

Research Paper

Role of Platelet-Rich Plasma in Treating Osteoarthritis

¹Uzma Naseeb, ²Syed Hafeez ul Hassan, ³Rubina Ghani ⁴Soobia Saeed, ⁵Zeelaf Shahid

^{1&3}Department of Biochemistry, ²Department of Physiology, ⁴Department of Stem Cell

⁵Department of Medical Education, ¹Jinnah Sindh Medical University, ^{3&5}Jinnah Medical and Dental College/Sohail University, ²Liaquat National Hospital and Medical College, ^{3&4}Musavvir Stem Clinic/ Pathological and Molecular Laboratories

*Corresponding author's email: ghanimusavvir35@yahoo.com

ARTICLE INFO

Article history:

Received: 26-11-2024

Revised: 13-04-2026

Accepted: 22-04-2026

Available online: 17-10-2026

Keywords:

Osteoarthritis,
Platelet-rich plasma
(PRP), Uric Acid,
Vitamin D, Diabetes
Mellitus, C-Reactive
Protein (CRP),
Kellgren-Lawrence
scale

Abstract

Osteoarthritis (OA) is a degenerative condition that causes inflammation, cartilage breakdown, and finally cartilage loss in the joints. In Osteoarthritis joint architecture gradually deteriorates, usually affecting the knee and/or hip joints. The purpose of this study is to evaluate the effect of the PRP in the treatment of knee joint cartilage injuries and degenerative meniscus lesions as well as pain relief. The clinical trial (n=50) randomly selected for the knee joint treatment with PRP came to Musavvir Stem Cell Clinic. During the study the patient revealed the history of pain and stiffness, could not stand to more than 5-10 minutes, and could not bear the pain. All the patients went through the baseline investigation before treatment. All the rheumatoid arthritis cases were excluded. Kellgren-Lawrence scale was used to select the patients for the treatment of PRP. The PRP procedure was performed on 50 patients. There were 60% females and 40% male patients in our study. After application, vast differences were noted, and hematological, biochemical, and inflammatory markers and x-rays with Kellgren-Lawrence scale grades were changed. The treatment periods were between three 3 to 6 months. After the application of PRP, significant changes were observed in different laboratory investigations and radiological results. Thus, the study shows that PRP therapy is effective in the treatment of knee joint cartilage injuries as well as pain relief.

Introduction

In mid- 20th century the osteoarthritis (OA) has been doubled and expected with higher incidence in future (Bricca et al., 2019). OA is a progressive degenerative joint disease that causes some type of failure in the joint, which is associated with varying degrees of limitation in different functional ambits as well as a relatively diminished quality of life. It is during the knee joint that the effects of OA are more pronounced than in any other joint (Dai et al., 2017). It is reported that OA is dramatically characterized by a range of risk factors, including genetic defects, aging, obesity, and low-grade systemic inflammation (Ren et al., 2020). This distinct disease is most often characterized by degenerative arthritis and inflammation, usually leading to impaired joint function and pathology. It describes degeneration of cartilage and its underlying bone along with bony overgrowth of the joint. In this manner, disease onset is usually gradual, beginning after the age of 40 (Duymus et al., 2017). This includes the joint destruction, which, in turn, occurs as a combination of cellular changes along with biomechanical stresses on joints that create numerous secondary changes within these joints (Glynn et al., 2018). With advances in various studies focused on certain biochemical pathways evolved therapeutically by biological intervention, platelet-rich plasma (PRP) treatment, a form of regenerative medicine, has continued to become an increasingly popular form of providing that biological boost just to the healing continuum.

Media attention focusing on PRP treatments and their use in numerous athletes is quite a striking prototype. Gentile et al. in 2017 presented the competitive effects of nonactivated versus calcium-activated PRP in the management of hair loss, both exhibiting equally satisfying hair density results despite the earlier amounts of the activated PRP six growth factors (CAPDGBB, TGF- β 1, and VEGF); it opened the avenue for injection of PRP through a medical injector gun where one can specifically manage both the delivery dosage and shining depth (Palazzo et al., 2016; Nelson et al., 2014).

Current medication strategies for OA predominantly target pain alleviation and symptom control, not disease modification. Furthermore, increased inflammatory cytokines, such as IL-1B and TNF-alpha, and several known risk factors form the basis by which similar inflammatory cytokines were implicated in OA pathophysiology. Treatments for OA, however, are largely unsatisfactory. Whether it be acetaminophen, aspirin, or non-steroidal anti-inflammatory drugs (NSAIDs), they are the mainstay of pharmacologic management. These include duloxetine, topical NSAIDs, and intra-articular corticosteroid injections for pain relief, given the side effects associated with prolonged use (Gentile et al., 2018; Gentile et al., 2017; Conaghan et al., 2008). PRP is used first in the open-heart surgery (McAlindon et al., 2014; Arden et al., 2021). It seems almost most of the studies on the subject are carried out in areas such as orthopedics, sports medicine, and odontology.

Platelets (PLTs) are multifunctional active cells that are now looked upon as a great reservoir of growth factors such as Vascular endothelial growth factors (VEGF) (Metcalf et al., 2013), Epidermal growth factor (EGF) (Andia & Abate, 2013); fibroblast growth factor (FGF) (Paus, 2008); and Transforming growth factor beta (TGF- β). (Du, 1993). Platelet-derived growth factor (PDGF) (Shi et al., 2013), hepatocyte growth factor (HGF) (Lin et al., 2015), and insulin-like growth factor-1 (IGF-1) (Takikawa et al., 2011; Anitua et al., 2011).

PRP has been reported to provide symptomatic relief in OA of the knee and works effectively better than intraarticular hyaluronic acid and steroid injections to control pain and symptoms. This therapy involves minimally invasive intervention through which tissue regeneration can be improved. PRP contains alpha granules where ~70% of the released growth factors are secreted in the first 10 min, and then almost all the amount stored is then released after 1 hour (Li et al., 2012; Eppley et al., 2006).

This was the rationale for applying PRP in the treatment of knee joints. It has been hypothesized that PRP will confer some degree of synergism to reactivation of cartilage regeneration. Thus, finding out the effects of PRP on articular cartilage under inflammation in knee clinical trials became imminent.

Material and Methods

The prospective study for the 6 months involving 50 patients whose age was between 40 and 70 years. Female/Male 60:40 treated at *Musavvir Stem Cell Clinic* with Knee OA in July 2019 to January 2021 and were followed up for a period of 10 -12 months.

All those patients were selected having a history of low back pain, being difficult to walk, and being unable to stand for more than 5 to 10 minutes. The patient also revealed that they were unable to sleep without a painkiller, and body stiffness occurred usually in the morning, and this episode was more than a year. All the patients underwent a clinical examination, including an X-ray of the knee by using the Kellgren-Lawrence scale. All the baseline investigations, including biochemical and hematological parameters, were carried out before starting the treatment. The entire procedure was explained to the patients, and written consent was taken by all participants. There was no pressure on participants to be a part of this research. The identity of the participants was not disclosed due to the Privacy Act. The PRP was prepared by taking 30 cc of blood, and it was distributed accordingly in an EDTA tube for a complete blood count, ESR, fluoride for fasting/random blood sugar, and serum to check the baseline parameters. The remaining sample was added into PRP kit for the preparation of PRP.

The selection criteria included patients with negative Rheumatoid Arthritis factor with high uric acid and pain in knee joints and lower back pain. The patients presented with immunodeficiency and collagen vascular diseases, malignant diseases, infection or active sores in the knee region, recent heavy trauma to knees, autoimmune disease and blood disorders, were excluded from this study.

The PRP kit centrifuged for 15 minutes at 1600 rpm. The three layers were observed, which were the red cell layer, the white buffy coat layer, and the upper plasma layer. Both the white cell and plasma layer were separated together and then centrifuged for 7 minutes at 2800 rpm to concentrate platelets. The final product was 3-4 mL of PRP containing leukocytes. The platelets were activated with Adi light2 for 20 minutes for pain management and activation of platelets (opening of growth factor and cytokines).

Results

The prospective 50 patients were selected in these clinical trials who were suffering from knee joint pains, and both genders were selected with consent forms. Before starting the

treatment, all the baseline investigations were carried out. All those parameters that were elevated before starting the treatment were repeated before the 4th procedure. It was noted that the systolic BP and diastolic BP with urea, creatinine, uric acid, and HbA1c were elevated before treatment, with increased inflammatory markers CRP and ESR and low calcium and vitamin D. After PRP treatment, HbA1c and uric acid were reduced with normal CRP, ESR, calcium, and vitamin D, as shown in Table 1.

Table 1: Descriptive Baseline analysis of clinical, hematological and biochemical analysis in the patients treated with Platelet rich plasma, N = 50 before and after treatment.

	Before Treatment Mean $\pm$ SD, [95% CI]	After Treatment Mean $\pm$ SD [95% CI]	<i>p</i> value
Age, years	51.18 $\pm$ 9.17, [48.57, 53.78]	51.18 $\pm$ 9.17, [48.57, 53.78]	1.000
Systolic BP, mmHg	128.56 $\pm$ 16.06, [123.99, 133.12]	124.24 $\pm$ 10.59, [121.22, 127.25]	.035
Diastolic BP, mmHg	80.54 $\pm$ 10.43, [77.57, 83.50]	77.96 $\pm$ 10.59, [75.88, 80.03]	.022
ESR, mm in 1 st hr	63.40 $\pm$ 12.95, [59.71, 67.08]	20.90 $\pm$ 5.94, [19.20, 22.59]	.000
FBS, mg/dL	95.88 $\pm$ 23.67, [89.15, 102.60]	93.00 $\pm$ 16.47, [88.31, 97.68]	.253
Urea, mg/dL	30.96 $\pm$ 9.29, [28.31, 33.60]	29.76 $\pm$ 7.30, [27.68, 31.83]	.262
Creatinine, mg/dL	0.97 $\pm$ 0.47, [0.83, 1.10]	0.92 $\pm$ 0.37, [0.82, 1.03]	.339
Uric acid, mg/dL	4.92 $\pm$ 2.03, [4.34, 5.50]	4.62 $\pm$ 1.24, [4.27, 4.98]	.117
Calcium, mg/dL	8.14 $\pm$ 0.65, [7.96, 8.33]	8.80 $\pm$ 0.22, [8.73, 8.86]	.000
Vitamin D, ng/mL	17.46 $\pm$ 12.02, [14.04, 20.88]	25.36 $\pm$ 6.64, [23.47, 27.25]	.000
RA factor IU/mL	8.83 $\pm$ 3.31, [7.89, 9.77]	8.83 $\pm$ 3.31, [7.89, 9.77]	1.000
CRP, mg/dL	18.49 $\pm$ 6.15, [16.74, 20.24]	3.37 $\pm$ 1.15, [3.04, 3.70]	.000
HbA1c, %	5.03 $\pm$ 1.98, [4.46, 5.59]	4.75 $\pm$ 1.19, [4.41, 5.09]	.068

Abbreviations: BP, blood pressure; ESR, erythrocyte sedimentation rate; FBS, fasting blood sugar; U.A, Uric Acid; CRP, C-reactive protein; Hb A1c, glycolate hemoglobin; CI, confidence interval; SD, standard deviation

The knee X-ray of all patients was considered before. During the clinical trials with knee joint x-rays were graded according to the Kellgren-Lawrence scale.

After selection of patients and grading with Kellgren-Lawrence scale with X-ray, treatment was started with PRP injection. The four treatments were carried out and before injecting PRP the baseline study was carried out to see the changes in blood parameters. The PRP pre-injection was applied to the patients in knee, thigh, ankle, back and shoulders joints. The second procedure was carried out after 30 days and the same protocol was followed.

After the second 2nd treatment, the patient was asked for X-ray before coming for third treatment. The radiographic progress was noted before starting the treatment and assessed during the treatment as shown in Figure 1.

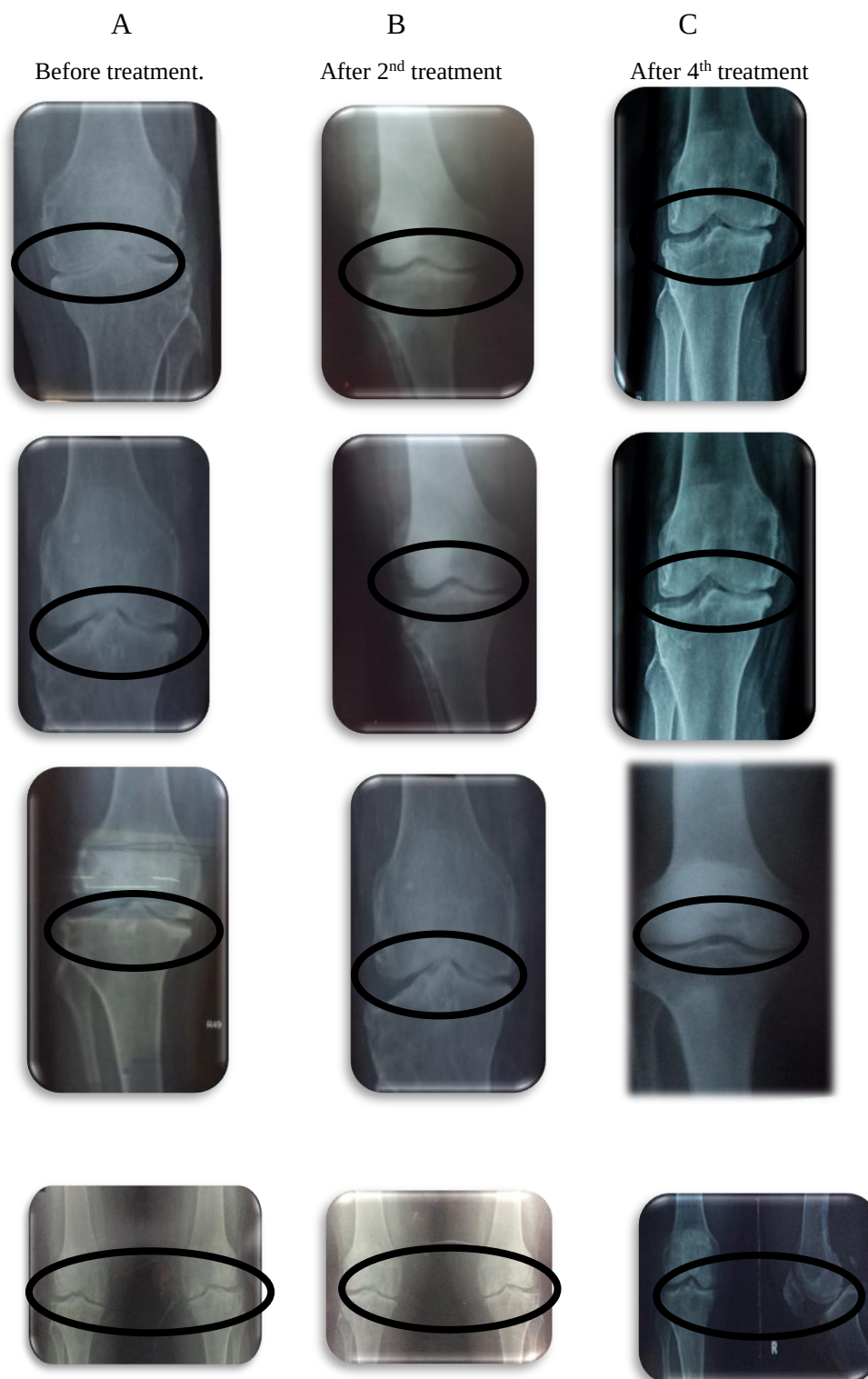


Figure 2: The figure showing X-rays before starting treatment, after 2nd and 4th treatment

During this clinical study, some patients were diabetic with elevated HbA1c. On revealing history, it was noted that blood sugar level was out of control despite medication and/or use of insulin. During the course of treatment, it was observed that after treating these patients with PRP for knee joints, there was a change in the baseline parameters with changes in HbA1c, and sugar was in control.

Discussion

Osteoarthritis (OA) is the most common degenerative joint disease, which affects primarily mobility and ultimately quality of life among the older generation. There are countless forms of ailments that affect the body during its wear and tear, but osteoarthritis (OA) has remained one of the longest chronic degenerative joint diseases, becoming its foremost challenge. Instead of assuming knee-replacement surgery to be a possible answer, innovations in regenerative medicine over the last decade have made it possible for younger, middle-aged, and older patients alike to attempt effective nonsurgical interventions. Platelet-rich plasma (PRP) in particular is gaining much momentum as a biological therapy that stands a chance to enhance quality of life for OA patients in significant ways. In recent years, use of PRP in osteoarthritis has gained momentum, with promising results to be seen in both preclinical and clinical trials. This clinical study showed that PRP injection brought about some good outcomes for osteoarthritis patients with cost-effectiveness. PRP application to osteoarthritis has developed rapidly in recent years, presenting promising results for both preclinical and clinical trials.

PRP is well known to have an angiogenic, anti-inflammatory, and anti-catabolic drive. The anabolic effect of the transforming growth factor beta, as well as fibroblast growth factor in PRP, has been reported on cartilage metabolism (Marx et al., 1998)²³.

In our study, we also observed that all patients felt better with decreasing pain intensity. Twenty percent of patients were unable to climb stairs before treatment and were able to do so after 4 months. Currently, all patients can move freely and perform their normal daily functions. Most critically, none of the patients experienced any side effects or complications from treatment, such as microbial infection or tumor formation at the joint.

PRP contains growth factors such as platelet-derived growth factor and transforming growth factor beta. These factors regulate cell migration and proliferation, and they also enhance wound healing and ECM remodeling through the stimulation of angiogenesis (Khafagy et al., 2018; El- Sharkawy et al., 2007).

Injury and the offering of degenerative cartilages or joints have been comprehensively researched. Cole et al. in 2017 compared the clinical parameters of the administration of HA versus platelet-rich plasma and noted their biological impacts. However, this study used radiographic imaging to determine degenerative changes (Kellgren-Lawrence Score) with selection criteria of treatment of PRP in the 1 to 3 grades in clinical parameters since these had the potential for biological effects (Du et al., 1993). Rahimzadeh et al. (2018) reported beneficial effects of joint function and pain relief of PRP injections in osteoarthritis involving knee joints (Lin et al., 2015). Current therapies are limited, and in cases of advanced disease, complete joint replacement is indicated, a procedure accompanied by significant morbidity, morbidity that can escalate to such extreme as to be life-threatening but invariably involves infections, thromboembolisms, myocardial infarction, stroke, as well as death.

This study confirmed that PRP injection provided some benefits, relieving pain and improving quality of life in patients with osteoarthritis. This set of patients was different from other study proposals. There are numerous approaches via which PRP is delivered; these

include the cells' intra-articular injection. This clinical trial involved the application of PRP for treatment of patients of grade 2–4 degenerative osteoarthritis with no effect on systemic health noted. The largest proportion of these patients showed a gradual but definite improvement within 3-12 months after treatment. The author concluded PRP treatment is a novel and promising treatment option for patients with osteoarthritis. In our study, the knee X-rays were graded, and the raised inflammatory markers were brought down to normal in the absence of pain. This study showed that these injections produce no side effects since they use the autologous type and therefore do not need any pain-killing medicine. Anti-inflammatory and pain-reducing effects are also due to the growth factor components in PRP. In this study, it was observed that PRP treatment resulted in improved outcomes such as relief of pain and improvement of quality of life in osteoarthritis patients without any side effects. Management of PRP can be related to the applied field in medicine, and it will go on increasing and expanding as the increasing options and understanding are gained on PRP therapy. Nevertheless, the substantial burden OA would cause in such populations underscores the necessity for identifying the best strategy for treating them, which means allowing strategies facing clinical realities based firmly on the existence of rigorous clinical practice guidelines.

Conclusion

With the high prevalence of OA in most populations, it is of utmost importance to develop the best possible treatment regime. Patients suffering from this condition have also benefitted from regenerative medicine and cell-based therapies. In knee OA, intra-articular PRP has the ability to decrease pain and enhance functional efficiency. The factors of therapeutic efficiency from PRP therapy range greatly. in the usage of injuries of the cartilage of the knee joint and degenerative lesions of the meniscus along with easing the pain. PRP injection is an easy, inexpensive, safe, and effective technique with good repeatability that greatly enhances the life quality of any patient with osteoarthritis of the knee who scores mild to moderate on the visual analog scale. More such treatments, including new stem cell-based and existing ones for OA, require further observation of the patients.

References

- Bricca, A., Juhl, C. B., Steultjens, M., Wirth, W., & Roos, E. M. (2019). Impact of exercise on articular cartilage in people at risk of, or with established, knee osteoarthritis: A systematic review of randomized controlled trials. *British Journal of Sports Medicine*, 53(15), 940–947.
- Cole, B. J., Karas, V., Hussey, K., Pilz, K., & Fortier, L. A. (2017). Hyaluronic acid versus platelet-rich plasma: A prospective, double-blind randomized controlled trial comparing clinical outcomes and effects on intra-articular biology for the treatment of knee osteoarthritis. *American Journal of Sports Medicine*, 45(2), 339–346.
- Conaghan, P. G., Dickson, J., & Grant, R. L. (2008). Care and management of osteoarthritis in adults: Summary of NICE guidance. *BMJ*, 336(7642), 502–503.
- Dai, W.-L., Zhou, A.-G., Zhang, H., & Zhang, J. (2017). Efficacy of platelet-rich plasma in the treatment of knee osteoarthritis: A meta-analysis of randomized controlled trials. *Arthroscopy*, 33(3), 659–670.e1.

- Du Cros, D. L. (1993). Fibroblast growth factor and epidermal growth factor in hair development. *Journal of Investigative Dermatology*, 101(1 Suppl), 106S–113S.
- Duymus, T. M., Mutlu, S., Dernek, B., Komur, B., Aydogmus, S., & Kesiktaş, F. N. (2017). Choice of intra-articular injection in treatment of knee osteoarthritis: Platelet-rich plasma, hyaluronic acid or ozone options. *Knee Surgery, Sports Traumatology, Arthroscopy*, 25(2), 485–492.
- El-Sharkawy, H., Kantarci, A., Deady, J., Hasturk, H., Liu, H., Alshahat, M., et al. (2007). Platelet-rich plasma: Growth factors and pro- and anti-inflammatory properties. *Journal of Periodontology*, 78(4), 661–669.
- Eppley, B. L., Pietrzak, W. S., & Blanton, M. (2006). Platelet-rich plasma: A review of biology and applications in plastic surgery. *Plastic and Reconstructive Surgery*, 118(6), 147e–159e.
- Gentile, P., Cole, J. P., Cole, M. A., Garcovich, S., Bielli, A., Scioli, M. G., et al. (2017). Evaluation of not-activated and activated PRP in hair loss treatment: Role of growth factor and cytokine concentrations obtained by different collection systems. *International Journal of Molecular Sciences*, 18(2).
- Gentile, P., Garcovich, S., Scioli, M. G., Bielli, A., Orlandi, A., & Cervelli, V. (2018). Mechanical and controlled PRP injections in patients affected by androgenetic alopecia. *Journal of Visualized Experiments*, 131.
- Glynn, L. G., Mustafa, A., Casey, M., Krawczyk, J., Blom, J., Galvin, R., Hannigan, A., Dunne, C. P., Murphy, A. W., & Mallen, C. (2018). Platelet-rich plasma (PRP) therapy for knee arthritis: A feasibility study in primary care. *BMC*, 4, 93. <https://doi.org/10.1186/s40814-018-0288-2>
- Khafagy, Y. W., Abd Elfattah, A. M., Moneir, W., & Salem, E. H. (2018). Leukocyte- and platelet-rich fibrin: A new graft material in endoscopic repair of spontaneous CSF leaks. *European Archives of Oto-Rhino-Laryngology*, 275(9), 2245–2252.
- Li, Z. J., Choi, H. I., Choi, D. K., Sohn, K. C., Im, M., Seo, Y. J., Lee, Y. H., et al. (2012). Autologous platelet-rich plasma: A potential therapeutic tool for promoting hair growth. *Dermatologic Surgery*, 38(7), 1040–1046.
- Lin, W. H., Xiang, L. J., Shi, H. X., Zhang, J., Jiang, L. P., Cai, P. T., et al. (2015). Fibroblast growth factors stimulate hair growth through β -catenin and Shh expression in C57BL/6 mice. *BioMed Research International*, 2015, 73017.
- Marx, R. E., Carlson, E. R., Eichstaedt, R. M., et al. (1998). Platelet-rich plasma: Growth factor enhancement for bone grafts. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontology*, 85(6), 638–646.
- McAlindon, T. E., Bannuru, R. R., Sullivan, M. C., Arden, N. K., Berenbaum, F., Bierma-Zeinstra, S. M., et al. (2014). OARSI guidelines for the non-surgical management of knee osteoarthritis. *Osteoarthritis and Cartilage*, 22(3), 363–388.

- Metcalf, K. B., Mandelbaum, B. R., & McIlwraith, C. W. (2013). Application of platelet-rich plasma to disorders of the knee joint. *Cartilage*, 4(4), 295–312.
- Nelson, A. E., Allen, K. D., Golightly, Y. M., Goode, A. P., & Jordan, J. M. (2014). A systematic review of recommendations and guidelines for the management of osteoarthritis. *Seminars in Arthritis and Rheumatism*, 43(6), 701–712.
- Palazzo, C., Nguyen, C., Lefevre-Colau, M. M., et al. (2016). Risk factors and burden of osteoarthritis. *Annals of Physical and Rehabilitation Medicine*, 59(3), 134–138.
- Paus, R. (2008). Do we need hair follicle stem cells and hair follicle neogenesis to cure common hair loss disorders? *Hair Transplant Forum International*, 18, 89–90.
- Rahimzadeh, P., Imani, F., Faiz, S. H., Entezary, S. R., Zamanabadi, M. N., & Alebouyeh, M. R. (2018). The effects of injecting intra-articular platelet-rich plasma or prolotherapy on pain score and function in knee osteoarthritis. *Clinical Interventions in Aging*, 13, 73–79.
- Ren, H., Zhang, S., Wang, X., Li, Z., & Guo, W. (2020). Role of platelet-rich plasma in the treatment of osteoarthritis: A meta-analysis. *Journal of International Medical Research*, 48(10), 1–10.
- Shi, H. X., Lin, C., Lin, B. B., Wang, Z. G., Zhang, H. Y., Wu, F. Z., et al. (2013). The anti-scar effects of basic fibroblast growth factor on wound repair in vitro and in vivo. *PLoS ONE*, 8(4), e59966.
- Subash, Y., Kamalakumar, K., & Lydia, M. (2018). The role of platelet-rich plasma injection in the management of early osteoarthritis of the knee. *International Journal of Research in Orthopaedics*, 4(1), 128–132.
- Takikawa, M., Nakamura, S., Nakamura, S., Ishihara, M., Kishimoto, S., & Sasaki, K. (2011). Enhanced effect of platelet-rich plasma containing a new carrier on hair growth. *Dermatologic Surgery*, 37(12), 1721–1729.