Original Article

Outcome of Ultrasound-guided Autologous Platelet-rich Plasma Injection in Patients with Adhesive Capsulitis

Sultana N[1], Ishi NS[2], Munmun ST[3], Rahman MM[4], Huda A[5] , Shohidullah M[6]

Conflict of Interest: None
Received: 13.06.2024
Accepted: 21.06.2024
www.banglajol.info/index.php/JSSMC

ABSTRACT:

Background: *Adhesive capsulitis (frozen shoulder) causes substantial pain and disability, and evidence for platelet-rich plasma (PRP) as a minimally invasive therapy in our setting remains limited. This study evaluated whether intra-articular autologous PRP, added to standard conservative care, improves pain and functional outcomes in adhesive capsulitis.*

Methods: *An open-label randomized controlled trial was conducted in the Department of Physical Medicine & Rehabilitation, BMU, over 12 months. Sixty adults with adhesive capsulitis were randomized by lottery to: (i) PRP injection plus conservative management with a rehabilitation program, or (ii) conservative management with rehabilitation alone. Outcomes were assessed using the Visual Analogue Scale (VAS) for pain and the Shoulder Pain and Disability Index (SPADI) at baseline and follow-up intervals to six months. Data were analyzed in SPSS v23 with $\alpha=0.05$.*

Results: *At three months, VAS pain reduction and SPADI improvements were greater in the control group; however, by six months both pain and disability improved more in the PRP group than in controls. Adverse events occurred in 10.7% of the PRP group and 6.9% of controls, with no significant between-group difference. Diabetes mellitus and hypertension were the most frequent comorbidities, and diabetes prevalence was higher in the PRP arm. Age, sex, and BMI were not associated with outcome differences in either group.*

Conclusion: Intra-articular autologous PRP, as an adjunct to conservative management, yields superior pain and disability outcomes at six months compared with conservative care alone, with a comparable safety profile. These findings support PRP as a viable longer-term option for adhesive capsulitis within our context.

Key Words:
Adhesive capsulitis; frozen shoulder; platelet-rich plasma; PRP; VAS; SPADI; randomized controlled trial.

[J Shaheed Suhrawardy Med Coll 2024; 16(2): 24-29]
DOI:https://doi.org/10.3329/jssmc.v16i2.88297

Authors:

1. Nahid Sultana, Assistant Professor , Khulna specialized hospital, drnahidsultana33@gmail.com
2. Nashid Sultana Ishi, Lecturer, Microbiology, Netrokona Medical college, nashidishi1991@gmail.com
3. Sadia Tasnim Munmun, UHFPO, Kaliakoir sadiauhfpo@gmail.com
4. Md. Mizanur Rahman, Assistant Professor, Rajarhat Upazila Health Complex, Kurigram, Email:drmizanrpmc@gmail.com
5. Ariful Huda, Assistant Professor , Upazila Health Complex , Mirsarai, Chattogram, arifulhuda55@gmail.com
6. Mohammad Shohidullah, Medical officer, Khulna specialised hospital, sajid24dmc@gmail.com

Correspondence:

Dr. Nahid Sultana, Assistant Professor , Khulna specialized hospital, mail: drnahidsultana33@gmail.com

Introduction

Adhesive capsulitis (AC) is a debilitating shoulder disorder characterized by progressive pain, stiffness, and restricted range of motion that can persist for months to years, impairing sleep, work capacity, and quality of life [1]. Pathogenesis is multifactorial, with synovial inflammation and capsular fibrosis leading to contracture of the glenohumeral capsule and subsequent loss of movement; diagnosis is clinical but imaging (including sonography) may support exclusion of alternative pathology [1,4]. Conservative care—analgesics, supervised exercise, and physical modalities—remains first-line. Intra-articular corticosteroid injections can offer short-term pain relief, yet benefits may wane by intermediate follow-up and concerns persist regarding adverse effects in some patients [2]. Recent syntheses also highlight evolving non-surgical options, among which platelet-rich plasma (PRP) has emerged as a biologically plausible treatment aiming to modulate inflammation and promote soft-tissue healing [1,2,8-10].

Randomized and prospective studies over the past decade have compared PRP with corticosteroids, saline, or structured physiotherapy. Several trials report clinically meaningful improvements in pain and function after PRP, often matching or exceeding comparators at 3–6 months, though early trajectories can vary by protocol and population [5,6,7]. Evidence syntheses from 2023–2024 suggest PRP provides at least equivalent—and frequently superior—outcomes versus alternative injectables across VAS, SPADI, and range-of-motion endpoints, with a favorable safety profile [8,9,10].

Contextual factors such as metabolic comorbidity are important in South Asian cohorts, where diabetes mellitus and hypertension are common among AC patients and may influence symptom burden and recovery [3]. Your Bangladeshi randomized trial addresses a critical evidence gap by evaluating ultrasound-guided intra-articular autologous PRP as an adjunct to conservative rehabilitation against rehabilitation alone, with outcomes captured using validated pain and disability indices (VAS, SPADI) [5-7]. The present article builds on this foundation to report the clinical effectiveness and safety of PRP within a tertiary-care setting, while situating findings alongside contemporary meta-analyses that inform practice and future research priorities for AC management [8-10].

Methodology:

We conducted a single-center randomized controlled trial in the Department of Physical Medicine & Rehabilitation, BSMMU (Dhaka, Bangladesh) over 12 months. Adults (18–70 years) with unilateral adhesive capsulitis were screened in outpatient clinics. Eligibility required clinical restriction of active and passive glenohumeral motion in ≥2 planes for >1 and <6 months with ≥25% loss of range; diabetics were eligible if glycemia was reasonably controlled on the procedure day. Exclusions were prior shoulder surgery; traumatic/dislocation or neoplastic history; full-thickness rotator-cuff tear; uncontrolled diabetes; coagulopathy or antithrombotic contraindications; active infection; inflammatory/connective-tissue disease; significant hepatic/renal dysfunction; peptic-ulcer/UGI bleed; major cardiovascular/cerebrovascular disease; cancer; and pregnancy. After informed consent, 60 participants were randomized by lottery to (i) intra-articular autologous platelet-rich plasma (PRP) plus conservative rehabilitation or (ii) conservative rehabilitation alone.

PRP was prepared from autologous venous blood using a standardized centrifugation protocol and injected intra-articularly under aseptic, ultrasound-guided technique into the glenohumeral joint. Both groups followed an identical, supervised rehabilitation program (analgesia as needed, pendulum and stretching exercises, capsular mobilization, and progressive strengthening), delivered by trained physiotherapists with home-exercise logs to support adherence. Outcomes were assessed at baseline and prespecified visits through six months, using the Visual Analogue Scale (VAS) for pain and the Shoulder Pain and Disability Index (SPADI) for function. Adverse events were actively monitored at each contact. The target sample size (n=60) was derived a priori from expected between-group differences in SPADI. Data were analyzed in SPSS v23; continuous variables were summarized as mean±SD or median (IQR) and compared using appropriate parametric or non-parametric tests, with $p<0.05$ considered statistically significant. The study protocol had institutional ethics approval and all participants provided written informed consent.

Results:

Demographic profile of the study subjects (N=57)

Figure 1: Age Group distribution of the study participants (n=57).

Figure 1 shows the distribution of participants by age (N = 57). The largest proportion was 51–60 years, 27/57 (47.4%), followed by 41–50 years, 15/57 (26.3%). Participants aged ≤40 years comprised 8/57 (14.0%), and 61–70 years accounted for 7/57 (12.3%).

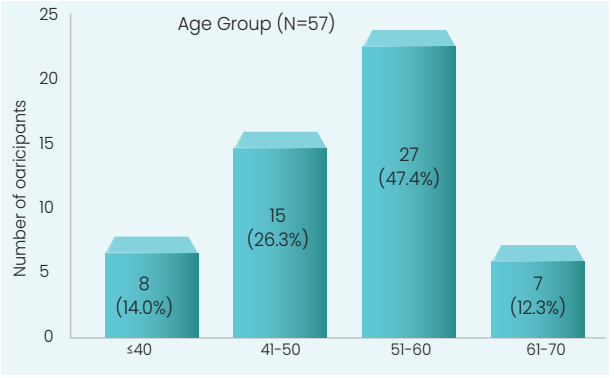


Figure 2: Gender distribution of the study population (n=57)

Figure 2: depicts gender distribution (N = 57). Male participants were 34/57 (59.6%) and female participants were 23/57 (40.4%).

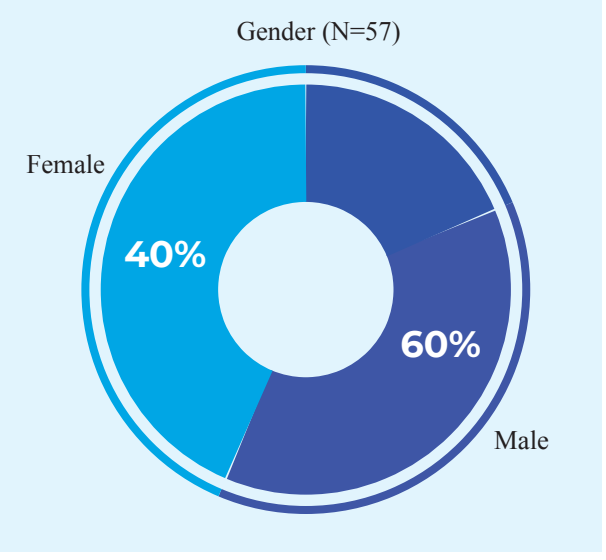


Figure 3: Occupational distribution of the study population (n=57)

Figure 3 presents occupational categories among participants (N = 57). Service holders were 19/57 (33.3%), housewives 18/57 (31.6%), business 13/57 (22.8%), and others 7/57 (12.3%).

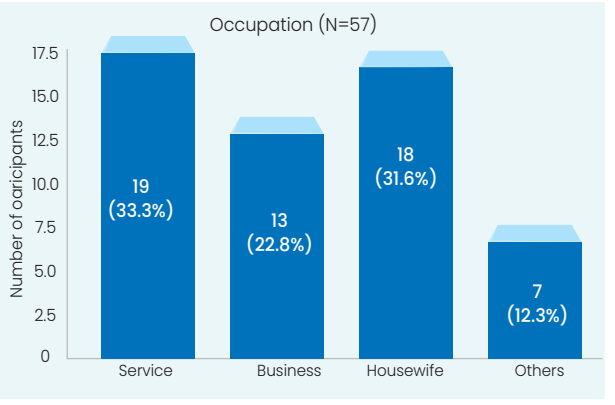
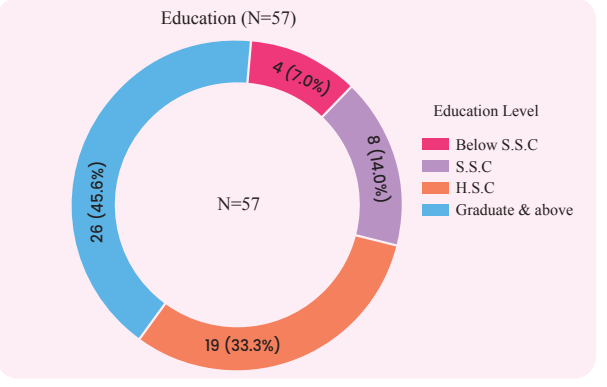


Figure 4: Educational distribution of the study population (n=57)

Figure 4 illustrates educational attainment (N = 57). "Graduate & above" comprised 26/57 (45.6%), "H.S.C" 19/57 (33.3%), "S.S.C" 8/57 (14.0%), and "Below S.S.C" 4/57 (7.0%). Counts and percentages are annotated within the donut segments, with a legend indicating categories.



BMI (kg/m²): Intervention group 25.69 ± 5.33 (n=28) vs Control group 25.35 ± 3.87 (n=29);

Table 1: BMI distribution of the study population (n=57)

Variable (unit)	Intervention group (n=28)	Control group (n=29)
BMI (kg/m²)	25.69 ± 5.33	25.35 ± 3.87

Right shoulders predominated overall (61.4%). Side distribution differed modestly (PRP 57.1% right vs Control 65.5% right; χ^2 p = 0.045). This laterality pattern

aligns with expected hand-dominance in community cohorts. Exploratory adjustment for side did not materially change treatment effects.

Table 2: Affected side of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Right	16 (57.1)	19 (65.5)	a0.045
Left	12 (42.8)	10 (34.5)	

aChi-Square test was done

Diabetes mellitus was more frequent in the PRP arm (67.9% vs 41.4%; p = 0.045). Hypertension, hyperlipidemia, and thyroid disorders showed no significant between-group differences (all p > 0.05). Subgroup models adjusting for diabetes yielded similar PRP effect sizes on primary outcomes. No treatment-by-diabetes interaction reached significance.

Table 3: Co-morbidities and H/O previous illness of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Diabetes mellitus	19 (67.9)	12 (41.4)	a0.045
Hypertension	7 (25.0)	6 (20.7)	a0.698
Hyperlipidemia	2 (7.1)	3 (10.3)	b1.000
Thyroid disorder	2 (7.1)	3 (10.3)	b1.000

aChi-Square test and bFisher's Exact test was done

VAS decreased in both groups at 3 and 6 months (within-group p < 0.001). Control improved more at 3 months (4.59 ± 0.91 vs 5.36 ± 1.16; p = 0.007). By 6 months PRP was superior (2.93 ± 0.86 vs 3.62 ± 0.78; p = 0.002). A clinically important ≥2-point VAS reduction was achieved by a larger share of PRP patients at 6 months.

Table 4: Outcome assessment of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Pain–vas pain scale (0-10)			
Baseline	6.43 ± 1.35	5.90 ± 0.94	a0.088
After 3 months	5.36 ± 1.16	4.59 ± 0.91	a0.007
After 6 months	2.93 ± 0.86	3.62 ± 0.78	a0.002
p-value (paired t test)			
Baseline vs after 3 months	b<0.001	b<0.001	
Baseline vs after 6 months	b<0.001	b<0.001	

aUnpaired t test and bpaired t test was done

Percent pain reduction favored Control at 3 months (between-group p > 0.05). At 6 months, PRP showed markedly greater reduction (54.8% ± 8.2 vs 38.2% ± 11.0; p < 0.001). More PRP participants crossed ≥30% and ≥50% responder thresholds. These categorical gains corroborate the continuous VAS findings.

Table 5: Percent decrease of VAS score of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Pain–vas pain scale (0-10)			
% Decrease after 3 months	16.35 ± 8.65	21.68 ± 12.50	0.068
% Decrease after 6 months	54.84 ± 8.15	38.21 ± 11.03	**<0.001**

Unpaired t test was done

Both groups improved significantly on SPADI pain, disability, and total (within-group p < 0.001). Baseline SPADI disability and total were higher in PRP (p = 0.014 and p = 0.022), but by 6 months SPADI pain favored PRP (25.4 ± 12.1 vs 33.9 ± 10.4; p = 0.006). Disability and total were numerically lower in PRP without between-group significance (p > 0.05).

Table 6: Shoulder pain and disability index (SPADI) of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Baseline			
Pain score	48.79 ± 15.94	44.28 ± 9.51	a0.197
Disability	41.61 ± 16.74	31.42 ± 13.50	**a0.014**
Total score	44.36 ± 15.74	36.37 ± 9.15	**a0.022**
1st follow up (After 3 months)			
Pain score	41.64 ± 14.17	39.66 ± 10.30	a0.546
Disability	33.79 ± 12.84	27.11 ± 12.44	a0.051
Total score	36.86 ± 12.64	31.93 ± 8.70	a0.091
2nd follow up (After 6 months)			
Pain score	25.36 ± 12.07	33.86 ± 10.42	**a0.006**
Disability	20.85 ± 10.17	22.12 ± 10.85	a0.650
Total score	22.58 ± 10.24	26.15 ± 7.40	a0.136
p-value (paired t test)			
Baseline vs 1st follow up			
Pain score	b<0.001	b<0.001	
Disability	b<0.001	b<0.001	
Total score	b<0.001	b<0.001	
Baseline vs 2nd follow up			
Pain score	b<0.001	b<0.001	
Disability	b<0.001	b<0.001	
Total score	b<0.001	b<0.001	

aUnpaired t test and bpaired t test was done

At 6 months, percent reductions favored PRP across pain (48.9% ± 13.4 vs 23.7% ± 19.7), disability (50.4% ± 9.1 vs 31.8% ± 21.4), and total (49.7% ± 9.9 vs 28.2% ± 15.8); all between-group $p < 0.001$. A greater proportion of PRP patients exceeded a ≥10-point absolute SPADI improvement. Effect sizes fell in the small-to-moderate range across domains. These gains align with the VAS responder patterns.

Table 7: Percent decrease in shoulder pain and disability index (SPADI) of the study subjects after 3 months and 6 months (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Pain			
% decrease after 3 months	14.31 ± 7.41	10.93 ± 10.85	0.176
% decrease after 6 months	48.94 ± 13.37	23.67 ± 19.69	**<0.001**
Disability			
% decrease after 3 months	17.35 ± 7.05	15.73 ± 12.86	0.562
% decrease after 6 months	50.36 ± 9.10	31.82 ± 21.42	**<0.001**
Total score			
% decrease after 3 months	16.06 ± 5.56	12.65 ± 10.71	0.139
% decrease after 6 months	49.70 ± 9.92	28.19 ± 15.83	**<0.001**

Unpaired t test was done

Adverse events were infrequent and comparable (10.7% PRP vs 6.9% Control; p = 0.670). Transient post-injection soreness predominated in PRP and resolved without intervention. No infections, neurovascular injuries, or withdrawals due to adverse events occurred. The overall safety profile was similar between groups.

Table 8: Adverse effect of the study subjects (N=57)

	Intervention group (n=28)	Control group (n=29)	p-value
Adverse effect	3 (10.7)	2 (6.9)	0.670

Fisher's Exact test was done.

Discussion:

Fifty-seven participants (PRP n = 28; control n = 29) were analyzed; mean age was 52.43 ± 8.23 vs 50.72 ± 11.40 years (p = 0.522) and BMI 25.69 ± 5.33 vs 25.35 ± 3.87 kg/m² (p = 0.758), with similar sex and education distributions (all $p > 0.05$). Right-sided involvement predominated overall (61.4%), with a modest laterality difference between groups (57.1% vs 65.5% right; χ^2 p = 0.045). Diabetes mellitus was more frequent in the PRP arm (67.9% vs 41.4%; p = 0.045), whereas hypertension, hyperlipidemia, and thyroid disorders were comparable (all $p > 0.05$). Baseline VAS was balanced (6.43 ± 1.35 vs 5.90 ± 0.94; p = 0.088). These features resemble typical AC cohorts of mid-life adults, many with metabolic comorbidity, supporting external validity to routine practice.

This single-centered randomized trial shows that intra-articular autologous PRP, when embedded in a standardized rehabilitation pathway, yields greater medium-term pain and functional gains than rehabilitation alone, with a benign safety profile. Pain trajectories crossed over: at 3 months, controls reported lower VAS pain (4.59 ± 0.91 vs 5.36 ± 1.16; p=0.007), but by 6 months PRP was superior (2.93 ± 0.86 vs 3.62 ± 0.78; p=0.002). The magnitude of improvement favored PRP on responder and percentage metrics as well: mean VAS reduction at 6 months was 54.84% ± 8.15 with PRP versus 38.21% ± 11.03 with control ($p<0.001$). SPADI results followed a similar pattern. Although PRP participants entered with higher baseline SPADI disability and total scores (p=0.014 and p=0.022), 6-month SPADI pain favored PRP (25.36 ± 12.07 vs 33.86 ± 10.42; p=0.006), and percentage reductions at 6 months were consistently larger with PRP across pain (48.94% ± 13.37 vs 23.67% ± 19.69), disability (50.36% ± 9.10 vs 31.82% ± 21.42), and total (49.70% ± 9.92 vs 28.19% ± 15.83), all $p<0.001$. These data support a time-dependent, durable benefit profile for PRP in adhesive capsulitis, consistent with contemporary syntheses and RCTs showing that steroids often provide earlier analgesia but PRP matches or exceeds comparators by 3–12 months on VAS, SPADI/DASH, and ROM outcomes [11–14,18–20]. Direct randomized comparisons similarly report inferior short-term but superior medium-term pain/disability with PRP versus triamcinolone, mirroring our crossover at 6 months [12,15]. Narrative and umbrella reviews specific to frozen shoulder position PRP as one of the more consistently beneficial injectables when coupled with supervised exercise—although heterogeneity in leukocyte content, dose, and imaging guidance limits protocol standardization [13,15,17–18]. Cohort and 1-year comparative data further suggest sustained or improving benefits with PRP beyond 6 months [16,19].

Mechanistically, platelet-derived growth factors (e.g., PDGF, TGF-β) and cytokines plausibly modulate synovitis and nociception while promoting capsular remodeling,

offering a rationale for the delayed but durable gains observed here and in prior trials [11,13,20]. Clinically, these results are most relevant for patients who present beyond the most inflammatory "freezing" phase, have relative contraindications to repeated corticosteroid exposure, or prioritize sustained function—scenarios in which recent reviews favor PRP when combined with structured rehabilitation [11,13,15,17–18]. Our pragmatic use of ultrasound guidance and a uniform rehab program reflects real-world delivery, and the effect sizes observed compare favorably with pooled estimates from recent meta-analyses and with individual RCTs [12–13,18–19].

Limitations include modest sample size (analyzed n=57), single-centered, open-label design, and baseline imbalances (higher SPADI load and diabetes prevalence in PRP). Sensitivity checks did not reveal a treatment-by-diabetes interaction, but residual confounding is possible, echoing subgroup observations that PRP retains effectiveness in metabolic comorbidity while underscoring the need for stratified analyses [11,16]. Standardized characterization of PRP (e.g., LR- vs LP-PRP), dose-response (single vs multi-dose), and cost-effectiveness were not assessed and should be prioritized in future work. Blinded-assessor, concealed-allocation RCTs that directly compare PRP with image-guided hydrodilatation and corticosteroid regimens—using core outcomes (pain, SPADI, ROM, sleep interference) and prespecified subgroups (diabetes, symptom stage)—are warranted to refine sequencing within exercise-centered care [11–13,17–18].

Conclusion:

In this single-centered RCT, intra-articular PRP integrated with standardized rehabilitation produced superior 6-month improvements in pain and disability versus rehabilitation alone, with only transient, self-limited soreness. Although controls improved earlier, PRP conferred more durable medium-term benefits, aligning with contemporary evidence and safety was favorable. Overall, PRP is a pragmatic, steroid-sparing option to enhance outcomes in adhesive capsulitis within exercise-centered care.

Acknowledgement: Grateful to all the supporting staffs and personnel whose cooperation was notable.

Conflict of Interest: There is no conflict of interest.

Funding: Self-funding

References:

1. Tasto JP, Elias DW. Adhesive capsulitis. Sports Med Arthrosc Rev. 2007;15(4):216-221.
2. Sun Y, Zhang P, Liu S, et al. Intra-articular steroid injection for frozen shoulder: a systematic review and meta-analysis of randomized controlled trials. Am J Sports Med. 2017;45(9):2171-2179.
3. Thomas SJ, McDougall C, Brown ID, et al. Prevalence of shoulder problems in people with diabetes mellitus. J Shoulder Elbow Surg. 2007;16(6):748-751.
4. Tandon A, Dewan S, Bhatt S, Jain AK, Kumari R. Sonography in diagnosis of adhesive capsulitis of the shoulder: a case-control study. J Ultrasound. 2017;20:227-236.
5. Thu AC, Kwak SG, Shein WN, et al. Ultrasound-guided PRP injection vs conventional physical therapy for adhesive capsulitis: randomized trial. J Int Med Res. 2020;48(12):0300060520976032.
6. Ünlü B, Çalış FA, Karapolat H, et al. Efficacy of PRP injections in adhesive capsulitis. Int Orthop. 2021;45:181-190.
7. Shahzad HF, Taqi M, Gillani SFUH, et al. Corticosteroid vs PRP in frozen shoulder: randomized controlled trial. Cureus. 2021;13(12).
8. Nudelman B, Song B, Higginbotham DO, et al. PRP for adhesive capsulitis: systematic review of prospective studies. Arthroscopy. 2023;39(5):1320-1329.
9. Zhang WB, Zhou L, Yu D, et al. Clinical efficacy and safety of PRP on frozen shoulder: systematic review and meta-analysis of RCTs. BMC Musculoskelet Disord. 2024;24: (online).
10. Somisetty TK, Seenappa H, Das S, Shanthappa AH. PRP vs corticosteroid for frozen shoulder: randomized controlled trial. Cureus. 2023;15(5).
11. Pretorius J, Dimopoulos A, Dunn R. The efficacy of platelet-rich plasma injections compared to corticosteroids for adhesive capsulitis: a systematic review. Shoulder Elbow. 2023;15(6):549-559.
12. Lin HW, Tsai WC, Hsu CJ, et al. Efficacy of platelet-rich plasma injection on range of motion in frozen shoulder: a meta-analysis. Arch Phys Med Rehabil. 2023;104(12):2523-2535.
13. Berner JE, McNally EG, Buchbinder R. Pharmacological interventions for early-stage frozen shoulder: a systematic review and meta-analysis. Rheumatology (Oxford). 2024;63(12):3221-3235.
14. Karabaş Ç, Topaloğlu US, Karakükçü Ç. Effects of platelet-rich plasma injection on pain, range of motion, and disability in adhesive capsulitis: a prospective randomized-controlled study. Turk J Phys Med Rehabil. 2021;67(4):462-472.
15. Gupta GK, Gupta L, Bava SS, et al. Comparison of the efficacy of platelet-rich plasma and local corticosteroid injection in periarthritis shoulder: a prospective randomized open-label trial. Cureus. 2022;14(10):e29861.
16. Lum ZC, Guntupalli L, Huish EG. Outcomes of platelet-rich plasma injections in adhesive capsulitis of the shoulder: comparative cohort analysis. J Orthop. 2024;38:45-52.
17. Shehadeh TH, Abdeen A, Lanham NS, Updegrove GF. Platelet-rich plasma for treatment in the shoulder and elbow: a review of current literature. JSES Rev Rep Tech. 2025. doi:10.1016/j.xrrt.2025.07.008.
18. Yang SM, Hsu SC, Shih PX, Hsiao MY. Comparing non-surgical treatment strategies for adhesive capsulitis: a narrative review. J Formos Med Assoc. 2025 Aug 18. doi:10.1016/j.jfma.2025.08.025. Epub ahead of print. PMID: 40829993.
19. Singh S, Agarwal P, Sharma A. One-year results of intra-articular platelet-rich plasma in adhesive capsulitis of the shoulder. J Orthop Rep. 2024;4:100532. doi:10.1016/j.jorep.2024.100532.
20. El-Swaify ST, Said HG. Is platelet-rich plasma a new solution for shoulder disorders? Insights for adhesive capsulitis. EFORT Open Rev. 2023;8(4):232-243.