



## Orthopaedics

## NON-DRUG NON-INVASIVE TREATMENT IN THE MANAGEMENT OF FROZEN SHOULDER

Ramji Lal Sahu

MS Orthopaedics, Professor, Saraswathi institute of medical science Hapur UP India.

Harsh Pratap Shishodia\*

DNB Orthopaedics, Assistant Professor, Saraswathi institute of medical science Hapur UP India. \*Corresponding Author

## ABSTRACT

**Objectives:** To evaluate the results of non-drug non-invasive treatment in the management of frozen shoulder. **Methods:** From December 2010 to December 2015, 140 shoulders in 120 patients (58 males and 62 females) of frozen shoulders with a mean age of 58 years were studied. They were managed with non-invasive treatment and were followed for twelve months. The functional outcomes were evaluated by using Quick dash scoring system and Constant-Murley Score. **Results:** Complete pain relief was achieved in 60.83% patients. The results were excellent in 60.83% (73/120) cases and good in 39.17% (27/120) cases. On subjective evaluations, 60.83% (73/120) patients reported full satisfaction and 39.17% (27/120) patients reported partial satisfaction with the results of treatment. **Conclusions:** Nondrug non-invasive interventions can reduce pain and improve function in frozen shoulder.

## KEYWORDS : Non-drug; Non-invasive; Frozen shoulder; Treatment

## Introduction:

Frozen shoulder describes the common shoulder condition in which there is pain and limited active and passive range of motion (ROM). Frozen shoulders are reported to affect 2% to 5% of the general population, which increases patients from diabetes and thyroid disease by 10% to 38%. [1] People with primary frozen shoulders usually occur between 40 to 65 years and this phenomenon is more visible in females than in men. [1, 2] The occurrence of frozen shoulder in one shoulder increases the risk of contra lateral shoulder involvement by 5% to 34%, and simultaneous bilateral shoulder involvement occurs as often as 14% of the time. [3] To date, the frozen shoulder's etiology remains unclear; however, patients usually display a specific history, clinical presentation and recovery. Codeman described the frozen shoulder as "difficult to define a condition, difficult to cure and difficult to explain from the perspective of pathology." [4] Nevaier introduced the word adhesive capsulitis to describe the inflamed and fibrotic condition of the capsuloligamentous tissue. [5] Lundberg divided patients who met the pain and motion requirements of frozen shoulder into two groups: primary and secondary. [6] Classically, symptoms of primary frozen shoulder have been divided into three phases: freezing (painful), frozen (stiffening), and thawing. The purpose of this study was to find out the outcome results of nondrug non-invasive treatment in the management of frozen shoulder.

## Materials and methods:

This prospective study was carried out at Orthopaedics department from December 2010 to December 2015. Institutional medical ethics committee approved it. In this series, 120 patients were enrolled. The average age of patients was 58 years (ranging from 40 to 75 years) [table 1]. The average follow up was done up to twelve months.

## Inclusion criteria

1. Age 40 to 75 years old
2. Shoulder pain present for at least three months and spontaneous onset of a painful stiff shoulder
3. Marked loss of active and passive shoulder motion, with at least 50% loss of external rotation
4. Normal x rays on anteroposterior and axillary radiographs of the glenohumeral joint
5. Only primary (Idiopathic) frozen shoulders are included in the study

## Exclusion criteria

1. History of trauma, local corticosteroid injection or any physiotherapy intervention to the affected shoulder within the last three months
2. Pathological finding on X-ray, CT SCAN and MRI in shoulder and cervical spine
3. Cerebral vascular accident or inflammatory joint disease affecting the shoulder

A written informed consent was obtained from all the patients; they were explained the treatment plan. All patients underwent a standardised subjective and objective examination, as recommended

by Wadsworth [7] and Bowling *et al.* [8]. Routine anteroposterior and lateral radiographs were performed. Following baseline evaluation, outcome measures were taken at six weeks, six months and at one year. All outcome measures were performed and recorded.

## Interventions:

Non-operative interventions include patient education, modalities, stretching exercises, soft tissue massage, myofascial trigger point release, and joint mobilisations. patient education is essential in helping to reduce frustration and encourage compliance. Modalities, such as hot packs, can be applied before or during shoulder exercises and cold packs after shoulder exercises. [Table 2]

## Initial Phase: painful, freezing

During this time, any activities that cause pain should be avoided. Better results have been found in patients who performed simple pain free exercise, rather than intensive physical therapy.

A pulley may be used to assist range of motion and stretch, Core exercises include pendulum exercise, passive supine forward elevation, passive external rotation with the arm in approximately 40 degrees of abduction in the plane of the scapula, and active assisted range of motion in extension, horizontal adduction, and internal rotation. isometric strengthening in all ranges once motion returned to 90% of normal ranges, theraband exercises in all planes, scapular stabilization exercises, and later, advanced muscular strengthening with dumbbells.

## Second Phase: adhesive:

During the second phase of treatment, movement with mobilization and end range mobilizations are recommended.

## Third Phase: resolution:

There are significant beneficial effects of joint mobilization and exercise for patients with adhesive capsulitis

## Manual Techniques

More intense stretching and exercises using a device, such as a pulley, can be performed to influence tissue remodelling.

During the initial/painful freezing stage, treatment should be directed at pain relief with pain guiding activity. Stretching, strengthening and range of motion exercises, as well as Maitland Grade I-II mobilisations have been shown to improve function and reduce pain and disability. As the patient progresses to the adhesive stage, intervention should focus on aggressive, end-range stretches combined with Maitland Grade III-IV mobilizations.

## Outcome Measures

The primary outcome measure was the Constant-Murley Score [9], [Table 3] which reflects shoulder function with accuracy, reliability, and reproducibility [10]. The score combines subjective and objective measures to produce a 100 point score, comprising four parameters: activities of daily living, range of motion, pain and strength. The

minimal clinically important difference (MCID) is the smallest change in a score that patients perceive as meaningful, causing clinicians to consider a change in the patients' management [11]. There is no data, which clearly state the MCID for the Constant score. However, routine clinical practice within the organisations involved would normally consider a change of approximately 15 points to be clinically important. [Table 4] The secondary outcome measures were the Quick dash scoring system. The quick dash [12] is a shortened version of the dash scoring system. It consists of 11 items to measure physical function and symptoms in people with any or multiple musculoskeletal disorders of the upper limb. Similar to the dash, each item has five response options (1 = no difficulty; 2 = mild difficulty; 3 = moderate difficulty; 4 = severe difficulty; 5 = unable). From the item scores, a summative score is calculated.

**Results:** 140 shoulders in 120 patients (58 males and 62 females) with frozen shoulders admitted to our institute were included in present study. Sixty-two patients (51.66%) were women and fifty-eight patients (48.33%) were male. 20 patients had bilateral frozen shoulders and 100 patients had unilateral frozen shoulders. 90 cases of frozen shoulder were found on the right side and 50 cases were seen on the left side. All the patients were divided in three age groups. In the age group between 40-50 years, there were 24 females and 21 males. In the age group between 50-60 years, there were 18 females and 19 males and in the age groups between 60-75 years, there were 20 females and 18 males. The average age of patients was 58 years (ranging from 40 to 75 years) [Table 1]. All patients were followed for twelve months. At twelve months follow-up visits, the functional outcomes were evaluated by using Quick dash scoring system [12] and Constant-Murley Score [9]. [Table 3]. Before treatment pain, disability and unable to do were severe and worst in both the scale in 100% cases. At twelve months follow-up, the subjective overall assessment at the age of 40-50 years was done, 100% of the patients were given one point. Between 50-60 years, 75% of the patient had one point, 15% had four to six points and 10% had seven to eight points. Over the age of 60 years, 50% of the patients had one point, 30% had four to six points and 20% had four to five points.

In Quick dash scoring functional disability scale [12] at the age of 40-50 years, 100% had full recovery (0% disability). Between 50-60 years, 75% of the patient had full recovery (0% disability), 25% had minor recovery (<20% disability). Above the age of 60 years, 50% had full recovery (0% disability) and 50% had minor recovery (<20% disability). (Table 3) In Global Assessment of frozen shoulder, between the ages of 40-50 years, 100% had full improvement. Between 50-60 years, 75% of the patient had full improvement. 25% had minor improvement. Above the age of 60 years, 50% had full improvement and 50% had minor improvement. In Objective Physician global evaluation, between the ages of 40-50 years, 100% had full improvement. Between 50-60 years, 75% of the patient had full improvement. 25% had minor improvement. Above the age of 60 years, 50% had full improvement and 50% had minor improvement. In the patient global evaluation, between the ages of 40-50 years, 100% had no difficulty. Between 50-60 years, 75% of the patient had no difficulty, 25% had minor difficulty. Above the age of 60 years, 50% had no difficulty and 50% had minor difficulty. Between the ages of 40-50 years, At 6 months, complete subjective, functional, and clinical recovery had occurred in almost 100% of the patients. From 50 to 60 years of age at 6 months, complete subjective, functional, and clinical recovery had occurred in almost 75% of the patients. Twenty percent of the patients had minor recovery even at 12 months, but their severity became lowered significantly. Over the age of 60 years at 6 months, complete subjective, functional, and clinical recovery had occurred in almost 50% of the patients, rest 50% had minor recovery even at 12 months, but their severity became lowered significantly. Physician global evaluations between the ages of 40-50 years at 1 year were excellent. At 40 to 60 years of age, it was good to excellent. Over the age of 60 years, it was good. The patient global evaluation were found very good between the ages of 40-50 years at 1-year follow up, good to very good between 50 to 60 years and over the age of 60 years it was good [Table 4]. At final follow-up, complete pain relief was achieved in 60.83% patients. The results were excellent in 60.83% (73/120) cases and good in 39.17% (27/120) cases. On subjective evaluations, 60.83% (73/120) patients reported full satisfaction and 39.17% (27/120) patients reported partial satisfaction with the results of treatment.

## Discussions:

The primary goal of physical therapy is to regain full range of motion in

the shoulder. If pain is too strong at first to begin working on shoulder movement, we may need to start with treatments to help control pain. Treatments to ease pain include ice, heat, ultrasound, and electrical stimulation. We also use massage or other types of hands-on treatment to ease muscle spasm and pain. Therapy will focus on regaining shoulder's movement. Sessions may begin with treatments like moist hot packs or ultrasound. These treatments relax the muscles and get the shoulder tissues ready to be stretched. We then begin working to loosen up the shoulder joint, especially the joint capsule. We can also get a good stretch using an overhead shoulder pulley in the clinic or as part of a home program. Management of frozen shoulder can be surgical or nonsurgical. The disease is often self-limited with a natural history of about 15 to 20 months. [13] Physiotherapy is a popular nonsurgical treatment especially in the stiffness phase, despite the lack of high-quality evidence to support its use. Some studies have shown that low grade physiotherapy programmes (movements within the comfort zone) may show better long-term outcome as compared to high intensity (movements at the limits of pain tolerance) programmes. [14, 15] The present study results showed that majority of the patients were in age range of 40-75 years. Hence middle and older age is common life period where frozen shoulder occurrence is maximum in the current study. The present study result on age of occurrence coincides well with the recent studies.[16] But the studies done 5 or more years back observed that frozen shoulder is more common in 5th to 6th decade. [16, 17, 18] Therefore it can be inferred that in recent years this condition starts little early. In the present study female patients (51.66%, N=62) are comparatively higher than male patients (48.33%, N=58). Many previous studies report that women patients constitute maximum for this disabling shoulder condition that coincides well with the recent studies. [19, 20, 21] The current study was carried out in rural area of Greater noida where agricultural workers and manual labours represent maximal numbers. Female and males both are usually performing this job and repetitive physical work demands on shoulder make them susceptible to undue pressure on the joint and surrounding structures which contributes early wear and tear. The majority of women patients (51.66%, N=62) enrolled in the present study were house wives. Again, physical demands of the shoulder joint put them into the risk of the frozen shoulder. Majority of the patients in the present study were in freezing stage (2<sup>nd</sup> stage) of frozen shoulder. Pain was prominent feature of them. 60.83% (73/120) patients have moderate to severe pain and 39.17% (27/120) have mild pain. Regarding side of involvement, right shoulder is affected for 64.28% (90/140) of patients and left shoulder is affected for 35.71% (50/140) of patients. The trend is almost similar for both genders. Hand dominance could be the reason for such scenario. In the current study as previously stated manual labors, agricultural workers and housewives constitute bulk of population and repetitive work demands of dominant shoulder make them exposed to right shoulder pathology. The other important finding is that majority of the patients present with associated comorbidities. The important associated medical conditions are diabetes, cervical spondylosis, back pain, tennis elbow and hypertension. Many of previous work have observed that diabetes is an important risk factor for frozen shoulder shoulder. [20,] There is no positive association for specific associated comorbid condition and severity of pain. This means that pain severity is not dependent on the associated comorbid conditions. Similar to what is known from previous studies, abduction and external rotation was considered to be the most severely restricted range of motion (22). Physiotherapy forms the mainstay of early- and mid-stage disease. The majority of studies that have examined the role of physiotherapy have shown improvement in pain scores, functionality and range of motion [23]. Griggs et al. [23] performed a prospective outcome study of non-operative treatment, including physiotherapy and passive stretching, and followed up 77 patients over a two-year period. Nine out of ten patients had favourable results; only 10% were dissatisfied with the outcome. It is worth noting that, compensation claims and pending lawsuits were linked to a need for further operative treatment. These results were echoed by Melzer et al. [24] studied 110 shoulders over a 3.8-year period and found that patients receiving physiotherapy alone had better clinical outcomes than patients undergoing MUA. However, in a prospective randomized study of 77 patients with frozen shoulder, Dierks et al. [25] demonstrated that supervised neglect provided better outcomes at 2 years when compared with an intensive physiotherapy regime, suggesting that physiotherapy may not alter disease progression, particularly if the regime is aggressive. The first prospective RCT was performed by Bulgen et al. [26] in 1984. Forty-two patients were divide into four groups, and the Authors assessed the effect of mobilization (11 patients), mobilization and ice- pack (12

patients), intra-articular corticosteroid injection (11 patients) and no treatment (8 patients). They found just a few differences between patients treated with physiotherapy and no treated controls. More recently Griggs et al. [27] concluded that patients with phase- II idiopathic AC can be treated successfully with shoulder stage stretching exercises program. Furthermore, stretching exercises should be continued for three months, after that more aggressive physiotherapy or invasive management should be considered. The frequency and the technique with which the mobilization should be performed is still debated. In a level III study, Diercks et al. [28] compared intensive physical therapy program, including active and passive exercises with stretching beyond the pain threshold to exercises within the pain limits. They found that exercises within the pain limits was superior than intensive physical therapy and passive stretching with regard to functional outcome and speed of recovery. In fact, 89% of patients treated with exercises within the pain limits reached a Constant score of 80 or higher compared to 63% of patients treated with intensive physical therapy. In contrast, Vermeulen [29] found that high-grade mobilization technique was more effective than low-grade mobilization technique (within the pain limits) in increasing mobility and functional ability. However, all patients improved significantly with both treatment strategies and only a minority of outcome measures reached statistical significance. Johnson et al. [30] compared anterior versus posterior glide mobilization. They concluded that a posteriorly directed joint mobilization technique was more effective than an anteriorly directed mobilization technique for improving external rotation after three treatment sessions. A retrospective cohort study [31] of more than 2.000 patients affected by AC found that both manual shoulder mobilization techniques and self-exercise like stretching and home programs are effective for the treatment of AC. Self-exercises twice [32] daily appeared instead superior than shoulder mobilization by a physiotherapist twice a week. The efficacy of physiotherapy interventions for shoulder pain and dysfunction have been evaluated by a Cochrane Review. [33] Unfortunately many pathologies of the shoulder such as rotator cuff tears, calcific tendinopathy, AC, anterior gleno-humeral instability have been considered. Laser therapy was demonstrated to be more effective than placebo for AC48. It was confirmed more recently by Stergioulas. [34] Low-level laser treatment seemed to be more effective than placebo respect to pain but not respect to ROM. So, the Author concluded that lower-level laser therapy did not affect the underlying capsular pathology and adhesion. Leung et al. [35] conducted a RCT which demonstrate that addition of deep heating to stretching exercises produces a greater improvement in pain relief, and leads to improved performance in daily living activities and in range of motion, more than superficial heating. However, there is no evidence that physiotherapy alone is of benefit for AC48. Ultrasound, massage, iontophoresis, and phonophoresis not only seems to be no effective for the treatment of AC, but they seems to reduce the likelihood of a favorable outcome. So, their use has been discouraged by some Authors. [31] The results of the study confirmed that patients seen in an exercise class had better outcomes and recovered in a shorter time frame than those patients in an individual multimodal physiotherapy or home exercise programme. This can influence clinical practice by potentially reducing the number of individual physiotherapy treatment sessions, which increases cost effectiveness, as suggested by Carr et al. [36] It may also improve care pathways by initiating effective management from initial diagnosis. This could standardize treatment outcomes and impact upon the need for surgical or more invasive interventions. A limitation of the study is the absence of a natural history control group. In our study, complete pain relief was achieved in 60.83% patients. The results were excellent in 60.83% cases and good in 39.17% cases. On subjective evaluations, 60.83% patients reported full satisfaction and 39.17% patients reported partial satisfaction with the results of treatment.

### Conclusion:

In conclusion, this study demonstrates that an exercise class, aimed at a rapid recovery rate with a minimum number of interventions, provides superior outcomes in relieving the signs and symptoms of frozen shoulder.

**Acknowledgement:** nil

**Conflict of interest:** nil

**Table 1: Age and sex variations in study group (n=120)**

| Age   | Male | Female | Total |
|-------|------|--------|-------|
| 40-50 | 21   | 24     | 45    |

|       |    |    |     |
|-------|----|----|-----|
| 50-60 | 19 | 18 | 37  |
| 60-75 | 18 | 20 | 38  |
| Total | 58 | 62 | 120 |

**Table 2: Frozen Shoulder Exercises (Rehabilitation Protocol):**

| Phase 1: Weeks 0-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Phase 2: Weeks 8-16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Phase 3: 4 months and beyond                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Goals</b> <ul style="list-style-type: none"> <li>Relieve pain</li> <li>Restore Motion</li> </ul> <b>No restriction or immobilization.</b> <b>Pain Control</b> <ul style="list-style-type: none"> <li>Ice, ultrasound, HVGS</li> <li>Apply moist heat before therapy and ice pack at the end of session.</li> </ul> <b>Motion: Frozen Shoulder Exercises</b> <p>Initially focus on forward flexion and internal and external rotation with the arm at the side, and the elbow at 90 degrees.</p> <ul style="list-style-type: none"> <li>Active ROM exercises.</li> <li>Active assisted ROM exercises.</li> <li>Passive ROM exercises.</li> <li>In home these Frozen Shoulder Exercises should be performed 3-5 times per day.</li> <li>A sustained stretch, of 15-30 seconds, at the end ROMs should be part of all ROM routines.</li> </ul> | <b>Criteria for progression to Phase 2</b> <ul style="list-style-type: none"> <li>Improvement in shoulder discomfort.</li> <li>Improvement in shoulder motion.</li> <li>Satisfactory physical examination.</li> </ul> <b>Goals</b> <ul style="list-style-type: none"> <li>Improve shoulder motion in all plane</li> <li>Improve strength and endurance of rotator cuff and scapular stabilizers</li> <li>Pain Control by same means as used in 1st 8 weeks.</li> </ul> <b>Motion: Frozen Shoulder Exercises</b> <p>Perform active, active assisted and passive range of motion exercises to obtain around 140 degree of forward flexion, 45 degree of external rotation and internal rotation to twelfth thoracic spinous process.</p> <p>Muscle strengthening</p> <ul style="list-style-type: none"> <li>Start with rotator cuff strengthening exercises 3 times per week, 8-12 repetitions for three sets.</li> <li>Closed chain isometric strengthening with the elbow flexed to 90 degrees and the arm at the side. Perform internal rotation, external rotation, abduction and forward flexion.</li> <li>Progress to open chain strengthening exercises with theraband for same group of muscles.</li> <li>Progress to light weight dumbbell exercises for internal rotators, external rotators, abductors and forward flexors.</li> <li>Perform strengthening of scapular stabilizers.</li> <li>Deltoid strengthening.</li> </ul> | <b>Criteria for progression to Phase 3</b> <ul style="list-style-type: none"> <li>Significant functional recovery of shoulder motion.</li> <li>Successful participation in activities of daily living.</li> <li>Resolution of painful shoulder.</li> <li>Satisfactory physical examination.</li> </ul> <b>Goals</b> <ul style="list-style-type: none"> <li>Frozen shoulder exercises.</li> <li>ROM exercises 2 times a day.</li> <li>Rotator cuff strengthening 3 times a week.</li> <li>Scapular stabilizer strengthening 3 times a week.</li> </ul> |

**Table 3. Pre and post management evaluation of frozen shoulder (n=120)**

| Age group | Quick dash [12] scoring system |                               | Constant-Murley Score [9] |                 |
|-----------|--------------------------------|-------------------------------|---------------------------|-----------------|
|           | Before treatment               | After treatment               | Before treatment          | After treatment |
| 40-50     | 100% had                       | 100% had                      | 100% had                  | 100% had        |
| 50-60     | Severe difficulty to           | No difficulty                 | Worst pain                | No pain and     |
| 60-75     | unable To do                   | 75% had no difficulty and 25% | Unable to do              | No difficulty   |

|  |                                            |                                                   |                                      |                                                                       |
|--|--------------------------------------------|---------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|
|  | Severe difficulty to unable To do          | had mild difficulty                               | 100% had Worst pain and Unable to do | 75% had no pain and difficulty, 25% had mild pain and mild difficulty |
|  | 100% had Severe difficulty to unable To do | 50% had no difficulty and 50% had mild difficulty | 100% had Worst pain and Unable to do | 50% had no pain and difficulty, 50% had mild pain and mild difficulty |

**Table 3. Pre and post management evaluation of frozen shoulder (n=120)**

| Age group | Quick dash scoring system [12]             |                                                   | Constant-Murley Score [9]            |                                                                       |
|-----------|--------------------------------------------|---------------------------------------------------|--------------------------------------|-----------------------------------------------------------------------|
|           | Before treatment                           | After treatment                                   | Before treatment                     | After treatment                                                       |
| 40-50     | 100% had Severe difficulty to unable To do | 100% had No difficulty                            | 100% had Worst pain and Unable to do | 100% had No pain and No difficulty                                    |
| 50-60     | 100% had Severe difficulty to unable To do | 75% had no difficulty and 25% had mild difficulty | 100% had Worst pain and Unable to do | 75% had no pain and difficulty, 25% had mild pain and mild difficulty |
| 60-75     | 100% had Severe difficulty to unable To do | 50% had no difficulty and 50% had mild difficulty | 100% had Worst pain and Unable to do | 50% had no pain and difficulty, 50% had mild pain and mild difficulty |

**Table 4: Results in study group (n=120)**

| Age group | Subjective overall assessment [Constant-Murley Score] [9] | Quick dash scoring system functional disability scale [12] | Global Assessment of frozen shoulder | Physician global evaluation | The patient global evaluation |
|-----------|-----------------------------------------------------------|------------------------------------------------------------|--------------------------------------|-----------------------------|-------------------------------|
| 40-50     | 100% full recovery                                        | 100% full recovery                                         | 100% full recovery                   | Excellent                   | Very good                     |
| 50-60     | 75% full recovery                                         | 75% full recovery                                          | 75% full recovery                    | Good-excellent              | Good-very good                |
|           | 25% minor recovery                                        | 25% minor recovery                                         | 25% minor recovery                   | Good                        | Good                          |
|           | 50% full recovery                                         | 50% full recovery                                          | 50% full recovery                    |                             |                               |
| 60-75     | 50% minor recovery                                        | 50% minor recovery                                         | 50% full recovery                    |                             |                               |
|           |                                                           |                                                            | 50% minor recovery                   |                             |                               |

## REFERENCES:

- Aydeniz A, Gursoy S, Guney E. Which musculoskeletal complications are most frequently seen in type 2 diabetes mellitus? *J Int Med Res.* 2008; 36: 505– 511. [Crossref][Medline]
- Milgrom C, Novack V, Weil Y, Jaber S, Radeva-Petrova DR, Finestone A. Risk factors for idiopathic frozen shoulder. *Isr Med Assoc J.* 2008; 10: 361– 364. [Medline]
- Griggs SM, Ahn A, Green A. Idiopathic adhesive capsulitis. A prospective functional outcome study of nonoperative treatment. *J Bone Joint Surg Am.* 2000; 82-A: 1398– 1407. [Medline]
- Codman EA. The Shoulder: Rupture of the Supraspinatus Tendon and Other Lesions in or About the Subacromial Bursa. Boston, MA: T. Todd Co; 1934.
- Neviaser JS. Adhesive capsulitis of the shoulder, a study of the pathological findings in periarthritis of the shoulder. *J Bone Joint Surg Am.* 1945; 27: 211– 222.
- Lundberg BJ. The frozen shoulder. Clinical and radiographical observations. The effect of manipulation under general anesthesia. Structure and glycosaminoglycan content of the joint capsule. Local bone metabolism. *Acta Orthop Scand Suppl.* 1969. 119:1-59. [Medline]
- Wadsworth CT. Frozen shoulder. *Physical Therapy* 1986; 66:1878-83.
- Bowling RW, Rochar PA, Erhard R. Examination of the shoulder complex. *Physical Therapy* 1986; 66:1866-78.
- Constant CR, Murley AGH. A clinical method of functional assessment of the shoulder. *Clinical Orthopaedics* 1987; 214:160-4.
- Yian EH, Ramappa AJ, Arneberg O, Gerber C. The Constant Score in normal shoulders. *Journal of Shoulder and Elbow Surgery* 2005; 14:128-33.

- Fayers P, Machin, D. Quality of Life: The assessment, analysis and reporting of patient-reported outcomes 2nd edition. Wiley, New York. 2007.
- Beaton DE, Wright JG, Katz JN. Development of the Quick-DASH: comparison of three item-reduction approaches. *J Bone Joint Surg Am* 2005; 87:1038-1046. [CrossRef][Medline]
- Vastamäki H, Kettunen J, Vastamäki M. The natural history of idiopathic frozen shoulder: A 2- to 27-year follow up study. *Clinical Orthopaedics and Related Research.* 2012; 470(4):1133-1143.
- Russell S, Jariwala A, Conlon R, Selfe J, Richards J, Walton M. A blinded, randomized, controlled trial assessing conservative management strategies for frozen shoulder. *Journal of Shoulder and Elbow Surgery/American Shoulder and Elbow Surgeons.* 2014; 23(4):500-507.
- Jain TK, Sharma NK. The effectiveness of physiotherapeutic interventions in treatment of frozen shoulder/adhesive capsulitis: A systematic review. *Journal of Back and Musculoskeletal Rehabilitation.* 2014; 27(3):247-273.
- Alvin C. powers. Diabetes mellitus .Fauci / McGraw-Hill's. Harrison's principle of internal medicine. 17th ed. 2008; 1289-1316.
- James P. Tasto, MD and David W. Elias, MD. Adhesive Capsulitis. *Sports Med Arthrosc Rev.* Volume 15, Number 4, December 2007.
- Silvio E. Inzucchi . Diabetes mellitus. Lee Goldman / Saunders Elsevier. Cecil Medicine, 23rd ed. 2008. pp 1123-1178.
- Aydeniz A, Gursoy S, Guney E. Which musculoskeletal complications are most frequently seen in type 2 diabetes mellitus? *J Int Med Res.* 2008; 36:505-511.
- Milgrom C, Novack V, Weil Y, Jaber S, Radeva-Petrova DR, Finestone A. Risk factors for idiopathic frozen shoulder. *Isr Med Assoc J.* 2008; 10:361-364.
- Sheridan MA, Hannafin JA. Upper extremity: emphasis on frozen shoulder. *Orthop Clin North Am.* 2006; 37:531-539. <http://dx.doi.org/10.1016/j.ocl.2006.09.009>
- Robinson C, Seah K, Chee et al. Frozen shoulder. *J Bone Joint Surg Br* 2012; 94: 1-9.
- Griggs SM, Ahn A, Green A. Idiopathic Adhesive Capsulitis: A Prospective Functional Outcome Study of Nonoperative Treatment. *J Bone Joint Surg Am* 2000; 82(10): 1398.
- Melzer C, Hoffmann S, Wallny T, Wirth C. Frozen shoulder— treatment and results. *Arch Orthop Traum Surg* 1995; 114(2): 87-91.
- Diercks RL, Stevens M. Gentle thawing of the frozen shoulder: a prospective study of supervised neglect versus intensive physical therapy in seventy-seven patients with frozen shoulder syndrome followed up for two years. *J Shoulder Elbow Surg* 2004; 13(5): 499-502.
- Bulgen DY, Binder AI, Hazleman BL, Dutton J, Roberts S. Frozen shoulder: prospective clinical study with an evaluation of three treatment regimens. *Ann Rheum Dis* 1984; 43: 353-360.
- Griggs SM, Ahn A, Green A. Idiopathic Adhesive Capsulitis: A Prospective Functional Outcome Study of Nonoperative Treatment. *J Bone Joint Surg Am* 2000; 82:1398-1407.
- Diercks RL, Stevens M. Gentle thawing of the frozen shoulder: a prospective study of supervised neglect versus intensive physical therapy in seventy-seven patients with frozen shoulder syndrome followed up for two years. *J Shoulder Elbow Surg* 2004; 13: 499-502.
- Vermeulen HM, Rozing PM, Obermann WR, le Cessie S, Vliet Vlieland TP. Comparison of high-grade and low-grade mobilization techniques in the management of adhesive capsulitis of the shoulder: randomized controlled trial. *Phys Ther* 2006; 86: 355-368.
- Johnson AJ, Godges JJ, Zimmerman GJ, Ounanian LL. The effect of anterior versus posterior glide joint mobilization on external rotation range of motion in patients with shoulder adhesive capsulitis. *J Orthop Sports Phys Ther* 2007; 37: 88-99.
- Jewell DV, Riddle DL, Thacker LR. Interventions associated with an increased or decreased likelihood of pain reduction and improved function in patients with adhesive capsulitis: a retrospective cohort study. *Phys Ther* 2009; 89: 419-429.
- Tanaka K, Saura R, Takahashi N, Hiura Y, Hashimoto R. Joint mobilization versus self-exercises for limited glenohumeral joint mobility: randomized controlled study of management of rehabilitation. *Clin Rheumatol* 2010; 29:1439-1444.
- Green S, Buchbinder R, Hetrick S. Physiotherapy interventions for shoulder pain. *Cochrane Database Syst Rev* 2003; Cd004258.
- Stergioulas A. Low-power laser treatment in patients with frozen shoulder: preliminary results. *Photomed Laser Surg* 2008; 26:99-105.
- Leung MS, Cheing GL. Effects of deep and superficial heating in the management of frozen shoulder. *J Rehabil Med* 2008; 40:145-150.
- Carr JL, Klaber Moffett JA, Howarth E, Richmond SJ, Torgerson DJ, Jackson DA Metcalfe CJ. A randomized trial comparing a group exercise programme for back pain patients with individual physiotherapy in a severely deprived area. *Disability and Rehabilitation* 2005; 27:16929-937.