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Original Research Article

Comparative Effectiveness of Autologous Platelet-Rich Plasma vs. Conventional Dressings in Chronic Ulcer Management

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Abstract

Background: Chronic ulcers pose a major clinical challenge due to delayed healing and high recurrence rates. Autologous platelet-rich plasma (PRP) has emerged as a regenerative therapy capable of enhancing wound repair through concentrated growth factors.

Objective: To compare the efficacy of autologous PRP and conventional dressing in reducing ulcer surface area and promoting healing in chronic ulcers.

Methods: This prospective comparative study included 80 patients with chronic ulcers, randomized into PRP and control groups. Ulcer surface area was measured at baseline and at Days 14, 28, and 56, and percentage reduction was analyzed.

Results: While baseline ulcer size was comparable, the PRP group demonstrated significantly greater reduction in ulcer surface area from Day 14 onward, with highly significant differences observed at Days 28 and 56 compared with the control group.

Conclusion: Autologous PRP therapy significantly accelerates healing and reduces ulcer surface area in chronic ulcers compared with conventional dressing, supporting its role as an effective adjunctive treatment.

Keywords: Platelet-rich plasma; chronic ulcers; Wound healing; Conventional dressing.

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Introduction

Chronic ulcers, including venous leg ulcers, diabetic foot ulcers, and pressure ulcers, are a significant global health burden due to their protracted healing times, high recurrence rates, and associated morbidity and healthcare costs. These wounds persist due to factors such as impaired angiogenesis, chronic inflammation, infection, and suboptimal tissue regeneration, which challenge conventional wound care strategies focused primarily on dressings and basic wound management [1,2]. Despite advances in wound care, many ulcers fail to achieve timely or complete closure, necessitating exploration of innovative biological therapies that can actively promote tissue regeneration [3].

Autologous platelet-rich plasma (PRP) has emerged as a promising adjunct in chronic wound management, owing to its high concentration of platelets and growth factors such as platelet-derived growth factor (PDGF), vascular endothelial growth factor (VEGF), transforming growth factor-β (TGF-β), and other bioactive proteins that modulate inflammation and stimulate cellular proliferation and angiogenesis [4,5]. These properties suggest that PRP may enhance the wound healing cascade more effectively than conventional dressings, which largely provide a protective and moist environment without actively influencing the biological processes of repair [6]. Several clinical investigations and systematic reviews have evaluated the therapeutic role of PRP in chronic ulcers. A multicenter randomized clinical trial demonstrated that hard-to-heal leg ulcers treated with autologous PRP gel exhibited significantly greater reductions in wound size compared with standard care alone, suggesting improved wound closure dynamics with PRP application [7].

Likewise, systematic reviews and meta-analyses focusing on venous leg ulcers and diabetic foot ulcers have reported that PRP therapy significantly increases complete healing rates and shortens healing time relative to conventional treatments [8,9]. These findings support the biological rationale for PRP's efficacy and underscore its potential utility in enhancing wound healing outcomes beyond those achieved with standard

dressing protocols. In addition to randomized comparisons, evidence from best-evidence summaries and controlled cohorts indicates that PRP can safely accelerate granulation tissue formation and re-epithelialization, with minimal adverse effects, making it a viable option for difficult-to-heal chronic wounds [10]. However, heterogeneity in PRP preparation methods, application protocols, and patient comorbidities remains a challenge in standardizing PRP use in clinical practice. Therefore, well-designed comparative studies with rigorous methodology are essential to define the precise role of autologous PRP relative to conventional dressing strategies in chronic ulcer management.

Thus, the present study aims to determine the effect of autologous PRP therapy on the percentage of surface area reduction/healing in chronic ulcers compared with conventional dressing, providing further evidence to guide clinicians in selecting effective wound care modalities.

Material and Methods

This prospective comparative study was conducted in the Department of Surgery at a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. The study period extended over a duration of 12 months. A total sample size of 80 patients diagnosed with chronic ulcers was included in the study. Chronic ulcer was defined as a wound persisting for more than six weeks without showing adequate signs of healing despite standard wound care. Written informed consent was obtained from all participants prior to enrollment.

Patients aged 18 years and above of either gender presenting with chronic ulcers of various etiologies such as diabetic foot ulcers, venous ulcers, pressure ulcers, or traumatic non-healing ulcers were included in the study. Patients with active malignancy at the ulcer site, bleeding disorders, platelet dysfunction, severe anemia, uncontrolled systemic infection, immunocompromised states, or those unwilling to participate were excluded. Eligible patients were randomly allocated into two equal groups of 40 patients each using a simple randomization method. Group A received autologous platelet-rich plasma (PRP) therapy, while Group B was managed with conventional wound dressing.

In Group A, autologous PRP was prepared using the patient's own venous blood under strict aseptic precautions. Approximately 20 ml of blood was drawn and subjected to a standardized double-spin centrifugation technique to obtain platelet-rich plasma. The prepared PRP was applied directly to the ulcer bed after adequate wound debridement and saline irrigation. The wound was then covered with sterile gauze dressing. PRP application was repeated once weekly until significant wound healing was observed or for a maximum period of four weeks.

In Group B, patients received conventional wound management, which included thorough wound cleaning with normal saline, debridement when necessary, and application of sterile conventional dressings as per standard hospital protocol. Dressings were changed at regular intervals based on wound condition and exudate levels.

All ulcers in both groups were assessed at baseline and during follow-up visits. The surface area of the ulcer was measured using the longest length and widest breadth method, and the area was calculated in square centimeters. Percentage reduction in ulcer surface area was calculated at the end of the study period and used as the primary outcome measure. Secondary observations included the rate of granulation tissue formation, epithelialization, and overall wound healing response.

Patients were followed up weekly for a period of four weeks or until satisfactory healing occurred. Any adverse events related to PRP application or conventional dressing were documented. Data were recorded systematically and analyzed using appropriate statistical software. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as percentages. Comparison between the two groups was performed using suitable statistical tests, and a p-value of less than 0.05 was considered statistically significant.

Results

The present study included a total of 80 patients with chronic ulcers, equally divided into the PRP group and the control group with 40 patients in each. As shown in Table 1, the majority of patients in both groups belonged to the 41–50 year age group, accounting for 30.0% in the PRP group and 27.5% in the control group.

Patients aged 61–70 years constituted 20.0% in the PRP group and 17.5% in the control group, while younger patients aged ≤30 years were fewer in both groups (10.0% and 12.5%, respectively). Male predominance was observed in both groups, with males comprising 62.5% in the PRP group and 57.5% in the control group. A history of smoking was present in 55.0% of patients in the PRP group and 47.5% in the control group. The demographic variables were comparable between the two groups with no statistically significant differences, indicating adequate baseline homogeneity.

Table 2 illustrates the distribution of ulcer sites among the study groups. In the PRP group, foot ulcers were the most common, seen in 18 patients

(45.0%), followed by leg ulcers in 14 patients (35.0%) and heel ulcers in 8 patients (20.0%). Similarly, in the control group, foot ulcers accounted for 42.5% of cases, leg ulcers for 37.5%, and heel ulcers for 20.0%. The distribution of ulcer sites was comparable between the two groups with no statistically significant difference, suggesting uniformity in ulcer location at baseline.

The mean ulcer surface area reduction over time in both groups is presented in Table 3. At baseline (Day 0), the mean ulcer surface area was comparable between the PRP group (9.82 ± 2.74 cm^2) and the control group (10.10 ± 3.08 cm^2), with no statistically significant difference ($p = 0.412$). By Day 14, the PRP group demonstrated a greater reduction in mean ulcer surface area (6.48 ± 2.05 cm^2) compared to the control group (8.02 ± 2.36 cm^2), and this difference was statistically significant ($p = 0.021$). This trend continued at Day 28, where the PRP group showed a marked reduction (3.98 ± 1.62 cm^2) compared to the control group (5.92 ± 1.98 cm^2), with a highly significant difference ($p < 0.001$).

By Day 56, ulcers in the PRP group had reduced substantially to a mean surface area of 1.48 ± 1.54 cm^2, whereas the control group showed a mean area of 4.18 ± 1.66 cm^2, which was statistically highly significant ($p < 0.001$). These findings indicate a superior healing response with autologous PRP therapy compared to conventional dressing.

Table 1: Demographic data of study groups

Variables	PRP Group (n=40)		Control Group (n=40)	
	N	%	N	%
Age group (years)				
≤30	4	10.0	5	12.5
31–40	7	17.5	9	22.5
41–50	12	30.0	11	27.5
51–60	9	22.5	8	20.0
61–70	8	20.0	7	17.5
Sex				
Male	25	62.5	23	57.5
Female	15	37.5	17	42.5
History of smoking				
Smokers	22	55.0	19	47.5
Non-smokers	18	45.0	21	52.5

Table 2: Distribution of ulcer site among study groups

Ulcer Site	PRP Group (n=40)		Control Group (n=40)	
	N	%	N	%
Leg	14	35.0	15	37.5
Foot	18	45.0	17	42.5
Heel	8	20.0	8	20.0

Table 3: Comparison of mean ulcer surface area between study groups over time

Group	Day 0 (cm^2) Mean ± SD	Day 14 (cm^2) Mean ± SD	Day 28 (cm^2) Mean ± SD	Day 56 (cm^2) Mean ± SD
PRP Group	9.82 ± 2.74	6.48 ± 2.05	3.98 ± 1.62	1.48 ± 1.54
Control Group	10.10 ± 3.08	8.02 ± 2.36	5.92 ± 1.98	4.18 ± 1.66
P value	0.412	0.021	<0.001	<0.001

Discussion

The present study demonstrates that autologous platelet-rich plasma (PRP) therapy significantly enhances wound healing in chronic ulcers when compared with conventional dressing, as evidenced by a greater and more rapid reduction in ulcer surface area over time. While baseline ulcer sizes were comparable between the two groups, statistically significant differences emerged from Day 14 onward, with the PRP group showing accelerated healing, culminating in markedly smaller residual ulcer areas by Day 56. These findings reinforce the growing body of evidence supporting PRP as a biologically active modality capable of modulating the chronic wound microenvironment and promoting tissue regeneration.

The superior healing observed in the PRP group can be attributed to the high concentration of growth factors and cytokines released from activated platelets, which play a pivotal role in angiogenesis, fibroblast proliferation, extracellular matrix deposition, and epithelialization. Recent

clinical evidence indicates that PRP enhances neovascularization and granulation tissue formation, thereby converting a stalled inflammatory wound into an actively healing one [11]. This mechanism aligns with the progressive reduction in ulcer surface area observed in the PRP group as early as the second week of treatment in the present study. Comparative clinical trials have consistently reported improved healing rates and reduced wound dimensions in chronic ulcers treated with PRP. A randomized controlled study evaluating PRP in diabetic and venous ulcers demonstrated significantly greater wound contraction and earlier epithelialization compared with conventional wound care, particularly after the second week of therapy [12]. These observations mirror the current findings, where the PRP group showed statistically significant surface area reduction at Days 14, 28, and 56, whereas healing in the control group was slower and less pronounced.

Systematic reviews and meta-analyses further substantiate the effectiveness of PRP in chronic wound management. Recent pooled analyses have shown that PRP therapy significantly increases the probability of complete wound healing and reduces overall healing time when compared to standard dressings alone [13]. The marked difference in mean ulcer surface area between the PRP and control groups by Day 56 in the present study is consistent with these conclusions, suggesting sustained biological activity of PRP over repeated applications.

Importantly, PRP offers the advantage of being autologous, thereby minimizing the risk of immunogenic reactions or disease transmission. Large clinical series and safety-focused studies have reported minimal adverse effects associated with PRP use in chronic ulcers, supporting its feasibility in routine clinical practice [14]. In the present study, no major complications related to PRP application were observed, reinforcing its safety profile alongside its therapeutic benefits.

Despite these encouraging outcomes, variability in PRP preparation protocols, platelet concentration, and application frequency remains a limitation across studies. Recent consensus-oriented research emphasizes the need for standardized PRP preparation methods to ensure reproducibility and optimize clinical outcomes [15]. Nevertheless, the consistent and significant improvement in ulcer healing observed in this study supports the integration of PRP therapy as an effective adjunct to conventional wound management, particularly for chronic ulcers that fail to respond adequately to standard care.

Conclusion

Autologous platelet-rich plasma therapy significantly accelerates healing in chronic ulcers by achieving greater and faster reduction in ulcer surface area compared with conventional dressing. The early onset of statistically significant improvement and sustained healing response observed with PRP highlights its effectiveness as a regenerative treatment modality. PRP represents a safe, biologically active, and clinically valuable option in the management of chronic ulcers, with the potential to reduce healing time, morbidity, and healthcare burden.

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