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# Effects of Platelet-rich Plasma Injection on Adhesive Capsulitis: An Interventional Case Series

BRIEF REPORT

Havva Talay Çalış, Çağlar Karabaş, Emel Güler

ABSTRACT

The aim of this case series was to present the effectiveness of platelet-rich plasma (PRP) on pain, range of motion (ROM), and functionality in patients with frozen shoulder and chronic shoulder pain. The study included 9 patients aged 18–75 years who had shoulder pain for at least 3 months with 50% limited ROM in at least one direction and Visual Analog Scale (VAS) score >5. Under sonography guidance, PRP injection was performed into the glenohumeral joint at baseline and on week 2. Concurrently, proprioceptive neuromuscular facilitation stretching and Codman exercises were given to all patients. Significant improvements were detected in VAS scores on weeks 2, 6, and 12 when compared with baseline ($p<0.05$) and Shoulder Pain and Disability Index scores in all time points when compared with baseline ($p<0.05$). There was a significant improvement in active and passive ROMs on weeks 2, 6, and 12 when compared with baseline ($p<0.05$). Treatment of adhesive capsulitis with PRP may be an alternative treatment method for patients.

**Keywords:** Adhesive capsulitis, platelet rich plasma, ultrasound guided intraarticular injection

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Department of Physical Medicine and Rehabilitation, Kayseri City Hospital, Kayseri, Turkey

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**Correspondence**
Havva Talay Çalış,
Department of Physical Medicine and Rehabilitation, Kayseri City Hospital, Kayseri, Turkey
Phone: +90 352 336 88 84-1647
e.mail:
htalaycalis@yahoo.com



## INTRODUCTION

Adhesive capsulitis, also called as frozen shoulder, defines a pathological process that causes limited movement, pain, and dysfunction in the shoulder due to adhesion occurring at the glenohumeral joint. There is a limitation in daily living activities due to pain and stiffness, as well as impaired sleep quality due to night pain and fatigue, all of which result in significant impairment in the quality of life. Its incidence is approximately 3%–5% in the general population (1). Clinical presentation may progress with spontaneous remission within 2–4 years, but it is refractory in 40% of cases (2).

Pain and limited movement and resultant loss of labor force and impaired quality of life have led individuals to seek for rapid and effective treatment modality for adhesive capsulitis. In the treatment, conservative approaches and surgical treatment, if conservative measures failed, are recommended. Conservative treatment includes several modalities, such as nonsteroidal inflammatory drugs (NSAIDs), physical therapy, hydrodilatation, oral steroids, intra-articular steroid injection, intra-articular hyaluronic acid injection, and suprascapular block. Given the mechanisms involved in the pathogenesis, intra-articular steroid injection has been used as a rapid and effective therapeutic modality; in previous controlled studies, short-term efficacy was shown, but no long-term efficacy could be shown for intra-articular steroid injection (3). Thus, research for alternative treatment options is ongoing.

Platelet-rich plasma (PRP) is a component of plasma containing higher concentration of platelet than whole blood, which is obtained by centrifugation of whole blood collected from the patient. There are many growth factors in PRP, leading use in the treatment of several musculoskeletal diseases. It has been suggested that PRP can be potentially used in the treatment by local injection of growth factors, which is thought to improve the healing process with regenerative effect on tendons and cartilage tissue (4). In the literature, to our knowledge, there is one case report on PRP injection in frozen shoulder. Aslani et al. applied intra-articular PRP in a patient and reported improvements in shoulder movements, quality of life, and Visual Analog Scale (VAS) (5).

In this case series, we aimed to present the effectiveness of PRP on pain, range of motion (ROM), and functionality in patients with frozen shoulder and chronic shoulder pain.

## MATERIALS and METHODS

The study included 9 patients aged 18–75 years who had shoulder pain for at least 3 months with 50% limited ROM in at least one direction and VAS score >5. Patients who received local injection to the shoulder within the prior 3 months; those who underwent physical therapy involving the shoulder within the prior 6 months;

those with local infection at the shoulder, systemic infection, or inflammatory disease (e.g., rheumatoid arthritis and hepatitis); those with a history of diabetes mellitus and malignancy (either hematological or non-hematological); pregnant women; and those who received systemic steroid therapy within the prior 3 weeks were excluded from the study. Informed consent was obtained from all participants in the present study. In all patients, complete blood count, erythrocyte sedimentation rate, hepatitis markers, blood urea nitrogen and creatinine values, sodium and calcium levels, international normalized ratio, prothrombin time, activated partial thromboplastin time, and shoulder magnetic resonance imaging studies were available.

In each patient, venous blood samples (8 ml x 3) were collected in three sterile tubes containing 2 ml of anticoagulant citrate dextrose solution from the cubital veins. The tubes were centrifuged at 1195 rpm for 20 min, resulting in three layers of whole blood sample: first layer, plasma (superior layer); second layer, buffy coat (platelets together with leukocytes); and third layer, erythrocytes (inferior layer). The first and second layers were transferred to three empty tubes and re-centrifuged at 1890 rpm for 15 min under laminar flow. The first platelet-poor layer was collected by a syringe, which was not used. The second layer was PRP. From three tubes, 4.5 ml of PRP (1.5 ml from each tube) was obtained and divided into three aliquots. Two aliquots were used in the treatment, whereas one aliquot was assigned for platelet count to ensure the platelet count desired. Under sonography guidance, intra-articular PRP injection was performed into the glenohumeral joint under sterile conditions via the posterior approach at baseline and on week 2. Concurrently, proprioceptive neuromuscular facilitation stretching and Codman pendulum exercises were given to all patients.

In all patients, VAS-day, VAS-night, VAS-movement, Shoulder Pain and Disability Index (SPADI)-disability, and SPADI-total scores, as well as ROM, were assessed at baseline, before the second injection (on week 2), and on weeks 6 and 12. The patients were instructed not to use NSAIDs during 5 days before treatment. Only paracetamol was allowed during the study period.

The patients and/or their families were informed that data from the case would be submitted for publication, and they provided consent.

### Statistical Analysis

Quantitative data were expressed as mean±SD. Kolmogorov–Smirnov test was used to assess the normality of quantitative data. Repeated measure analysis was used to assess the differences between time points. The LSD test was used to identify different time points. Qualitative data were expressed as percent (%). A p value <0.05 was considered as statistically significant.

## RESULTS

The mean age of the patients was 54.11±5.92 (44–61) years. Of the 9 patients, there were 7 women and 2 men. The right shoulder was involved in 5 patients, whereas the left shoulder was involved in 4 patients. Mean symptom duration was 5.11±1.90 (3–8) months (Table 1).

Significant improvements were detected in VAS-day, VAS-night, and VAS-movement scores on weeks 2, 6, and 12 when compared with baseline (p<0.05) (Figure 1).

**Table 1.** Demographic data

| | | |
|---|---|---|
| Symptom duration | 5.11±1.90 (3–8) | |
| Mean age (n=9), year | 54.11±5.92 (44–61) | |
| Symptom duration, month | 5.11±1.90 (3–8) | |
| Gender | 7 women | 2 men |
| Involved shoulder | 5 right shoulder | 5 left shoulder |

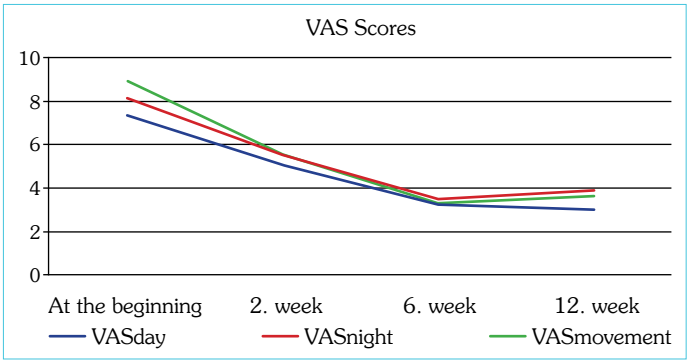


**Figure 1. Graph of VAS scores**

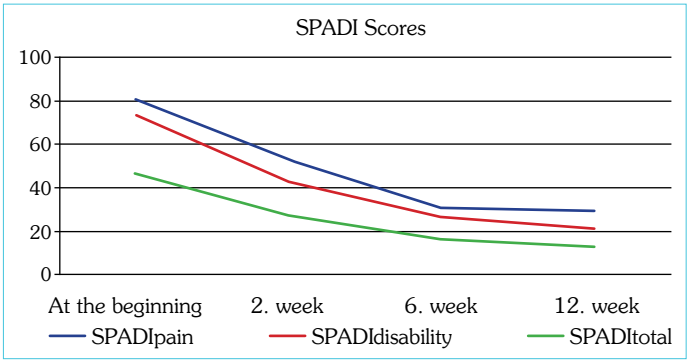


**Figure 2. Graph of SPADI scores**

There was a significant improvement in active and passive ROMs on weeks 2, 6, and 12 when compared with baseline (p<0.05). External rotation values were 70.00±13.22 and 83.33±14.14 on weeks 6 and 12, respectively. External rotation values were significantly higher than baseline (p<0.05).

Regarding functional recovery, significant improvements were observed in SPADI-pain, SPADI-disability, and SPADI-total scores in all time points when compared with baseline (p<0.05) (Figure 2).

## DISCUSSION

The pathophysiology has not been fully elucidated in adhesive capsulitis. The pathology is triggered by the onset of inflammation without any specific causes. An autoimmune process is evidenced by the presence of cytokines although no relationship with etiology has been established. Capsular hyperplasia, fibrosis reducing capsular volume, and limitation in the movements of the glenohumeral joint occur following active fibroblast and myofibroblast proliferation in the joint capsule (6).

Intra-articular injection can be performed via blinded technique, sonography-guided technique, or under fluoroscopic guidance. However, fluoroscopy-guided technique is rarely used due to ionizing radiation exposure. In addition, blinded injection technique is associated with complications and potential injuries in adjacent anatomic structures; thus, sonography-guided injection has become increasingly popular.

In a meta-analysis comparing sonography-guided and blinded injection techniques, Aly et al. concluded that sonography-guided corticosteroid injections are more effective out of subacromial space (7). In a randomized controlled study on 43 patients with adhesive capsulitis, Lee et al. compared the results of sonography-guided and blinded corticosteroid injections and found that there are significant differences in pain intensity, ROM, and functional shoulder scores between two techniques until week 2 but not on subsequent weeks (8). In our study, intra-articular PRP injections were performed via the posterior approach under sonography guidance to identify anatomic structures and to minimize potential complications (9).

Shoulder pain has five components: pain at resting, pain during activity, night pain, pain at sport activity, and pain during work, all which can be rated by VAS (10). Pain has negative influences on working, daily living activities, and sleep quality; thus, the primary goal of treatment is to relieve pain and to provide functional recovery as soon as possible. In our study, we assessed pain intensity level by VAS-day, VAS-night, and VAS-movement. Pain intensity was highest during movement, followed by night and day. In our study, a significant improvement was observed in all pain patterns in agreement with the case report by Aslani et al. (5).

In our study, the SPADI questionnaire was completed by all patients, which synchronously assess pain and functionality (11). SPADI was assessed at baseline and on weeks 2, 6, and 12. A significant improvement was observed in SPADI scores. Aslani et al. used the Disabilities of the Arm, Shoulder, and Hand questionnaire for functional assessment and also reported functional improvement (5).

Regarding the mechanism of action of PRP, there are studies suggesting that PRP provides analgesia through its effects on cannabinoid receptor in addition to complex and unexplained mechanism of action associated with enriched growth factor content and a protein in alpha granules of platelets, which initially induces proinflammatory mechanism and subsequent decrease in inflammation. In conclusion, the number of PRP therapies has been increasing in recent years due to the regenerative and restorative effects on involved tissue and cartilage, as well as its effects on pain (4, 12). Autologous administration, minimal invasive technique, and safety and effectiveness of PRP have resulted in widespread use in several fields. There are limited studies on the use of PRP in adhesive capsulitis. There is one case report by Aslani et al. This interventional case series has demonstrated if PRP is effective on patients with adhesive capsulitis. There is a need for randomized controlled studies with sufficient sample size.

**Informed Consent:** Written informed consent was obtained from patients who participated in this study.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Designed the study: HTÇ, ÇK; EG. Collected the data: HTÇ, ÇK, EG. Analyzed the data: HTÇ, ÇK, EG. Wrote the paper: HTÇ, ÇK, EG. All authors have read and approved the final manuscript.

**Conflict of Interest:** The authors have no conflict of interest to declare.

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