

# FUNCTIONAL OUTCOMES OF ADHESIVE CAPSULITIS TREATED WITH GROWTH FACTOR THERAPY VERSUS PLATELET-RICH PLASMA: A COMPARATIVE STUDY

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## ABSTRACT

**Background:** Adhesive capsulitis is a disabling musculoskeletal condition characterized by progressive pain and restriction of both active and passive shoulder movements. The pathology involves capsular inflammation followed by fibrosis, leading to significant functional limitation. Conventional treatment modalities, including nonsteroidal anti-inflammatory drugs, physiotherapy, and corticosteroid injections, primarily provide symptomatic relief and may not adequately address the underlying disease process. Biological therapies such as platelet-rich plasma (PRP) and growth factor-based injections have emerged as promising regenerative treatment options targeting the underlying pathology.

**Purpose:** The present study aims to compare the functional outcomes of intra-articular growth factor therapy and platelet-rich plasma injections in patients with adhesive capsulitis using the Disabilities of the Arm, Shoulder and Hand (DASH) score.

**Methods:** This prospective comparative study included ten patients diagnosed clinically with adhesive capsulitis. Patients were divided into two groups: five treated with growth factor therapy and five treated with PRP injections. Functional outcomes were assessed using the DASH score at baseline, 1 month, 3 months, and 6 months post-injection.

**Results:** All patients demonstrated progressive improvement in functional outcomes. The growth factor group showed earlier improvement in pain and range of motion, particularly within the first month, whereas the PRP group demonstrated gradual and sustained improvement. At 6 months, both groups showed significant reduction in DASH scores, with slightly better outcomes in the growth factor group.

**Conclusion:** Both growth factor therapy and PRP are safe and effective treatment modalities for adhesive capsulitis. Growth factor therapy may provide faster early recovery, while PRP offers sustained long-term improvement. These therapies may act as disease-modifying interventions by addressing the underlying inflammatory and fibrotic processes. Level of Evidence: Level III

**KEYWORDS:** Adhesive capsulitis, PRP, Growth factors, DASH score, Frozen shoulder, Functional outcome

## INTRODUCTION

Adhesive capsulitis, commonly referred to as frozen shoulder, is a clinical condition characterized by progressive pain and marked restriction of both active and passive shoulder movements. It is a common cause of shoulder disability, particularly affecting individuals between 40 and 60 years of age, and is frequently associated with systemic conditions such as diabetes mellitus and thyroid dysfunction.

The pathophysiology of adhesive capsulitis involves an initial inflammatory phase characterized by synovitis and hypervascularity, followed by fibroblastic proliferation and excessive collagen deposition within the joint capsule. This leads to capsular thickening, contracture, and formation of adhesions, resulting in decreased joint compliance and restricted mobility.

Conventional management strategies primarily aim to reduce pain and improve mobility but often fail to address the underlying fibrotic process. In recent years, biological therapies have gained increasing attention due to their potential to modify disease progression.

Platelet-rich plasma (PRP) is an autologous concentration of platelets obtained from centrifuged blood and contains multiple growth factors such as platelet-derived growth factor, vascular endothelial growth factor, and transforming growth factor-beta. These factors play a crucial role in modulating inflammation, promoting angiogenesis, and enhancing tissue repair.

Growth factor therapy represents a more targeted biological approach, wherein concentrated growth factors are isolated and administered directly. Unlike PRP, which relies on in vivo platelet activation, growth factor therapy provides immediate availability of bioactive molecules, potentially leading to faster therapeutic effects.

## MATERIALS AND METHODS

This study was conducted as a prospective comparative study involving ten patients diagnosed with adhesive capsulitis at a tertiary care orthopedic center.

Patients were selected based on clinical evaluation demonstrating restriction of both active and passive shoulder movements. All patients had failed conservative management including physiotherapy and medications.

Patients were divided into two groups:

- Growth Factor Group (n=5)
- PRP Group (n=5)

Preparation of Injectates

### Platelet-Rich Plasma (PRP) Preparation

PRP was prepared using a standardized double-spin centrifugation method. Approximately 20–30 mL of venous blood was collected in anticoagulant-containing tubes. The first centrifugation (soft spin) was performed at 2000 rpm for 10 minutes to separate red blood cells from plasma. The supernatant plasma was then subjected to a second centrifugation (hard spin) at 4000 rpm for 10 minutes to concentrate platelets.

The lower fraction containing platelet-rich plasma was collected and activated using calcium chloride prior to injection. This activation leads to gradual release of growth factors at the injection site, contributing to sustained biological activity.

### Growth Factor Preparation

Growth factor therapy was prepared by further processing platelet-derived components. Following centrifugation, platelets were activated using calcium chloride or similar agents, leading to degranulation and release of growth factors. The cellular components were then separated, and the supernatant rich in growth factors was collected.

This preparation, often referred to as platelet lysate or autologous growth factor concentrate, contains a high concentration of bioactive molecules such as PDGF, TGF- $\beta$ , VEGF, and IGF. Unlike PRP, this formulation does not contain intact platelets and provides immediate availability of growth factors, resulting in faster onset of action.

### Injection Technique

All injections were administered intra-articularly into the glenohumeral joint under strict aseptic precautions using a posterior approach. The needle was inserted approximately 2 cm inferior and 1–2 cm medial to the posterolateral corner of the acromion and directed anteriorly toward the coracoid process.

Following the procedure, patients were advised rest for 48 hours. Nonsteroidal anti-inflammatory drugs were avoided, and a structured physiotherapy program was initiated.



### Outcome Assessment

Functional outcome was assessed using the DASH score at baseline, 1 month, 3 months, and 6 months.

### Case Series Description

#### Growth Factor Group

##### Case 1:

A 50-year-old male presented with 5 months of progressive shoulder pain and stiffness, with difficulty in overhead activities and dressing. Examination revealed restriction of abduction and external rotation. Baseline DASH score was 72. Following growth factor therapy, early pain relief was noted with progressive improvement, and DASH score improved to 18 at 6 months.



**Case 2:**

A 48-year-old female with diabetes mellitus presented with 6 months of shoulder stiffness affecting daily activities. Clinical examination showed global restriction of movements. Baseline DASH score was 68. Post-treatment, early reduction in pain and gradual improvement in mobility were observed, with DASH score improving to 19 at final follow-up.



**Case 3:**

A 55-year-old male presented with 4 months of shoulder stiffness associated with night pain. Examination revealed restriction in all planes of movement. Baseline DASH score was 74. Following growth factor injection, gradual improvement was noted, with DASH score improving to 20 at 6 months.

**Case 4:**

A 46-year-old female presented with 5 months of severe shoulder stiffness, particularly affecting internal rotation. Examination showed marked restriction of movements. Baseline DASH score was 69. After treatment, steady improvement was observed, with DASH score improving to 17 at final follow-up.

**Case 5:**

A 52-year-old male presented with 6 months of progressive shoulder stiffness and functional limitation. Examination revealed significant restriction of all movements. Baseline DASH score was 68. Following therapy, consistent improvement occurred, with DASH score improving to 20 at 6 months.

**PRP Group**

**Case 6:**

A 45-year-old male presented with 4 months of shoulder pain and stiffness with restricted movements. Examination showed limitation of abduction and rotation. Baseline DASH score was 65. Gradual improvement was observed over time, with DASH score improving to 24 at 6 months.



#### Case 7:

A 52-year-old male presented with 6 months of shoulder stiffness affecting daily activities. Clinical examination revealed global restriction of movements. Baseline DASH score was 70. Improvement was gradual, with steady functional recovery, and DASH score improved to 27 at final follow-up.



#### Case 8:

A 47-year-old female presented with 5 months of progressive restriction of shoulder movements. Examination showed reduced range in all planes. Baseline DASH score was 66. Progressive improvement was noted over follow-up, with DASH score improving to 22 at 6 months.

#### Case 9:

A 49-year-old female presented with 5 months of shoulder stiffness and functional limitation. Examination revealed restricted movements. Baseline DASH score was 69. Gradual recovery was observed, with DASH score improving to 26 at final follow-up.

#### Case 10:

A 51-year-old male presented with 6 months of shoulder pain and restricted mobility. Examination showed significant limitation of movements. Baseline DASH score was 72. Steady improvement occurred following PRP injection, with DASH score improving to 24 at 6 months.

## RESULTS

All patients demonstrated progressive improvement in functional outcomes. The growth factor group showed earlier improvement, particularly within the first month, whereas the PRP group showed gradual and sustained improvement. At 6 months, both groups showed significant reduction in DASH scores.

| Criteria                     | PRP                                     | GFC                                                                        |
|------------------------------|-----------------------------------------|----------------------------------------------------------------------------|
| Final outcome is             | Platelets with some unwanted cells      | Only High Concentration of Growth factors derived from Platelet activation |
| Centrifugation               | It's a first step to separate Platelets | Post Platelet activation- No platelet loss                                 |
| Platelet loss                | Yes                                     | No                                                                         |
| Complexity of Procedure      | Complex                                 | Simple                                                                     |
| Operator Dependent variation | High                                    | No                                                                         |
| Output Stability             | To be used immediately                  | 8 hrs at room temperature 7 days at 4° C                                   |
| Results                      | Variable & take longer time             | Optimum & take less time                                                   |
| Number of session required   | More                                    | Less                                                                       |
| Pain & Reactive Synovitis    | Almost always present                   | No as completely Acellular                                                 |
| Risk of infection            | Present                                 | Not present as completely sterile                                          |
| NSAIDs and Steroids          | Contra-indicated                        | can be given in same sitting                                               |

## DISCUSSION

The present study demonstrates that both PRP and growth factor therapy are effective treatment modalities for adhesive capsulitis. The difference in the pattern of recovery observed between the two groups can be explained by their biological mechanisms.

PRP acts as a reservoir of platelets that release growth factors gradually over time following activation. These growth factors promote angiogenesis, collagen remodeling, and modulation of inflammation, resulting in sustained therapeutic effects. This explains the gradual but consistent improvement observed in the PRP group.

In contrast, growth factor therapy involves the direct administration of concentrated bioactive molecules. Since the growth factors are already released and available, the therapeutic effect is more immediate. This likely accounts for the faster improvement observed in the growth factor group, particularly in the early stages.

Adhesive capsulitis involves both inflammation and fibrosis, and effective treatment requires addressing both components. Growth factor therapy may provide rapid anti-inflammatory effects, while PRP contributes to long-term remodeling of fibrotic tissue.

Additionally, improvement in pain and function enhances patient participation in physiotherapy, which plays a critical role in recovery. Both treatments were found to be safe, with no complications observed.

These findings are consistent with existing literature suggesting that biological therapies may offer advantages over conventional treatments by targeting the underlying pathology rather than providing only symptomatic relief.

## CONCLUSION

The present study demonstrates that both platelet-rich plasma and growth factor therapy are effective in improving functional outcomes in adhesive capsulitis. Growth factor therapy provides faster early recovery, likely due to immediate availability of bioactive molecules, whereas PRP offers gradual and sustained improvement through prolonged release of growth factors.

Both modalities appear to be safe and effective and may act as disease-modifying treatments by targeting the underlying inflammatory and fibrotic processes. Growth factor therapy may be preferred when early pain relief and rapid functional recovery are desired, while PRP remains a reliable option for long-term improvement.

Further large-scale randomized controlled studies are required to establish definitive superiority and standardize treatment protocols.

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