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Immediate effect of mulligan technique on shoulder abduction and external rotation in frozen shoulder patients

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ABSTRACT: **Background**: The shoulder joint capsule is a fibrous sheath which encloses all the structures of shoulder joint. Frozen shoulderis defined as a common condition characterized by insidious and gradual inflammation of the glenohumeral joint capsule leading to its contracture and resulting in stiffness and loss of shoulder mobility. Patients with frozen shoulder have a painful restriction of both active and passive glenohumeral joint motion in all planes. Mobilization with movement (MWM) is a class of manual therapy techniques that is widely used in the management of pain.It has been shown, the mulligan technique can produce hypoalgesic effects during and following its application as well as sympathetic nervous system.

Method: In this study 30 patients between the age of 50-70 years were selected according to convenient sampling method. patients who have any type of arthritis, developed painful stiff shoulder after severe trauma, previous h/o of fractures and dislocations, rotator cuff tears or tendinitis were excluded from the study. Pain was assessed using NPRS scale, range of motion of abduction and external rotation was assessed using universal goniometer and muscle strength was assessed using manual muscle testing (oxford grading).

Conclusion: The study concluded that there is immediate effect of mulligan technique on shoulder abduction and external rotation and pain threshold. However, there is no immediate effect on shoulder muscle strength.

KEYWORDS:frozen shoulder, mulligan technique, abduction, external rotation.

I. INTRODUCTION

The shoulder joint capsule is a fibrous sheath which encloses the structures of the shoulder joint. It extends from the anatomical neck of humerus to the border of 'rim' of glenoid fossa. The joint capsule is lax, permitting greater mobility. [(1)]

Frozen shoulder is an insidious painful condition of shoulder. This condition causes fibrosis of the GH joint capsule and is accompanied by gradually progressive stiffness and restriction in ROM.Frozen shoulder is defined as a common condition characterized by insidious and gradual inflammation of the glenohumeral joint capsule leading to its contracture and thus resulting in stiffness and loss of shoulder mobility. Frozen shoulder is most frequent in the age of 40-60 years. [(2)]

Clinical symptoms include pain, a limited range of motion (ROM), and muscle weakness from disuse. [(3)]

The pathology of frozen shoulder is believed to be as follows: pain in the shoulder which may lead to neurological, vascular, musculoskeletal or referred visceral which causes vasospasm which leads to congestion and myospasm which leads to disuse and further vascular congestion. This leads to the development of fibrous tissues that are responsible for functional disability.

The disease process particularly affects the antero-superior joint capsule and the coracohumeral ligament. Some research shows a synovial inflammation with subsequent reactive capsular fibrosis. A matrix of type I and type III collagen is laid down by fibroblasts and myofibroblasts in the joint capsule. The pattern in which frozen shoulder usually is developed may be described as three stages of 6 months each: Freezing, Frozen, and Thawing. [(4)] In the

- Freezing stage- it shows an insidious onset where pain is predominating.
- In the frozen stage, pain is reduced but the restricted mobility remains.
- The thawing includes re-establishment of normal or near normal range of motion.

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Adhesiveness increases cross link structures of the collagen, tightness of the coracohumeral ligament and inferior glenohumeral ligament. Limitation of the movement of the supraspinatus tendon will present. Clinical symptoms include pain, a limited range of motion (ROM), and muscle weakness from disuse. Rehabilitation includes various manual mobilization techniques which leads to relieving pain and restore mobility and function. The treatments for adhesive capsulitis include rehabilitation as the initial conservative measure, anti-inflammatory drugs, capsular distension injections, intra-articular corticosteroids, and surgical interventions in refractory cases. (5)

Manual treatment options for this condition include high-velocity, low amplitude manipulation, end-range mobilization, mid-range mobilization and mobilization with movement of the shoulder only and/or of the shoulder girdle. The rehabilitative management and intervention performed depends on the institution. Manual therapy is considered as an intense stimulation of mechanoreceptors and proprioceptors in and around joints which probably releases such stronger chemicals that only relieves pain but also increases range of motion.(5)

Mulligan technique was introduced by mulligan in 2004.Mobilization with movement (MWM) is a class of manual therapy techniques that is widely used in the management of musculoskeletal pain. Essentially, this means repositioning a joint to enable proper motion while taking that joint through pain-free passive and active range of motion (ROM). Mulligan technique combines sustained manual application of gliding force to a joint, with aim of repositioning the bone positional false with concurrent physiological (osteokinematics) motion of the joint either performed actively by patient or passively by the therapist in pain free range. It has been shown, the mulligan technique can produce hypoalgesic effects during and following its application as well as sympathetic nervous system. (6)

MATERIALS AND METHODOLOGY

1. STUDY DESIGN: Experimental Study
2. STUDY SETTING: Tertiary care hospitals
3. SAMPLE POPULATION: Individuals with frozen shoulder
4. SAMPLING METHOD: convenience sampling
5. SAMPLE SIZE: 30

Outcome measures:

1. Numerical Pain Rating Scale (NPRS) ($r > 0.8$, $p < 0.01$)
2. Universal Goniometer($r>0.8$, $p< 0.01$)
3. Manual Muscle Testing (MMT) (Oxford Grading)

Procedure:

Permission was taken from ethical committee. Aim and objectives were explained tosubjects and consent was taken. 30 Subjects were selected according to inclusion exclusion criteria. The patient should be Diagnosed with frozen shoulder (Diabetic and non-diabetic), Had a painful and stiff shoulder for 3 months (stage 2 or 3), Both Male and female patients and Age between 50-70 years were all included in the study. Patient having any type of arthritis, developed a painful stiff shoulder after a severe trauma to upper extremity, Previous fractures or dislocations of the shoulder complex, Rotator cuff tendinitis or tear, Previous intra-articular injection or surgical release and Complex regional pain syndrome were all excluded from the study. Pre-Assessment was done for pain, ROM and muscle strength using NPRS, Goniometer and MMT, respectively.

Two glides were given:

- **For Abduction**: Patient sitting with therapist posterolateral to him/her. Therapist places the Mulligan belt across the humeral head and to his waist. Leaning backward, or with the hands he applies a posterolateral glide to the shoulder joint and then asks the patient to perform the painful/restricted movement of shoulder flexion or abduction, which would be pain free now.
- **For External Rotation**: patient is in supine lying with scapula stabilized at the end of plinth. Belt should be placed close to the joint line and secured around the therapist's waist. Patient's shoulder and elbow is placed at 90 flexion. The therapist pulls the mobilizing belt and shifts his weight backwards to distract the joint laterally. Patient then performs the offending movement in a pain free range.

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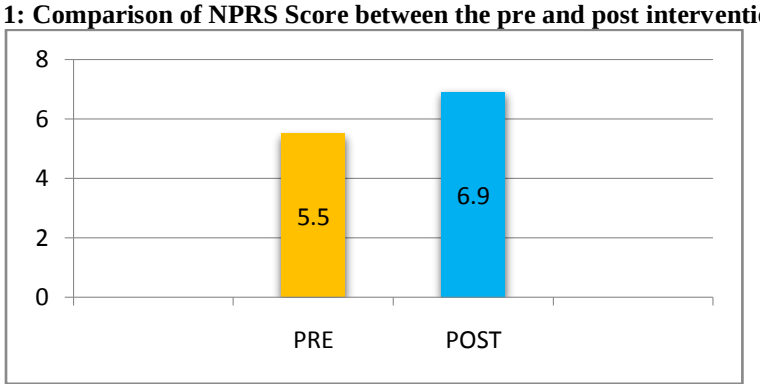
Mulligan technique for abduction

Mulligan technique for external rotation

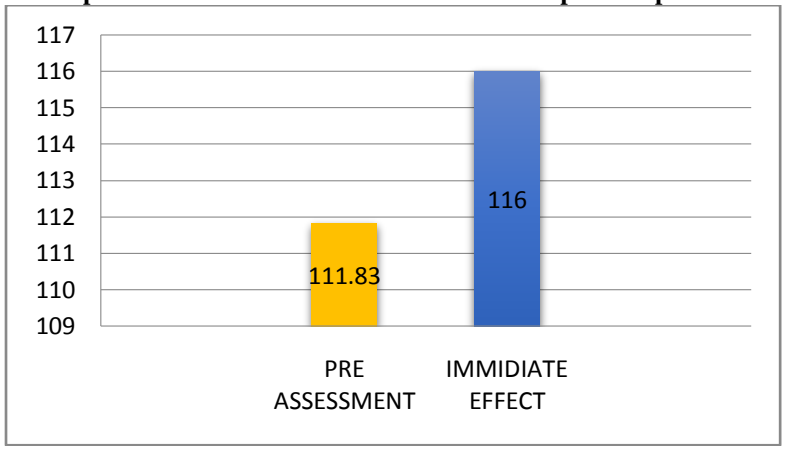
II. RESULTS

Microsoft excel office 2007 and Instat software version 3.0 used for statistical analysis.Average values for various parameters were calculated**.** Data was tested for normality using Shapiro wilk test. Data did not pass normality hence nonparametric test was done for comparison of pre and post intervention.

GRAPH NO. 1: Comparison of NPRS Score between the pre and post intervention (p<0.001)



GRAPH NO. 2: 4: comparison of ROM of abduction of shoulder pre and post intervention (p<0.001)



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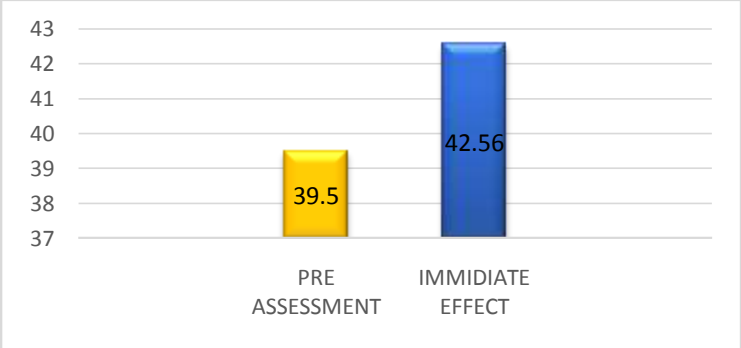
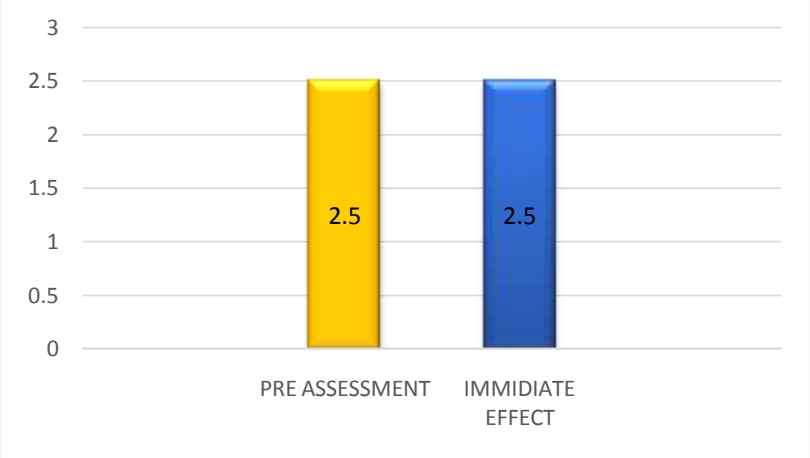
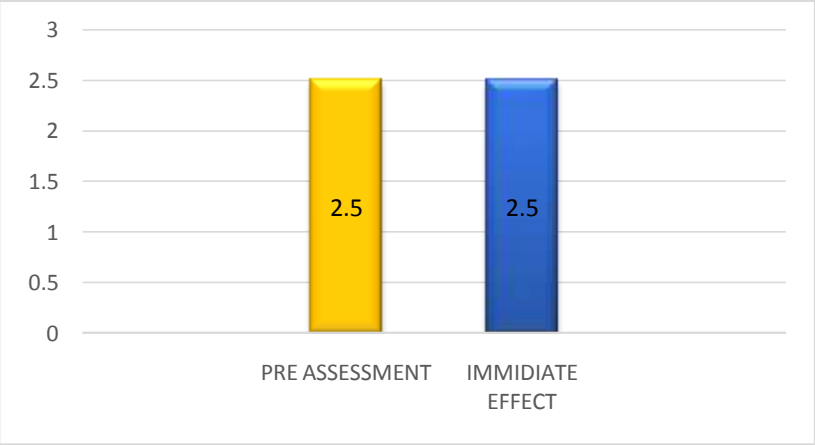
GRAPH NO. 3: comparison of ROM of External Rotation of shoulder pre and post treatment (p<0.001)



GRAPH NO. 4: comparison of MMT of shoulder Abductors pre and post treatment



GRAPH NO. 5: comparison of MMT of shoulder external rotators pre and post treatment



III. DISCUSSION

Graph no. 1 shows the pre and post pain intensity using NPRS scale which shows that pain intensity Pre assessment mean value (5.5±1.009) was reduced after giving the treatment. The post assessment mean value (6.9±0.9595) was lesser than pre assessment which concludes that there was reduction in pain post application of mulligan technique hence the p value was extremely significant. A study by Gokhan Doner et,al studied on effect of mulligan technique on frozen shoulder showed that mulligan technique was effective in reducing pain. Mulligan's technique was chosen for this study because it has the advantage of increasing ROM in addition to providing analgesia. It also proposed that manipulative therapy may

provide sufficient sensory input to activate the endogenous pain inhibitory systems.[5]

Graph no. 2 demonstrated the pre assessment and post assessment of mulligan technique on abduction. It shows that there is increase in range of abduction i.e pre value (111.83± 31.49) when compared with post assessment (114± 32.06), shows marked improvement. [6]

Above readings supported the article of Gaurav Mhaske et, al which showed immediate effect of mulligan technique in frozen shoulder patients. The study concluded that there is immediate improvement in range of motion in frozen shoulder patients. Mulligan's technique was chosen for this study because it helps in increasing range of motion and provides analgesia. [7]

It has been seen that the application of a posterior glide MWM to the shoulder may correct this fault and allow optimal pain free motion to occur. 29 Hsu et al.30 in a study of 11 cadavers, found the application of an antero posterior glide towards the end of range of abduction was effective in improving the range of motion of glenohumeral abduction. To date, no studies have investigated the effects of the MWM in people with shoulder pain and reduced ROM.

Graph no. 3 demonstrated the pre assessment and immediate effect of mulligan technique on external rotation. It shows that there is increase in range of external rotation i.e pre value (39.5±20.187) when compared with immediate effect (42.56±20.681), shows marked improvement. Above readings was supported by the article Gokhan Doner et, al: to compare the effects of Maitland and mulligan technique in frozen shoulder patients. Statistical analysis of the data in pre- and post-intervention score regarding range of motion data show decreasing trends. Mechanical force during mobilization includes breaking up of adhesions, realigning of collagen, or increasing fiberglide when specific movements stress the specific parts of the capsule. Mobilization techniques increases or maintains joint mobility by inducing biological changes in synovial fluid, enhanced exchange. [9]

Graph no. 4 and Graph no. 5 shows the strength of the abductors and external rotators by using manual muscle testing. With pre and post value i.e pre intervention (2.5±0.508) and post intervention (2.5±0.508) for abduction shows no improvement. Pre intervention value (2.5±0.508) and post intervention (2.5±0.508) value for external rotators also shows no improvement. A study by K.Aliesha et, al suggested that it takes up to 6-8 weeks to increase muscle your strength. We studied only the immediate effect of mulligan technique, hence no improvement was seen in strength post treatment. [10] Another study by Benjamin Wedro et,al supported the above study: The contractile tissue is made up of thousands of cylindrical, parallel fibers that run the length of the muscle. The fibers are made up of smallprotein filaments called myofibrils that contain even smaller protein myofilaments called actin and myosin [11]. The sliding filament theory of muscle contraction shows how actin and myosin slide over each other, causing the myofibrils to shorten and then it causes muscle fibers to contract. There is a relationship between mass and strength and the power to move also comes from recruitment patterns in the nervous system that connect to muscle fibers. Regularly lifting weights recruits new patterns of communication between the brain, nerves, neuromuscular junction, and muscle fibers. [10]

IV. CONCLUSION

The study concluded that there is immediate effect of mulligan technique on shoulder abduction and external rotation and pain threshold. However, there is no immediate effect on shoulder muscle strength. The limitations of the study were due to Covid-19 pandemic, a smaller sample size was chosen.

The follow up of the patients was not done post intervention. The future scope of the study will be weekly immediate effect can be seen on ROM and Pain threshold.The study can also be done on effect of mulligan on muscle strength with greater intervention period.

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