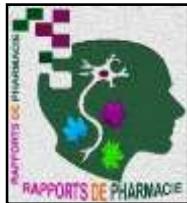


## CLINICAL ANATOMY OF MOBILISING THE FROZEN SHOULDER– A REVIEW ARTICLE



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### ABSTRACT

Frozen shoulder or adhesive capsulitis is manifested by stiffness and pain in the shoulder joint with severe disability. Signs and symptoms typically begin gradually, it undergoes resolution after the three phases with a time period of one to three years. The movements of abduction and external rotation were severely limited. The patient will have difficulty in performing the activities of daily living (ADL) like dressing, bathing, combing etc. The conservative management includes administration of analgesics, Non-steroidal anti-inflammatory drugs (NSAIDs) and intra articular injection with steroid and saline. Manipulation under anaesthesia, shoulder arthroscopy assisted capsule release were common procedures to improve the function. Physiotherapy management includes exercise therapy to increase the range and electrotherapy modalities to relieve the pain. Active and passive mobilisation techniques such as gliding, oscillatory techniques, joint distraction plays a significant role in improving the mobility of gleno-humeral joint.

**Key words:** Clinical Anatomy, Frozen shoulder, Adhesive capsulitis, Mobilisation techniques, Shoulder joint, Shoulder function.

### INTRODUCTION

Frozen shoulder is the term coined by Codman in 1934. Long before Codman, in 1872, the same condition had already been labelled “peri-arthritis” by Duplay [1]. In 1945, Naviesar introduced the name “adhesive capsulitis. Although still in use, this more recent term is unfortunate since, although a frozen shoulder is associated with synovitis and capsule contracture[2]. Frozen shoulder is a specific condition with an insidious onset that has a natural history of spontaneous resolution and requires a management pathway that is completely different from other distinct shoulder conditions such as a rotator cuff tear or osteoarthritis. It is characterized by shoulder pain and limitations of both active and passive range of movement in all directions[3]. Limitation of gleno-humeral movement is due to decreased intra-articular volume. It is the result of fibrosis and thickening of the joint capsule and adherence to the humeral head. Frozen shoulder is self-limiting in almost all cases[4]. The natural

course takes 12–42 months before resolution. Fifteen percent of the patients experience long-term disability as a result of chronic loss of shoulder mobility[5]. Pain is less prominent in this group of patients but the restrictions in active motion appear to limit the patient in personal care, ADL (Activities of Daily Living), and occupational activities [6].

Clinicians opinions differ on the evaluation and treatment of frozen shoulder. The prevalence of frozen shoulder is 2%–5% in the general population, with a peak in the fifth and sixth decades of life. A frozen shoulder is rarely seen in patients under the age of 40 years. Women are more affected than men. Twins have a 2–3-fold higher risk once one of them has developed a frozen shoulder[4]. There is no known genetic predisposition [7]. The non-dominant arm is slightly more affected than the dominant arm[8]. Once a patient has experienced an episode of frozen shoulder, the risk of recurrence on the contralateral side is 6%–17% within 5 years[9]. Recurrence in the same shoulder is rare[1]. Manipulation & mobilisation are manual techniques used in physical therapy in order to improve the mobility and function of your soft tissues, joints, muscles, tendons and ligaments. Manipulation is a controlled technique by which movement in joint is encouraged beyond its restricted

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range of movement. Mobilisation is a slower technique performed on joints, ligaments or muscle, and is also used for pain reduction and flexibility improvement. The purpose of the mobilizing exercise therapy for a frozen shoulder is primarily to increase the gleno-humeral joint movement by stretching the joint capsule [10]. In this review the effects of therapeutic mobilization in increasing the range of motion of the shoulder joint is elaborated.

### **Etiopathogenesis**

The causes of the frozen shoulder condition are not fully understood. There are various risk factors, such as diabetes mellitus, hemiplegia, thyroid related diseases, fracture of bones surrounding the shoulder or trauma of that region, Dupuytren's disease, parkinsonism, metastatic conditions and complex regional pain syndromes were accompanied with the condition. Various other factors such as avascular necrosis, tuberculosis, shortness of breath, severe cough, rheumatism, secondary deposits, multiple joint involvement and fever were also included [11].

### **Altered Anatomy & Patho-mechanics of frozen shoulder**

Frozen shoulder is usually described as fibrotic, inflammatory contracture of the rotator interval, capsule, and ligaments [12]. There is no clear review or explanation about the development of adhesive capsulitis. The arthroscopic examinations show fibroblastic proliferation and cytokine-mediated synovial inflammation. There are adhesions around the rotator cuff muscles due to higher proportion collagen fibres with nodular band formation [13]. The initial structure which is involved is the coracohumeral ligament above the roof of the rotator cuff interval. In the initial stages of adhesive capsulitis the external rotation is affected due to the contraction of the coraco humeral ligament followed by the thickening and contraction of the shoulder joint capsule, which alters the action of the joint in all the directions. There will be changes in and around the joint especially the capsular cavity volume during the development of contracture [14]. The capsule is very loose and provides 2 to 3 millimeters under normal conditions which is reduced further [15]. The changes in the capsular architecture can be compared with the Dupuytren's contracture of the hand [16]. The contraction of the coraco-humeral ligament and inferior glenohumeral ligament is

seen [17]. The inferior glenohumeral ligament supports like a "hammock" below the shoulder joint capsule [18]. The anterior band, a posterior band, and an interposed axillary pouch of this ligament is tightened that results in the reduction of accessory movements of the gleno-humeral joint [19]. There is a disproportion between aggressive fibrosis and lack of usual collagen remodelling, that causes the stiffness of fibrous capsule and surrounding ligaments [20]. The condition is presented as three stages, Freezing stage (2-9 months): Slow onset of pain over the shoulder joint during rest and sharpness in pain during the movement, Stiffening stage (4 -12 months): The pain decreases in this phase. There will be loss of shoulder joint movement due to increase in the contracture of the capsule accompanied by pain during the final degrees of the movement. Thawing stage (5 to 24 months): There will be resolution and slow progression of movements which may continue till 3 years [11, 13].

### **Diagnosis**

Physical examination can alone provide a valid idea about the severity [11]. Radiology rules out the pathology to the bones such as osteopenia and the involvement of articular structures [21]. Shoulder arthrography will show decreased joint volume and adhesive capsulitis. Magnetic resonance imaging (MRI) identifies the changes glenoid labrum, capsule and soft tissues around the joint. Ultrasound provides the idea in differential diagnosis between frozen shoulder and other rotator cuff tendinitis [22]. Pain associated with frozen shoulder will be diffuse and severe around the shoulder joint that typically worsens at night. The patient cannot be able to sleep over the affected side in the side-lying position [23]. The pain will start to suppress at the frozen stage accompanied by loss of glenohumeral flexion, abduction, internal rotation and external rotation of various degrees [24]. There is decrease in various ranges of both active and passive elevation depending upon the phase [15]. The assessment of passive movements with respect to resistance in end feel give an impression about the affected range. Most commonly, the passive shoulder joint movements are limited because of the pain. This can be observed at the level of end range or after [25].



**Figure 1: Active range of abduction is limited to 40 degrees.**



**Figure 2: Active range of external rotation is limited by 10 degrees.**

The contracture of the capsule is responsible for disturbance in external rotation. The most common impression is the decrease of about 33° of external rotation[26,11]. Initial phases of frozen shoulder can

be similar to the features of rotator cuff tendinopathy[11]. The rotators and abductors were significantly weaker in frozen shoulder comparing other tendinopathies. Various other evaluation methods such as Disabilities of the Arm, Shoulder, and Hand Questionnaire (DASH), Simple Shoulder Test (SST), Penn Shoulder Score, American Shoulder and Elbow Surgeons (ASES) score, and the Constant-Murley score were used in physical assessment and during different phases of recovery[27]. Goniometry is used as an evaluation tool of measuring the shoulder movements especially abduction and external rotation[28,29,30].

### Management

The choice of medication to relieve the pain is mainly the NSAID'S (Non-steroidal anti-inflammatory drugs) can be taken orally to alter the pathology[31]. Hazelman used intra-articular injection of the steroids like methylprednisolone, triamcinolone and recorded the effectiveness during the earlier phase of the condition[1]. The analgesics will be having only a short duration in inhibiting the pain and no role in improving the functional range. NSAIDS can be administered orally and intra-articular injections of 9ml saline with 1ml of anaesthetic agent will be effective, the intra articular injections are given through the posterior aspect of the gleno-humeral joint repeatedly for 6 months[32]. The studies with subacromial corticosteroid injections were seen in the literature[33]. The surgical measures such as suprascapular nerve block and repeated joint distension or manipulating the joint under anesthesia can improve the altered mobility[13]. Arthroscopic assisted surgical release of the contracted and thickened capsule with synovectomy can be done if manipulation under anesthesia(MUA) fails [34]. The lever arm handled by the surgeon should be of appropriate size and cannot be long to avoid humerus fracture. The structures of rotator cuff and gleno-humeral joint dislocation may occur during the MUA, should this procedure is not employed in the conditions such as shoulder dislocation, fractured shoulder, osteoporosis, osteopenia. The main advantage of the MUA is the adhesions can be broken down and range of motion will be restored[35]. This intervention should be followed by physical therapy to maintain the range of motion. The main query related to the condition is about the ADL(Activities of daily living) and functional aspects of the stiff shoulder.



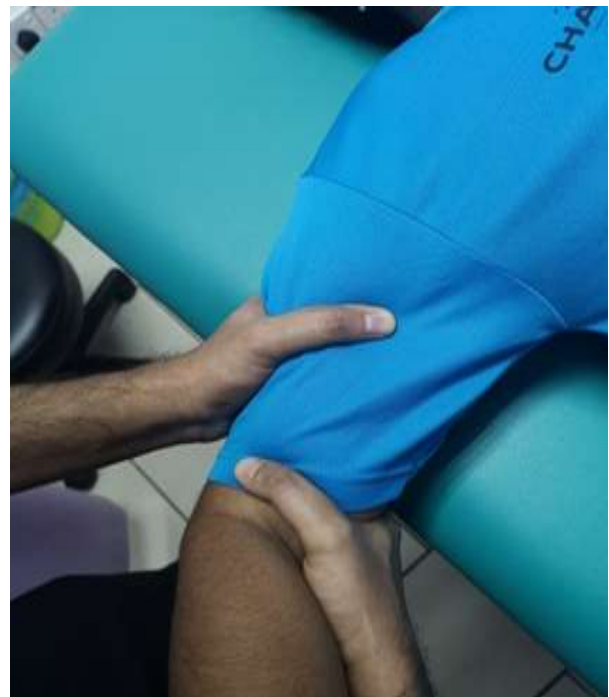
Physiotherapy along with the medical and conservative management plays an important role in the long term basis with respect to patient education and rehabilitation exercise within the limits of pain with intensive physiotherapy in patients with frozen shoulder, this helps in regaining the pain free range of movements[36, 37].The electrotherapy modalities with the combination of various active and passive therapeutic exercises were used in this particular condition for improving the joint stability and mobility. Low-frequency laser therapy, TENS(Trans cutaneous nerve stimulation), Interferential therapy, and other deep heating modalities such as wax therapy, cryotherapy, therapeutic ultra sound, pulsed short wave diathermy were in practice[38, 39,40,41, 42]. The main choice in long term management is active and passive mobilisation followed by strengthening exercisesto regain the muscle physiology [39].

### **Passive Therapeutic Mobilisation**

The application of mobilisation techniques in physical therapy parallel to medical and surgical management is very significant because of the evidence supporting its effect in reducing pain and disability with improving the joint range of movement[29,43, 44]. Mobilisation otherwise known as manual therapy is as skilled and controlled technique with application of passive movements to the joints and the soft tissues with varying speeds and amplitudes[10]. The acuteness of mobilisation is commonly classified based on a 5-grade system established by therapeutic mobilisation stimulates the peripheral mechanoreceptors, inhibits the nociceptors, and increases the synovial circulation[36, 45].Oscillatory grading of movements within various restricted ranges of the joint were done towards the direction of accessory movements of that particular joint. These movements are said to induce physiological changes like breaking the joint adhesions, aligns the collagen fibres, and restores the normal gleno-humeral joint function [10].Anatomical and biomechanical aspects of the shoulder mobilisation had been explained by various authors, Novotny et al studied the glenohumeral joint in vitro, the contact between the capsule and articular surface control the movement of the humeral head. The humeral head



**Figure 3: Shoulder joint capsular traction.**



**Figure 4: Anterior gliding of the gleno-humeral joint.**



**Figure 5: Posterior gliding of the gleno-humeral joint.**



**Figure 6: Caudal gliding of the gleno-humeral joint.**

translates across the glenoid surface in the direction opposite to the movement because of the articular surface geometry with regarding of the concave-convex rule. The increase of moment and angle of rotation changes the humeral head changes direction as the capsule tightens. “pushing the humeral head back along the glenoid surface. So the tension of the capsule controls the translatory movements of the humeral head[46]. Maitland’s oscillatory techniques and Kaltenborn’s constant stretch technique were applied in the mobilising adhesive capsulitis[47]. The main concept in the mobilization and exercise therapy is to improve shoulder mobility by distending the contacted and thickened joint capsule[48]. The above said techniques organize the shoulder joint with the scapula is stabilized in relation to thoracic cage and the shoulder joint. Anterior gliding is applied to improve the

restricted lateral rotation[49]. Posterior gliding of the gleno-humeral joint will be more effective for improving both the external and internal rotation[50, 51]. Caudal gliding increases the flexion and abduction[52]. Lateral joint distraction can improve the range of abduction and lateral rotation[53]. Some studies reports that end-range caudal along with posterior glide mobilisation regains the full range of abduction.

Reverse distraction technique on the glenohumeral joint at different angles of abduction and flexion at end ranges with a purpose of stretching the contracted periarticular structures in patients with adhesive capsulitis. There is an increase in mean capacity of the glenohumeral joint capsule and active movement of flexion and lateral rotation, and progression in shoulder range after 3 months of mobilisation. Oscillatory gliding (Maitland grades III and IV) in conjunct with the reverse distraction technique mobilization techniques can be used in the treatment of adhesive capsulitis[54]. In the Mid Range Mobilisation (MRM) technique the patient is relaxed supine position, the humerus was moved to the optimum resting position of about 40° of abduction[55, 56]. In conjunct with the MRM technique, ERM (End Range Mobilisation) is also practiced. The aim of ERM is to employ a stretching force over the contracted periarticular structures. The techniques were demonstrated by Vermeulen and Maitland to improve the movement of gleno-humeral joint beyond its restricted end range. Mulligan developed the the Movement with Mobilisation technique(MWM) which combines a continued presentation of a manual technique to the shoulder joint with synchronized osteo-kinematic movement of the joint, either actively performed by the subject or passively performed by the therapist[57,58,59]. The manual force or mobilization, is supposedly proposed in transposing the structural defecits in the frozen shoulder.

### **Active Mobilisation and Patient Education**

Home exercises actively done by the patient will be the initial therapy depending upon the manifestations and phase of the condition. During the freezing phase, mild active stretching exercises can be taught by the therapist with a less period of time duration. In the frozen phase, resistance exercises such as scapular retraction, posterior capsular stretching and isometric shoulder lateral rotation were included to improve the muscle power. The patient can able to

perform the movement with increase in the range at the thawing phase. During this period active stretching and strengthening for longer duration can be actively done by the patient. In general free oscillatory pendular exercises, active assisted shoulder forward flexion, wand assisted shoulder lateral rotation should be done by the patient for the gradual recovery[39].

## CONCLUSION

Frozen shoulder is a painful condition which cause disability in functional activities. The manifestations were progressive and different in the three phases of the disease. The recovery of this condition may take a longer course. Even though the choices of management are many like analgesics, NSAIDs, intra-articular injection and arthroscopic surgical release of the capsule. This article stresses about the importance of therapeutic mobilisation in conjunction with other conservative and surgical management. The aim of mobilisation of the joint is to prevent disability and improve the range of motion. Active home exercises and self care by the patient plays a main role in recovery. Patient counseling is very important before the starting of treatment regarding the long term management. In this concise text, we discussed about the major and standard mobilisation techniques. They are practiced in common especially for this condition. The therapeutic effects over the periarticular structures and capsule have been summarized with respect to clinical anatomy.

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## CONFLICTS OF INTEREST

There are no conflicts of interest

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