তিশালি ২) ব্যাথাসহ দূর্বল ৩) ব্যাথাছারা শক্তিশালি ৪) ব্যাথাছারা দূর্বল

E) ম্যাসল পাওয়ার মেজারমেন্ট (অক্সফোর্ড গ্রেড স্কেলের সাহায্যে):

ক) ল্যাটারাল রোটেটর	১) ০	২) ১	৩) ২	৪) ৩	৫) ৪	৬) ৫
খ) অ্যাবডাকটর	১) ০	২) ১	৩) ২	৪) ৩	৫) ৪	৬) ৫
গ) মিডিয়াল রোটেটর	১) ০	২) ১	৩) ২	৪) ৩	৫) ৪	৬) ৫
ঘ) ফ্লেক্জর	১) ০	২) ১	৩) ২	৪) ৩	৫) ৪	৬) ৫

F) ইন্সপেকশন:

১) গায়েঁর রঙের পরিবর্তন: .....

২) ফোলা : .

কোথায়	তীব্রতা
	১) কম ২) মাঝামাঝি ৩) তীব্র ৪) নেই

৩) মাংসপেশী শুকিয়ে যাওয়া:

মাংসপেশী	তীব্রতা
	১) কম ২) মাঝামাঝি ৩) তীব্র ৪) নেই

৪) কাধেঁর লেভেল: .....

৫) বাকাঁনো কাধঁ: .....

৬) ইনফেরিঅর অ্যাঙ্গেল অব স্ক্যাপুলা: .....

৭) সাবলাক্সেশন / ডিসলোকেশন: .....

৮) ম্যাসল স্পাজম: .....

৯) গ্লেনো-হিউমেরালরিদম: .....

১০) ম্যাসলটাইটনেস: .....

১১) উইংগিংঅব স্ক্যাপুলা: .....

G) স্পেশাল টেস্টস:

ক) ড্রপআর্ম টেস্ট:	১) পজিটিভ	২) নেগেটিভ
খ) ইয়ারগাছন টেস্ট:	১) পজিটিভ	২) নেগেটিভ
গ) রমবয়েড ইন্টিগ্রিটি টেস্ট:	১) পজিটিভ	২) নেগেটিভ
ঘ) ম্যাসলটাইটনেস টেস্ট:	১) পজিটিভ	২) নেগেটিভ
ঙ) অ্যাপরিহেনশন টেস্ট:	১) পজিটিভ	২) নেগেটিভ
চ) অ্যাপলি স্ক্র্যাচ টেস্ট:	১) পজিটিভ	২) নেগেটিভ

H) আনুসঙ্গিক সমস্যা:

১) শুধু কাধঁ জরিত

২) ঘাড়েঁর সমস্যা থেকে পরবর্তিতে কাধেঁর সমস্যা

৩) ঘাড়ঁ ও কাধঁ উভয়েই জরিত

Appendix-03 (B) (English)

Questionnaire

BIOMECHANICAL CHANGES AT SHOULDER GIRDLE AMONG THE FROZEN SHOULDER PATIENT ATTENDED AT CRP

Subject no: Date:

Age:

Sex:

Occupation:

Clinical diagnosis:

A) Check list:

a) Affected shoulder: 1) Right 2) Left

b) Shoulder pain: 1) Present 2) Absent

c) Severity of pain: 1) Mild 2) Moderate 3) Severe

d) Nature of pain: 1) Constant 2) Intermittent

e) Aggravating factors:

f) Relieving factors:

B) Range of Motion (ROM):

Movement	Active Range of Movement	Passive Range of Movement	End feel
	Painful / Painless range	Painful / Painless range	
1)Shoulder Lateral Rotation			
2)Shoulder Abduction			
3)Shoulder Medial Rotation			
4)Shoulder Flexion			

C) Capsular pattern: 1) positive (+) 2) Negative (-)

D) Resisted Test:

1) Lateral Rotation	Isometric	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
2) Abduction	Isometric	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
3) Medial Rotation	Isometric	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
4)Flexion	Isometric	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
5) Lateral Rotation	Isotonic	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
6) Abduction	Isotonic	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
7) Medial Rotation	Isotonic	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak
8) Flexion	Isotonic	i)Painful strong ii)Painful weak iii)Painless strong iv)Painless weak

E) Muscle Power Measurement (By OXFORD Grade Scale):

1)Lateral Rotator	i) 0	ii) 1	iii) 2	iv) 3	v) 4	vi) 5
2)Abductor	i) 0	ii) 1	iii) 2	iv) 3	v) 4	vi) 5
3)Medial Rotator	i) 0	ii) 1	iii) 2	iv) 3	v) 4	vi) 5
4)Flexor	i) 0	ii) 1	iii) 2	iv) 3	v) 4	vi) 5

F) Inspection:

1) Colour change:…….

2) Swelling:

Where	Severity
	i)Mild ii)Moderate iii)Severe iv)No

3) Muscle Wasting:

Which muscle	Severity
	i)Mild ii)Moderate iii)Severe iv)No

4) Shoulder Level:……

5) Rounded Shoulder:……...

6) Inferior Angle of Scapula:……

7) Subluxation / Dislocation: ……...

8) Muscle Spasm: ……..

9) Gleno-humeral Rhythm: ……...

10) Muscle Tightness: …….

11) Winging of Scapula: ……

G) Special Tests:

1) Drop Arm Test: i) Positive ii) Negative

2) Yergason's Test: i) Positive ii) Negative

3) Rhomboid Integrity Test: i) Positive ii) Negative

4) Muscular Tightness Test: i) Positive ii) Negative

5) Apprehension Test: i) Positive ii) Negative

6) Apley Scrratch Test: i) Positive ii) Negative

H) Associated Problems:

1) Only shoulder joint involvement

2) Shoulder pathology is secondary to cervical problem

3) Both cervical and shoulder joint involvement