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Role of platelet rich plasma in patients of osteoarthritis knee-a prospective study

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Abstract

Introduction: In the present study, we evaluated the effects of 2 courses of PRP injections with 3 weeks interval, on patient's quality of life and functional ability.

Materials and Method: It was a prospective study carried out on 55 patients (14 males & 41 females) in the Department of Orthopedics', Era's Lucknow Medical College, Lucknow, and Uttar Pradesh from Sep 2015 to March 2016. Age >40 years, Knee arthralgia (>3 months) and Radiologic evidence of articular damage (grades 1-3 of Kellgren-Lawrence scale) based on knee Osteoarthritis criteria of American College of Rheumatology were enrolled in our study. Two intra-articular injections of Platelet Rich Plasma (PRP) at 3 weeks interval was given and patient was regularly followed up after 3rd week, 6th week, 3 months & 6 months of the 1st injection

Results: Mean scores of all WOMAC parameters improved significantly compared to before treatment. Each Parameter of the WOMAC Score was compared with baseline score at each follow-up. Reduction in the mean pain, mean physical function and mean total womac scores from base line scores were observed during the course of 1st (3 weeks) &2nd (6 weeks) follow-ups then after marginal increase in scores were reported during 3rd (3 months) and 4th (6 months)follow ups but difference in mean of all scores were significant with the respective base line scores.

Conclusion: The results of our study showed that intra-articular knee injections of Autologous Platelet Rich Plasma (PRP) are effective in reducing joint pain, stiffness and improve knee functions in early knee Osteoarthritis.

Keywords: Platelet Rich Plasma, Knee Osteoarthritis.

Introduction

Osteoarthritis is a chronic disorder of synovial joints resulting from disintegration of articular cartilage.

There are numerous methods used for reducing the symptoms of patients with knee osteoarthritis (OA) but no treatment option can alter the natural history of disease and so, none of them cannot be considered as an treatment of Osteoarthritis ideally.[1,2,3]

Recently**,** Platelet Rich Plasma has emerged as an treatment option for knee OA, due to the various growth factors which are stored in the α-granules of platelets like Transforming Growth Factor-β (TGF-β), Platelet Derived Growth Factor (PDGF), Insulin-like growth factor **(**IGF) etc.

There are extensive ongoing studies about the effects of PRP on knee OA. In these studies, patients' symptoms and their functions have been improved significantly after the usual 2-3 courses of injections with 2-3-week intervals.[4-8]

There is still no unanimity regarding the number of injections, time interval between injections and the duration of PRP effects.[9,10]

In the present study, we evaluated the effects of 2 courses of PRP injections with 3 weeks interval, on patient's quality of life and functional ability.

Material and Method

This is a prospective study and it was carried out on 55 patients (14 males & 41 females) in the Department of Orthopedics', Era's Lucknow Medical College and hospital, Sarfarazganj, Hardoi Road, Lucknow, Uttar Pradesh from Sep 2015 to March 2016. AGE >40 years, Knee arthralgia (>3 months) and Radiologic evidence of articular damage (grades 1-3 of Kellgren-Lawrence scale) based on knee Osteoarthritis criteria of American College of Rheumatology were enrolled in our study.

Participant not willing to enroll in the study, Secondary osteoarthritis, Systemic diseases like rheumatic diseases, coagulation disorders, severe cardiovascular diseases, immune suppression, malignancy, Infection or active wound of the knee and Tense joint effusion patients were excluded.

BMI was not considered in the included patients.

Method of Recruitment: Patients were recruited from Orthopaedics OPD. All selected patients were screened for positive exclusion criteria signs. Patient fulfilling inclusion criteria were asked to fill WOMAC questionnaire. In patients with Osteoarthritis of both the knee joints, the worse affected knee joint as per WOMAC score (higher score) was selected and in patients with Osteoarthritis of single knee joint, the same affected knee joint was selected. Plain radiograph of the selected knee joint was done (standing Anteroposterior and lateral view).

PRP Preparation: About 27 ml of venous blood was drawn under aseptic condition from patient's antecubital vein and collected in three 10ml vaccutainers tubes containing 1ml of 3.2% sodium citrate as anticoagulant. The sample was collected in the orthopaedic O.P.D. and then send to pathology lab

for PRP preparation. The sample was then passed into two stages of centrifuge using Remi 8c centrifuge model (first with 100×gfor 10 minutes and next with 400×g for 10 minutes). By using formula RCF (Relative centrifugal Force) or G Force = 1.12 x Radius (mm) x $(rpm/1000)^2$ and calculating radius 116.6mm, for 100g force 875rpm and for 400g force 1750 rpm were required. After first centrifugation at 100g (875rpm) for 10 minutes, the upper layer above the buffy coat layer was collected and transferred to empty tubes. These tubes were centrifuged again at 400g (1750 rpm) for 10 minutes. After this $1/3^{rd}$ of the upper portion of volume was discarded and lower $2/3^{rd}$ portion was collected as Platelet Rich Plasma (PRP). The final product of 5-6 ml of PRP was obtained and it was injected intra-articularly in affected knee on the same day. Platelet count assessment was done initially in the whole blood as well as in PRP in all the patients. The mean platelet count in the whole blood was 241,000/µl and mean platelet count in the PRP was 1,019,000/µl.

Interventional Procedure: After taking informed and written consent, patient was shifted to Minor O.T. Patient was placed in supine position. Under aseptic condition, 4-5 ml of PRP was injected in knee through supralateral approach with 22 gauge needle without local anesthetic as they could have toxic effects on chondrocytes and could influence activation of platelets by changing pH of the environment. No exogenous factor was used for platelet activation. Aseptic dressing was done by the bandage. After PRP injection, the knee was flexed and extended for a few times. No NSAIDs were prescribed to the patients after PRP injections.

Follow up: Two intra-articular injections of Platelet Rich Plasma (PRP) at 3 weeks interval was given and patient was regularly followed up after 3^{rd} week, 6^{th} week, 3 months & 6 months of the 1^{st} injection.

Outcome Measures: At each visit assessment was done using WOMAC questionnaire.

Statistical Analysis: The data obtained was analyzed using SPSS software version 20.0. All demographic data were expressed as mean±SD. All diseases severity data was expressed as frequencies. Paired sample T-test was used for follow up from baseline to 3^{rd} week, 6^{th} week, 3 months and 6 months. P value <0.05 is considered to be statistically significant.

Results

Mean age was 51.82± 8.6 years, male to female ratio was 14:41 (1:3) and mean BMI was 25.7±1.2 (kg/cm^2). In K-L Grade I, 5(9.09%) cases were characterized and 16 (29.09%) cases were distributed in Grade II whereas in grade III, 34 (61.82%) cases were distributed among the Osteoarthritis patients.

Mean scores of all WOMAC parameters improved significantly compared to before treatment. Each Parameter of the WOMAC Score was compared with baseline score at each follow-up. Reduction in the mean pain, mean physical function and mean total womac scores from base line scores were observed during the course of 1^{st} (3 weeks) & 2^{nd} (6 weeks) follow-ups then after marginal increase in scores were reported during 3^{rd} (3 months) and 4^{th} (6 months) follow ups but difference in mean of all scores were significant with the respective base line scores.

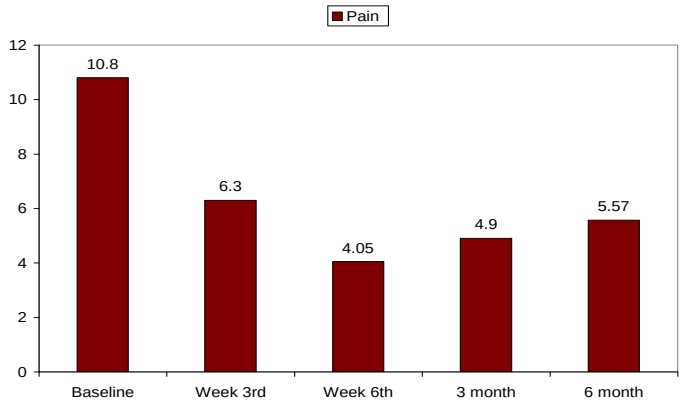
As for stiffness a steady reduction was reported by patients on each subsequent follow-up.

Table 1

WOMAC Parameter	0	1st	2nd	3rd	4th
Pain	10.8±1.99	6.30±2.5	4.05±1.25	4.90±1.50	5.57±1.50
T value/ P Value	0	11.5/<0.001	23.9/<0.001	21.23<0.001	17.02/<0.001
Stiffness	3.62±0.86	2.32±1.02	2.18±0.79	1.98±2.3	1.68±0.87
T value/ P Value	0	8.04/<0.001	9.84/ 0.002	4.99/<0.001	11.76/<0.001
Physical Function	37.15±6.42	22.02±7.1	16.80±2.94	17.55±1.95	20.55±2.32
T value/ P Value	0	13.03/<0.001	20.84/<0.001	21.43/<0.001	15.21/<0.001
Total Score	49.75±6.56	30.63±9.08	22.85±3.44	24.45±3.12	29.60±2.99
T value/ P Value	0	14.3/<0.001	26.07/<0.001	26.16/<0.001	19.9/<0.001

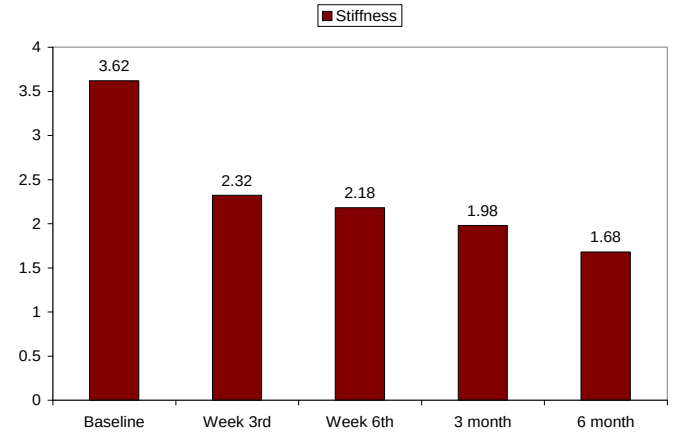
* 0 = Baseline, 1^{st}= Week 3^{rd}, 2^{nd} = Week 6^{th}, 3^{rd} = 3month, 4^{th} = 6 month.
* P value paired with baseline.

Graph 1



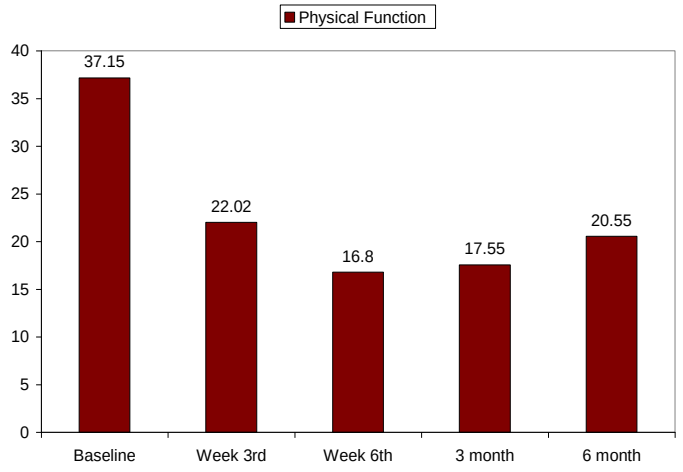
Bar Graph for Pain Score: Above Graph shows the reduction in the mean Pain score from base line during the course of 1st& 2nd follow-up and then marginal increase was observed during 3rd and 4th follow up.

Graph 2



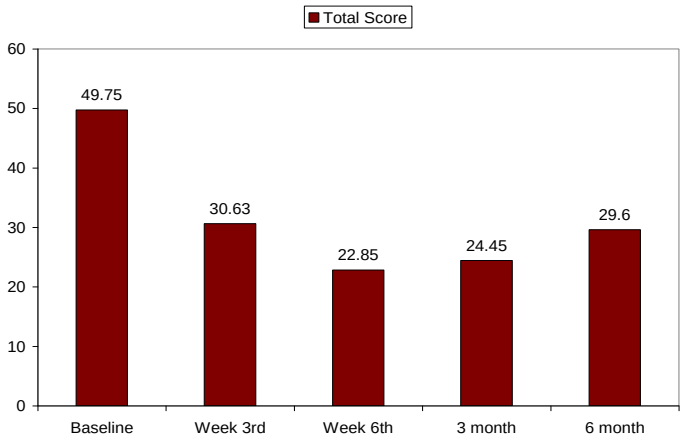
Bar graph for Stiffness: Above Graph shows the reduction in the mean stiffness score from base line during the course of subsequent follow ups.

Graph 3



Bar graph for Physical Function: Above Graph shows the reduction in the mean Physical Function score from base line during the course of 1st& 2nd follow-up and then marginal increase was observed during 3rd and 4th follow up.

Graph 4



Bar graph for Total Score: Above Graph shows the reduction in the mean Total score from base line during the course of 1st& 2nd follow-up and then marginal increase was observed during 3rd and 4th follow up.

Adverse Effects: No severe adverse effects were observed during the injections and follow up periods. Four patients developed mild pain and swelling of the knee joint after injection which resolves spontaneously within 4-5days.

Discussion

Osteoarthritis (OA) is one of the common chronic joint disease.[11] Management of Osteoarthritis has relied on symptomatic interventions. The goals of osteoarthritis treatment include alleviation of pain and improvement of functional status.

PRP contains a platelet count of 4-5 times above baseline.[12] Present study has planned to determine whether the promising results obtained at 6 months were maintained over time and establish whether there were significant differences between results achieved at 3rd weeks, 6th weeks, 3 months and 6 months of follow-up.

Sánchez et al[13] showed that application of GF rich PRP was more effective than hyaluronic acid injections on pain management. Previous studies such as by Kon E et al,[14] Say F et al,[15] Spakova T et al[16] shows that prp injections are effective in reducing pain in osteoarthritic knee joint. Wang-Saegusa et al(17) reported improved WOMAC, VAS, Lequesne Index, and Short Form-36 values at the six months follow-up in 261 patients with unilateral or bilateral knee OA. Chang et al[18] reported that PRP applications were more effective as compared to hyaluronic acid administration in knee OA patients. Cerza et al[19] used ACP (Autologous Conditioned Plasma) for knee OA treatment. Their results demonstrates that ACP gives better functional improvement.

Present study also observed that PRP application improved pain and clinical outcomes. WOMAC scores improved significantly in the follow up after treatment compared to before treatment. These results were meaningful with regard to the symptomatic and functional recovery in six months after PRP application.

Each Parameter of the WOMAC Score was compared with baseline score at each follow-up. Improvement in the mean pain, mean physical function and mean total womac scores from base line scores were observed during the course of 1st &2nd follow-ups then after marginal increase in scores were reported during 3rd and 4thfollow ups but difference in mean of all scores were significant with the respective base line scores.

As for stiffness a steady reduction was reported by patients on each subsequent follow-up.

Conclusion

The results of our study showed that intra-articular knee injections of Autologous Platelet Rich Plasma (PRP) are effective in reducing joint pain, stiffness and improve knee functions in early knee Osteoarthritis. But the marginal increment of the WOMAC parameters at 3rd and 4th follow ups as compared with 1st and 2nd follow ups indicates that the PRP injections in knee osteoarthritis have short term efficacy and the beneficial effects tends to reduce over time.

Limitations

1. Small sample size
2. Single centric study
3. Study duration was short.
4. The lack of a placebo or control group.

References

1. Hochberg MC, Altman RD, Brandt KD, et al. (1995) Guidelines for the medical management of osteoarthritis. Part II. Osteoarthritis of the knee: American College of Rheumatology. Arthritis Rheum 38(11):1541–1546.
2. Sampson S, Gerhardt M, Mandelbaum B. Platelet rich plasma injection grafts for musculoskeletal injuries: a review. Ethics in Science and Environmental Politics. 2008;1(3):165–174.
3. Tate K, Crane D. Platelet rich plasma grafts in musculoskeletal medicine. Journal of Prolotherapy. 2010;2(2):371–376.
4. Raeissadat S, Rayegani S, Babaee M et al (2013)The Effect of Platelet-Rich Plasma on Pain, Function, and Quality of Life of Patients with Knee Osteoarthritis Pain Res Treat. 2013;2013:165967.
5. Kon E, Buda R, Filardo G, et al. Platelet-rich plasma: intra-articular knee injections produced favorable results on degenerative cartilage lesions. Knee Surgery, Sports Traumatology, Arthroscopy. 2010;18(4):472–479.
6. Filardo G, Kon E, Buda R, et al. Platelet-rich plasma intra-articular knee injections for the treatment of degenerative cartilage lesions and osteoarthritis. Knee Surgery, Sports Traumatology, Arthroscopy. 2011;19(4):528–535.
7. Sampson S, Reed M, Silvers H, Meng M, Mandelbaum B. Injection of platelet-rich plasma in patients with primary and secondary knee osteoarthritis: a pilot study. American Journal of Physical Medicine & Rehabilitation. 2010;89(12):961–969.
8. Filardo G, Kon E, Ruiz M et al (2012) Platelet-rich plasma intra-articular injections for cartilage degeneration and osteoarthritis: single- versus double-spinning approach. Knee Surg Sports Traumatol Arthrosc .2012 oct;20(10):2082-91.
9. Smyth NA, Murawski CD, Fortier LA, Cole BJ, Kennedy JG. Platelet-rich plasma in the pathologic processes of cartilage: review of basic science evidence. Arthroscopy. 2013;29(8):1399–1409.
10. Zhu Y, Yuan M, Meng HY, et al. Basic science and clinical application of platelet-rich plasma for cartilage defects and osteoarthritis: a review. Osteoarthritis Cartilage. 2013;21(11):1627–1637.
11. Nam CW, Kim K, Lee HY: The influence of exercise on an unstable surface on the physical function and muscle strength of patients with osteoarthritis of the knee. J Phys Ther Sci, 2014, 26: 1609–1612.
12. Alsousou J, Thompson M, Hulley P, Noble A, Willett K (2009) The biology of platelet-rich plasma and its application in trauma and orthopedic surgery: a review of the literature. J Bone Joint Surg Br 91:87-996.
13. Sánchez M, Anitua E, Azofra J, Aguirre JJ, AndiaI. Intra-articular injection of an autologous preparation rich in growth factors for the treatment of knee OA: A retrospective cohort study. Clin Exp Rheumatol 2008;26:910-3.
14. Kon E, Mandelbaum B, Buda R, et al. Platelet-rich plasma intraarticular injection versus hyaluronic acid visco supplementation as treatments for cartilage pathology: from early degeneration to osteoarthritis. Arthroscopy. 2011;27(11):1490-1501.
15. Say F, Gurler D, Yener K, Bulbul M, Malkoc M. Platelet-rich plasma injections more effective than hyaluronic acid in the treatment of knee osteoarthritis. Acta Chir Orthop Traumatol Cech. 2013;80(4):278-283.
16. Spakova T, Rosocha J, Lacko M, Harvanova D, Gharaibeh A. Treatment of knee joint osteoarthritis with autologous platelet-rich plasmain comparison with hyaluronic acid. Am J Phys Med Rehabil.2012;91(5):411-417.
17. Wang-Saegusa A, Cugat R, Ares O, Seijas R, CuscóX, Garcia-Balletbó M. Infiltration of plasma rich in growth factors for osteoarthritis of the knee short-term effects on function and quality of life. Arch Orthop Trauma Surg 2011;131:311-7.
18. Chang KV, Hung CY, Aliwarga F, Wang TG, Han DS, Chen WS. Comparative effectiveness of platelet-rich plasma injections for treating knee joint cartilage degenerative pathology: a systematic review and meta-analysis. Arch Phys Med Rehabil2014;95:562-75.
19. Cerza F, Carnì S, Carcangiu A, Di Vavo I, Schiavilla V, Pecora A, De Biasi G, Ciuffreda M. Comparison between hyaluronic acid and platelet-rich plasma, intra-articular infiltration in the treatment of gonarthrosis. Am J Sports Med.2012 Dec;40(12):2822-7. doi: 10.1177/0363546512461902. PubMed PMID: 23104611.