REVIEW ARTICLE

Role of Platelet-Rich Plasma in Osteoarthritis of Knee Joint among Indian Population

Salim Patel

Arthroplasty Surgeon, Kamdar Nursing Home, Mumbai, Maharashtra, India

ABSTRACT

Osteoarthritis (OA) is a widespread condition that can cause pain and reduced functional ability in approximately half of the population at some point in their lives. To alleviate symptoms and postpone surgical intervention, new non-operative treatments are being suggested to treat early stages of joint deterioration. For knee OA, platelet rich plasma (PRP) is a new treatment option knee osteoarthritis (KOA). Studies have examined the efficacy of intra-articular PRP, which may only partially treat KOA since it ignores extra-articular tissue dysfunction. A straightforward and minimally intrusive treatment option for treating knee OA in primary care is PRP therapy. Numerous growth factors included in PRP may speed up the healing of tendons. A relatively recent treatment for tendinopathies is local PRP injection. As of now, there have been no negative effects associated with PRP injections used to treat tendinopathy. The important advantages and disadvantages in the use of PRP in OA and its scope for long-term use will be discussed in this review.

Key words: Intra-articular therapy, osteoarthritis, platelet rich plasma

INTRODUCTION

The most common type of arthritis in the world is osteoarthritis (OA). The incidence and prevalence of OA have increased as the population becomes older, and it has now become a significant public health issue. Numerous medications, including nonsteroidal anti-inflammatory drugs, glucosamine, chondroitin-sulfate, hyaluronic acid, and glucocorticoids, have been suggested as non-invasive therapies for treating knee OA pain, improving function, reducing disability, and ultimately modifying severe chondral degeneration and OA, with varying degrees of success.[1]

This study's objective was to conduct a comprehensive analysis of the outcomes of platelet-rich plasma (PRP) use in treating knee OA and following TKA. The efficacy of PRP remains controversial. As most patients regain their baseline knee function within a year of receiving PRP injections, it has been hypothesized that the costs associated with producing PRP outweigh the potential long-term benefits, it might offer to patients with OA. Musculoskeletal problem management is still a developing

Grading of OA:[2]

Grade 1	No radiographic features of OA are present.
Grade 2	Doubtful joint space narrowing (JSN) and possible osteophytic lipping.
Grade 3	Definite osteophytes and possible JSN on anteroposterior weight-bearing radiograph.
Grade 4	Multiple osteophytes, definite JSN, sclerosis, and possible bony deformity
Grade 5	Large osteophytes, marked JSN, severe sclerosis, and definite bony deformity.

Access this article online

Quick Response Code:

Website: www.jbmh.in

Received on: 02-06-2022
Accepted on: 24-06-2022

Address for the correspondence:
Salim Patel, Arthroplasty Surgeon, Kamdar Nursing Home, Mumbai, Maharashtra, India.
E-mail: drsalimpatel@gmail.com

field. PRP is thought to be beneficial in the non-surgical therapy of OA by slowing the course of the condition by promoting bone regeneration. A growing body of research has shown that PRP is an effective therapy option for knee osteoarthritis (KOA) during the past few years. Numerous studies have demonstrated the effectiveness and safety of intra-articular PRP in reducing pain and enhancing function in KOA patients.[3] In clinical practice, extra-articular PRP injections on soft-tissue attachment are also frequently employed and have positive outcomes. PRP injections into isolated knee tissues have been researched; these have included patella tendon grafts and repair of the anterior cruciate ligament, with varying degrees of success. Positive outcomes have been seen in studies using animal models when PRP has been applied to the medial collateral ligament. PRP therapy for meniscus repair is still debatable.

MECHANISM OF ACTION OF PRP IN OA

Alpha granules and dense granules, two distinct granule types, are found in platelets. In platelets, alpha granules serve as storage compartments for several hemostatic proteins, dormant growth factors, cytokines, and other proteins such as adhesion proteins.[4] histamine, adenosine triphosphate, calcium, dopamine, serotonin, Adenosine diphosphate, and calcium are among the bioactive substances that are stored and released by dense granules to support platelet aggregation, tissue regulation, and regeneration. Transforming growth factor-b1 (TGF-b1), vascular endothelial growth factor, basic fibroblastic growth factor, Platelet-derived growth factor, TGF-b1, insulin-like growth factor, endothelial cell growth factor, are among the growth factors present in these granules (EGF). These growth factors are thought to promote tissue regeneration and repair in OA and after TKA. These cytokines, which are growth factors, are crucial for cell division, chemotaxis, proliferation, and angiogenesis.[5] A significant route involved in the pathogenesis of OA, which is characterized by a catabolic and inflammatory joint environment, is nuclear factor-kB activation, which is decreased by the pool of growth factors obtained from PRP, according to Sanchez *et al*. In addition, the supernatant of autologous proteins prevents human articular chondrocytes activated by interleukin 1B and tumor necrosis factor-a from producing matrix metalloproteinase.[6]

PREPARATION AND STANDARDIZATION

Beginning with a precise volume of autologous blood drawn from the patient using a syringe containing an anticoagulant, the PRP is prepared. This sample is then centrifuged to separate it into two layers: A superior layer of plasma that contains the platelet layer, which will be extracted and injected into the patient's knee in a sterile environment, and an inferior layer that contains erythrocytes. Considering the most recent European Guidelines for the use of PRP, the production of PRP for the study concentrated on the following important processes: Increasing the platelet concentration over the baseline, using anticoagulation, and including exogenous activation.[7] The PRP was activated prior to the injection by adding 10% calcium chloride. The preparation procedure utilized made it possible for the platelets per milliliter to rise above baseline blood values. There were also leukocytes.

PHOTOACTIVATED PRP IN OA

It has also been demonstrated that OA -related biological variables can be improved by photo-activating peripheral blood with low-level light irradiation. According to studies, photoactivation increases the concentration of leucocyte-derived anti-inflammatory substances (interleukin 1 receptor antagonist) while decreasing the levels of proinflammatory cytokines (interleukin 2 and 6). This activation method may, therefore, be useful in PRP preparations with higher leukocyte concentrations.[8] Only two case studies have examined coupled photo-activation and PRP (PA-PRP) in degenerative disorders to date. One patient with a chondral defect and another with knee OA reported clinical improvements.[9]

ADMINISTRATION OF PRP

Participants should be positioned in the supine position, and the area should be covered with sterile curtains. Following cleaning with a chlorhexidine and iodine solution, the participant's symptomatic knee be anaesthetized with a 5 ml intra-articular injection of 1% Xylocaine. After activation, 3 ml of PRP will be administered using an anteromedial route under ultrasound guidance (Logic I GE Healthcare). After the injection, the knee passively flexed and extended 10 times. The subject should be rested in the supine position for around 10 min. Participants were instructed to use paracetamol if they felt any pain, to avoid engaging in any weight-bearing activities for the following day, and to gradually resume their normal activities after that.[10]

CLINICAL RESPONSE IN INDIAN POPULATION

Studies have shown that PRP therapy for knee OA can be safely and effectively administered in primary care

settings. The intervention and all outcome assessments were completed by all patients. There have been no losses to be investigated. Significant improvements in pain, health utility, patient satisfaction, and goal-oriented outcomes appear to be linked to this therapy. Clinical improvements in self-reported pain and functional capacity have been seen in pilot and prospective studies examining the clinical efficacy of intra-articular injections of PRP in individuals with knee OA, with no significant side effects.[11] Our study team recently included six randomized and controlled trials comparing the efficacy of PRP to other intra-articular injections, exercise, or analgesia for at least 6 months in a related systematic review. Patients with knee OA who had PRP injections saw statistically significant improvements in their WOMAC scores up to 12 months after the procedure. The duration of the anticipated benefit of PRP injections is still unknown because the majority of other studies only look at the persistence of the desired effects up to 12 months after interventions; very few studies have a follow-up period longer than that. The long-term effects of this type of therapy have not been established. In addition, PRP preparation techniques vary widely between research, for instance, in terms of the total quantity of absolute platelets and the presence or absence of white blood cells, necessitating agreement on PRP standardization.[12]

ADVERSE EFFECTS ASSOCIATED WITH PRP

Pain and swelling following intra-articular PRP injection were two of the unfavorable events that were considerably more frequent in the leukocyte rich PRP (LR-PRP) group. Even though there was no discernible difference between LP-PRP and LR-PRP, pain was noticeably reduced following the intra-articular PRP injection. Furthermore, independent of leukocyte concentration, our meta-analysis discovered a significant increase in functional outcomes following intra-articular PRP injection. These findings suggest that intra-articular PRP injections may be used to treat knee OA. These results might also aid clinicians in choosing a particular PRP type for knee OA.[13-15]

CONCLUSION

A straightforward, inexpensive, and minimally invasive treatment option for treating degenerative lesions of the knee's articular cartilage is PRP therapy, which can be administered in primary care settings. In terms of pain, health utility, patient happiness, and goal-oriented outcomes, this therapy looks to be relatively safe and may even have positive consequences. Additional research is required, in particular well-designed randomized and controlled trials, to define best practices, identify the mechanism of action, quantify results, and determine the longevity of an effect.

REFERENCES

1. Wu PI, Diaz R, Borg-Stein J. Platelet-rich plasma. Phys Med Rehabil Clin N Am 2016;27:825-53.
2. Bennell KL, Paterson KL, Metcalf BR, Duong V, Eyles J, Kasza J, *et al*. Effect of intra-articular platelet-rich plasma vs placebo injection on pain and medial tibial cartilage volume in patients with knee osteoarthritis: The RESTORE randomized clinical trial. JAMA 2021;326:2021-30.
3. Tang JZ, Nie MJ, Zhao JZ, Zhang GC, Zhang Q, Wang B. Platelet-rich plasma versus hyaluronic acid in the treatment of knee osteoarthritis: A meta-analysis. J Orthop Surg Res 2020;15:403.
4. Everts P, Onishi K, Jayaram P, Lana JF, Mautner K. Platelet-rich plasma: New performance understandings and therapeutic considerations in 2020. Int J Mol Sci 2020;21:7794.
5. Southworth TM, Naveen NB, Tauro TM, Leong NL, Cole BJ. The use of platelet-rich plasma in symptomatic knee osteoarthritis. J Knee Surg 2019;32:37-45.
6. Bennell KL, Hunter DJ, Paterson KL. Platelet-rich plasma for the management of hip and knee osteoarthritis. Curr Rheumatol Rep 2017;19:24.
7. Szwedowski D, Szczepanek J, Paczesny Ł, Zabrzyński J, Gagat M, Mobasheri A, *et al*. The effect of platelet-rich plasma on the intra-articular microenvironment in knee osteoarthritis. Int J Mol Sci 2021;22:5492.
8. Irmak G, Gümüşderelioğlu M. Photo-activated platelet-rich plasma (PRP)-based patient-specific bio-ink for cartilage tissue engineering. Biomed Mater 2020;15:065010.
9. Irmak G, Gümüşderelioğlu M. Patients- and tissue-specific bio-inks with photoactivated PRP and methacrylated gelatin for the fabrication of osteochondral constructs. Mater Sci Eng C Mater Biol Appl 2021;125:112092.
10. Martínez-Martínez A, Ruiz-Santiago F, García-Espinosa J. Platelet-rich plasma: Myth or reality? Radiologia (Engl Ed) 2018;60:465-75.
11. Chen Z, Wang C, You D, Zhao S, Zhu Z, Xu M. Platelet-rich plasma versus hyaluronic acid in the treatment of knee osteoarthritis: A meta-analysis. Medicine (Baltimore) 2020;99:e19388.
12. Belk JW, Kraeutler MJ, Houck DA, Goodrich JA, Dragoo JL, McCarty EC. Platelet-rich plasma versus hyaluronic acid for knee osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. Am J Sports Med 2021;49:249-60.
13. Meheux CJ, McCulloch PC, Lintner DM, Varner KE, Harris JD. Efficacy of intra-articular platelet-rich plasma injections in knee osteoarthritis: A systematic review. Arthroscopy 2016;32:495-505.
14. Mlynarek RA, Kuhn AW, Bedi A. Platelet-rich plasma (PRP) in orthopedic sports medicine. Am J Orthop (Belle Mead NJ)

2016;45:290-326.
15. Derwich M, Mitus-Kenig M, Pawlowska E. Mechanisms of action and efficacy of hyaluronic acid, corticosteroids and platelet-rich plasma in the treatment of temporomandibular joint osteoarthritis-a systematic review. Int J Mol Sci 2021;22:7405.

How to cite this article: Patel S. Role of Platelet-rich Plasma in Osteoarthritis of Knee Joint among Indian Population. J Bones Muscles Health 2022;1(1):33-36.

Conflicts of Interest: None. **Source of support:** None.