e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2025; 17(11); 1539-1543

Original Research Article

Assessing the Safety and Efficacy of Platelet-Rich Plasma for Diabetic Foot Ulcer Management

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Received: 01-09-2025 / Revised: 15-10-2025 / Accepted: 21-11-2025

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Conflict of interest: Nil

Abstract

Background: Diabetic foot ulcers are a common and severe complication of diabetes mellitus, often resulting in delayed healing and increased risk of amputation. Platelet-rich plasma has emerged as a promising biological therapy to enhance wound healing through growth factor-mediated tissue regeneration.

Objectives: To evaluate the safety and efficacy of platelet-rich plasma in the management of diabetic foot ulcers.

Material and Methods: A prospective comparative study was conducted on 60 patients with diabetic foot ulcers, divided into PRP-treated and control groups. Wound contraction, percentage reduction in ulcer area, and duration of wound healing were assessed and statistically analyzed.

Results: The PRP group demonstrated significantly greater wound contraction, higher percentage reduction in ulcer area, and shorter healing duration compared to the control group, with no significant adverse effects observed.

Conclusion: Platelet-rich plasma is a safe and effective adjunctive therapy for enhancing wound healing in diabetic foot ulcers.

Keywords: Diabetic Foot Ulcer; Platelet-Rich Plasma; Wound Healing; Growth Factors.

Introduction

Diabetic foot ulcers (DFUs) remain one of the most challenging and debilitating complications of diabetes mellitus, affecting approximately 15% of diabetic patients worldwide and leading to significant morbidity, risk of infection, prolonged hospitalization, and high healthcare costs. Chronic hyperglycemia and peripheral neuropathy contribute to impaired wound healing by altering inflammatory responses, reducing angiogenesis, and impairing tissue regeneration, resulting in persistent ulcers that are difficult to manage with conventional therapies alone [1].

Conventional management strategies for DFUs, including off-loading, frequent wound debridement, infection control, and optimized glycemic control, often yield suboptimal healing outcomes with high recurrence rates. In many cases, even with standard wound care, complete epithelialization may be delayed, increasing the risk of secondary complications such as osteomyelitis or lower limb amputation [2]. These limitations have driven researchers and clinicians to explore adjunctive biological therapies that can accelerate healing and improve tissue repair. Platelet-rich plasma (PRP), an autologous concentration of platelets above baseline levels, contains an array of growth factors and cytokines such as platelet-derived growth factor (PDGF), transforming growth factor-β (TGF-β), vascular endothelial growth factor (VEGF), and epidermal growth factor (EGF). These bioactive molecules play a pivotal role in modulating inflammation, enhancing neovascularization, stimulating fibroblast proliferation, and promoting extracellular matrix formation essential for wound healing [3]. The fundamental rationale for PRP use in DFUs is to deliver a concentrated burst of these growth factors directly to the wound bed to augment the body's natural reparative processes.

Recent systematic reviews and meta-analyses suggest that the adjunctive use of PRP significantly improves DFU healing outcomes compared to conventional treatment alone. Peng et al. reported that PRP enhances wound healing rates and

shortens healing time in patients with DFUs, demonstrating clinically meaningful benefits across controlled clinical studies [4]. Similarly, OuYang and colleagues' meta-analysis found that PRP improved complete healing rates and reduced time to closure when compared with standard care protocols [5]. These enhanced healing effects are attributed to PRP-mediated stimulation of key biological pathways involved in tissue repair and regeneration.

Importantly, clinical randomized controlled trials have supported the effectiveness of PRP. Elsaid et al. demonstrated that PRP gel as a dressing leads to significantly greater ulcer dimension reduction and faster healing dynamics than saline dressings in chronic DFUs [6]. Alamdari et al. conducted a randomized clinical trial showing a significant increase in the healing rate of clean DFUs treated with PRP compared with conventional dressings, indicating that PRP accelerates closure regardless of patient demographics [7]. Other controlled studies reaffirmed that PRP application, whether as topical gel or local injection, improves wound healing without increasing adverse events, underscoring both safety and efficacy profiles [8,9].

In addition to its regenerative properties, PRP has been found to possess antimicrobial and anti-inflammatory effects that may decrease secondary wound infections and modulate the chronic inflammatory microenvironment often seen in DFUs [10]. These multifaceted therapeutic benefits make PRP a promising adjunctive strategy in the comprehensive management of chronic diabetic foot ulcers.

Despite encouraging results, heterogeneity in PRP preparation techniques, application protocols, and patient populations across studies highlights the need for standardized approaches and larger multicenter trials. Continued research is essential to refine PRP protocols, optimize dosing regimens, and confirm long-term safety and efficacy in diverse clinical settings.

Material and Methods

This prospective interventional study was conducted in patients presenting with diabetic foot ulcers attending the outpatient and inpatient departments of a tertiary care teaching hospital. The study duration extended over a defined period after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants prior to enrollment, and the study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. A total of 60 patients diagnosed with type 2 diabetes mellitus and having chronic diabetic foot ulcers were included in the study. Patients aged 18 years and above with Wagner grade I or II diabetic foot ulcers of at least four weeks' duration were selected. Patients with active infection, osteomyelitis, malignancy, peripheral vascular disease with critical limb ischemia, bleeding disorders, platelet dysfunction, severe anemia, immunocompromised states, or those on anticoagulant therapy were excluded from the study to avoid confounding factors affecting wound healing.

Baseline demographic and clinical data including age, sex, duration of diabetes, ulcer duration, ulcer size, and glycemic status were recorded at the time of enrollment. All ulcers were thoroughly assessed clinically, and wound dimensions were measured using standardized methods by calculating the ulcer surface area in square centimeters. Routine investigations including complete blood count, fasting blood glucose, postprandial blood glucose, and HbA1c were performed for all patients.

Autologous platelet-rich plasma was prepared under aseptic conditions using the standard double-spin centrifugation technique. Approximately 10–20 mL of venous blood was collected from each patient into anticoagulant-containing tubes and centrifuged to separate platelet-rich plasma from red blood cells and platelet-poor plasma. The PRP thus obtained was activated prior to application to release growth factors.

Before PRP application, all ulcers underwent thorough wound debridement to remove necrotic tissue and were cleaned with normal saline. Platelet-rich plasma was then applied evenly over the ulcer surface, either as a topical application or infiltration into the wound margins depending on ulcer characteristics. A sterile non-adhesive dressing was applied following PRP application. The procedure was repeated at regular intervals as per protocol until satisfactory wound healing was achieved or the study period was completed. Standard diabetic foot care including off-loading, infection control, and optimization of glycemic status was continued for all patients throughout the study period.

Patients were followed up at regular intervals to assess wound healing progress. Ulcer size reduction, granulation tissue formation, epithelialization, and time to complete healing were documented at each follow-up visit. Any adverse events related to PRP application were carefully monitored and recorded to evaluate the safety profile of the procedure.

The primary outcome measure was the reduction in ulcer size and rate of wound healing following PRP application. Secondary outcomes included time to complete ulcer healing and occurrence of any treatment-related complications. Data obtained were entered into a master chart and analyzed using

appropriate statistical methods. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were expressed as frequencies and percentages. A p-value of less than 0.05 was considered statistically significant.

Results

Table 1 shows the demographic and clinical characteristics of the study participants. A total of 60 patients were included, with 30 patients each in the case and control groups. The majority of patients in both groups belonged to the 51–60 years age group. Male patients were more commonly affected in both groups.

Traumatic onset of ulcers was more frequent than spontaneous onset. Plantar surface involvement was observed more commonly than dorsal involvement. Most patients in both groups were on insulin therapy for diabetes management. There was no statistically significant difference between the two groups with respect to baseline characteristics, indicating good comparability.

Table 2 presents the wound culture sensitivity findings. No organism growth was the most common culture result in both groups. Among the positive cultures, Staphylococcus aureus was the most frequently isolated organism, followed by Pseudomonas aeruginosa, Proteus mirabilis, and Escherichia coli. The distribution of organisms between the two groups did not show a statistically significant difference.

Table 3 depicts wound contraction assessed using the difference between initial area and final area. A significantly higher proportion of patients in the case group demonstrated wound contraction in the range of 15.1–25.0 cm^2, whereas the majority of control group patients showed wound contraction in the range of 5.1–15.0 cm^2. Minimal wound contraction was predominantly observed in the control group. The difference between the groups was statistically significant.

Table 4 illustrates the percentage reduction in wound area. Most patients in the case group achieved more than 26% reduction in wound area, while the majority of patients in the control group had less than 16% reduction. This difference was statistically significant, indicating superior wound healing in the case group. Table 5 shows the duration required for wound contraction. Most patients in the case group achieved wound contraction within 4–5 weeks, whereas the majority of patients in the control group required 6–7 weeks. The difference in duration of wound contraction between the two groups was statistically significant.

Table 1: Patient characteristics

Patient characteristics	Case (n=30)	%	Control (n=30)	%
Age group (years)				
<50	6	20.0	9	30.0
51–60	16	53.3	14	46.7
>60	8	26.7	7	23.3
Gender				
Male	17	56.7	19	63.3
Female	13	43.3	11	36.7
Onset of ulcer				
Spontaneous	13	43.3	11	36.7
Traumatic	17	56.7	19	63.3
Site of ulcer				
Dorsum	12	40.0	10	33.3
Plantar	18	60.0	20	66.7
Diabetes treatment				
Insulin	18	60.0	17	56.7
Oral drugs	12	40.0	13	43.3

Table 2: Wound culture sensitivity

Wound culture	Case (n=30)	%	Control (n=30)	%	P value
Escherichia coli	2	6.7	1	3.3	0.682
No organism growth	16	53.3	20	66.7	
Pseudomonas aeruginosa	3	10.0	2	6.7	
Proteus mirabilis	3	10.0	3	10.0	
Staphylococcus aureus	6	20.0	4	13.3	
Total	30	100	30	100	

Table 3: Wound contraction (IA–FA = CA)

Wound contraction (cm²)	Case (n=30)	%	Control (n=30)	%	P value
<5.0	1	3.3	4	13.3	<0.0001
5.1–15.0	6	20.0	26	86.7	
15.1–25.0	21	70.0	0	0.0	
>25.0	2	6.7	0	0.0	
Total	30	100	30	100	

Table 4: Percentage of wound area reduction

Area reduction (%)	Case (n=30)	%	Control (n=30)	%	P value
<16.0	1	3.3	25	83.3	<0.0001
16.1–26.0	3	10.0	5	16.7	
>26.0	26	86.7	0	0.0	
Total	30	100	30	100	

Table 5: Duration of wound contraction

Duration (weeks)	Case (n=30)	%	Control (n=30)	%	P value
4–5	24	80.0	2	6.7	<0.0001
5–6	6	20.0	4	13.3	
6–7	0	0.0	24	80.0	
Total	30	100	30	100	

Discussion

The present study demonstrates that platelet-rich plasma (PRP) is a safe and effective adjunctive therapy in the management of diabetic foot ulcers, as evidenced by significantly enhanced wound contraction, greater percentage reduction in ulcer area, and shorter duration required for wound healing in the PRP-treated group. These findings reinforce the growing body of evidence supporting the regenerative potential of PRP in chronic non-healing wounds associated with diabetes mellitus. The superior outcomes observed in the PRP group can be attributed to the concentrated delivery of growth factors that directly modulate the impaired wound healing cascade characteristic of diabetic ulcers.

Recent clinical evidence supports the role of PRP in accelerating granulation tissue formation and epithelialization. In a randomized controlled trial by Driver et al., autologous PRP significantly improved healing rates of diabetic foot ulcers compared to standard wound care, highlighting the importance of biologic therapies in addressing the chronic inflammatory state of diabetic wounds [11]. Similarly, a multicenter study by Martinez-Zapata et al. demonstrated that PRP promotes faster wound closure by enhancing angiogenesis and fibroblast migration, which aligns with the pronounced wound contraction observed in the present study [12].

The significant reduction in wound area noted in the PRP group further substantiates the biological efficacy of PRP. Platelets release platelet-derived growth factor, vascular endothelial growth factor, and transforming growth factor-β, all of which play critical roles in extracellular matrix deposition and neovascularization. A meta-analysis by Villela and Santos confirmed that PRP significantly improves ulcer size reduction and healing velocity in diabetic foot ulcers, supporting the findings of improved percentage area reduction in the current study [13]. These biological mechanisms are particularly relevant in diabetic patients, where microvascular compromise and impaired cellular response hinder natural wound repair.

Another important observation in this study was the reduced duration required for wound contraction in the PRP group. Faster wound closure not only decreases the risk of infection but also reduces hospital visits and overall treatment costs. A prospective study by Ahmed et al. reported significantly shorter healing times in PRP-treated diabetic ulcers, emphasizing the clinical and economic benefits of PRP therapy [14]. The ability of PRP to modulate inflammation and promote early granulation likely accounts for the rapid healing observed.

The safety profile of PRP was favorable, with no significant adverse effects reported during the study period. As PRP is an autologous product, the risk of immunological reactions or disease transmission is minimal. This finding is consistent with the systematic review by Guo et al., which concluded that PRP is a safe therapeutic option with low complication rates when used for diabetic foot ulcer management [15]. The simplicity of preparation and application further enhances its feasibility in routine clinical practice.

Despite these encouraging results, variability in PRP preparation methods and application protocols across studies remains a limitation. Standardization

of PRP concentration, activation methods, and treatment intervals is necessary to optimize outcomes and facilitate broader adoption. Larger multicenter trials with long-term follow-up are warranted to further establish the role of PRP as a standard adjunct in diabetic foot ulcer management.

Conclusion

Platelet-rich plasma is a safe and effective adjunctive therapy in the management of diabetic foot ulcers. The present study demonstrates that PRP significantly enhances wound contraction, increases percentage reduction in ulcer area, and shortens the duration required for wound healing when compared to conventional treatment. Given its autologous nature, favorable safety profile, and regenerative potential, PRP represents a promising therapeutic option for improving clinical outcomes and reducing morbidity associated with diabetic foot ulcers.

References

1. Gomez PT, Andrews KL, Arthurs JR, Bruce AJ, Wyles SP. Platelet-rich plasma in the treatment of diabetic foot ulcers. Adv Skin Wound Care. 2024;37(11):608-615.
2. Zanzov E, Ruseva M, Dimitrova D. Biological therapies for diabetic foot ulcers: current perspectives. Med Sci Monit. 2023;29:e939742.
3. Smith J, Brown K, Patel R. Role of platelet-rich plasma in chronic wound healing. Int J Mol Sci. 2024;25(23):12864.
4. Peng Y, Wang JP, Liu X, Zhou YQ, Jia SH, Xu JR. Efficacy of platelet-rich plasma in the treatment of diabetic foot ulcers: a systematic review and meta-analysis. Ann Vasc Surg. 2024; 98:365-373.
5. OuYang H, Huang L, Chen Y, Lin X. Platelet-rich plasma therapy for diabetic foot ulcers: a meta-analysis of randomized controlled trials. Front Endocrinol (Lausanne). 2023; 14:1256081.
6. Elsaid A, El-Said M, Emile S. Autologous platelet-rich plasma versus saline dressing in non-healing diabetic foot ulcers: a randomized controlled trial. World J Surg. 2020;44(4):1294-1301.
7. Alamdari NM, Shafiee A, Mirmohseni A, Besharat S. Evaluation of platelet-rich plasma efficacy in clean diabetic foot ulcers: a randomized clinical trial. Diabetes Metab Syndr. 2021;15(2):621-626.
8. Xu H, Huang K, Tao X. Platelet-rich plasma versus conventional therapy in diabetic foot ulcers: a meta-analysis. Acta Diabetol. 2025;62(7):985-995.
9. Nasr M, El-Hawary A, Kamel M. Injected versus topical platelet-rich plasma in diabetic foot ulcer management: a randomized trial. J Wound Care. 2025;34(8):712-720.
10. Su YN, Li J, Feng DH, Zhao DY. Autologous platelet-rich plasma in diabetic foot ulcers: efficacy and safety meta-analysis. J Orthop Surg Res. 2023;18:545.
11. Driver VR, Hanft J, Fylling CP, Beriou JM. A prospective, randomized, controlled trial of autologous platelet-rich plasma gel for the treatment of diabetic foot ulcers. Ostomy Wound Manage. 2006;52(6):68-87.
12. Martinez-Zapata MJ, Martí-Carvajal AJ, Solà I, Expósito JA, Bolíbar I, Rodríguez L. Autologous platelet-rich plasma for treating chronic wounds. Cochrane Database Syst Rev. 2016;5:CD006899.
13. Villela DL, Santos VL. Evidence on the use of platelet-rich plasma for diabetic foot ulcer: a systematic review. Growth Factors. 2019;37(1-2):111-120.
14. Ahmed M, Reffat SA, Hassan A, Eskander F. Platelet-rich plasma for the treatment of diabetic foot ulcers: a prospective randomized study. J Wound Care. 2017;26(5 Suppl):S20-S25.
15. Guo J, Li J, Zhang P, Liu J. Safety and efficacy of platelet-rich plasma in chronic diabetic foot ulcers: a systematic review and meta-analysis. Int Wound J. 2021;18(3):344-353.