

## Review Article

# Current non-operative treatments for adhesive capsulitis: A Review

Roshan Chhatlani<sup>1</sup>, Lara Morgan Oberle<sup>2</sup>, Gene Tekmyster<sup>2</sup>

<sup>1</sup>SUNY Downstate Medical Center, Brooklyn NY, USA

<sup>2</sup>Keck Medicine of USC, Los Angeles, USA

### Abstract

This study aims to determine the best available non-operative approach for adhesive capsulitis and to create a guided treatment plan based on the research and evidence. An electronic search of multiple databases including PubMed, Cochrane Library, Wiley Online Library, Google Scholar, and Ovid Medline was completed. Search terms included “adhesive capsulitis”, “frozen shoulder”, “adhesive capsulitis treatments”, and “frozen shoulder treatments”. Exclusion criteria included articles that were published before the year 1984 and non-peer reviewed articles. Seventy-four articles were retrieved from the original search, and of those forty-nine articles were included and twenty-five were excluded. In the available research and literature, there is no clear consensus of one non-operative approach against the other. There is however clear evidence that intra-articular corticosteroid injections provide pain relief in the short term. There may be a role for the other non-operative interventions in the treatment for adhesive capsulitis but the current evidence does not support them being implemented as standalone treatment options. In order to determine the best available non-operative approach for adhesive capsulitis there is a need for higher quality randomized controlled trials moving forward. The available literature has limitations that would restrict one to formulate a consensus on a guided treatment plan.

**Keywords:** Adhesive capsulitis, Adhesive capsulitis treatments, Frozen shoulder, Frozen shoulder treatments, Platelet-rich plasma

### Introduction

Adhesive capsulitis also often referred to as frozen shoulder is a common condition among adults that creates significant obstruction to one’s ability to function normally. Patients who suffer from adhesive capsulitis typically have pain and limited motion of their shoulder in both the active and passive range. The goal of treatment involves reducing pain and improving range of motion (ROM) to maximize functionality. This literature review of the current non-operative treatments for adhesive capsulitis appraises the research and evidence for the use of the most commonly used interventions including but not limited to physical/occupational therapy, intra-articular corticosteroid injections, oral pharmacological therapy, capsular hydrodilatation, intra-articular platelet-rich plasma (PRP) injections, intra-articular sodium hyaluronate injections, suprascapular nerve blocks, acupuncture, and botulinum toxin injections. A guided treatment plan may also be adjusted depending on the most

common risk factors associated with adhesive capsulitis which include diabetes mellitus and hypertension.

### Objective

Determine the best available non-operative approach for adhesive capsulitis and to create a guided treatment plan based on the research and evidence.

*The authors have no conflict of interest.*

**Corresponding author:** Roshan Chhatlani DO, 450 Clarkson Ave, Brooklyn, NY 11203, USA

**E-mail:** roshanchhatlani1@gmail.com

**Edited by:** Konstantinos Stathopoulos

**Accepted 25 November 2020**

## Methods

An electronic search of multiple databases including PubMed, Cochrane Library, Wiley Online Library, Google Scholar, and Ovid Medline was completed. Search terms included “adhesive capsulitis”, “frozen shoulder”, “adhesive capsulitis treatments”, and “frozen shoulder treatments”. The treatments included in this review are considered the most commonly performed interventions for adhesive capsulitis and/or the treatments that had available research on the adhesive capsulitis patient population.

## Selection Criteria

This review included case studies, consensus recommendations, literature reviews, systemic reviews, and original research. Exclusion criteria included articles that were published before the year 1984 and non-peer reviewed articles. Seventy-four articles were retrieved from the original search, and of those forty-nine articles were included and twenty-five were excluded.

## Discussion - Non-Operative Treatments/ Interventions

### *Physical/Occupational therapy (PT/OT)*

Patients are commonly prescribed occupational therapy and/or physical therapy for shoulder pathologies that are painful and result in decreased range of motion (ROM). This lack of shoulder motion interferes with a patient's functionality and subsequently patients are sent for rehabilitation therapy in order to restore motion and improve pain which ultimately allows for the improvement in daily function. Adhesive capsulitis patients commonly present with pain and limited range of motion of the affected shoulder. Adhesive capsulitis has 3 stages - the freezing, frozen, and thawing phases<sup>1</sup>. In each phase, the therapist alters their program and progresses to more involved exercises.

Initially, the early research did not show clear benefit of PT/OT for adhesive capsulitis. A systematic review published in 2002 researched the efficacy of physical therapy for adhesive capsulitis and revealed that the efficacy of physical therapy for adhesive capsulitis was unclear<sup>4</sup>. Studies published between January 1990 and December 2000 had poor execution, lack of standardizing terminology and outcome measurements and were poor quality randomized controlled trials (RCTs). Additionally, Green et al reported in his review that physical therapy interventions for adhesive capsulitis alone are not effective<sup>5</sup>.

More recent studies however have shown some benefit when it comes to physical therapy for adhesive capsulitis. A RCT published in 2010 revealed that subjects with adhesive capsulitis improved with the use of three different mobilization techniques<sup>6</sup>. Limitations included the small sample size of twenty-eight subjects. A trial that included forty-four participants published in 2015 revealed that both exercises with manual therapy and exercises alone are

equally effective in the management of adhesive capsulitis<sup>10</sup>. Both groups studied had improved visual analog scale (VAS) and shoulder pain and disability index (SPDI) scores. VAS and SPDI scores are self-administered questionnaires that question the severity of an individual's pain. SPDI additionally includes functional questions involving the shoulder.

Guler-Uysal F et al performed a randomized comparative clinical trial that evaluated the use of Cyriax approach of deep friction massage and mobilizations as it compared to traditional physical therapy exercises<sup>9</sup>. Results showed the Cyriax method of rehabilitation was faster and more beneficial in the early phase of adhesive capsulitis than traditional physical therapy. In another unique approach, Russel et al found that a hospital-based exercise class has significant benefit in a patient recovering from frozen shoulder than individualized physical therapy plans or a home exercise plan<sup>13</sup>.

Carette et al revealed that supervised physical therapy performed as a stand-alone treatment modality has limited efficacy but found that PT combined with corticosteroid injection resulted in faster improvement in shoulder range of motion<sup>8</sup>. A recent systematic review published in 2014, showed evidence that the combination of manual therapy and exercise may not be as effective as corticosteroid injection in the short term for adhesive capsulitis patients and it is unclear if physical/occupational therapy is an effective adjunct to corticosteroid injections or oral non-steroidal anti-inflammatories (NSAIDs)<sup>2</sup>. This review included thirty-two trials most recent of which was published in May of 2013 and were considered low quality due to the fact that none of the trials compared a combination of manual therapy and exercises against no intervention group or placebo.

### *Intra-Articular Corticosteroid Injections*

Second to initiating physical/occupational therapy, intra-articular shoulder corticosteroid injections are one of the most commonly performed interventions for patients who suffer from adhesive capsulitis. Steroids act as an anti-inflammatory agent by decreasing capillary vasodilation and vascular permeability. As adhesive capsulitis is a condition in which there is diffuse inflammation of the articular capsule of the shoulder, it is clear as to why corticosteroid injections have been widely used for this application<sup>47</sup>.

In 1984, Belgun et al performed a direct comparison between intra-articular steroid injections, mobilization therapy, ice therapy, and no treatment<sup>7</sup>. The study included forty-two patients with previously untreated adhesive capsulitis who received one of the respective treatments and were monitored for eight months. The results revealed that in the long term (six to eight-month range) there was no significant improvement in pain and shoulder ROM in any of the treatment regimens but that intra-articular steroid injections may improve pain and ROM outcomes in the early stages.

On the other hand, Arslan and Celiker found that a local

corticosteroid injection was found to be as effective as physical therapy for the treatment of adhesive capsulitis as both interventions helped improve ROM and both had statistically significant differences between mean visual analog scale (VAS) scores at a 10-week interval<sup>3</sup>. Of note, the patients of this study received a 40 mg methylprednisolone acetate injection compared to the patients in the 1984 study done by Belgun et al which were administered 20 mg of methylprednisolone.

There is evidence that suggests that therapy combined with intra-articular corticosteroid injections could be the ideal combination for adhesive capsulitis management. A placebo-controlled trial published in 2003, revealed that a single intra-articular corticosteroid injection given under fluoroscopy combined with a simple home exercise program helps reduce shoulder pain and disability in patients with frozen shoulder<sup>8</sup>. The patients in this study that received the intra-articular corticosteroid injection were given 40 mg of triamcinolone.

It is important to note that the type of steroid, amount of injectate, and use of image guidance is a significant variable in each study. To answer the question of the amount of intra-articular steroid injections that should be administered for a patient with frozen shoulder, Erickson et al found that multiple steroid injections provided no benefit when compared with a single intra-articular corticosteroid injection<sup>12</sup>. This was illustrated in both the diabetic and non-diabetic patient population. A systematic review done by Kim Hwee Koh on corticosteroid injections for adhesive capsulitis revealed that these injections reduce pain and improve function until the 12-week period but the long-term efficacy beyond 12 weeks was not shown<sup>14</sup>. A recent literature review published in 2017, also reported that corticosteroid injections reduced pain and improved function in the short term but may not provide long term benefit (past 24 weeks) for frozen shoulder patients<sup>15</sup>. On the contrary, Ahn et al noted in a one-year retrospective longitudinal study that early corticosteroid injection for adhesive capsulitis improved outcomes in both the short and long-term<sup>16</sup>. In this study, short term was measured as one month and long term as 12 months.

### **Oral Pharmacological Therapy**

Oral pharmacological agents are a staple for patients who suffer from any type of pain including adhesive capsulitis. The most common oral medications used for adhesive capsulitis are acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs) and oral steroids (prednisone)<sup>47</sup>. Acetaminophen and NSAIDs have traditionally been reserved as the first line oral agents in patients with no contraindication while oral steroids have been used for more severe cases<sup>47</sup>. Literature addressing acetaminophen and NSAIDs use for treating adhesive capsulitis is limited. In a RCT by Ranalletta et al, oral NSAIDs were compared directly to a single corticosteroid injection which showed the injection providing faster pain relief and quicker time to improvement

of shoulder function<sup>20</sup>. A RCT looking at diabetic patients with concomitant diagnosis of adhesive capsulitis found that both NSAIDs and intra-articular corticosteroid injection were efficacious yet there was no significant difference between the two<sup>21</sup>. Oral steroids are usually prescribed for musculoskeletal conditions in a tapering course for a short period of time and are reserved for severe cases due to their widely-known side effect and risk profile<sup>47</sup>. Buchbinder et al took data from two placebo-controlled trials and one no-treatment-controlled trial and was able to show that oral steroids provided short-term benefits in pain and range of motion of the affected shoulder<sup>17,18</sup>. However, the effects may not last longer than six weeks. Additionally, a review completed by Favejee et al supports the effectiveness of oral steroids compared with no treatment or placebo in the short term for adhesive capsulitis patients<sup>11</sup>. Canbulet et al completed a study of thirty-three patients who underwent oral steroid therapy combined with pregabalin and a home exercise program<sup>19</sup>. The study showed that patients had significant improvement in pain scores and ROM of the affected shoulder over a twenty-one month follow up period.

### **Capsular Hydrodilatation**

Hydrodilatation for adhesive capsulitis is a treatment that involves injecting a solution into the glenohumeral joint which is typically done utilizing imaging guidance (commonly fluoroscopy, ultrasound, or computed tomography). Although some injectates may differ, most include saline, corticosteroid, local anesthetic combined with contrast material. In 1994, Rizk et al showed that capsular rupture provides symptomatic relief in a study of sixteen patients with adhesive capsulitis<sup>22</sup>. The goal of hydrodilatation is to create capsular rupture which then allows the adhesions in the shoulder capsule to break apart which in turn provides symptomatic relief<sup>22</sup>.

A RCT done by Tveita et al compared fluoroscopic guided hydrodilatation procedure with steroid injectate directly to intra-articular corticosteroid injections alone and results showed a similar degree of improvement in shoulder ROM and SPDI scores in both groups with no significant difference<sup>23</sup>. In another RCT which used an ultrasound guided technique, the data also suggested no significant difference between hydrodilatation with steroid injectate and intra-articular corticosteroid injection alone<sup>27</sup>.

In a large systematic review done by Catapano et al which included 2276 studies, the authors conclude that hydrodilatation combined with corticosteroid injection possibly expedites recovery of pain-free range of motion and that the greatest benefit is in the first three months<sup>24</sup>. Noted by authors is the limitation of current studies which include small sample size, variation in injection techniques, and differing imaging guidance. Yet, another systematic review and meta-analysis that was published revealed that hydrodilatation has a small but not statistically significant effect on treating adhesive capsulitis<sup>25</sup>. Authors also noted

that the amount of volume injectate had no real effect on improvement. On the contrary, a retrospective study done by Haughton et al supports the use of hydrodilatation for adhesive capsulitis and states the amount of volume injectate does indeed influence the outcome<sup>26</sup>.

### ***Intra-Articular Platelet-Rich Plasma (PRP) Injections***

Platelet-rich plasma (PRP) is defined as autologous blood with a concentration of platelets above baseline values and its use in sports/musculoskeletal medicine has grown tremendously given its potential to enhance muscle and tendon repair<sup>28</sup>. Although limited clinical evidence is currently present for PRP, the use of PRP has been increasing.

In a study done by Calis et al, nine patients with adhesive capsulitis that received PRP injection had significant improvement in pain and shoulder ROM<sup>32</sup>. However, these patients also received concurrent proprioceptive neuromuscular facilitation stretching and Codman exercises during the twelve-week follow up which may have played a substantial role in the noted clinical improvement. Agrawal et al in his study of twenty patients with adhesive capsulitis who received intra-articular PRP injection showed improvement of pain and shoulder ROM at the one-month period<sup>33</sup>.

A cohort study of sixty patients composed of a group receiving intra-articular steroids and another group receiving intra-articular PRP injections revealed that the PRP group had more significant pain relief and improved shoulder ROM at the twelve-week follow up<sup>29</sup>. Lin et al was able to complete an RCT that showed evidence that a PRP injection was more effective and provided prolonged efficacy over a procaine alone injection for adhesive capsulitis<sup>30</sup>. In another study which compared PRP injection versus hydrodissection for adhesive capsulitis, the PRP therapy was found to be superior to hydrodissection when it comes to improving pain and shoulder range of motion<sup>31</sup>. It is important to note, the small sample sizes for the above-mentioned studies.

### ***Intra-Articular Sodium Hyaluronate Injections***

Sodium hyaluronate is a tissue lubricant substance that is believed to allow joints to have more space which in turn enables the range of motion to occur more easily. Harris et. al completed a systematic review which concluded that sodium hyaluronate injections help to reduce pain and increase ROM when compared to patients who did not receive the injection at all<sup>36</sup>. In addition, it was concluded that the sodium hyaluronate injection provided similar benefits to intra-articular corticosteroid injections in the treatment for adhesive capsulitis. In a systematic review done by Papalia et al it was reported that there is evidence that hyaluronic acid (HA) injections have similar clinical outcomes to intra-articular corticosteroid injections for patients with adhesive capsulitis<sup>34</sup>. However, the RCTs used in both reviews make it hard to prove this definitive conclusion due to the differences in the studies and notable performance biases. Performance biases included subacromial versus intra-articular

glenohumeral injection and the use of image guidance versus anatomic guided injections.

In a study comparing HA injections against NSAID (specifically ketorolac) injections in adhesive capsulitis patients, the group which received the NSAID injection had significantly improved pain as compared to the HA group<sup>35</sup>. Along the same lines, a review by Lee et. al reported that HA injections for adhesive capsulitis is not superior to conventional therapies such as NSAIDs, intra-articular corticosteroid injections, and physical therapy<sup>37</sup>.

Another RCT which involved HA injections in one group compared to HA plus tramadol in another group showed that the HA plus tramadol injection treatment arm experienced a much greater analgesic effect that was more rapid without any adverse events<sup>38</sup>.

### ***Suprascapular Nerve Blocks***

Suprascapular Nerve Blocks (SSNB) are typically used to treat patients with degenerative changes and chronic shoulder pain<sup>39</sup>. The SSNB are ideally performed with ultrasound guidance and involve an anesthetic injectate.

In a double blind RCT done by Dahan et al, patients who received the bupivacaine SSNB had more effective pain reduction at one month compared to the group that received the saline injection<sup>40</sup>. The sample size of this trial was very limited at thirty-four subjects and the study duration was only one month with no long-term follow up.

In a study designed to compare patients with adhesive capsulitis who underwent SSNB along with PT, there was evidence that the addition of the SSNB led to improved pain scores and functional tolerance<sup>41</sup>. Jung et al was able to compare the effect of adding an intra-articular corticosteroid injection to SSNB which revealed improved functional outcomes compared to the group that only received the SSNB alone<sup>42</sup>. The authors in this study used triamcinolone acetonide with lidocaine and ultrasound guidance for the group that received the intra-articular corticosteroid injection along with SSNB. This study was unique as it included a one year follow up with the greatest improvements in SPADI scores favoring intra-articular corticosteroid injection along with SSNB at the two-month interval.

### ***Acupuncture***

Acupuncture has been an ongoing treatment option for chronic pain but has largely remained controversial. Traditional acupuncture involves non anatomical entities such as meridians and non-physiological processes such as the flow of energy or *qi* energy<sup>43</sup>. Acupuncture involves the introduction of fine needles into strategic points in the body. In a double blinded RCT, patients who received distal needling acupuncture received immediate pain reduction compared to the group that received placebo<sup>44</sup>. In a study done by Yang et al, they specifically targeted the Tiaokou (ST38) distal acupoint in their systematic review which suggests that acupuncture can improve pain, shoulder

function, and range of motion in the adhesive capsulitis population<sup>45</sup>. This review contained nineteen RCTs however many were low quality due to inevitable bias, heterogeneity across the studies, and lack of patient follow up. In an RCT done by Asheghan et al, acupuncture for adhesive capsulitis patients led to an increase in ROM of the shoulder along with improved pain scores<sup>46</sup>. Important to note, the patients in this study showed improvement of visual analog scores at the three-month period but were not followed up after to show any long-term benefit.

### **Botulinum-Toxin Injections**

Botulinum toxin injections have been widely used for a variety of conditions which include upper limb spasticity, urinary incontinence, migraine headache prophylaxis, cervical and eye dystonia. However, its use in the adhesive capsulitis population is limited. Botulinum toxin prevents the release of acetylcholine from the pre-synaptic membrane which results in a muscle paralytic effect<sup>48</sup>. There is a single pilot RCT that compared botulinum toxin type A and triamcinolone acetate in the adhesive capsulitis population<sup>49</sup>. The sample size was small at twenty-eight total patients and the results suggest that both interventions decrease pain and improve shoulder ROM but there were no statistically significant short-term differences between botulinum toxin type A and triamcinolone acetate injections. Follow up in this study was limited to eight weeks.

### **Conclusion**

In order to determine the best available non-operative treatment approach for adhesive capsulitis, higher quality RCTs are needed. There are limitations in the current body of evidence which include but are not limited to, the lack of long-term follow up following treatment administration and inevitable biases. In the available literature there is also heterogeneity of treatments and other variables that exist which make it difficult to provide recommendations for one treatment over another.

As in any treatment plan for a patient, it is important to individualize treatment based on a patients' pre-existing condition/diagnoses. Diabetic patients usually suffer from concomitant hypertension or diabetic nephropathy, so it may be more appropriate to start with an intra-articular corticosteroid injection for this population with adhesive capsulitis rather than oral NSAIDs to prevent/avoid kidney damage in the long term.

Although the literature lacks a consensus on the proper non-operative treatment algorithm for adhesive capsulitis, non-operative management remains the primary intervention for patients suffering from shoulder pain and decreased range of motion due to a diagnosis of adhesive capsulitis. Available studies do show that most of aforementioned treatments have benefit, however there is no clear consensus of one approach against the other. The highest amount of studies involve intra-articular

corticosteroid injections and it is clear that this intervention aids to reduce pain in the short term for adhesive capsulitis patients. Physical/occupational therapy has been a mainstay of treatment for musculoskeletal problems in order to restore functionality. It does appear that PT/OT combined with corticosteroid injections are effective but this effect may be limited. There is a role for capsular hydrodilatation, SSNB, acupuncture, intra-articular sodium hyaluronate injections, and botulinum toxin injections as an adjunct to intra-articular corticosteroid injections to help reduce pain and increase range of motion but these modalities do not show as much benefit as a standalone treatment option. More studies involving these interventions with larger sample sizes and homogeneity would help create a clearer guided treatment plan for these patients. The use of intra-articular platelet-rich plasma (PRP) injections has been gaining traction in the musculoskeletal medicine community but its evidence for use in adhesive capsulitis is limited. Potentially, PRP may have a role in refractory cases but more multi-center randomized control trials with longer duration are needed. Further studies, with direct head to head treatment comparison will certainly help in choosing the appropriate treatment for each patient with the ability for the clinician to design an individualized treatment plan to aid in functional recovery for those patients with adhesive capsulitis.

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