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COMPARE THE EFFECTIVENESS OF CAPSULAR STRETCHING AND MAITLAND MOBILIZATION IN REDUCING PAIN AND DISABILITY AND IN IMPROVING RANGE OF MOTION IN DIABETIC PATIENTS WITH CHRONIC FROZEN SHOULDER (FREEZING STAGE)

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Abstract

Background: *Frozen shoulder (adhesive capsulitis) is a prevalent musculoskeletal disorder characterized by progressive pain and global restriction of shoulder movement. The incidence is notably higher in patients with type II diabetes mellitus, often resulting in prolonged disability. Capsular stretching and Maitland mobilization are common physiotherapeutic interventions used to manage this condition, yet their comparative effectiveness in diabetic populations remains under-investigated.*

Objective: *To evaluate and compare the effectiveness of capsular stretching and Maitland mobilization in reducing pain and disability and in improving range of motion in diabetic patients with chronic frozen shoulder (freezing stage).*

Methods: *Thirty diabetic patients diagnosed with chronic frozen shoulder were randomly divided into two groups receiving either capsular stretching (Group A) or Maitland mobilization (Group B). Both interventions were administered over four weeks. Outcome measures included the Shoulder Pain and Disability Index (SPADI) and goniometric measurements of shoulder flexion, abduction, and external rotation recorded pre- and post-intervention.*

Results: *Both groups showed statistically significant improvement in SPADI scores and shoulder range of motion after intervention ($p < 0.05$). Group A showed a reduction in mean SPADI scores from 54.6 to 36.3 and an increase in abduction from 71.8° to 112.6°, whereas Group B improved in SPADI from 55.1 to 32.4 and abduction from 72.1° to 118.7°. No statistically significant differences were observed between the two groups post-intervention, suggesting comparable efficacy.*

Conclusion: *Capsular stretching and Maitland mobilization are equally effective physiotherapy techniques for improving pain, function, and range of*

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motion in diabetic patients with chronic frozen shoulder. Selection between these techniques can be based on therapist expertise and patient preference.

INTRODUCTION

BACKGROUND:

The third most common musculoskeletal problem that people seek medical help from there general physicians for shoulder pain, out of which 50-80% people taking no medical advice at all. About 2% to 5% people with no medical diseases general population related to frozen shoulder is reported and 10% to 15% reported with Diabetes mellitus causing a self-limiting condition (2). In the 6th decade, the most common problem reported in women was a combination of shoulder pain and stiffness that runs bilaterally, causing sleep disturbance and marked disability, which was seen to be a resolving situation in some years, but the higher ratio was of Diabetes mellitus in which type II was reported (12). This pain was usually reported after an injury, atrophy of muscle or by an autoimmune component was seemed to be involved (N, 2011). We have heard the phrase that 'If you don't use it, you will lose it'.

This phrase applies perfectly to the condition of shoulder that we might lose its mobility either voluntary or involuntary. Physician and patients do not understand the importance of shoulder until the functions are compromised. Frozen shoulder is considered as a syndrome in which there is global restriction of shoulder movement, which results in idiopathic painful shoulder. It is considered as a self-limiting condition (2). Adhesive capsulitis, which is commonly known as frozen shoulder. Duplay first described the term in1872 as a 'Peri-arthritis scapula –humeral'.

In1934, Codman first used the term 'Frozen shoulder' (3). He gave a thought that frozen shoulder can be resolved within two years followed by no treatment. He was the first to describe the hallmark of the disease that is marked reduction in forward elevation and external rotation (4).

In 1945 Neviaser described the term "Adhesive Capsulitis" (3).

Those people who are at highest risk factor for developing frozen shoulder are those suffering from diabetes mellitus, lung diseases, heart diseases, stroke, Patients who have a pervious history of dupytren's disease. Female gender is more prone to disease with a ratio of 3:1, age group of people in 40-60s is most affected, and left shoulder is more effected than right with a ratio of 1.3:1 along with 15% develop bilateral pain in shoulder as stated by Brukner and khan 2009(1).

The major sign and symptoms that are reported in patients suffering from adhesive capsulitis are progressive loss in active and passive range of motion, which shows true joint pathology (9). The range of motion gets painful along with severely restricted, it might arise because of certain injury but it can occur spontaneously without any other cause leading to idiopathic frozen shoulder.

The duration for the symptom last for thirty months and it may continue for seven years(7) .The phase one ,which is freezing phase ,is a progressive painful phase with stiffness and loss of motion, causing the worst pain of night .In second phase ,which is frozen phase the stiffness remains the same but there is decrease in pain gradually, the restriction in range of motion is still considerable .In the third phase of resolution, the pain is present in a very ident, connective tissue diseases, tonic seizures, and thyroid(9),less amount as well stiffness has improved and improved range of motion (10).The diagnostic imaging for adhesive capsulitis can be seen on non-contrast MRI, MR Arthrography, invasive arthroscopy, and ultrasound(11).The basic interventions which are used to manage adhesive capsulitis is education / watchful waiting, physical therapy(moist heat or cold application, range of motion exercises, strengthening ,stretching, manual therapy mobilizations and

manipulations along with patient education and home exercise program (12,13 and 14). Physician and patients do not understand the importance of shoulder until the functions are compromised. Adhesive capsulitis is considered as

a syndrome in which there is global restriction of shoulder movement, which results in idiopathic painful shoulder.

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As physiological accessory movements are resolved by joint mobilization techniques with traction and glide which are used to stretch the capsule. The distraction of one articular surface which is perpendicular to the other surface is called traction and when there is translational movement of one surface parallel to other is called gliding movement (15, 16).

The International Maitland Teachers Association (IMTA) defines the Maitland concept as a process of examination, assessment, and treatment of neuromusculoskeletal disorder by manipulative physiotherapy (17)(18). Maitland mobilization in which grade I and grade II mobilization techniques are used for the painful and restricted range of shoulder joint and limited pain. There is inhibitory effect on painful stimulus by stimulating mechanoreceptors repeatedly and this repetition stops the nociceptive pathway of spinal cord or brain stem level (19) (20), while grade III and IV follows the stretching maneuvers. A study in which Andrea J Johnson and Joseph J Godges et al found out that posterior anterior glide is more effective in restoring range of motion than anterior posterior glide (32). This is very important that a proper assessment and examination leads to the selection of correct grade of mobilization. In current study the goal is to find out the effectiveness of capsular stretching and Maitland mobilization in patients with chronic frozen shoulder along with diabetes mellitus type II.

STATEMNET OF PROBLEM:

To study the effectiveness in frozen shoulder by comparison of Capsular stretching and Maitland mobilization in effected individual with frozen shoulder having diabetes melltius type II and chronic (freezing stage) shoulder to reduce the pain and disability to perform the functional activities of daily life. There for it is the need of every day's life to have a fit shoulder, so the study emphasis on finding out the best treatment in comparison to both for improving the quality of life.

RESEARCH OBJECTIVE:

To find out the effectiveness of Capsular stretching versus Maitland mobilization in subjects of Diabetes mellitus with chronic frozen shoulder.

RESEARCH SIGFINANCE:

This study distinguished between the two major techniques Capsular stretching and Maitland mobilization to understand which therapy is beneficial and have higher improved prognosis among the diabetic frozen shoulder patients. This study was not only improve the patients with frozen shoulder for functional activities of daily life but also helped physiotherapists to treat frozen shoulder patients with righteous techniques which will improve and help them further in future.

OPERATIONAL DEFINITIONS:

CAPSULAR STRETCHING:

As we know that capsular joints are more prone to calcify with age and cause a restricted range of motion and painful joint so stretching the capsule cause the movement of synovial fluid and it activates the synovial gland which facilitates the sliding movement of articular joint.

MAITLAND MOBILIZATION:

Maitland concept is a process of examination; assessment and treatment of musculoskeletal disorder by manipulative physiotherapy where a chain of oscillatory joint mobilization grades based on the pathological limit of tissue are used. There are 5 grades of mobilization in the Maitland concept:

Grade I: Small-amplitude, rhythmic oscillations are performed at the beginning of the range.

Grade II: Large-amplitude, rhythmic oscillations are performed within the range below tissue resistance, not reaching the anatomic limit.

Grade III: Large-amplitude, rhythmic oscillations are performed to the limit of the available motion and into tissue resistance.

Grade IV: Small-amplitude, rhythmic oscillations are performed to the limit of the available motion and to tissue resistance.

Grade V: A small-amplitude, high velocity thrust technique is performed to stretch adhesions to the limit of the available motion.

GONIOMETER:

Gonio =angle and metron=measure

An instrument use to measure angles and allows the object to rotate to a precise angular position is known as Goniometer. In 1538 Gemma Frisius

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discovered this it has two arms one is moveable and other one is fixed one. There is a fulcrum to which both arms are attached, and 360-degree measurements were written on it to note the range of motion of joint and the moveable arm has measurement of 1cm to 20cm.

SHOULDER PULLEY:

It is a small pulley system having a skipping rope over a fulcrum. Apparatus gets hooked over the top of the door and the handles hang downwards. The patient comfortably sits on a chair using both the ropes of pulley in hands and moving alternatively to improve shoulder flexion and extension.

LITERATURE REVIEW:

In September 2020, Ola I.Ibrahim and Salwa et al did a randomized controlled trail about the effect of mobilization in frozen shoulder chronic stage by using VAS , SPAID and Goniometry having pre and post treatment record showing a significant increase in shoulder flexion, abduction and external rotation with the probability of (p=0.0001) it was concluded that mobilizations specially anterior , posterior and inferior glide were effective in frozen shoulder stage II and III in which six sessions were given in twice a week for two months (21).

Yang et al did a randomized multiple treatment trail on two groups having a comparison of Maitland end range mobilization with mid-range mobilization using outcome of functional score and shoulder kinematics it was randomly allocated blind between group interventions which proposed the conclusion that mid-range mobilization seems to be less effective than end range mobilization and mobilization with arm movements. (22).

About the effectiveness of sustained capsular stretching (inferior capsule) a 100-participant randomized controlled trail was done by Antony Paul and Joshua Samuel Rajkumar et al for two weeks in which more than 60% of participants were improved in shoulder function willing to do over head activities and decreased pain with improved range. According to the outcome of Oxford Shoulder Score (OSS) in which the experimental group improved 18% while the control group showed the least results (23).

The international journal of medical and health research in 2017 did a comparative study in 2017 to know the efficacy of Maitland mobilization in stage II adhesive capsulitis, as we know that the treatment principles of adhesive capsulitis are to relieve pain , ultimately increasing the range of motion and bringing back the function to normal activities of daily life, Sengpya Phukon and Sowmya MV used the participants with age of 40-60years with restricted capsular pattern in which Maitland mobilization group received positive aspects of outcome (24).

To find out the reliability and validity of the outcome measure being used in shoulder adhesive capsulitis patients SPAID (shoulder pain and disability index) Einer Kristian Tveita and Ole Marius Ekberg et al included seventy six patients having adhesive capsulitis, results indicated the responsiveness of SPAID to shoulder range of motion when compared, SPAID showed ($p<0.001$ for all the comparisons with range of motion) showing the use and reliability of extensively employed shoulder outcome variable in adhesive capsulitis patients(25).

N Maricar, C Shacklady and L McLoughlin et al did a single case study design to restore the shoulder functions, reduce the pain and ranges by physiotherapy approach in 2017. Stage III shoulder considered as the most freezing phase, the author made two groups for comparison treating with shoulder capsular stretching and another group with shoulder Maitland mobilizations. Two most important glides in Maitland mobilization anterior posterior for shoulder flexion and longitudinal caused in shoulder abduction were evaluated. The outcome score was concluded by SPAID measurements to monitor functional and disability, the SPAID score showed improvement in all four ranges of shoulder (flexion, abduction, external rotation, and extension), N Maricar concluded that both capsular stretching exercises and Maitland mobilization founds to be affective for adhesive capsulitis patients on SPAID score (26).

In 2020, Sami S. Almureef1 and Waleed Medhat Ali et al included randomized controlled trails from 2010-2020 from many different scholar websites and made a critical review about the condition of freezing shoulder, capsulitis, or a global restriction of shoulder joint. In all the articles of last 10 years there

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is a range of 30-60 participants seen with frozen shoulder may have other co-morbidities like Diabetes mellitus, the studies were conducted randomly sharing the Maitland mobilization techniques and comparing it with exercises and capsular stretches, the outcome measures were similar those which are globally used like VAS, SPAID, OSS and goniometry. The evidence concluded that not only Maitland mobilization alone but with other strengthening and stretching exercises along with home program can benefit the participants more (27).

Saba Aijaz Ali and Muhammad Khan et al, 2015 conducted a randomized controlled trail in Karachi. The study consisted if age group 25-40 years and were allocated in two groups. They proposed the comparison of Maitland mobilization with exercise therapy, after a 5 weeks of intervention significant improvement in outcome measures of VAS, ROM and SPAID was shown with $p<0.001$), but the study showed no significant difference between both the therapies of frozen shoulder patients (28). In February 2016, a randomized trial was made with convenient sampling having 37 patients in which an oscillatory Maitland mobilization technique was compared with sustained capsular stretch technique having an age criterion of 30-60 years, having Numeric pain rating scale and SPAID as the functional, disability and pain outcome. The results showed no significant statically difference in ranges of abduction, internal rotation, external rotation, NPRS and SPAID except for the oscillatory movements of abduction showed marked improvement (29).

Insulin dependent diabetes mellitus and shoulder joint mobility limitations, B Pal, and J Anderson et al did a study on diabetes mellitus insulin dependent patients around 109 patients were included in the study, those participants having impaired joint mobility showed a longer duration of diabetes ($p=0.01$), they also showed increased frequency of retinopathy showing ($p<0.05$). Shoulder capsulitis was present in 95% of the patients showing restriction in mobility (30).

In 2019 Irem Duzgun and Elif Turgut proposed a study of posterior capsular stretching having single blinded, randomized control trail of 54 patients, the capsule tension was recorded immediately and before the mobilization showing statically significantly improve in all ranges of motion with ($p<0.05$) except a slight difference was seen with internal rotation ($p>0.05$). Hence the authors found out, it was observed with experimental trail that the shoulder joint range was improved with the implementation of posterior capsular stretching (31).

PATHOPHYSIOLOGY OF FROZEN SHOULDER:

The frozen shoulder is commonly known as "idiopathic "a term which is described as no known cause of it, hence it is considered as the most severely debilitating condition. The pain in shoulder starts slowly can be just an overnight cause or due to secondary complications, the pain is felt in the deltoid muscle at the point of insertion. Commonly it is accepted that inflammation initially occurs in the joint capsule and synovial fluid causing reactive fibrosis and adhesion in the line of synovial glenohumeral joint. The atrophy of spinatie and a local tenderness and swelling is observed. The glenohumeral capsular tissue and particularly coracohumeral ligament in rotator interval becomes localized. The inflammatory changes causing fibrosis and proliferate in the rotator cuff muscles causing myelofibrosis. It is a cytokine mediated response to the inflammation or injury. The immunocytochemical techniques and antibodies give a clearer picture of the debilitating condition.

CLINICAL PRESENTATION OF FROZEN SHOULDER:

The patient clinically presents with insidious onset of vague and dull pain usually seen at the point of insertion of deltoid, the patient complains of pain as the shoulder joint is moved.

The nights get sleepless and there is inability to sleep on the affected side in initial freezing stage me. As the patient reports the pain after two months or 15 days showing severe hardness and inability to make the shoulder joint move and a marked increase in pain in stage II freezing or painful stage in which the patient complains of having the worst night of life.

In stage III the patient does not complain of pain or tenderness but shows a restricted shoulder ranges not even able to do the activities of daily life and the shoulder becomes severely stiff. As it is a myth, or

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some studies suggest that stage IV or the thawing stage the frozen shoulder gets painless and may even return to normal showing its idiopathic behavior.

CLINICAL EXAMINATION OF FROZEN SHOULDER:

The patient is examined with both arms and shoulder exposed, the clavicle, acromion and acromion clavicular joint are the anterior landmarks while scapula and scapular spine are the posterior landmarks, ask the patients to shrug its shoulder showing any asymmetry leads to muscle wasting at deltoid, supraspinatus, and infraspinatus, palpate to see any tenderness on both the landmarks. Now ask the patient to move hands up (flexion), down (extension), side (abduction), over the chest (adduction), with elbow flexed on side table (internal and external rotation) and finally move like a wheel (circumduction) to note the active range of motions of the body compare the ranges with the unaffected arm. If the same examination was done by therapist, it is called passive range of motion. The person with frozen shoulder has limited shoulder range of motions both active and passive.

DIAGNOSIS:

The patient is diagnosed by applying following test:

NEER TEST:

The patient is in standing position therapist stabilize the scapula with one hand and passively move the shoulder in flexion with arm above the head if the patient complains of pain, it is a positive test for impingement and differential diagnosis for frozen shoulder.

HAWKINS TEST:

The patient is in standing and therapist stabilize the scapula, flex the shoulder to 90 degrees, flex the elbow to 90 degrees and then internally rotate the shoulder, patient complains of pain is positive test for impingement and dd for frozen shoulder.

ROTATOR CUFF STRENGTH TEST:

The patient is in standing position and the therapist ask to resist the external rotation with hands in a fist position to check rotator cuff strength or abduct the arm to 90 degree and therapist gently pushed down the abducted arm if the patient is actively able to move hand up against resistance than the test is negative.

SUPRASPINATOUS TEST:

This test may be performed with the patient standing or seated, with the elbow extended, the patient's arm is held a t90° of abduction,30° of horizontal flexion, and in internal rotation (with thumb facing down). The examiner exerts pressure on the upper arm during the abduction and horizontal flexion motion.

•when this test elicits severe pain and the patient is unable to hold his or her arm abducted 90° against gravity, this is called a positive empty can test/supra spinatus tendinitis.

INTERVENTION:

The basic recommendations are of NSAIDS (anti-inflammatory drugs) which reduces the painful shoulder usually aspirin, ibuprofen etc. Many studies have showed that corticosteroid injections in the shoulder joint capsule, helps the tissues to release the fibrosis and move. Not only has this but joint distension by sterilized water made it easier to move. Local and both general anesthesia by applying manipulation can be pain free treatment now as it loses the tight joint capsules

and the surgeon moves the shoulder completing all ranges. The last option for frozen shoulder to be treated is arthroscopy in which a light, tubular instrument is inserted with a small incision in shoulder joint.

PHYSICAL THERAPY INTERVENTION:

Physiotherapy includes active and passive range of motion exercises, usage of modalities like ultrasound to reduce swelling along with ice packs and restricted shoulder having hot packs, laser, infrasound, and diathermy. Use of pulley, TheraBand, weights and towel exercises. But the most important are Maitland, mulligan and keltanborn gliding techniques along with capsular and scapular stretching and tractions. Resistance training and strengthening exercises.

CAPSULAR STRETCHING:

ANTERIOR SHOULDER STRETCH: The patient is standing in front of the wall having palm against

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the wall, keeping the shoulder bend to 90 degrees, now turn your body away from your arm and stretch the anterior capsule of your shoulder, hold stretch for 20seconds and repeat 5 times.

POSTERIOR SHOULDER STRETCH: The patient is standing and asks the patient to bring the affected arm across the chest height and use the other hand with elbow bend and pull it up straight high you will feel stretch at the back of the shoulder and upper back, hold for 20 seconds, and repeat 5 times.

INFERIOR SHOULDER STRETCH: Make the position sit in a comfortable position and ask the patient to touch the upper back of the affected shoulder as the patient does so apply over pressure with his other hand, slowly and in a downward motion to stretch the capsule. Do this for 30seconds and repeat 5 times.

MAITLAND MOBILIZATION:

ANTERIOR GLIDE:

The external rotation is enhanced with anterior glide, First we ask the patient to expose the affected arm to be treated, the patient lies comfortably in prone position (face facing towards pillow) the towel is placed right on the coracoid process, the patient lies closed to the edge in such a position that glenohumeral joint is off the table make the open pack position, which is 55 degree abduction and elevation , the therapist bends the knee slightly so that the patients affected arm lies over it, right hand of therapist is in patient's axilla and left hand stabilized the arm and distract the humerus, after distraction palpate the lateral side of acromion and place the right hand on it and make anterior glide carefully , as the joint is off the treatment bed, both the therapist hands elbow must be locked to maintain the position. Small amplitude rhythmic oscillation at the beginning is performed 15sets for grade I, a little deeper in range and large amplitude in grade II. While performing grade III with the resistance large amplitude oscillatory movements were made and in grade IV small amplitude oscillations into the restricted range a 15set of glide was given completing the therapy with 60 glides in total.

POSTERIOR GLIDE:

As we know that posterior anterior glide restores flexion, internal rotation, and horizontal adduction range of motion. First, we ask the patient to expose the affected arm to be treated, the patient lies comfortably in supine position (face facing towards roof) and the affected arm is at the edge of the table in a loose pack position, 30-degree flexion, 55degree abduction and neutral rotation. Now the therapist stands on the side of the treatment bed and locks the patient's arm with his own arm, a towel is placed below the affected shoulder of patient to stabilize the scapula, the right hand and elbow locked of therapist, lies over the glenohumeral joint with the palm pressing downward on it and left hand distracts the shoulder joint. Small amplitude rhythmic oscillation at the beginning is performed 15sets for grade I, a little deeper in range and large amplitude in grade II. While performing grade III with the resistance large amplitude oscillatory movements were made and in grade IV small amplitude oscillations into the restricted range a 15set of glide was given completing the therapy with 60 glides in total.

INFERIOR GLIDE:

This glide improves abduction of shoulder joint, the patient lies comfortably in same position as posterior glide, while performing inferior glide the therapist feet should move in inferior position, making a walk standing like pattern. The therapist locks the patients affected arm with left hand and palm of left hand in axilla, while right hand over superior side of humerus and distract the joint in this position and simultaneously gives inferior glide (glide towards bed) the body of therapist should move in inferior direction same as the patients arm movement. All four glides are performed with 15 sets each and making a total 60 glide treatment protocol.

HOME EXERCISE PROGRAM (HEP):

PULLEY EXERCISES:

A moveable device known as pulley which basically is a skipping rope passing over a fulcrum or an iron beam. The patient is instructed to sit in a chair with pulley over his head, now we ask the patient to gently hold both the arms of pulley and alternatively move up and down the beam, this helps the patient to

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improve its flexion and extension range of motion. Patient was asked to perform this thrice a day for 10 minutes every day, patient might add weights to it when working on shoulder strengthening.

FINGER LADDER EXERCISES:

Usually in physical therapy department a ladder is fixed to the wall for frozen shoulder patients, but it was instructed to patient to mark lines on wall from 1cm to 30cm. The patient is instructed to stand in front of the wall facing it and asked to place the affected hand over the ladder from lowest level 1-2cm than slowly move the fingers in a climbing position till the patient can lift the arm up. Then slowly brings back the arm in same position to the starting point. Repeat this exercise thrice a day for 10 minutes, patient can hold the hand in this position later for 5 seconds to improve the strength of shoulder.

CIRCUMDUCTION EXERCISES:

The patient is asked to lie down in prone position (face facing downward to pillow), at the edge of the bed and hang the affected arm outside the bed in a comfortable position. The patient is instructed either to take a 1kg dumbbell or a 1-liter water bottle in hand and move the hand in a circular manner both clockwise and anti-clockwise direction. Each movement is performed 5 times total 10 times thrice a day for at least 10 minutes, weight can be increased for strengthening purpose.

PENDULUM EXERCISES:

The patient was instructed to hold the same 1kg dumbbell or 1 liter water bottle in hand in standing position, the patient was asked to bend forward by place the non-affected arm on a table to maintain the balance, now gently swing the affected arm in to and for motion (forward and backward) until the patient feels the stretch and it should be pain free. Do this exercise thrice a day for at least 10 minutes, weight can be increased for strengthening purpose.

METHODOLOG:

Individual with frozen shoulder having an age group of 30 to 65 years were included in the study having a frozen phase of frozen shoulder about three months old, showing a positive diagnosis of diabetes mellitus type II and a decreased guarding movement of shoulder joint. Around 50 participants (male and female) were selected and divided in to two groups having a randomized controlled trail with group (A) having capsular stretching and group (B) having Maitland mobilization with equal division of participants in both groups. The outcomes were measured according to the scales and pain, range of motion and disability were noted pre and post the treatment.

INCLUSION CRITERIA:

- Age limit will be in between 30-65 years
- Frozen shoulder that lasted more than 3 months
- Frozen shoulder with Diabetes mellitus type II
- Having reduced arm and swinging with rounded shoulder
- Painful shoulder with sleepless nights

EXCLUSION CRITERIA:

- Traumatic shoulder complains including fractures etc.
- Shoulder subluxations
- Acute frozen shoulder
- Systematic illness
- Steroidal intake for sports related activity
- Manipulation under anesthesia

RESEARCH DESIGN:

It was a randomized control trail performed for frozen shoulder patients.

STUDY SETTINGS:

The data was collected at the physiotherapy outpatient department of The Family Care Hospital Karachi.

STUDY DURATION:

Duration of study was six months after the approval of synopsis.

TREATMENT TIME:

The First treatment time was for 45 minutes and follow up session had a time interval for 30 minutes, the total treatment session was for 15 days for 3

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weeks, the treatment was given 5 days a week for 3 weeks.

SAMPLE SIZE ESTIMATION:
The sample size was estimated by Open Epi Calculator operating system.

SAMPLING TECHNIQUE:
Non-probability purposive sampling technique was used to collect data.

OUTCOME MEASURES:
Data was collected based on different outcome measure such as: VAS, SPAID, OSS and goniometry. Finally, all the data were recorded pre and post after the physical therapy sessions.

VAS (VISUAL ANALOGUE SCALE):
The visual analog scale (VAS) is a validated, subjective measure for acute and chronic pain. Scores are recorded by making a handwritten mark on a 10-cm line that represents a continuum between 0 "no pain" and 10 "worst pain or might say unbearable pain while 5 indicates distressing pain.

OSS (OXFORD SHOULDER SCORE):
The Oxford Shoulder Score (OSS) is a validated scoring system (range 0-49) a12 item self-administrated questionnaire used to assess the degree of pain and disability caused by shoulder pathology. It consists of questions related to the worst pain in shoulder, to dressing yourself, pain in getting in and out of car, usage of fork and knife, doing household shopping, carrying a tray, hanging up the clothes, brushing with the affected hand, washing, and bathing underarms and how many sleepless nights of the patient.

SPAID (SHOULDER PAIN AND DISABILITY INDEX):
The Shoulder Pain and Disability Index (SPADI) is a self-administered questionnaire having two dimensions, which is described as one for pain and the other for functional activities. There are 5 dimensions of pain which consists of five questions regarding the severity of an individual's pain. There are 8 dimension of Functional activities which are assessed and designed to measure the degree of difficulty an individual has with various activities of daily living that require upper-extremity use. It requires 5 to 10 minutes for a patient to complete and is the only reliable and valid region-specific measure for the shoulder. It produces the mean of the two subscales which are averaged to produce a total score ranging from 0 (best) to 100 (worst). Minimum Detectable Change (90% confidence) = 13 points (Change less than this may be attributable to measurement error).

VARIABLES OF STUDY:
There are two variables in the study independent and dependent variables.

INDEPENDENT VARIABLES:
Age and sex are the independent variable of study

DEPENDENT VARIABLES:
Intensity of pain, ranges and its related disability which effects the patient functional status.

DATA COLLECTION PROCEDURE:
This is the quasi-experimental study in which 50 subjects both male and female genders were selected and by randomized trail allocated in two different groups, named as Group A and Group B. All the data was collected from The Family Care Hospital Karachi after the permission from hospital. The age group of 30 to 65 years were selected, after they were diagnosed with assessment and examination by physical therapist as chronic frozen shoulder of more than 3 months and have been diagnosed with Diabetes mellitus grade II showing guarded movements. After the initial assessment, informed consent from the participant were taken who met the inclusion criteria. All the movements of shoulder joint were restricted including flexion, abduction and marked external rotation. And those who showed the signs of inflammation, fractures, accidents, recent acute frozen shoulder or not having the complain of diabetes type II were excluded from the study. The selected candidates were randomly allocated to two groups Group A having capsular stretch and Group B having Maitland mobilization each having 25 participants. The outcome variables were goniometer for finding the pre and post range

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of motion for shoulder flexion, abduction, and external rotation. VAS (visual analogue scale) for pain, SPAID (shoulder pain and disability index) and OSS (oxford shoulder scale) for functional outcome measures. After the assessment and data collection participants were given therapeutic intervention according to their groups. It was decided that every individual will be given a 40minutes session on the first assessment day and later 30 minutes session, 5 days a week for 3 weeks having total 15 days of therapy. The whole procedure was approved by IRB (institutional review board) and ethical committee with the permission of 6 months of study duration.

TREATMENT PROCEDURE:

GONIOMETRY:

SHOULDER FLEXION:

Ask the patient to lie on bed in supine position and raise your hand actively to check the shoulder flexion, and therapist apply slight over pressure to feel the end-feel. Patient's trunk is stabilized for measuring the shoulder flexion, the therapist aligns the goniometer fulcrum at lateral aspect of greater tuberosity of humerus, while moving arm will be at lateral epicondyle of humerus and stationary arm at the mid axillary arm of thorax, now read and record goniometer measurements, normal shoulder flexion is 180 degrees.

SHOULDER ABDUCTION:

Patient is supine lying position the stationary arm of goniometer will be at the midline parallel to the sternum while the moving arm will be at the shaft of the bone, we ask the patient to bring the arm outside the bed to your head, now ask the patient to hold the arm in this position and measure the readings on goniometer, normal shoulder abduction is 190 degrees.

SHOULDER EXTERNAL ROTATION:

Patient lies in supine position at the edge of the bed and shoulder abducted to 90degrees place a towel below the elbow so the humerus is parallel to the floor and goniometer is perpendicular to floor, its even, the oleracon process is the axis of rotation and the stationary arm resides down in air while the moveable arm will be at forearm, note the measurements the normal shoulder external rotation is 90degrees.

CAPSULAR STRETCHING:

ANTERIOR SHOULDER STRETCH: The patient is standing in front of the wall having palm against the wall, keeping the shoulder bend to 90 degrees, now turn your body away from your arm and stretch the anterior capsule of your shoulder, hold stretch for 20 seconds and repeat 5 times.

POSTERIOR SHOULDER STRETCH: The patient is standing and asks the patient to bring the affected arm across the chest height and use the other hand with elbow bend and pull it up straight high you will feel stretch at the back of the shoulder and upper back, hold for 20 seconds, and repeat 5 times.

INFERIOR SHOULDER STRETCH: Make the position sit in a comfortable position and ask the patient to touch the upper back of the affected shoulder as the patient does so, apply over pressure with his other hand, slowly and in a downward motion to stretch the capsule. Do this for 20seconds and repeat 5 times.

MAITLAND MOBILIZATION:

ANTERIOR GLIDE:

The external rotation is enhanced with anterior glide, First we ask the patient to expose the affected arm to be treated, the patient lies comfortably in prone position (face facing towards pillow) the towel is placed right on the coracoid process, the patient lies closed to the edge in such a position that glenohumeral joint is off the table make the open pack position, which is 55 degree abduction and elevation , the therapist bends the knee slightly so that the patients affected arm lies over it, right hand of therapist is in patient's axilla and left hand stabilized the arm and distract the humerus, after distraction palpate the lateral side of acromion and place the right hand on it and make anterior glide carefully , as the joint is off the treatment bed, both the therapist hands elbow must be locked to maintain the position. Small amplitude rhythmic oscillation at the beginning is performed 15sets for grade I, a little deeper in range and large amplitude

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in grade II. While performing grade III with the resistance large amplitude oscillatory movements were made and in grade IV small amplitude oscillations into the restricted range a 15set of glide was given completing the therapy with 60 glides in total.

3.17.2 POSTERIOR GLIDE:

As we know that posterior anterior glide restores flexion, internal rotation, and horizontal adduction range of motion. First, we ask the patient to expose the affected arm to be treated, the patient lies comfortably in supine position (face facing towards roof) and the affected arm is at the edge of the table in a loose pack position, 30-degree flexion, 55degree abduction and neutral rotation. Now the therapist stands on the side of the treatment bed and locks the patient's arm with his own arm, a towel is placed below the affected shoulder of patient to stabilize the scapula, the right hand and elbow locked of therapist, lies over the glenohumeral joint with the palm pressing downward on it and left hand distracts the shoulder joint. Small amplitude rhythmic oscillation at the beginning is performed 15sets for grade I, a little deeper in range and large amplitude in grade II. While performing grade III with the resistance large amplitude oscillatory movements were made and in grade IV small amplitude oscillations into the restricted range a 15set of glide was given completing the therapy with 60 glides in total.

3.17.3 INFERIOR GLIDE:

This glide improves abduction of shoulder joint, the patient lies comfortably in same position as posterior glide, while performing inferior glide the therapist feet should move in inferior position, making a walk standing like pattern. The therapist locks the patients affected arm with left hand and palm of left hand in axilla, while right hand over superior side of humerus and distract the joint in this position and simultaneously gives inferior glide (glide towards bed) the body of therapist should move in inferior direction same as the patients arm movement. All four glides are performed with 15 sets each and making a total 60 glide treatment protocol.

DATA ANALYSIS PROCEDURE:

Statistical Analysis:

Data were stored and analyzed using IBM-SPSS version 23.0, Counts with percentages were reported for qualitative date sets , Mean with standard deviation were given for quantitative parameters of study. Mean Comparison of VAS, NPRS, Oxford Shoulder Scores, Pain Scale, Disability Scale , SPAID Score, Flexion, External Rotation and Abduction scores was done using paired samples t-test at pre and post stage of the treatment in each study group A and B. Independent sample t-test was use to compare the post study outcomes between two treatment groups. P-values less than 0.05 were considered statistically significant. Pie Diagram, bar charts was also used to give graphical presentation of data.

Results:

Table 1: Baseline Characteristics of Studied Samples (n=60)

Characteristics		Group			
		A (n=30)		B (n=30)	
		n	%	n	%
Gender	Male	7	23.3	6	20.0
	Female	23	76.7	24	80.0
Age (Years)	*Mean (±SD)*	*40.9*	*±9.2*	*42.8*	*±8.3*

Table-1 reports the baseline characteristics of the studied samples, in the present study there were total sixty samples divided into two treatment groups A and B equally. In treatment group A there were 76.7% female gender sample, mean age of group A samples was 40.9 (SD=±9.2) years old, in treatment group B there were 80% female gender sample and mean age was 42.8 (SD=±8.3) years old.

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Table 2: Mean Comparison of VAS and NPRS in Treatment Group A

Variables	Pre		Post		p-value
	Mean	SD	Mean	SD	
VAS	7.86	1.25	2.73	1.68	<0.01*
NPRS	3.90	1.12	1.13	0.73	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-2 gives the mean comparison of VAS and NPRS outcomes in treatment group A samples, the mean VAS before treatment was 7.86 (SD=±1.25) and after the treatment it was 2.73(SD=±1.68) a significant decrease of 5.13 units was observed in VAS after the treatment of group A samples with p<0.01. The mean NPRS before treatment was 3.90 (SD=±1.12) and after the treatment it was 1.13 (SD=±0.73), a significant decrease of 2.76 units was observed in mean NPRS of treatment group A samples with p<0.01.

Table 3: Mean Comparison of VAS and NPRS in Treatment Group B

Variables	Pre		Post		p-value
	Mean	SD	Mean	SD	
VAS	7.66	1.12	0.90	0.80	<0.01*
NPRS	3.86	0.77	0.80	0.71	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-3 gives the mean comparison of VAS and NPRS outcomes in treatment group B samples, the mean VAS before treatment was 7.66 (SD=±1.15) and after the treatment it was 0.90(SD=±0.80) a significant decrease of 6.76 units was observed in VAS after the treatment of group B samples with p<0.01. The mean NPRS before treatment was 3.86 (SD=±0.77) and after the treatment it was 0.80 (SD=±0.71), a significant decrease of 3.06 units was observed in mean NPRS of treatment group B samples with p<0.01.

Table 4: Mean Comparison of Oxford Shoulder, Pain Scale, Disability Scale and SPAID Scores in Treatment Group A

Parameters	Pre		Post		p-value
	Mean	SD	Mean	SD	
Oxford Shoulder Score	41.96	9.02	18.66	4.71	<0.01*
Pain Scale	81.46	4.71	29.26	16.60	<0.01*
Disability Scale	70.66	13.96	20.66	11.17	<0.01*
SPAID Score	74.81	15.78	24.19	12.75	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-4 reports in group A samples before treatment the mean oxford shoulder score was 41.96 (SD=±9.02) , mean pain scale score was 81.46 (SD=±4.71) , mean disability scale score was 70.66 (SD=±13.96) and mean SPAID score was 74.81 (SD=±15.78) units whereas after the treatment the mean oxford shoulder score was 18.66 (SD=±4.71) , mean pain scale score was 29.26 (SD=±16.60), mean Disability scale score was 20.66 (SD=±11.17) and mean SPAID score was 24.19 (SD=±12.75) units. Paired sample t-test showed a significant decrease of 23.30 units in shoulder pain scores, 52.20 units in pain scale scores,49.99 units in disability scale scores and 50.61 units in SPAID scores was observed in group A samples with p-value less than 0.01.

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Table 5: Mean Comparison of Oxford Shoulder, Pain Scale, Disability Scale and SPAID Scores in Treatment Group B

Parameters	Pre		Post		p-value
	Mean	SD	Mean	SD	
Oxford Shoulder Score	42.80	7.91	16.36	2.79	<0.01*
Pain Scale	78.41	12.75	25.89	7.68	<0.01*
Disability Scale	74.33	10.96	15.75	6.0	<0.01*
SPAID Score	82.33	16.73	20.02	6.11	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-5 reports in group B samples before treatment the mean oxford shoulder score was 42.80 (SD=±7.91) , mean pain scale score was 78.41 (SD=±12.75) , mean disability scale score was 74.33 (SD=±10.96) and mean SPAID score was 82.33 (SD=±16.73) units whereas after the treatment the mean oxford shoulder score was 16.36 (SD=±2.79) , mean pain scale score was 25.89 (SD=±7.68), mean Disability scale score was 15.75 (SD=±6.0) and mean SPAID score was 20.02 (SD=±6.11) units. Paired sample t-test showed a significant decrease of 26.43 units in shoulder pain scores, 52.51 units in pain scale scores,58.51 units in disability scale scores and 62.31 units in SPAID scores was observed in group B samples with p-value less than 0.01.

Table 6: Mean Comparison of Flexion, External Rotation and Abduction in Treatment Group A Samples (n=30)

Parameters	Pre		Post		p-value
	Mean	SD	Mean	SD	
Flexion	139.83	23.43	169.36	10.02	<0.01*
External Rotation	32.33	10.29	52.06	14.80	<0.01*
Abduction	110.0	33.93	159.73	10.24	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-6 gives the comparison on Flexion, External Rotation and Abduction scores. Results showed in group A, before the treatment mean Flexion score was 139.83 (SD=±23.43) , mean Rotation score was 32.33 (SD=±10.29) and mean Abduction score was 110.0 (SD=±33.93) units, after treatment the mean Flexion score was 169.36 (SD=±10.02) , mean External Rotation score was 52.06 (SD=±14.80) and mean Abduction score was 159.73 (SD=±10.24) , paired sample t-test showed a significant increase in group A samples in Flexion scores of 29.53 units, in external rotation scores of 19.73 units and in Abduction scores of 49.73 units on average with p-value less than 0.01.

Table 7: Mean Comparison of Flexion, External Rotation and Abduction in Treatment Group B Samples (n=30)

Parameters	Pre		Post		p-value
	Mean	SD	Mean	SD	
Flexion	117.0	22.46	175.30	3.08	<0.01*
External Rotation	31.60	5.0	74.63	6.85	<0.01*
Abduction	106.63	32.61	164.83	4.25	<0.01*
p<0.05 was considered significant using paired sample t-test					

Table-7 gives the comparison on Flexion, External Rotation and Abduction scores. Results showed in group B, before the treatment mean Flexion score was 117.0 (SD=±22.46) , mean Rotation score was 31.60 (SD=±5.0) and mean Abduction score was 106.63 (SD=±32.61) units, after treatment the mean Flexion score was 175.30 (SD=±3.08) , mean External Rotation score was 74.63 (SD=±6.85) and mean Abduction score was 164.83 (SD=±4.25) , paired sample t-test showed a significant increase in

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group B samples in Flexion scores of 58.30 units, in external rotation scores of 43.03 units and in Abduction scores of 58.20 units on average with p-value less than 0.01.

Table 8: Mean Comparison of Post VAS and NPRS between Groups

Variables	Group "A" (n=30)		Group "B" (n=30)		p-value
	Mean	SD	Mean	SD	
VAS	2.73	1.68	0.90	0.80	<0.01*
NPRS	1.13	0.73	0.80	0.71	0.07
p<0.05 was considered significant using Independent sample t-test					

Table-8 gives the mean comparison of Post VAS and NPRS scores between group A and B, results showed after the treatment mean VAS of Group A samples was 2.73 (SD=±1.68) units and mean NPRS was 1.13 (SD= ±0.73) units, whereas in treatment group B after the treatment mean VAS scores was 0.90 (SD= ±0.80) and mean NPRS was 0.80 (SD=±0.71) units, Independent sample t-test showed a significant decrease in VAS score of 1.83 units in treatment group B as compare to A with p<0.01. The decrease in NPRS was 0.33 units in group B as compare to A, however it was not statistically significant, p=0.07.

Table 9: Mean Comparison of Oxford Shoulder, Pain Scale, Disability Scale and SPAID Scores between Groups

Variables	Group "A" (n=30)		Group "B" (n=30)		p-value
	Mean	SD	Mean	SD	
Oxford Shoulder Score	18.66	4.71	16.36	2.79	0.026*
Pain Scale	29.26	16.60	25.89	7.68	0.32
Disability Scale	20.66	11.17	15.75	6.0	0.039*
SPAID Score	24.19	12.75	20.02	6.11	0.11
p<0.05 was considered significant using Independent sample t-test					

Table-9 reports the post mean comparison of oxford shoulder pain score, pain scale, disability scale and SPAID scores between group A and group B samples, results showed in group A after the treatment the mean oxford shoulder score was 18.66 (SD=±4.71) , mean pain scale score was 29.26 (SD=±16.60), mean Disability scale score was 20.66 (SD=±11.17) and mean SPAID score was 24.19 (SD=±12.75) units whereas in group B after the treatment the mean oxford shoulder score was 16.36 (SD=±2.79) , mean pain scale score was 25.89 (SD=±7.68), mean Disability scale score was 15.75 (SD=±6.0) and mean SPAID score was 20.02 (SD=±6.11) units, independent sample t-test gives a decrease of 2.30 units for oxford shoulder pain, 3.37 units for pain scale, 4.91 units for disability scale and 4.17 units for SPAID scores in group B as compare to group A samples , a significant decrease was observed in shoulder pain scores and disability scales with p-value less than 0.05.

Table 10: Mean Comparison of Flexion, External Rotation and Abduction between Groups

Variables	Group "A" (n=30)		Group "B" (n=30)		p-value
	Mean	SD	Mean	SD	
Flexion	169.36	10.02	175.30	3.08	<0.01*
Rotation	52.06	14.80	74.63	6.85	<0.01*
Abduction	159.73	10.24	164.83	4.25	0.016*
p<0.05 was considered significant using Independent sample t-test					

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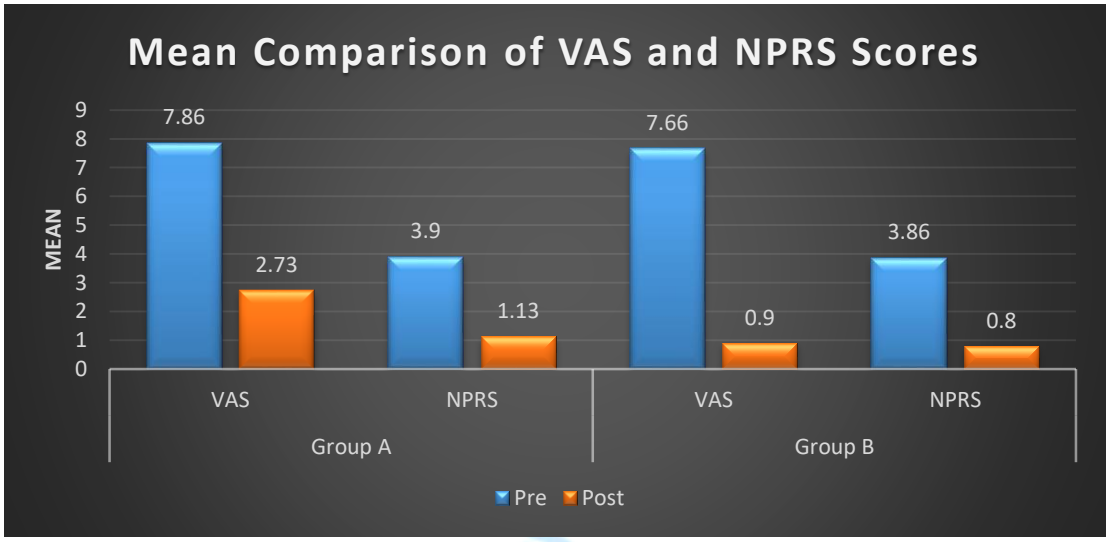
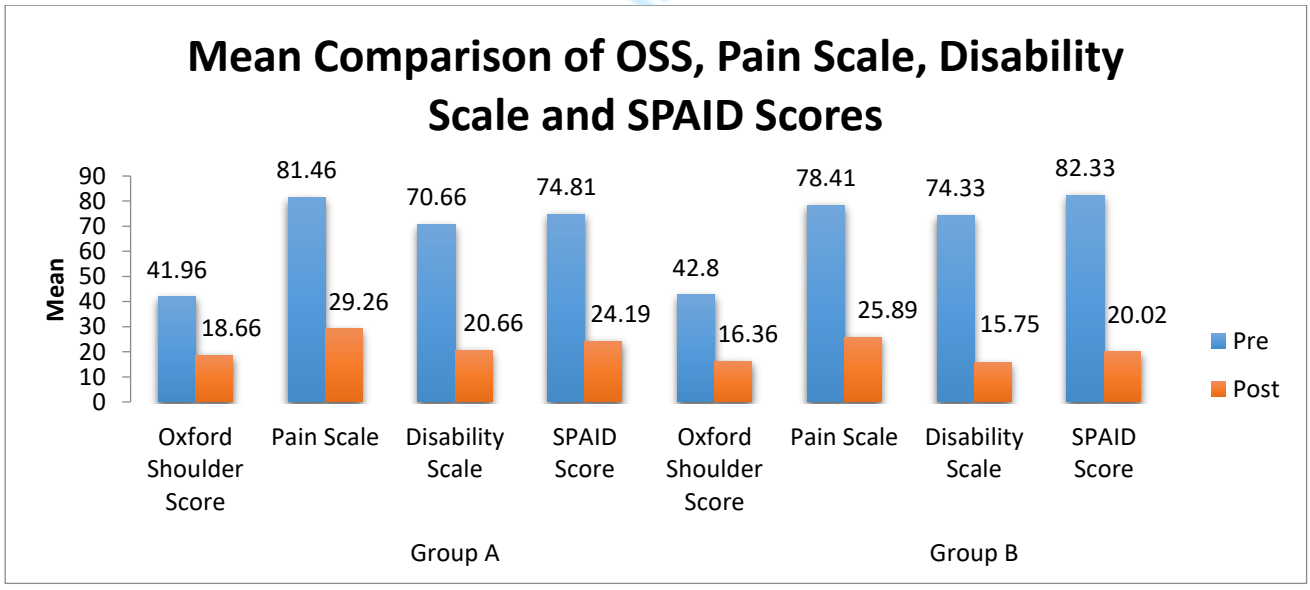
Table-10 gives the post mean comparison of Flexion, External Rotation and Abduction scores, results showed in group A samples after treatment the mean Flexion score was 169.36 (SD=±10.02) , mean External Rotation score was 52.06 (SD=±14.80) and mean Abduction score was 159.73 (SD=±10.24) units whereas in group B after treatment the mean Flexion score was 175.30 (SD=±3.08) , mean External Rotation score was 74.63 (SD=±6.85) and mean Abduction score was 164.83 (SD=±4.25) units, a significant increase of 5.93 units for Flexion, 22.56 units for External Rotation and 5.10 units for Abduction was observed in group B samples as compare to Group A samples with p-value less than 0.05.

Bar Chart 1:



Bar Chart 2:



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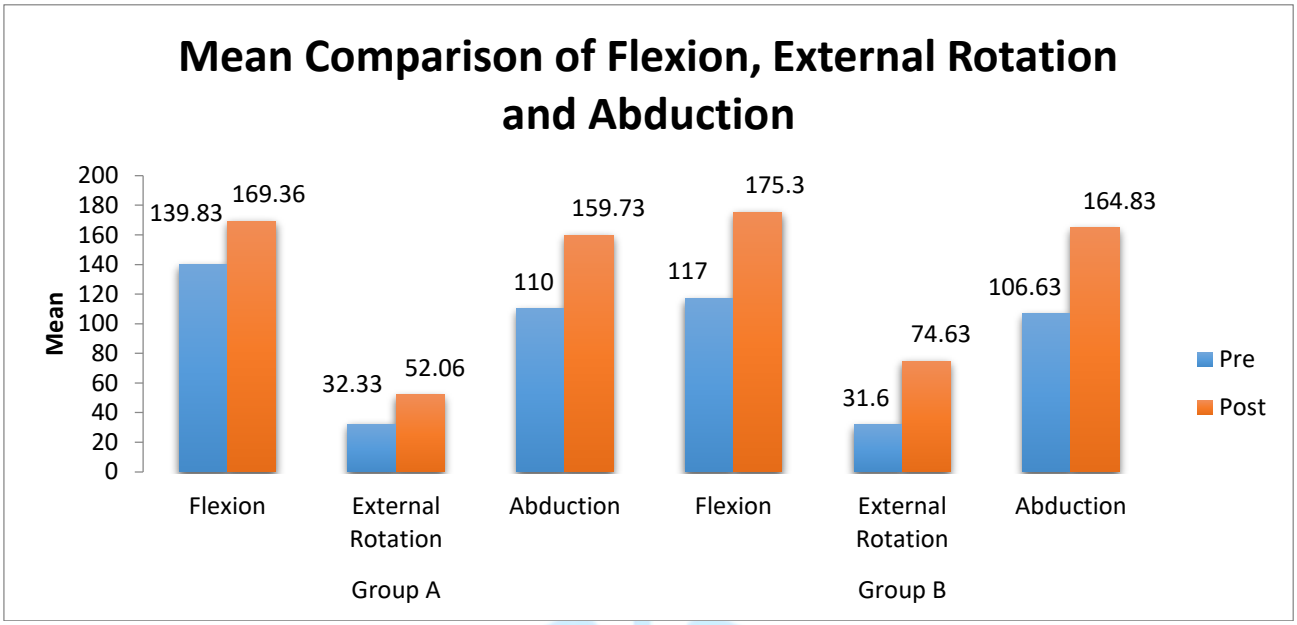
Bar Chart 3:



Discussion

This study compared the outcomes of capsular stretching with Maitland mobilization in diabetic individuals suffering from chronic frozen shoulder (freezing stage). Both groups experienced meaningful improvements in shoulder pain, disability, and active range of motion after the four-week intervention period. These improvements are consistent with extant literature emphasizing the benefits of manual therapy and therapeutic stretching in managing adhesive capsulitis, especially in diabetic patients who tend to have more severe symptoms and prolonged recovery periods.

Capsular stretching likely facilitates synovial fluid circulation and capsular extensibility, whereas Maitland mobilization employs graded oscillatory joint movements targeting capsular tightness and pain modulation by stimulating mechanoreceptors, inhibiting nociceptive pathways. Your findings align with previous studies (e.g., N Maricar et al., 2017; Ola I. Ibrahim et al., 2020) that report improvements in pain and shoulder function with both modalities but no superiority of one over the other.

The absence of a statistically significant difference between groups implies clinicians can tailor treatment plans based on patient comfort, clinical presentation, and resource availability without compromising outcomes. This flexibility is especially important in diabetic populations, where comorbidities may influence therapy responsiveness.

Study limitations

It include a relatively small sample size, single-center design, and short-term follow-up, limiting the ability to evaluate long-term treatment effects or relapse rates. Future multicenter trials with larger cohorts and extended follow-up are necessary to confirm these findings and to optimize treatment protocols for this population.

Conclusion

This study demonstrates that both capsular stretching and Maitland mobilization effectively reduce pain and disability and increase shoulder joint range of motion in patients with chronic frozen shoulder and type II diabetes mellitus. Since no significant difference in effectiveness was found between the two interventions, clinicians should consider either based on patient preference, clinical judgment, and available expertise. Further research is warranted to explore long-term outcomes and the impact of combined or adjunct therapies in this patient group.

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Dr. Noreen Ahmed has Substantial Contribution to study design, analysis, and acquisition of Data Manuscript Writing. She has given Final Approval of the version to be published.
Muhammad Tahir Akram has Substantial Contribution to study design, acquisition and interpretation of Data Critical Review and Manuscript Writing. He has given Final Approval of the version to be published**.**
Dr Tanzeela Mujtaba has Substantial Contribution to acquisition and interpretation of Data. Contribution. She has given Final Approval of the version to be published.
Dr. Geeta Goswami has Substantial Contribution to acquisition and interpretation of Data. Contribution. She has given Final Approval of the version to be published
Muhammad Wahb Siraj has Substantial Contribution to acquisition and interpretation of Data
Peraha Wagan has given Final Approval of the version to be published

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