

Comparative study between platelet-rich plasma injection and steroid injection in mild–moderate shoulder osteoarthritis and their relation to quality of life

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Context

Osteoarthritis (OA) is a degenerative joint disorder that causes joint pain and stiffness. Platelet-rich plasma (PRP) is considered a recent effective line of management of OA.

Aims

To compare the effect of local injection of PRP versus steroid in shoulder OA and their relation to quality of life.

Patients and methods

This study included 50 patients with mild–moderate OA shoulder diagnosed according to Samilson and Prieto grading system of shoulder OA and were recruited from the outpatient clinic of physical medicine, and rehabilitation, Faculty of Medicine, Menoufia University Hospital, in the period between 2017 and 2018. The study included both sexes. Group I included 25 patients who were injected intra-articularly with PRP in the affected shoulder, and group II included 25 patients who were injected with triamcinolone acetate. They were evaluated by Western Ontario Osteoarthritis Shoulder index and visual analogue scale before and after injection.

Statistical analysis

A descriptive and analytic study by SPSS, version 16, on IBM compatible computer was done.

Results

There was a highly statistical significant difference between preinjection and postinjection parameters regarding Western Ontario Osteoarthritis Shoulder score and visual analogue scale in both groups, with more improvement in the PRP group.

Conclusion

Intra-articular injections with PRP and steroids are effective less-invasive lines of shoulder OA treatment, with superiority to PRP owing to more persistence of its effects.

Keywords:

platelet-rich plasma, steroid, visual analogue scale, Western Ontario Osteoarthritis Shoulder intra-articular injection

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Introduction

Osteoarthritis (OA) is a degenerative joint disorder that may cause cartilage loss and morphological damage to joint tissues with destruction of the underlying bone [1].

The most common symptoms of OA are joint pain, limited range of motion (ROM), swelling, and stiffness [2].

Management of OA includes medical treatment such as NSAIDs, chondroprotective drugs (glucosamine and chondroitin) and intra-articular injections [of steroid, hyaluronic acid, or platelet-rich plasma (PRP)], physiotherapy as strength training, aerobic exercise [3], and surgical treatment [4].

Intra-articular injection of long-acting corticosteroid in OA has a role in pain relieve and improvement of

function. Despite its safety, studies reported a short period of its benefits [5].

Intra-articular injection of PRP stimulates cartilage healing process and improvement of damaged area [6,7]. So, the role of PRP in OA joint includes the following:

- (1) Inhibition of inflammation and slow down of the progression of OA [8].
- (2) Limits painful joint friction [9] and contains proteins that alter a patient's pain receptors and reduce pain sensation [10].

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The aim of our study is to compare the therapeutic effect of local injection of PRP versus steroid in patients with early shoulder OA and to demonstrate their effects on patient's quality of life (QOL).

Patients and methods

This study included 50 patients with OA shoulder diagnosed and classified according to Samilson and Prieto grading system of shoulder OA [11]. Our patients were recruited from outpatient clinic of Physical Medicine, Rheumatology and Rehabilitation Department, Faculty of Medicine, Menoufia University hospital, in the period between 2017 and 2018. The study included both sexes. Forty patients were females and 10 were males. Their age ranged from 27 to 50 years. They are young as they have secondary (mild–moderate not advanced) OA caused by very active lifestyles, that have resulted in overuse and chronic traumatic injuries to the shoulder and regarding our aim which is to study the effects of PRP in early OA pointing to the importance of its early injection in early OA to restore joint function and prevent its damage.

All patients were from the Menoufia Governorate. Ethical approval and written consent were obtained.

The study group includes patients complaining of persistent shoulder arthralgia for more than 3 months even with conservative treatment with evidence of glenohumeral joint OA of mild to moderate degree confirmed by radiography according to Samilson and Prieto grading system of shoulder OA [11].

The present study excluded patients with local abscesses, diabetes mellitus, malignancy, pregnancy, and blood disorders (coagulopathy and thrombocytopenia); patients on NSAIDs or systemic steroids within one week before injection; those who received previous local injection of steroid within past 3 weeks or previous injection of PRP within past 6 months; and patients with painful active, cervical spine conditions.

All patients were subjected to demographic data recording, history taking, and clinical examination including general examination and local examination of shoulder joints.

All patients underwent complete blood count, erythrocyte sedimentation rate, rheumatoid factor, C-reactive protein, hepatitis C virus antibody, serum uric acid, and also radiological examination such as plain radiography shoulder joint, where two projections were formed: antero-posterior view with the patient

standing, the arm in the hanging position first with maximal external and then with maximal internal rotation of the shoulder.

The follow-up was done by the Western Ontario Osteoarthritis Shoulder (WOOS) [12] and the visual analogue scale (VAS) [13,14].

The patients of the study group were divided into two groups: 25 patients were injected intra-articularly with ~3–4 ml of PRP in their affected shoulder and 25 patients were injected intra-articularly with 2 ml of triamcinolone acetonide into their affected shoulder; all injections were guided by musculoskeletal ultrasound posterior approach (technique).

They are two approaches (techniques) of shoulder injection: anterior and posterior approach. In the present study, we used the posterior approach, where the patients sit with their arms resting at their side with the shoulder in neutral rotation resting on their lap. The sulcus between the head of the humerus and acromion is identified. 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. An 18-G needle was sunk completely into the joint, and the plunger was pushed with great ease.

Then, they were re-evaluated again at 1 and at 3 months after injection. PRP was prepared by taking 10 ml of venous blood sample from every patient and was collected in sterile sodium citrated tubes. Then the tubes with citrated blood were centrifuged at 3500 rpm for 9 min to separate erythrocytes and produce ~3–4 ml of PRP for injection [15,16].

The present study was performed to detect the efficacy of a single-dose (one shot) injection of PRP in short-term duration of follow-up (3 months) in comparison with steroid intra-articular injection. So, we support the repeated injection for further improvement of function and pain relief regarding the long-lasting regenerative effects of PRP and its safety and availability.

The data collected were tabulated and analyzed by SPSS (statistical package for the social science software) statistical package, version 16, on IBM compatible computer (SPSS version 16 and SAS Users, 4th ed. Chicago, IL: SPSS Inc; 2007). Two types of statistics were done: descriptive statistics included percentage (%), mean, and SD, and analytical statistics included Student's *t* test, post-hoc test, and χ^2 test. *P* value was nonsignificant if *P* value more than 0.05, significant difference if *P* value

less than 0.05 and highly significant if P value less than 0.001 [17].

Results

The patients of the present study were divided into two groups. The first group included 25 patients who received a single intra-articular injection of PRP in their shoulders. The second group included 25 patients who received a single intra-articular injection of corticosteroid (triamcinolone acetonide). The patients were evaluated at a baseline and at 1 and 3 months after injection, with the comparison of the results of both groups.

There was no significant difference in both groups regarding age, sex, BMI, laboratory parameters, and radiological grading of OA in Table 1.

There was no significant difference in both groups regarding Laboratory data and Radiological grading of osteoarthritis among the two studied groups in Tables 2 and 3.

There was a highly statistically significant functional improvement in the first group of patients with shoulder OA who received intra-articular injection with PRP at 1 and 3 months after injection when compared with the baseline, and at 3 months after injection when compared with 1 month after injection regarding WOOS score, with more improvement after 3 months after injection in Table 4.

There was a highly statistically significant functional improvement in the second group of patients with shoulder OA who received intra-articular injection with steroid at 1 and 3 months after injection when compared with baseline regarding WOOS score, with more improvement 1 month after injection in Table 5.

There was no significant difference of functional assessment regarding WOOS between both groups of patients with shoulder OA before injection and 1 month after injection, but there was a highly

significant decrease in WOOS score, with functional improvement at 3 months after injection in the first group of patients with shoulder OA who received intra-articular injection with PRP compared with the second group who received intra-articular injection with steroid in Table 6.

There was a highly statistically significant pain reduction regarding VAS in the first group of patients with shoulder OA who received intra-articular injection with PRP at 1 and 3 months after injection compared with baseline and by comparing the results of 1 and 3 months after injection with more improvement after 3 months after injection in Table 7.

There was a highly statistically significant reduction of pain regarding VAS in the second group of patients with shoulder OA who received intra-articular injection of steroid at 1 and 3 months after injection compared with baseline, with more improvement after 1 month Table 8.

There was no significant difference in pain reduction regarding VAS between both groups before injection, but there was a highly significant decrease in pain regarding VAS at 1 and 3 months after injection in first group of patients with shoulder OA who received intra-articular injection with PRP group compared with the second group who received intra-articular injection with steroid (Table 9).

Discussion

The aim of the present study was to compare the therapeutic effect of a single local injection of PRP versus steroid in patients with early-moderate shoulder OA and to demonstrate their effects on patients' QOL.

The statistically significant progressive functional improvement of the PRP group observed at 1 and 3 months correspondingly comes in agreement with Thomas *et al.* [18], as they reported reduction in stiffness and functional improvement of shoulder

Table 1 Demographic data and body mass index in the studied groups

	Groups [n (%)]		Test of significance	P value
	PRP (N=25)	Steroid (triamcinolone) (N=25)		
Sex				
Male	1 (4)	9 (36)	Fisher's exact test 8.00	0.005
Female	24 (96)	16 (64)		
Age (mean±SD)	41.82±6.91	40.32±6.92	t test 0.49	0.626
BMI (mean±SD)	24.52±3.5	24.96±3.7	0.43	0.66

There was no significant difference in both groups regarding age, sex, and BMI. PRP, platelet-rich plasma.

Table 2 Laboratory data among the two studied groups

	PRP (N=25) (mean±SD)	Steroid (triamcinolone) (N=25) (mean±SD)	t test	P value
ESR	18.16±4.2	16.8±4.8	1.066	0.292
HB	19.12±26.8	11.8±0.71	1.36	0.18
WBC	6496±1941.5	7088±1799.4	47.8	0.269
PLT	300.7±69.4	297.6±94.5	0.133	0.895
CRP [n (%)]				
Negative	23 (92)	21 (84)	0.758 ^a	0.384
Positive	2 (8)	4 (16)		
Positive	0 (0)	0 (0)		

There was no significant difference between both groups regarding laboratory parameters. CRP, C-reactive protein; ESR, erythrocyte sedimentation rate; HB, hemoglobin; PLT, platelet; PRP, platelet-rich plasma; WBC, white blood cell. ^a χ^2 test.

Table 3 Radiological grading of osteoarthritis among the two studied groups

	PRP (N=25) [n (%)]	Steroid (triamcinolone) (N=25) [n (%)]	t test/ χ^2	P value
Radiograph				
1	14 (56)	7 (28)	4.02	0.043
2	11 (44)	18 (72)		

There was no significant difference between both groups regarding the radiological grading of osteoarthritis. PRP, platelet-rich plasma.

Table 4 Comparison between the functional assessments on Western Ontario Osteoarthritis Shoulder scale before and after injection in the platelet-rich plasma group

PRP group	Before injection	1 month after injection	3 months after injection	t test	P value
WOOS	74.16±9.8	60.64±7.8	46.08±8.2	$T_1=16.9$ $T_2=20.97$ $T_3=16.24$	$P_1=0.001$ $P_2=0.001$ $P_3=0.001$

T_1 and P_1 : comparison between before injection and 1 month after injection. T_2 and P_2 : comparison between before injection and 3 months after injection. T_3 and P_3 : comparison between 1 month after injection and 3 months after injection. There was a highly statistically significant functional improvement in the first group at 1 and 3 months after injection comparing with the baseline and at 3 months after injection compared with 1 month after injection regarding WOOS score, with more improvement at 3 months after injection. PRP, platelet-rich plasma; WOOS, Western Ontario Osteoarthritis Shoulder.

Table 5 Comparison between functional assessments on Western Ontario Osteoarthritis Shoulder score before injection and after injection in the steroid group

Steroid (triamcinolone) group	Before injection	1 month after injection	3 months after injection	t test	P value
WOOS	73.84±8.3	64.72±6.5	70.7±7.6	$T_1=17.1$ $T_2=10.3$ $T_3=14.8$	$P_1=0.001$ $P_2=0.001$ $P_3=0.001$

T_1 and P_1 : comparison between before injection and 1 month after injection. T_2 and P_2 : comparison between before injection and 3 months after injection. T_3 and P_3 : comparison between 1 month after injection and 3 months after injection. There was a highly statistical significant functional improvement in the second group at 1 and 3 months after injection compared with baseline regarding WOOS score and on comparison of the results of 1 and 3 months after injection, with more improvement after 1 month after injection. WOOS, Western Ontario Osteoarthritis Shoulder.

Table 6 Comparison between platelet-rich plasma group and steroid group regarding functional assessments according to Western Ontario Osteoarthritis Shoulder score before and after injection

	PRP (N=25) (mean±SD)	Steroid (triamcinolone) (N=25) (mean±SD)	t test	P value
WOOS before injection	74.16±9.8	73.84±8.3	0.125	0.901
WOOS 1 month after injection	60.64±7.8	64.72±6.5	2.023	0.049
WOOS 3 months after injection	46.08±8.2	70.7±7.6	10.9	0.001

There was no significant difference of functional assessment on WOOS scale between both groups before injection and 1 month after injection, but there was a highly significant decrease in WOOS score with functional improvement at 3 months after injection in PRP group compared with the steroid group. PRP, platelet-rich plasma; WOOS, Western Ontario Osteoarthritis Shoulder.

OA in the patients receiving PRP injection according to Constant–Murley and Shoulder Pain and Disability Index (SPADI) scores after 1 month of injection and up to 24 months of follow-up.

Similarly, the study by Julien [19] reported functional improvement of the shoulder on the questionnaire of Disabilities of Arm, Shoulder, and Hand score, which was recorded before the first injection and at weeks 8th,

Table 7 Comparison of pain status on visual analogue scale before and after injection in platelet-rich plasma group

PRP group	Before injection	1 month after injection	3 months after injection	t test	P value
VAS	76±13.6	37.36±11.68	13.5±6.02	$T_1=26.4$ $T_2=29.7$ $T_3=15.2$	$P_1=0.001$ $P_2=0.001$ $P_3=0.001$

There was a highly statistically significant pain reduction on VAS in the PRP group at 1 and 3 months after injection compared with baseline and on comparing the results of 1 and 3 months after injection, with more improvement at 3 months after injection. PRP, platelet-rich plasma; VAS, visual analogue scale.

Table 8 Comparison of pain status on visual analogue scale before and after injection in the steroid group

Steroid group	Before injection	1 month after injection	3 months after injection	t test	P value
VAS	74.5±12.05	60.72±11.23	70.6±11.8	$T_1=11.06$ $T_2=13.1$ $T_3=7.3$	$P_1=0.001$ $P_2=0.001$ $P_3=0.001$

There was a highly statistically significant reduction of pain on VAS in the steroid group at 1 and 3 months after injection compared with baseline and between 1 and 3 months after injection, with more improvement after 1 month. VAS, visual analogue scale.

Table 9 Comparison between pain improvement in platelet-rich plasma group and steroid group on visual analogue scale score before and after injection

	PRP (N=25) (mean±SD)	Steroid (N=25) (mean±SD)	t test	P value
VAS before injection	76±13.6	74.5±12.05	0.407	0.686
VAS 1 month after injection	37.36±11.68	60.72±11.23	7.21	0.001
VAS 3 months after injection	13.5±6.02	70.6±11.8	21.5	0.001

There was no significant reduction of pain on VAS between both groups before injection, but there was a highly significant decrease in pain regarding VAS after 1 and 3 months after injection in PRP group compared with the steroid group. PRP, platelet-rich plasma; VAS, visual analogue scale.

12th, 31st, and 42nd after injection of PRP in patients with shoulder OA.

Moreover, Hirahara [20] and Connolly [21] studies reported that the intra-articular injection with PRP in patients with shoulder OA leads to functional improvement of the joint regarding their active and passive ROM with subsequent improvement of QOL.

There was also a statistically high significant functional improvement in the second group of patients with shoulder OA who received intra-articular injection with steroid at 1 and 3 months after injection compared with baseline regarding WOOS score, with more improvement at 1 month after injection.

This comes in agreement with the study by Merolla and his colleague [22] and Thomas *et al.* [18], as they reported functional improvement in the shoulder OA on Pain and Disability Index (SPADI) and the Constant–Murley scale for functional assessment and subjective satisfaction in patients with shoulder OA who received intra-articular steroid injection in the first month after treatment compared with the baseline.

In accordance with our study, Ucuncu *et al.* [23] reported functional improvement in patients with shoulder OA who were receiving intra-articular steroid injection regarding ROM (mainly abduction) and activity at 1 month after injection of steroids and up to 6-week follow-up.

There was no significant difference of functional assessment regarding WOOS between both groups of patients with shoulder OA before injection and 1 month after injection. However, there was a highly significant functional improvement regarding WOOS at 3 months after injection in the first group of patients with shoulder OA who received intra-articular injection with PRP compared with the second group who received intra-articular injection with steroid.

This comes in agreement with the study by Connolly [21], as it shows the superiority of PRP injection in shoulder OA over steroids regarding functional improvement and QOL.

Similarly, the study by Kothary and his colleague [24] reported that PRP injection in patients with peri-arthritis shoulder resulted in statistically significant improvements over corticosteroid in active as well as passive ROM of shoulder according to Constant–Murley and SPADI scores (Quick Disabilities of Arm, Shoulder, and Hand) at 1 month after injection and up to 12 weeks of follow-up.

The study by Thomas *et al.* [18] also reported functional improvement of patients with shoulder OA who received PRP injection according to Constant–Murley and SPADI scores at first month after injection up to 24 months and reported the same improvement in patients who received steroid

injection, which was limited to the first month after injection only.

On the contrary, the study by Hirahara [20] suggested the equal effects of both PRP and steroid intra-articular injection, as they help in improvement of function and ROM in patients with shoulder OA, and reported the superiority of PRP injection over steroid injection owing to its safety and lack of adverse effects and risks.

There was a highly statistically significant pain reduction regarding VAS in the first group of patients with shoulder OA who received intra-articular injection with PRP at 1 and 3 months after injection compared with baseline and by comparing the results of 1 and 3 months after injection, with more improvement at 3 months after injection.

This comes in agreement with the study by Thomas *et al.* [18] as they reported more reduction in pain on VAS score in patients with shoulder OA who received intra-articular injection with PRP at 1 month after injection and up to 24 months of follow-up.

Similarly, the study by Julien [19] reported improvement of pain in patients with shoulder OA who received intra-articular injection of PRP regarding to numerical pain rating scale as it was recorded at baseline, with follow-up intervals at week third, fourth, eighth, 12th, 31st, and 42nd.

There was a highly statistically significant reduction of pain regarding VAS in the second group of patients with shoulder OA who received intra-articular injection of steroid at 1 and 3 months after injection compared with baseline, with more improvement after 1 month.

This comes in agreement with Merolla and John [22] and Thomas *et al.* [18], as they reported improvement of pain regarding VAS only in the first month after injection of steroid in patients with shoulder OA compared with the baseline.

The studies by Rastogi *et al.* [25] and Ucuncu *et al.* [23] also reported the efficacy of corticosteroids in pain reduction according to VAS for short-term to medium-term treatment (4–6 weeks) of patients with shoulder OA.

There was no significant difference pain reduction regarding VAS between both groups before injection, but there was a highly significant decrease in pain regarding VAS at 1 and 3 months after injection

in the first group of patients with shoulder OA who received intra-articular injection with PRP group compared with the second group OA who received intra-articular injection with steroid.

This comes in agreement with the study by Connolly [21], as he reported that the intra-articular injection with PRP reduces pain and improves the VAS in patients with shoulder OA, and its effects last longer than steroid injections, with minimal adverse effects compared with steroids.

Similarly, the study by Kothari *et al.* [24] reported that intra-articular injection with PRP in patients with peri-arthritis shoulder resulted in statistically significant improvements over corticosteroid in pain reduction on VAS at 1 month after injection up to 12 weeks of follow-up.

On the contrary, the study by Hirahara [20] suggested the equal effects of both PRP and steroid intra-articular injection, as they help in improvement of pain measured by VAS in patients with shoulder OA and reported the superiority of PRP injection over steroid injection owing to its safety and lack of adverse effects and risks.

Regarding the adverse effects and risks of intra-articular injection, the patients of our study groups had no adverse effects after injection during the period of follow-up.

Conclusion

From the present study, we conclude that intra-articular injection with both PRP and steroids are effective, nonsurgical less-invasive and economic lines of treatment of mild–moderate shoulder OA, with superiority to PRP regarding its long-lasting therapeutic effects compared with steroid injection, which could be explained by the regenerative effect of PRP that appears clearly and increases with time.

So, we recommend intra-articular injection of steroids in patients with mild OA (grade 1) and in mild inflammatory reactions, such as mild synovial effusion, owing to the anti-inflammatory, anti-edematous, and analgesic effects of steroids. However, the intra-articular injection of PRP is preferred in cases of moderate OA (grade 2) owing to its long-lasting regenerative effects.

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Conflicts of interest

There are no conflicts of interest.

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