

Comparative Study of Ultrasound Guided Intra Articular-Triamcinolone Injection vs Platelet Rich Plasma in Active Phase of Adhesive Capsulitis

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Abstract

Introduction: Unknown in its cause, adhesive capsulitis is a crippling shoulder ailment. There is a considerable reduction of both active and passive range of motion in addition to discomfort. Incidence rates range from 3% to 5% annually in the general population and can reach 30% in diabetics. Benign neglect, oral corticosteroids, intra-articular corticosteroid injections, intra-articular hyaluronic acid injections, physical therapy exercises, deep heat modalities, manipulation under anaesthesia, hydro dilation, and surgical release are few of the recommended treatments. A sample of autologous blood with platelet concentrations above baseline is referred to as PRP. Given the new advent of PRP as a biological agent promoting healing.

Aim and Objectives of the study: To compare the efficacy of Ultrasound guided single intra-articular Triamcinolone VS Autologous Platelet Rich Plasma in active phase of Primary Frozen Shoulder, in terms of patient outcome and improvement in range of movements of shoulder joint.

Materials & Methods: A prospective randomised interventional study conducted on 56 participants in central India who were selected according to inclusion & exclusion criteria's. Participants were segregated randomly into Group A with intervention with PRP & group B with Triamcinolone injection to the shoulder joint. The participants were evaluated for functional range of movements, Visual analogue scale and SPADI score at the time of the injection, at the end of 6 weeks, 12 weeks & 18 weeks.

Results: At 18 weeks, PRP treatment significantly improved the shoulder's active and passive range of motion, VAS, and SPADI scores compared to corticosteroid treatment. No major adverse effects were observed. The improvement in VAS score, SPADI scores, ROM in participants who received PRP injections was statistically more significant in comparison to participants who received steroid injections as inferred by P value of <0.001. The complications like nausea,

vomiting, skin rashes & hypotension occurred more in PRP group, they were transient and statistically not significant.

Conclusion: In terms of the autologous nature of PRP and economic effectiveness, this study shows that a single PRP injection is superior than a corticosteroid injection.

Keywords: Adhesive Capsulitis, Triamcinolone, Platelet Rich Plasma.

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Introduction

One of the most prevalent causes of shoulder pain and stiffness is adhesive capsulitis, which can occur either on its own (idiopathic) or as a result of other conditions such as diabetes mellitus, hypothyroidism, autoimmune diseases, post-injury, post-stroke, post-surgery, myocardial infarction, or prolonged immobilisation.[1]

Those between the ages of 40 and 60 are most frequently affected by adhesive capsulitis (frozen shoulder), which affects women more frequently than males. The prevalence of frozen shoulder is 3-5% in the general population, whereas it is 11%–30% in diabetes patients. [1,2]

Adhesive capsulitis is characterised by contracture of the capsule surrounding the shoulder joint. loss of the capsule's synovial layer, its adherence to the anatomical neck, a reduction in the volume of the capsule, and a thickened and fibrotic rotator interval. In adhesive capsulitis, a constricted coraco humeral ligament is regarded as the key finding.

Frozen shoulder often progresses in three stages: the freezing (painful), frozen (adhesive) and thawing (healing) phases. The freezing phase lasts for two to three months. There is a gradual decrease of range of motion, particularly external rotation, and a diffuse, intense shoulder discomfort that usually gets worse at night. Frozen stage, lasting three to twelve months. Pain subsides with time, and night pain goes away. The main characteristic is stiffness, which first affects external rotation and then shoulder

abduction. Last is thawing phase, where the patient gradually regains range of motion over the course of six to twelve months. There will be minimal to no pain, and ROM will gradually recover.[3,4] On the basis of pain and a restriction in the shoulder's passive and active range of motion, the diagnosis is determined clinically. The natural history of adhesive capsulitis is not fully understood, despite the fact that it is frequently regarded as a self-limiting disease process, and recent research has demonstrated that it can result in longer-term disability over the course of several years. [5-7]

The individual seeks medical attention due to pain and slowly fading function. Movements, especially external rotation, make shoulder pain worse; limiting use of the extremity makes it better. The patient commonly experiences sleep disturbances because the discomfort is typically worst at night. Early cases of frozen shoulder may have muscle spasms (especially in the pectoralis major and scapular muscles), whereas more advanced cases may experience muscle atrophy (particularly in the deltoid and supraspinatus). Having trouble putting on a shirt, reaching into one's back pocket for a wallet, or combing one's hair are examples of common functional impairments. Ladies frequently lament how difficult it is to button clothing behind their torsos.[8]

Benign neglect, oral corticosteroids, intra-articular corticosteroid injections, intra-articular hyaluronic acid injections, physical rehabilitation exercises, deep heat modalities,

manipulation under anaesthesia, hydro dilation, and arthroscopic release are just a few of the recommended treatments; however, the best course of action is still up for debate.[9] One of the often used methods in PA shoulder is the injection of intra-articular corticosteroid. In order to improve and speed up tendon repair, PRP has emerged as a new technology that is thought to stimulate the revascularization of soft tissue and increase the augmentation of growth factors. It is described as an autologous blood sample with platelet augmentations above baseline values.[10]

PRP is a good source of several growth factors & cytokines like PDGF, TGF-beta, and IGF-1, IGF-2, FGF, VEGF, EGF, Keratinocyte growth factors, & connective tissue growth factors. In comparison to steroid injection and other forms of conservative treatment, it has demonstrated improvement in a number of studies.[11]

Hence the present study was undertaken to study the efficacy and role of autologous platelet rich plasma injection in adhesive capsulitis by comparing with the intra-articular triamcinolone injection.

Materials & Methods

A prospective randomised interventional study conducted on 56 participants who were selected according to inclusion & exclusion criterias. Age group between 30 -70 years, not been treated before by any other interventional modality. Participants were segregated randomly into Group A with intervention with PRP 2ml injection & group B with Triamcinolone 40mg (1ml) injection to the shoulder joint. Assisted shoulder exercises and Isometric strengthening exercises (Home based 10 min exercise) suggested after 48 hrs of rest to the part. The participants were evaluated for functional range of movements, Visual analogue scale and SPADI score at the time of the injection, at the end of 6 weeks, 12 weeks & 18 weeks.

Inclusion criteria:

1. Both male and female patients aged between 30 to 70 years.
2. Being diagnosed for the first time and not treated by any other modality.
3. Shoulder pain for at least more than 1 month, associated with more than one-third loss of passive shoulder flexion, extension, abduction, external rotation and internal rotation based on clinical diagnosis.
4. Normal antero-posterior radiographs of the gleno humeral joint in neutral rotation.

Exclusion criteria

1. Patients with hematological disorders or on anti-platelet or anticoagulant therapy
2. Rheumatoid arthritis, autoimmune or inflammatory arthropathies
3. History of surgery on the particular shoulder
4. Infective foci around the shoulder.
5. Rotator cuff injury
6. Bilateral frozen shoulder.
7. Fracture of the shoulder girdle complex
8. Neuromuscular diseases
9. Secondary frozen shoulder
10. Any local skin pathology at injection site

Intervention

A 7.5% betadine solution and ethyl alcohol were used to paint the part. Following the test dose, 1mL of 2% lignocaine was administered at the injection site. The suggested injection was administered 10 minutes later. Participants received advice on after-injection care.

Posterior Approach: The participant is seated with their shoulder in neutral rotation resting on their lap and their arm resting at their side, sulcus between the acromion and the head of the humerus palpated. The needle is inserted 2-3 cm inferior and medial to the postero lateral corner of the acromion and directed anteriorly towards the coracoid

process under all aseptic precautions utilising 12.5 MHZ ultrasound guidance. The transducer is positioned caudal and parallel to the scapular spine with the participant seated. Between the humeral head and the posterior bony glenoid, the joint space is visible. The needle is inserted into the infraspinatus muscle from the lateral to medial direction

until the needle tip reaches the intersection of the lateral edge of the humeral head cartilage, to avoid the needle tip being ejected backward due to increased intra-articular pressure, the injection should be performed gently while the needle is gradually advanced.



Figure 1: Showing, a) painting, b) injection site, c) USG image.

Results

Table 1: Age distribution of subjects as per groups

Age (in years)	Group		Total
	PRP	Steroid	
45-55	11 (39.3%)	12 (42.9%)	23 (41.1%)
55-65	14 (50.0%)	12 (42.9%)	26 (46.4%)
65-75	3 (10.7%)	4 (14.3%)	7 (12.5%)
Total	28 (100.0%)	28 (100.0%)	56 (100.0%)
Mean Age±SD	56.04±6.43	55.75±7.29	55.89±6.81

In our study we found that age groups between 55- 65 years were found to be more affected.

Table 2: Sex distribution of subjects as per the group

Sex	Group		Total
	PRP	Steroid	
Male	17 (60.7%)	17 (60.7%)	34 (60.7%)
Female	11 (39.3%)	11 (39.3%)	22 (39.3%)
Total	28 (100.0%)	28 (100.0%)	56 (100.0%)

In our study we found male (60.7%) population were affected more than female (39.3%) population.

Table 3: Distribution of subjects as per side and the group

Side	Group		Total
	PRP	Steroid	
Right	16 (57.1%)	17 (60.7%)	33 (58.9%)
Left	12 (42.9%)	11 (39.3%)	23 (41.1%)
Total	28 (100.0%)	28 (100.0%)	56 (100.0%)

In our study we found participants had more of right sided (PRP 57.1% & STEROID 60.7%) dominance than the counterpart (PRP 42.9% & steroid 39.3%).

Table 4: Duration

Duration (in months)	Group		Total
	PRP	Steroid	
3-4	3 (10.7%)	0 (0.0%)	3 (5.4%)
5-6	18 (64.3%)	12 (42.9%)	30 (53.6%)
7-8	5 (17.9%)	14 (50.0%)	19 (33.9%)
>8	2 (7.1%)	2 (7.1%)	4 (7.1%)
Total	28 (100%)	28 (100%)	56 (100%)
Mean Duration±SD	6.0±1.33	6.8±1.12	6.41±1.30

In our study we found among PRP group 64.3% were in 5-6 months duration. Among steroid group 50% were in 7-8 months duration of symptoms.

Table 5: Comparison of Visual Analogous Scores between the groups

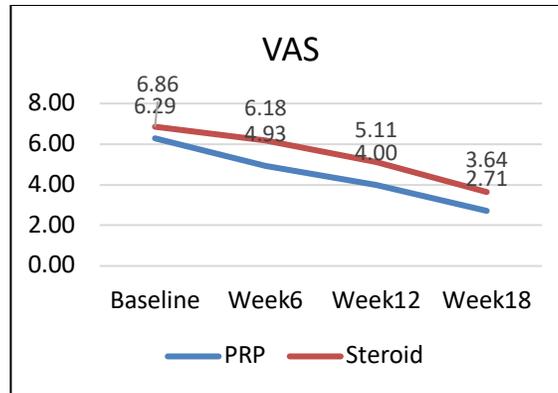
VAS	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	6.29	1.44	-0.571	-1.646	0.106
	Steroid	6.86	1.15			
Week6	PRP	4.93	1.09	-1.250	-4.438	<0.001
	Steroid	6.18	1.02			
Week12	PRP	4.00	0.98	-1.107	-4.773	<0.001
	Steroid	5.11	0.74			
Week18	PRP	2.71	0.76	-0.929	-4.369	<0.001
	Steroid	3.64	0.83			

In our study we found statistically significant results on comparison with PRP & steroid group under VAS system. In either group VAS system was seen to be in decreasing trend, whereas in PRP group there was much higher reduction seen by the end of 18 weeks follow-up (VAS in PRP & steroid: 2.71 & 3.64 respectively).

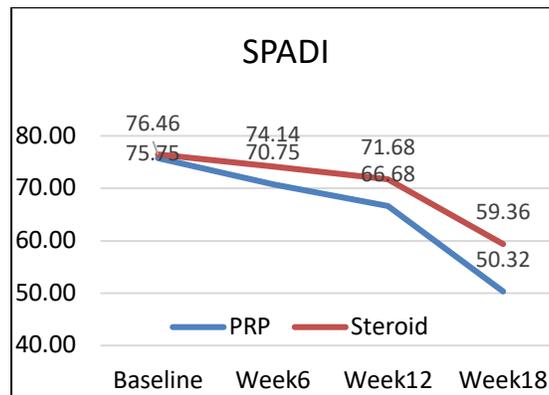
Table 6: Comparison of Shoulder Pain and Disability Index between the groups

SPADI	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	75.75	8.08	-0.714	-0.344	0.732
	Steroid	76.46	7.45			
Week6	PRP	70.75	4.96	-3.399	-2.317	0.024
	Steroid	74.14	5.95			
Week12	PRP	66.68	5.07	-5.000	-2.936	0.005
	Steroid	71.68	6.90			
Week18	PRP	50.32	5.81	-9.036	-5.206	<0.001
	Steroid	59.36	7.12			

In our study both the groups showed significant reduction in SPADI scoring, but in PRP group (50.32) had significantly more reduction than steroid group (59.36) at the end of 18 weeks.



Graph 1: Visual Analogous Scores



Graph 2: Shoulder Pain and Disability Index (SPADI)

Table 7: Comparison of External Rotation between the groups

Rom-External Rotation	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	39.82	5.00	1.250	1.052	0.297
	Steroid	38.57	3.81			
Week6	PRP	49.46	4.58	6.250	5.801	<0.001
	Steroid	43.21	3.39			
Week12	PRP	62.86	6.73	6.964	4.256	<0.001
	Steroid	55.89	5.45			
Week18	PRP	68.07	8.32	5.893	2.808	0.007
	Steroid	62.18	7.34			

In our study we have compared few of the range of movements, starting with external rotation which showed improvement in both groups but we found statistically significant improvement in PRP group(mean 68.07) than steroid group (mean 62.18) at the end of 18 weeks.

Table 8: Comparison of Abduction

Rom-Abduction	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	71.25	9.49	0.357	0.162	0.872
	Steroid	70.89	6.81			
Week6	PRP	96.61	11.71	20.357	7.929	<0.001
	Steroid	76.25	6.89			
Week12	PRP	103.93	8.86	11.768	4.948	<0.001
	Steroid	92.14	8.96			
Week18	PRP	148.96	12.84	8.853	2.585	0.012
	Steroid	140.43	12.86			

In comparison of abduction among both the groups both showed improvement but in PRP group (mean 148.96) there was significant improvement in comparison with steroid group (mean 140.43) at the end of 18 weeks.

Table 9: Comparison of Flexion

Rom-Flexion	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	48.39	10.98	2.500	0.976	0.333
	Steroid	45.89	7.94			
Week6	PRP	74.64	11.94	23.929	8.846	<0.001
	Steroid	50.71	7.90			
Week12	PRP	132.32	8.55	5.179	2.253	0.028
	Steroid	127.14	8.65			
Week18	PRP	153.75	14.63	14.285	3.806	<0.001
	Steroid	139.46	13.42			

In comparison among groups for flexion movement both groups showed improvement, but PRP group showed statistically significant improvement in flexion (mean 153.75) compared to steroid (139.46) group at the end of 18 weeks.

Table 10: Comparison of Extension movement

Rom-Extension	Group	Mean	Std. Deviation	Mean Difference	t-value	P-value
Baseline	PRP	17.50	4.81	0.040	0.022	0.980
	Steroid	16.46	4.86			
Week6	PRP	32.50	4.61	11.429	9.295	<0.001
	Steroid	21.07	4.59			
Week12	PRP	33.93	2.84	5.179	6.719	<0.001
	Steroid	28.75	2.93			
Week18	PRP	34.96	2.78	6.030	6.586	<0.001
	Steroid	28.93	2.84			

In our study we found extension movement improvement in both the groups, more significant improvement was seen in PRP group (mean 34.96) at the end of 18 weeks.

Table 11: Complications

Complications	Group		Total
	PRP	Steroid	
Giddiness	1 (3.6%)	0 (0.0%)	1 (1.8%)
Injection Site Redness	0 (0.0%)	1 (3.6%)	1 (1.8%)
Mild Persisting Pain at injection site *	0 (0.0%)	1 (3.6%)	1 (1.8%)
Nausea	1 (3.6%)	0 (0.0%)	1 (1.8%)
Rashes at site	0 (0.0%)	1 (3.6%)	
Skin Rashes + Hypotension	0 (0.0%)	1 (3.6%)	1 (1.8%)
Skin Rashes + Nausea	0 (0.0%)	1 (3.6%)	1 (1.8%)
Skin Rashes	1 (3.6%)	0 (0.0%)	2 (3.6%)
Total	3 (10.7%)	5 (11.9%)	8 (14.3%)

*Upto 5 days

In our study we found to have complications in both groups such as nausea, skin rashes, giddiness, persisting pain, injection site redness. All these complications were treated accordingly & none had any serious complications. Hypotension treated with IV fluids



Figure 2: Showing, a) day 0 flexion, b) day 0 abduction, c) 18th week flexion, d) 18th week abduction

Discussion

Primary adhesive capsulitis or “frozen shoulder” is a common condition encountered in the outpatient orthopaedic practice. It is characterized by the spontaneous onset of shoulder pain and global limitation of both active and passive shoulder motion. Adhesive capsulitis is an important public health disorder as it is one of the most common cause of shoulder pain in the outpatient setting. Many authors have reported that peri-arthritis is a self-limiting condition, which lasts for an average of 2–3 years. But, a considerable number of participants have notifying difficulties like limitation of movements for more than three years and a lesser significant number of people have residual disability. About 40% of

the participants have permanent symptoms after three years.[12]

So, there is a need for the treatment for adhesive capsulitis. But, many randomized controlled trials not providing conclusive information on the effectiveness of treatment, including non-steroidal anti-inflammatory drugs, corticosteroid injections and physiotherapy. Henceforth, there is a necessity for well-designed clinical trials to study the efficacy of treatment for peri-arthritis. Adhesive capsulitis occurs in 3% to 5% of the population [2] and a majority of participants are female. Age ranging from 40 to 60 years, about 20% to 30% of those affected will develop the condition in the

opposite shoulder. As more than one classification is there to describe staging of adhesive capsulitis, we have used Reeve's

classification for our study.[13] All results have been compared at final follow up, which is 18 week for our study.

Table 12: Duration of symptoms

Authors	mean duration of symptoms
Kothari.et. al (2017)[14]	4.6 months
Calis.et.al (2019)[15]	5.11 months
Sharma.et.al (2016)[10]	6.8 months
Present study	6.41 months

The mean duration of symptoms in PRP group and in steroid Group were 6.0 ± 1.33 and 6.8 ± 1.12 Months respectively. The mean duration of symptoms in all participants was 6.41 ± 1.30 , which is comparable to a study done by Sharma *et al* in 2016 where Mean symptom duration was 6.8 months.[15]

At presentation all the demographic and clinical variables in terms of SPADI, VAS, ROM in ER, abduction, flexion and restricted ROM for ER, abduction, flexion and extension were comparable between both the groups.

Table 13: Visual analogue score (VAS)

Authors	VAS in PRP Group at final follow up
Kothari <i>et al</i> (2017)[14]	1.9 ± 1.8
Madhan Jayaraman <i>et al</i> (2018) [16]	2.11 ± 1.28
Barman[17]	15.89 ± 8.05
Present study	2.71 ± 0.76
Authors	VAS in STEROID Group at final follow up
Kothari <i>et al</i> (2017)[14]	3.4 ± 2.2
Song <i>et al</i> [9]	4.3 ± 3.2
Mukherjee <i>et al</i> [18]	3.2 ± 1.5
Present study	3.64 ± 0.83

At presentation the mean VAS scores were comparable in both the groups (PRP 6.29 vs steroid 6.86, statistically not significant. At the end of 18th week the mean VAS in PRP group (2.71 ± 0.76) and steroid group (3.64 ± 0.83) with P value < 0.001 , that PRP group showed more significant reduction in VAS than steroid group.

The improvement in pain relief and decrease in VAS score in our study was comparable to a study done by Madhan jeyaraman *et al* in 2018,[16] where participants who received platelet rich plasma therapy showed improved range of movements and concluded PRP for adhesive capsulitis is superior when compared with hydro dissection with p

< 0.001 for VAS score. Our study is comparable with study conducted by Kothari *et al*.[14] which concluded PRP treatment resulted in statistically significant improvements over corticosteroid and ultrasonic therapy in range of motion of shoulder and VAS at 12 weeks.

SPADI Score

At presentation the mean SPADI scores were comparable in both the groups (PRP: 75.75 ± 8.08 vs Steroid: 76.46 ± 7.45). At the end of 12th week the mean SPADI scores further reduced to (PRP: 66.68 ± 5.07 vs Steroid: 71.68 ± 6.90 , P - 0.005) statistically significant. At the end of 18th week the mean

SPADI scores reduced to (PRP: 50.32 ± 5.81 vs Steroid: 59.36 ± 7.12 , $P < 0.001$) being statistically significant. Both at the end of 12th and 18th week, the mean SPADI scores decreased within the groups statistically being significant ($P < 0.001$).

The SPADI scores decreased more in PRP group than the steroid group at the end of 18th week follow up, showing greater and more

relief from pain and disabilities in PRP group compared to steroid group. The improvement in SPADI scores in our study was comparable to the improvement in SPADI scores in the study done by Calis *et al.*[15] at Turkey which concluded regarding functional recovery, significant improvements were observed in SPADI-pain, SPADI-disability, and SPADI-total scores in all time points when compared with baseline ($p < 0.05$)

Movements at the end of study

Table 14: ROM External rotation

Author	ER in PRP at final follow up
Aslani <i>et al</i> (2015)[19]	50°
Kothari <i>et al</i> (2017)[14]	80.2°
Madhan jayaraman <i>et al</i> (2018)[16]	70°
Present Study	68.07°
Author	ER in STEROID at final follow up
Sharma <i>et al</i> [20]	38.2°
Mukherjee <i>et al</i> [18]	59.2°
Khallaf <i>et al</i> [21]	35.3°
Present Study	62.18°

At presentation mean ER in PRP group compared to steroid group was 39.82 ± 5.00 vs 38.57 ± 3.81 , with a P value of 0.297 comparable to each other at baseline. At the end of 12th week mean ER improved to 62.86 ± 6.73 vs 55.89 ± 5.45 respectively with P value of < 0.001 , statistically significant.

Further at the end of 18th week the mean ER in PRP group improved to 68.07 ± 8.32 compared to 62.18 ± 7.34 in steroid group, P value of 0.007, which is comparable with Madhan jayaraman *et al* (2018) study in PRP group (ER: 70°) and Mukherjee *et al* study in steroid group (59.2°).

Table 15: ROM Abduction

Author	ABD in PRP GROUP
Aslani <i>et al</i> (2015) [19]	135°
Kothari <i>et al</i> (2017) [14]	142.3°
Madhan jayaraman <i>et al</i> (2018) [16]	165°
PRESENT STUDY	148.96°
Author	ABD in STEROID GROUP
Mukherjee <i>et al</i> [18]	109.2°
Kothari <i>et al</i> [14]	129.7°
Khallaf <i>et al</i> [21]	126.3°
Present study	140.83°

At presentation mean abduction in PRP group compared to steroid group was 71.25 ± 9.49 vs 70.89 ± 6.81 , with a P value of 0.872 comparable to each other at baseline. At the end of 12th week

mean abduction improved to 103.93 ± 8.86 vs 92.14 ± 8.96 respectively with P value of <0.001 , statistically significant.

Further at the end of 18th week the mean abduction in PRP group improved to 148.96 ± 12.84 compared to 140.43 ± 12.86 in steroid group, P value 0.012 which is statistically significant.

Table 16: ROM - Flexion

Author	FLEXION in PRP GROUP
Aslani <i>et al</i> (2015)[19]	150°
Kothari <i>et al</i> (2017)[14]	128.7°
Madhan jayaraman <i>et al</i> (2018)[16]	130°
Present Study	153.75°
Author	FLEXION in STEROID GROUP
Mukherjee <i>et al</i> [18]	138.9°
Kothari <i>et al</i> [14]	133.1°
Khallaf <i>et al</i> [21]	137.8°
Present study	139.46°

At presentation mean flexion in PRP group compared to steroid group was 48.39 ± 10.98 vs 45.89 ± 7.94 , with a P value of 0.333 comparable to each other at baseline. At the end of 12th weeks mean flexion improved to 132.32 ± 8.55 vs 127.14 ± 8.65 respectively with P value of 0.028, statistically significant.

Further at the end of 18th week the mean flexion in PRP group improved to 153.75 ± 14.63 compared to 139.46 ± 13.42 in steroid group, P value <0.001 which is statistically significant.

Table 17: ROM - Extension

Author	Extension in prp group
Madhan jayaraman <i>et al</i> (2018)[16]	50°
Present study	34.96°
Author	EXTENSION In STEROID GROUP
Mukherjee <i>et al</i> [18]	49.2°
Khallaf <i>et al</i> [21]	52°
Present study	28.93°

In our study at presentation mean extension in PRP group compared to steroid group was 17.50 ± 4.81 vs 16.46 ± 4.86 , with a P value of 0.980 comparable to each other at baseline. At the end of 12th weeks mean extension improved to 33.93 ± 2.84 vs 28.75 ± 2.93 respectively with P value of <0.001 , statistically significant. Further at the end of 18th week the mean extension in PRP group improved to 34.96 ± 2.78 compared to 28.93 ± 2.84 in steroid group, P value <0.001 which is statistically significant.

*Normal extension considered to be 40°- 60°, in our study full extension is considered upto

40° The improvement in ROM in our study was compared with a study done by Kothari *et al*[14] which concluded, PRP treatment resulted in statistically significant improvements over corticosteroid and ultrasonic therapy in active as well as passive range of motion of shoulder and pain (VAS) at 12 weeks. Also according to a study done by Aslani *et al*. [19] reported flexion improved from 70° to 150°, abduction improved from 75° to 135°, and external rotation improved from 25° to 50° in participants suffering with adhesive capsulitis. Which is comparable to our

present study in terms of functional outcome in ROM. In PRP group we had very few complications like giddiness, nausea & skin rashes (10.7%) whereas in steroid group we had injection site redness, persistent pain & rashes at injection site (11.9%).

In our study there is significant pain relief and improvement in SPADI scores & VAS and ROM for ER, Abduction, Flexion & extension at 18 weeks in platelet rich group compared to steroid group.

There is limited data showing comparison between autologous PRP injection and corticosteroid injection in the treatment of adhesive capsulitis. However the systematic reviews in terms of PRP and steroid group individually conclude better outcomes in both the groups, especially when USG guided compared to blind landmark based injections.

Aly *et al.* [4] concluded that sonography-guided corticosteroid injections are more effective out of subacromial space in a randomized controlled study on 43 participants with adhesive capsulitis, Lee *et al* [22]. compared the results of sonography guided and blinded corticosteroid injections and found that, US-guided intra-articular injections may offer advantages over a blind technique for the treatment of adhesive capsulitis. The limitation of the study was lack of comparison with other studies as there is minimal availability of the similar trials comparing PRP vs Steroid group, and the duration of the study was only 18 weeks follow up and sample size is small. Further Randomised studies and meta-analysis are necessary with long term follow up.

Conclusion

Our study showed that the efficacy of sonography guided intra-articular single injection of platelet rich plasma to relieve the pain and disabilities in active phase of Adhesive Capsulitis is better than single intra-articular Triamcinolone injection over a

short term follow up period in terms of improvement in ROM and relief from pain. However our's is a small series and require randomized control trial in a large series with long term follow up to establish efficacy of platelet rich plasma to further strengthen evidence based practice in treatment of Adhesive capsulitis.

References

1. Raeissadat SA, Rayegani SM, Langroudi TF, Khoiniha M. Comparing the accuracy and efficacy of ultrasound-guided versus blind injections of steroid in the glenohumeral joint in patients with shoulder adhesive capsulitis. *Clin Rheumatol.* 2017 Apr;36(4):933-940.
2. Calis HT, Karabas C, Guler E. Effects of platelet-rich plasma injection on adhesive capsulitis: an interventional case series. *Erciyes Med J/Erciyes Tip Dergisi.* 2019 Jan 1;41(1):102-6.
3. Griesser MJ, Harris JD, Campbell JE, Jones GL. Adhesive capsulitis of the shoulder: a systematic review of the effectiveness of intra-articular corticosteroid injections. *J Bone Joint Surg Am.* 2011;93(18):1727-33.
4. Grey RG. The natural history of "idiopathic" frozen shoulder. *J Bone Joint Surg Am.* 1978;60:564.
5. Binder AI, Bulgen DY, Hazleman BL, Roberts S. Frozen shoulder: a long-term prospective study. *Ann Rheum Dis.* 1984;43:361-4.
6. O'Kane JW, Jackins S, Sidles JA, Smith KL, Matsen FA 3rd. Simple home program for frozen shoulder to improve patients' assessment of shoulder function and health status. *J Am Board FamPract.* 1999;12:270-7.
7. Shaffer B, Tibone JE, Kerlan RK. Frozen shoulder. A long-term follow-up. *J Bone Joint Surg Am.* 1992;74:738-46.
8. Kessler RM: The shoulder. In: Kessler RM, Hertling D (eds), *Management of Common Musculoskeletal Disorders*, pp

- 274-3 10. Philadelphia: Harper & Row, 1983.
9. Dias R, Cutts S, Massoud S. Frozen shoulder. *BMJ*. 2005;331(7530):1453–56.
 10. Blanchard V, Barr S, Cerisola FL. The effectiveness of corticosteroid injections compared with physiotherapeutic interventions for adhesive capsulitis: a systematic review. *Physiotherapy*. 2010;96(2):95–107.
 11. Eppley BL, Woodell JE, Higgins J. Platelet quantification and growth factor [10] analysis from platelet-rich plasma: implications for wound healing. *Plast Reconstr Surg*. 2004;114(6):1502–08.
 12. Buchbinder R1, Hoving JL, Green S, *et al*. Short course prednisolone for adhesive capsulitis (frozen shoulder or stiff painful shoulder): A randomised, double-blind, placebo-controlled trial. *Ann Rheum Dis*. 2004;63(11): 1460-1469.
 13. Reeves 6: The natural history of the frozen shoulder syndrome. *Scand /Rheumatol*4: 193- 196, 1975.
 14. Shashank Yeshwant Kothari, Venkataraman Srikumar, Neha Singh. Comparative Efficacy of Platelet Rich Plasma Injection, Corticosteroid Injection and Ultrasonic Therapy in the Treatment of Periarthritis Shoulder. *Journal of Clinical and Diagnostic Research*. May 2017;11(5);RC15-RC18.
 15. Talay Çalış H, Karabaş Ç, Güler E. Effects of Platelet-rich Plasma Injection on Adhesive Capsulitis: An Interventional Case Series. *Erciyes Med J*. 2019; 41(1): 102-4.
 16. The comparative and prospective study on efficacy and functional outcome of autologous platelet rich plasma injection vs hydrodissection in adhesive capsulitis of shoulder Jeyaraman M *et al*. *Int J Res Orthop*. 2018 Nov;4(6):848-853.
 17. Barman A, Mukherjee S, Sahoo J, Maiti R, Rao PB, Sinha MK, Sahoo D, Tripathy SK, Patro BK, Bag ND. Single intra-articular platelet-rich plasma versus corticosteroid injections in the treatment of adhesive capsulitis of the shoulder: a cohort study. *American journal of physical medicine & rehabilitation*. 2019 Jul 1;98(7):549-57.
 18. Mukherjee RN, Pandey RM, Nag HL, *et al*. Frozen shoulder - A prospective randomized clinical trial. *World Journal of Orthopedics*. 2017;8(5): 394- 399.
 19. Aslani H, Nourbakhsh ST, Zafarani Z, *et al*. Platelet-Rich Plasma for Frozen Shoulder: A Case Report. *Arch Bone Jt Surg*. 2016;4(1):90-93.
 20. Sharma SP, Bærheim A, Moe-Nilssen R, Kvåle A. Adhesive capsulitis of the shoulder, treatment with corticosteroid, corticosteroid with distension or treatment-as-usual; a randomised controlled trial in primary care. *BMC musculoskeletal disorders*. 2016 Dec; 17(1):1-0.
 21. Khallaf SF, Hussein MI, Amal M, El Khouly RM. Efficacy of ultrasonography-guided intra-articular steroid injection of the shoulder and exercising in patients with adhesive capsulitis: Glenohumeral versus subacromial approaches. *The Egyptian Rheumatologist*. 2018 Oct 1;40(4):277-80.
 22. Lee HJ, Lim KB, Kim DY, Lee KT. Randomized controlled trial for efficacy of intra-articular injection for adhesive capsulitis: ultrasonography-guided versus blind technique. *Archives of physical medicine and rehabilitation*. 2009 Dec 1;90(12):1997-2002.