

Manual Therapy Interventions for Adhesive Capsulitis: A Review

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ABSTRACT

Adhesive Capsulitis is a debilitating condition which causes the capsule of the Gleno-humeral joint to get thickened and contracted progressively. The prevalence of the disease is much higher in the middle aged and elderly community. It is characterized by pain in the shoulder, and advance towards the restriction of the active and passive glenohumeral motions and thereby obstructing the overall functional activities of the daily living. The effectiveness of various non-operative methods in the treatment of Adhesive Capsulitis has been demonstrated in the literature. Corticosteroid injections and the oral medications are known to be alleviating the pain levels and the inflammatory reactions but not the mobility of the affected joint. Joint mobilization techniques, electrotherapeutic modalities and other manual treatment methods are also found to be effective. In summary, this review focuses on the pathophysiology of the adhesive capsulitis, stages of the condition progress and various manual therapy interventions.

Keywords: Gleno-humeral joint, frozen shoulder, rehabilitation, active and passive movements, functional activities

1. INTRODUCTION

Adhesive Capsulitis which is also referred to as frozen shoulder is a condition which results in limitation of the movements at the shoulder joint and thereby debilitating the daily activities.^[1] The condition was first recognized as “peri-arthritis scapula-humerae” with its clinical symptoms by Duplay in 1872.^[2] However, Codman 1934 described it as frozen shoulder indicating the possibility of developing the shoulder

stiffness and pain without the influence of external factors.^[3] Ultimately Neviaser was the one who introduced the term “Adhesive capsulitis” identifying that glenohumeral capsule is the site in which the pathological changes occur in the frozen shoulder.^[4] Though these two terms are used interchangeably, frozen shoulder refers to any pathology that restrains the active or passive gleno humeral joint movements where adhesive capsulitis is a definite pathology which affects the shoulder capsule.^[5]

Adhesive capsulitis is the leading cause of pain at the shoulder joint in middle aged and elderly persons.^[6] The exact underlying cause for adhesive capsulitis is not known. But non-dominant hand and the females are considered to be more affected.^[7] It is also more prevalent in the 40-70 years age group ^[2,6] and is estimated that 2-3% of the general population is affected with this pathology.^[8]

Adhesive capsulitis is primarily categorized into two types; primary and secondary.^[9] Primary or idiopathic adhesive capsulitis is characterized by gradual onset of pain and stiffness at the Gleno-Humeral joint without having any specific cause.^[10] Secondary adhesive capsulitis is known to be caused by several predisposing factors. Several review articles have classified these secondary factors further into systemic, intrinsic and extrinsic according to its nature.^[8,11-13] Systemic factors include diabetes mellitus, thyroid dysfunctions, hypoadrenalism. Intrinsic factors include rotator cuff pathologies, biceps tendinitis, calcific tendinitis and acromio-clavicular

arthritis. Extrinsic factors include cardiopulmonary dysfunctions, cervical disc disease, stroke, Parkinson's disease and humeral fractures.

Some authors have revealed that the patients with this condition may naturally recover within two to three years of period,^[14,15] whereas some have concluded that the disability may even persists beyond three years.^[2] However, the patients have been demonstrated with regular complain of pain or stiffness even up to seven years.^[16]

Although the exact treatment method is not known for adhesive capsulitis, the effectiveness of various non-operative treatment approaches has been evaluated in the literature. These include corticosteroid injections,^[17-21] oral medications,^[22,23] electro therapy modalities,^[24-27] stretching exercises,^[28-32] joint mobilization^[33-39] and Muscle energy techniques (MET).^[40-43] In the clinical set up, the use of a single intervention procedure to treat this condition is rare and a combination of treatment modalities are performed.^[27]

2. PATHOPHYSIOLOGY

2.1 Gleno-Humeral joint involvement

Gleno-Humeral joint is a ball and socket joint which allows number of motions in various directions and in various planes.^[44] It is also a synovial joint which encloses synovial membrane, long head of the biceps tendon, capsuloligamentous complex which is comprised of glenohumeral capsule, coraco humeral ligament and gleno humeral ligaments (superior, middle and inferior).^[8] Even though the exact pathogenesis of adhesive capsulitis is not known, several authors have described the underline mechanisms. In frozen shoulder, capsule of the gleno humeral joint contracts forming adhesive scar tissues and several bursae also could be affected hindering the mobility of the joint.^[45] Additionally, axillary recess also could become adherent.^[46] These pathogenic changes result in limitation of the joint movements and thereby causing the joint to rest in prolong immobilization.

Apart from the capsular restrictions, other soft tissues including muscles, tendons, and ligaments also can become contracted due to this prolong immobilization.^[6] It is featured by marked synovitis,^[5,47] increased vascularity and synovial angiogenesis.^[48,49] Following this angiogenesis and synovitis, evidences have shown the development of new nerve growths at the capsulo ligamentous complex which may be the root cause for pain.^[50] Eventually, with all of this capsular adhesions and soft tissue contractures, shoulder joint become stiff and patient experiences pain beyond certain degrees of range of motions.

2.2 Scapular involvement

In order to perform full humeral elevation, combined movements of scapulothoracic, sternoclavicular, acromioclavicular and glenohumeral joints are very much essential.^[51-53] Scapulothoracic and glenohumeral joints are predominantly involved of all.^[54] When consider the abduction phase of a healthy person, scapula is responsible only for one third of the arm elevation where the rest of the two third of the movement is occurred at the gleno-humeral joint, resulting in 2:1 ratio (GH/ST) ^[55] which is called as the scapular-humeral rhythm. This normal scapula-humeral rhythm can be altered in patients with adhesive capsulitis. These patients have demonstrated abnormal scapular kinematics including earlier and large amount of scapula external rotation in frontal, sagittal and scapular planes.^[44,56] Also it is found that limited gleno humeral motions due to capsular adhesions are compensated by increased scapular elevation and upward rotation.^[44,57,58] Additionally, it is found that the patients with adhesive capsulitis compensate for impaired glenohumeral motions with the over-activation of postural muscles such as trapezius.^[59] With repetitive loading or stress, these postural muscles have the tendency to become shorten while weakening the phasic muscles and thereby ultimately affecting the overall posture.^[60] It

is shown that the patients with shoulder pathologies are demonstrating shortening of the postural muscles such as upper trapezius, levator scapulae due to undue stress upon them.^[14] Hence, the importance of maintaining the normal scapular mechanics has been emphasized in literature through muscular MET. Since scapular rhythm is also an integral component of the shoulder rehabilitation in the patients with adhesive capsulitis,^[61] the importance of scapular mobilization in improving shoulder range of motion is also indicated in literature.^[62]

3. STAGES OF PROGRESSION

Adhesive capsulitis develops in four distinctive stages; inflammatory, freezing, frozen and thawing stages.^[5,8,11,12]

- **Stage 1:** This can last for about three months in which the patient might experience sharp, acute pain at the end range of movements as well as at rest and also sleep disturbances due to pain.^[8] Arthroscopic examinations reveal inflammatory synovial reactions without having any capsular adhesions or contractures. Biopsy of the joint capsule reflects inflammatory cell infiltrates synovitis with normal capsule during this stage.^[5,57] Early limitation of external rotation with intact strength of rotator cuff muscles is a unique symptom at the initial stage of the condition progression.^[5]
- **Stage 2:** Freezing stage, may last from three to nine months period.^[8] Patient might experience pain predominantly at night where the movements are limited in forward flexion, abduction, internal and external rotation. Arthroscopy shows synovitis or angiogenesis where biopsy reveals hypertrophic, hyper vascular synovitis, and scar tissue formation in the subsynovial and perivascular tissues.^[5]
- **Stage 3:** This stage is referred to as the frozen stage which may last from nine to fifteen month period.^[8] The most significant physical examination finding

is the mechanical block at the end ranges causing stiffness. Patient may still have the pain at the end ranges.^[5] During this stage, even the intra-articular anesthetic injections may not improve the motions.^[63] Less common Synovitis and loss of axillary recess are the arthroscopic findings. Capsular biopsy illustrates thin, hypercellularcollagenous tissue.

- **Stage 4:** which is the thawing stage, pain may be diminished with progressive improvement of movements. Arthroscopic findings reflect completely marked capsular adhesions at this stage.^[5]

4. MANUAL THERAPY INTERVENTIONS

Manual therapy interventions include skillful hand techniques which induce repairing process and the capability of healing of an individual.^[64] According to Breen AC, manipulative approaches have the effects on local tissue organization, neurological organization and as well as on psychophysiological organization. Mechanical force conveyed to the tissue causes changes in reparative process, changes in physical and mechanical properties of the tissues such as elasticity, compression, strength, changes in tissue fluid (blood, synovial, extracellular, lymph) dynamics. Manual therapy emphasizes in neurological changes also such as alteration of the pain mechanism, guiding the posture and movements. Psychological aspect of the manual therapy techniques includes changes in mood, emotion, behavior, perception of pain, autonomic changes.

4.1 Joint mobilization

Mobilization is defined as passive movements which can be either oscillatory or sustained stretches which are performed under the control of the patient, therefore can be prevented if patient desires so.^[65] Joint mobilization is used to treat painful and stiff joints.^[66] These mobility exercises are important in restoring the extensibility

of the capsule.^[67] Joint mobilization decreases pain by inhibiting the nociceptors by stimulation of peripheral mechanoreceptors.^[68,69]

- **Maitland joint mobilization**

Oscillatory technique was introduced by Maitland who is an Australian Physiotherapist.^[70] It is performed using either physiological (osteokinematic) movements or joint play (arthrokinematic) movements. He has described four grades of mobilization (I-IV) and manipulation.

Grade I- small amplitude oscillatory movements performed at the beginning of the available range.

Grade II- large amplitude oscillatory movements performed within a resistance free part of the available range.

Grade III- large amplitude oscillatory movements performed up to the resistance or to the limit of the available range.

Grade IV- small amplitude oscillatory movements performed at the resistance or limit of the available range.

Grade V- small amplitude, high velocity thrust manipulation performed at the end of the available range.

Grade I and II are performed for the painful joints where Grades III and IV are implemented in stiff joints to increase the range of motion.

- **Kaltenborn mobilization**

Sustained stretch technique was introduced by Kaltenborn.^[71] It uses only joint play techniques. With regard to this technique, three grades (I-III) have been introduced.

Grade I- Small amplitude distraction force is applied which places no stress on the capsule.

Grade II- Enough distraction force or glide is applied that stretches the periarticular structures which is referred to as taking up the slack.

Grade III- Enough distraction force or glide is applied that places adequate stretch on the joint capsule or periarticular structures.

Some studies have compared the efficacy of different mobilization techniques in treating adhesive capsulitis.^[81] Yang et al., (2007) have compared the end range mobilization, mid range mobilization and the mobilization with movement technique.^[72] The effectiveness of posterior versus anterior glide mobilization in the improvement of the external range of motion has been assessed in literature.^[73] Tanaka et al., (2010) had studied the effect of varying frequencies including high (twice a week), moderate (once a week) and low (less than once a week) frequency of mobilization in the treatment of adhesive capsulitis.^[37] Vermeulan et al., (2006) have compared high grades including grades III and IV with low grades including grades I and II.^[69] The efficacy of joint mobilization along with the other treatment methods also has been evaluated in the literature.^[36,38,74,75]

Shakil-ur-Rehman., (2012) have compared the two different scapular mobilization techniques (Kaltenborn and general scapular mobilization) in improving the glenohumeral abduction where it is concluded that Kaltenborn mobilization is much effective than the general one.^[76] The effectiveness of Kaltenborn mobilization has been compared with the Maitland mobilization in the improvement of pain and range of motion of patients with adhesive capsulitis.^[77] It is demonstrated that both the treatment methods were effective in the treatment of frozen shoulder where there was no any significant difference between them.

4.2 Muscle Energy Techniques

MET is a soft tissue osteopathic manipulative approach which is developed with the intention of improving the pain and musculoskeletal dysfunctions. This involves isometric/isotonic contractions which are accurately controlled and initiated by the patient.^[78] This technique was developed by Dr. Fred Mitchell who was an Osteopathic Physician. It not only focuses on increasing the extensibility of the soft tissues (muscular MET), but also improving

the joint mobilization (articular MET) and thereby increasing the joint range of motion [43] as well. It is found that MET is more effective in improving the extensibility of the soft tissues compared to static stretching. [79-81] The effectiveness of muscular MET [40] and also articular MET [41-43] are demonstrated in the patients with adhesive capsulitis.

MET works in two ways;

➤ **Post isometric relaxation**

This refers to the experience of subsequent tone reduction in a specific muscle or muscle group following brief isometric contraction.

➤ **Reciprocal inhibition**

This refers to the inhibition of the antagonist muscle following isometric contraction of the agonist due to release of inhibitory neurotransmitters at the antagonist sites. [78]

There are two types of receptors that respond to stretching; muscle spindles that are sensitive to alteration of length and speed of change in muscle fibers, golgi tendon organs which respond to prolonged stretch. When a muscle is stretched, that stretch impulse is transmitted to the dorsal horn of the spinal cord. This in turn causes an increased transmission of motor impulses from the ventral horn in turn to the muscle fibers in order to oppose the stretch as a protective mechanism. However, if there is sustained stretch maintained for some time, that will be detected by golgi tendon organs and send impulses to the posterior horn of the spinal cord. This causes an inhibitory effect on increased motor impulse which subsequently results in relaxation of the muscle. [82]

4.3 Stretching exercises

Stretching exercises are known to be improving pain and the range of motion though there is no any superiority over other interventions. [8] Evidences are less regarding the application of precise frequency, intensity and duration of the exercises [8] so called the “dosage”. This dosage or the total amount of stress being

applied to the tissue is vital to get the required therapeutic change. [83] More forceful stretching beyond the pain thresholds at the initial phases may even cause worsening of the condition. The effectiveness of stretching exercises along with the other treatment methods in treating the adhesive capsulitis has been evaluated in studies. [28-32]

4.4 Proprioceptive Neuromuscular Facilitation (PNF)

In PNF technique, functionally based diagonal patterns are used with neuromuscular facilitation techniques in order to improve the overall motor performance of the patient. [84] In active PNF stretch, the antagonist muscle is being contracted with the purpose of stretch of the target or agonist muscle. [32,43] PNF technique uses four theoretical mechanisms including autogenic inhibition, reciprocal inhibition, stress relaxation and gait control theory. [85] The effect of Proprioceptive Neuromuscular Facilitation (PNF) stretch in the treatment of adhesive capsulitis has been evaluated along with the MET technique by Ravichandran, 2019. [43] The effect of scapular PNF technique has been tested in the patients with adhesive capsulitis. [86-88] The efficacy of combined PNF technique with breathing exercises in the treatment of frozen shoulder also has been demonstrated. [89]

6. CONCLUSION

The effectiveness of various manual therapy interventions including joint mobilization approaches, muscle energy techniques, stretching techniques and PNF techniques have been evaluated in literature. Even though, limited evidences have been found with regard to the efficacy of the manual therapy interventions alone in treating this condition, it is assumed that they are having various physiological as well as biomechanical effects. Thus, manual therapy interventions would be essential to regain the range of motion, to reduce the

pain and to develop the overall functional status of the patient.

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