



# The Mechanisms, Effects, and Outcomes of Manual Therapy in the Treatment of Adhesive Capsulitis: A Literature Review

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## Mini Review

Volume 7 Issue 2

Received Date: January 22, 2024

Published Date: April 17, 2024

DOI: 10.23880/aphot-16000260

## Abstract

**Purpose of the Study:** Adhesive capsulitis, commonly called frozen shoulder, is frequently treated with manual therapy. This pathology cycles through three stages and usually resolves itself; however, many patients will use traditional treatments to expedite their recovery. The researchers theorize that a variety of manual therapy techniques improve the adverse effects of this condition, greater than that of traditional treatments. This literature review aimed to explore various manual therapy techniques that are beneficial in preventing and minimizing lifelong symptoms associated with adhesive capsulitis and analyze which ones are most effective in treating this pathology.

**Methods:** The mechanisms of orthopedic manual therapy for adhesive capsulitis are vast. This literature review examined the following techniques. The first technique reviewed was Mulligan's mobilization with movement techniques applied to the GH joint in elevation, internal rotation, and flexion compared with passive stretching. Proprioceptive neuromuscular facilitation (PNF) techniques were reviewed, where specific techniques were picked based on the patient's dysfunctions and compared to traditional manual therapies. In addition, Maitland's mobilization techniques were reviewed, and patients were given mobilizations to treat pain or restrictions in the tissue. These were compared to Kaltenborn's mobilization techniques. Next, Maitland's mobilization techniques were compared with a myofascial release arm-pull technique. Finally, scapular mobilization was compared to posterior capsular stretching in treating adhesive capsulitis.

**Discussion:** The outcomes of this literature review evaluated various manual therapy techniques for treating adhesive capsulitis, aiming to improve shoulder movement and alleviate pain. Researchers expected manual therapy to outperform traditional treatments like medications and surgery by enhancing ROM and reducing pain. Mulligan's manual therapy demonstrated significant pain reduction and ROM improvement, particularly in flexion, abduction, and rotation. Combining Mulligan's technique with other modalities yielded superior outcomes compared to passive stretching. Proprioceptive Neuromuscular Facilitation (PNF) techniques showed better pain reduction, ROM enhancement, and coracohumeral thickness reduction than traditional manual therapy. Maitland and Kaltenborn's techniques significantly improved shoulder rotation and functional movement, especially with soft tissue mobilization. Scapular mobilization techniques increased joint motions, but ROM improvements varied. Manual therapy techniques like Mulligan's, PNF, Maitland, and scapular mobilization offer promising results in improving the quality of life for adhesive capsulitis patients by enhancing ROM and reducing pain. As



more research is done with this pathology, it was found that Mulligan's, Maitland's, PNF's, and soft tissue mobilizations were effective in increasing ROM and decreasing stiffness in patients with this diagnosis. These are all effective forms of manual therapy, specifically when performed by a skilled clinician, further advocating for education on these techniques. Additionally, understanding the mechanisms, effects, and outcomes of different manual therapies for treating adhesive capsulitis can reduce the risk of life-long symptoms and improve quality of life.

**Results:** Various manual therapy methods, such as Mulligan's mobilization with movement (MWM), Maitland's mobilization, and PNF have been used to treat adhesive capsulitis. These manual therapy techniques increased joint range of motion (ROM) and reduced the patients' perceived pain.

**Keywords:** Pediatrics; Therapy; Evaluation; Sensory

**Abbreviations:** PNF: Proprioceptive Neuromuscular Facilitation; MWM: Mobilization With Movement; ROM: Range Of Motion; ADLs: Activities of Daily Living; MET: Muscle Energy Techniques; CR: Contract Relax; HR: Hold Relax.

## Introduction

Adhesive capsulitis is a diagnosis that is frequently encountered by physical therapists. More commonly referred to as frozen shoulder, it is a pathological condition that is defined as an onset of creeping, continuous shoulder pain that leads to a gross loss of motion at the joint [1]. It predominantly affects adults from the age of forty to sixty-five and women more than men (58:42) [1]. Earnest Codman, an American surgeon, described frozen shoulder as a condition that is "difficult to define, difficult to treat, and difficult to explain", as its onset is known to be spontaneous with no primary trauma or event necessary [2]. Patients who have adhesive capsulitis undergo this pathology in three stages, progressing from freezing, frozen, to finally thawing which then brings back some range of motion [3]. This condition is known to resolve itself after one to three years but can leave patients with lifelong symptoms, such as a loss of ROM and restrictions in activities of daily living [1]. However, some patients prefer to attempt to expedite the process with traditional treatments. Traditional treatments for this pathology include therapeutic rehabilitation, corticosteroids, anti-inflammatory medication, capsular distension, and surgery [3]. The purpose of this literature review was to explore a variety of manual therapy techniques that are beneficial in preventing and minimizing lifelong symptoms associated with adhesive capsulitis to analyze which ones are most effective in the treatment of this pathology. The researchers theorize that manual therapy techniques will improve dysfunction and quality of life more effectively than traditional treatments that involve only medications and surgery through increasing ROM and decreasing restrictions such as pain associated with adhesive capsulitis.

## Mechanisms of Orthopedic Manual Therapy

Adhesive Capsulitis is an idiopathic pathology that causes pain and loss of ROM in the glenohumeral joint that consequently leads to dysfunction of the shoulder girdle [3]. Therapeutic rehabilitation for adhesive capsulitis in the form of physical therapy most often involves a combination of treatments including manual therapy. Manual therapy and manipulation techniques for treatment of this pathology have been researched throughout the years and generally include high-velocity, mobilizations that go to mid and end range, mobilization of the glenohumeral joint with movement, and low amplitude manipulations. Although there are many different mechanisms of manual therapy for adhesive capsulitis, a single mechanism has not been named superior to others [3].

A study done by Doner G, et al. [3] explored Mulligan's technique to treat adhesive capsulitis which involved manually applying constant gliding forces to the joint in order to correct the osteokinematic motion of the joint. This technique is theorized to bring about hypoalgesic effects and change sympathetic nervous system function to improve pain and ROM. Using Mulligan's technique in the treatment of adhesive capsulitis, glides were applied in elevation, internal rotation, and flexion to the glenohumeral joint for three sets of ten repetitions. This study also incorporated passive stretching techniques in the treatment of adhesive capsulitis to compare with Mulligan's techniques. Participants did passive stretching involving abduction, rotational movements while in abduction, and flexion, while slowly increasing the degree of stretch. These stretches were held for thirty seconds [3].

Proprioceptive neuromuscular facilitation (PNF) techniques can be used in patients with adhesive capsulitis to improve muscle elasticity through stretching to increase ROM, as well as using this technique to increase strength, and promote stabilization [4]. A study done by Lin P, et al. aimed

to improve glenohumeral joint tissue structure in patients with adhesive capsulitis by promoting muscular contractions and using PNF techniques to stimulate proprioceptors to ultimately elicit neuromuscular responses [4].

Researchers picked a PNF technique based on the patient's specific dysfunctions at the initial evaluation and did the following patterns:

The rehabilitation training method adopts a diagonal movement of the upper limbs, the extension and contraction of the shoulder girdle, and the extension and flexion of the upper limbs. The scapular girdle patterns performed during the training include forward extension, retraction, forward retraction, and forward extension, encouraging patients to mobilize the shoulder joint against in the direction of the therapist's operation. The upper limb flexion and extension exercises include flexion-abduction-external rotation, extension-adduction-internal rotation, flexion-adduction-external rotation, and extension-abduction-internal rotation. A four-level loosening technique was simultaneously performed in the range of flexion-abduction-external rotation to extension-adduction-internal rotation and flexion-adduction-external rotation to extension-abduction-internal rotation... [4]

This study also compared PNF techniques to traditional manual therapy in the treatment of adhesive capsulitis [4]. A broad combination of manual therapies were used for the control group to create a comparison, "Manual therapy included separation traction, long axis traction, up-and-down sliding, abduction sliding to the side of the foot, front-to-back sliding, back-to-front sliding, side sliding, and internal rotation swings." Maitland's mobilizations grades I-IV was used according to patients' dysfunctions upon the initial evaluation. Patients experiencing loss of ROM or restrictions in ROM due to pain were treated with grades I and II. Patients experiencing loss of ROM due to stiffness or tightness were treated using grades III. Finally, patients experiencing loss of ROM due to adhesions were treated using grade IV [4].

A study done by Moon GD, et al. [5] used Maitland's Mobilizations to treat adhesive capsulitis by doing grade III anteroposterior oscillations to the humeral head to stretch the connective tissue and joint capsule in order to improve overall joint ROM. This was done with the patient in supine and the scapula was stabilized with a wedge. The patient's shoulder was abducted to end range, elbow flexed to ninety degrees, and the patient's forearm was turned toward their head. The grade III anteroposterior oscillations were done for thirty seconds, for fifteen sets. Maitland's mobilization techniques can be used on the shoulder complex in pathologies such as adhesive capsulitis where the therapist applies an oscillatory technique between grades I-IV to treat

restrictions in ROM caused by stiffness of the joint or pain. A small amplitude oscillation that is performed at the beginning of the joint's available ROM and used for neurophysiological effects such as pain reduction is classified as grade I. Grade II is a larger amplitude oscillation than grade I, going from the beginning to mid-range of the joints ROM. Both grades I and II fire receptors of the joint that lessen nociception and help to reduce pain. A large amplitude from the joints midrange to the beginning of the joints restriction is classified as a grade III oscillation. Grade IV is a smaller amplitude oscillation administered at the restriction of the joint. In addition, this study compared Maitland's mobilizations to Kaltenborn's mobilization techniques in the treatment of adhesive capsulitis. Kaltenborn's mobilization techniques involved examining motions of the articular surfaces of a joint and using those for treatment. Kaltenborn's technique used constant passive stretching to improve the joints ROM without inhibiting articular surfaces with grades I-III. A small distraction force that is used to reduce pain in which there is minimal stress to the joint capsule is classified as grade I. Grade II involves a distraction force that takes up the tissue slack by stretching the tissue around the joint. A larger distraction force that is used to improve joint ROM and stretch the joint capsule is classified as a grade III. In the study done by Moon GD, et al. [5], Kaltenborn's mobilizations were used to treat adhesive capsulitis by using a grade III posterior translation on the humeral head and constant stretching of the joint capsule. This was done with the patient in supine and their scapula was stabilized with a wedge. The shoulder was abducted, elbow flexed to ninety degrees, and the forearm turned toward the patient's head. The distraction was performed in thirty second intervals for fifteen sets.5 In this technique, a posterior translation was applied to increase ROM [5].

A study done by Deshmukh SS, et al. [6] compared Maitland's mobilization techniques alone and in combination with a myofascial release arm-pull technique in an effort to improve soft tissue lengthening. Maitland's mobilizations were done at four joints of the shoulder complex in group one including the glenohumeral joint, the acromioclavicular joint, the sternoclavicular joint, and the scapulothoracic joint. At the glenohumeral joint, abduction, lateral rotation, internal rotation, and anteroposterior mobilizations were manually performed. For the acromioclavicular joint, anteroposterior, longitudinal, and posteroanterior mobilizations were manually performed.6 Longitudinal and anteroposterior mobilizations in both the caudal and cephalad directions were manually performed at the sternoclavicular joint. For the scapulothoracic joint, elevation, depression, retraction, protraction, medial, and lateral rotation mobilizations were manually performed. A myofascial release in conjunction with Maitland's mobilizations and exercises were given to the second group. The myofascial release arm-pull

technique was administered to mobilize the soft tissue in five repetitions, based on feedback of the patient's tissue and then the previously listed Maitland's mobilizations were performed [6].

Scapular mobilization is another popular form of manual therapy used in the rehabilitation of adhesive capsulitis. For the treatment of adhesive capsulitis and to improve ROM at the shoulder, a study done by Duzgun I, et al. [7] compared scapular mobilization to manual posterior capsular stretching, while also comparing the effects of the two treatments combined for adhesive capsulitis. For mobilization of the scapula, physiotherapists had the patient's arms flexed to ninety degrees and the patient was side lying. Supero-inferior, medio-lateral, and circumduction movements were applied in sets of ten to the scapula with the therapist holding the medial scapular border. Posterior capsular stretching was done with the patient in a side lying position, the therapist stabilized the scapula at the lateral border, and the patient's arms were flexed to ninety degrees. The elbow was held on the medial side by the therapist and a stretch was applied with a downward force for ten sets of twenty seconds [7].

### Effects of Orthopedic Manual Therapy

The manual therapy techniques discussed by Mulligan were expanded upon in a literature review to determine the effects of this treatment on adhesive capsulitis. Razaq A, et al. [8] addressed frozen shoulder by comparing muscle energy techniques (MET) and Mulligan's mobilization with movement (MWM). The authors found both treatments to be effective in lessening pain while enhancing ROM and enhancing performance of activities of daily living (ADLs) [8]. Additionally, the article found MWM had greater success in controlling frozen shoulder when compared to MET. Moreover, Khalil R, et al. [9] similarly performed an evaluation of MWM and MET and their impact on frozen shoulder. The authors found a significant reduction of pain and an improvement in ROM and ADLs for MWM in post intervention measurements [9]. Both articles supported the use of MWM to mitigate nociception. MWM influences the somatosensory system by stimulating mechanoreceptors [10]. These mechanoreceptors are located within proprioceptive, nociceptive, and tactile neurons. Activation of this system can be accomplished with MWM which causes inhibition of pain signaling. This is suggested to occur by applying the correct force and direction to stimulate mechanoreceptors. MWM provides pain relief through mechanoreceptor-mediated reduction in nociceptive neuron signaling [10].

In further investigation of the effects of Maitland's mobilization manual therapy techniques, Bhatikar K, et al. performed a case study on an individual with radiotherapy-

induced adhesive capsulitis [11]. During ten sessions with the patient, the primary treatment intervention used was Maitland's mobilizations. This was completed by doing a posterior mobilization with grades II and III for five minutes during each treatment. Following this treatment plan, the authors reported a decrease in pain and an increase in joint ROM [11]. Further, Tiwari S, et al. conducted a study comparing MET and Maitland's mobilizations in thirty subjects diagnosed with adhesive capsulitis [12]. The session lasted for three weeks, and the individuals were split into two groups to receive either Maitland's mobilizations or MET specific interventions. The techniques they implemented sought to lower the symptoms of frozen shoulder such as pain, ROM, and a disability scale. The authors found a statistically significant increase in ROM and a decrease in pain and the disability scale. Similarly, Maitland's mobilizations showed the same improvements, but it was not significant between pre- and post-tests [12]. Maitland's mobilizations categorized the movement into five different grades [13]. The first two grades incorporate moving the joint in a small amplitude at the beginning ROM and a large amplitude in the middle of available ROM. These grades produce analgesia effects for the joint but may not lower the restrictions of the joint. The analgesia effects are produced from lubrication of the joint and by increasing the blood flow to the area. Applying oscillation, a movement between the grades, can activate mechanoreceptors leading to a reduction in nociceptive neuron signaling. The next two grades are applied near the end of the ROM which creates a multitude of effects such as a decrease in constrained movement. These grades activate inhibitory joint and muscle stretch receptors allowing for restrictions to be released through neurophysiological mechanisms [13]. Activation of muscle spindles and Golgi tendon organs, which play a role in regulating muscle tone, creating these beneficial effects [14].

Work done at various institutions suggest multiple effects of manual therapy techniques, such as PNF when treating adhesive capsulitis. Lee BK, performed a case study looking at the impact of PNF and deep breathing exercises in individuals with acute frozen shoulder [15]. The patient's pain was reported utilizing a VAS and self-reported pain scale. The initially reported pain of six was reduced to two by the end of the sessions. The authors also found that the interventions of PNF and deep breathing also increased ROM in the directions of flexion, abduction, internal rotation and external rotation. Furthermore, Balci NC, et al. [16] investigated the impact of PNF techniques on frozen shoulder in a randomized control study. Fifty-three individuals were split into three groups: scapular PNF exercises and general modalities, exercise and general modalities, and modalities only. The authors found no significant difference between the interventions, but there was a trend showing that implementing PNF treatment had an immediate increase of ROM. These PNF treatment-

mediated benefits were reported to be useful in reducing the intensity of pain. None of the interventions had an impact on scapular dyskinesis [16]. PNF is an effective method of increasing individuals' ROM through techniques such as contract relax (CR), and hold relax (HR) [17]. CR and HR are inhibitory interventions to achieve relaxation in a group of muscles surrounding the joint. These techniques use neurophysiological ideas such as autogenic and reciprocal inhibition to increase range of motion. For CR, the activation of the antagonistic muscle puts the agonist muscle into a relaxed state allowing for increased range of motion. HR achieves an increase in range of motion by activating the agonist muscle isometrically. This is followed by the muscle being out in a relaxed state allowing for increased ROM. This all happens via alpha motor activation through the Golgi tendon organ causing the muscle to enter a relaxed state after contractions [17].

### Outcomes of Orthopedic Manual Therapy

In returning to our thesis, the researchers theorize that manual therapy techniques will provide favorable outcomes by improving dysfunction and quality of life more effectively than traditional treatments that involve only medications and surgery through increasing ROM and decreasing restrictions such as pain associated with adhesive capsulitis.

One method of manual therapy that was previously discussed is Mulligan's manual therapy. Mulligan's manual therapy techniques were reviewed to determine the outcomes of this treatment on adhesive capsulitis. A study done by Doner G, et al. [3] revealed that when using Mulligan's technique for adhesive capsulitis, there was an improvement with pain in patients at rest while they were performing the activity in between baseline and after the treatment and follow-up at month three ( $p < 0.01$ ). However, when comparing the groups, the group that was treated with a hot pack, transcutaneous electrical stimulation, and Mulligan's technique reported less pain at rest and during the activity than the group that was treated with a hot pack, transcutaneous electrical stimulation, and passive stretching [3]. It was also reported that there was a significant improvement in ROM such as flexion, abduction, internal and external rotation. Patients who received hot packs, transcutaneous electrical stimulation, and Mulligan's technique had significantly more active and passive flexion, abduction, internal and external rotation than the other group that did not receive Mulligan's technique [3].

PNF manual therapy techniques were reviewed to determine the outcomes of this treatment on adhesive capsulitis. A study conducted by Lin P, et al. [4] tested the difference between using PNF and manual therapy on frozen shoulders. When using PNF, it was reported that there was

a significant improvement of pain and ROM as well as a reduction of coracohumeral thickness when compared to the traditional manual therapy. Overall, PNF was considerably more effective at treating shoulder pain than using traditional manual therapy [4].

The outcomes of Maitland and Kaltenborn's manual therapy techniques were reviewed in the treatment of adhesive capsulitis. Moon GD, et al. [5] lead a study comparing the techniques of Maitland and Kaltenborn for improving shoulder pain and ROM in individuals with adhesive capsulitis. They found that when using the Maitland and Kaltenborn techniques there was a significant improvement in internal and external rotation of the shoulder. However, when using these methods on frozen shoulder patients, there was no improvement [5].

The manual therapy Maitland technique was reviewed to determine the outcome of this treatment on adhesive capsulitis. Deshmukh SS, et al. [6] performed a study comparing the effectiveness of using soft tissue mobilization before joint mobilization techniques for treating adhesive capsulitis. They found that there was a bigger decrease in pain in the mobilization group which utilized the myofascial release arm pull compared to the control group that did not use this technique. It was reported that using the Maitland technique is significantly effective when treating adhesive capsulitis. There were also significant results in using the soft tissue mobilization, which consisted of a myofascial release arm pull, prior to the joint mobilization. This allowed for better functional movement in adhesive capsulitis [6].

The outcomes of scapular mobilization manual therapy techniques were analyzed in the treatment of adhesive capsulitis. Duzgun I, et al. [7] executed a study which compared two frozen shoulder mobilizations: manual posterior capsule stretching and scapular mobilization. Duzgun I, et al. reported that scapular mobilizations and manual posterior capsule stretching increased joint motions in all groups. However, among all of the groups, ROM was not significant in these methods. Scapular mobilizations increased joint abduction, flexion, internal rotation, external rotation, and active total elevation movements.

### Conclusion

As more research is done with adhesive capsulitis, it should be noted that manual therapy techniques seem to yield the best effects for treatment. The researchers primarily theorized that manual therapy techniques would improve dysfunction and quality of life more effectively than traditional treatments. When looking at the data presented in this literature review, Mulligan's technique, Maitland's technique, PNF, and soft tissue mobilizations were all

effective in increasing ROM and decreasing stiffness in patients that had a diagnosis of adhesive capsulitis. What these treatment forms all have in common, is that they are all forms of manual therapy, or hands-on therapy that must be performed by a skilled clinician, specifically a physical therapist. Our research is significant to physical therapy because it exemplified and further proved the importance of physical therapists knowing how to perform these techniques. Furthermore, understanding the mechanisms, effects, and outcomes of different manual therapies for the treatment of adhesive capsulitis can reduce the risk of life-long symptoms and physical disabilities that can optimize patient care and create a better quality of life for these patients.

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