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Role of Platelet Rich Plasma Therapy in Management of Chronic Non-Healing Wounds

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HIGHLIGHTS

1. PRP enhances tissue regeneration in wounds.
2. Accelerates healing by promoting cell growth.
3. Stimulates collagen production and tissue repair.
4. Reduces inflammation and improves circulation.
5. Effective in chronic, non-healing wound management.

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ABSTRACT

Introduction: Chronic non-healing wounds are a global healthcare challenge, causing significant socioeconomic burdens due to prolonged treatment times, increased healthcare costs, and decreased patient quality of life. Chronic wounds, often associated with underlying conditions like diabetes and vascular diseases, fail to progress through normal healing stages. Platelet-Rich Plasma (PRP) therapy, which involves applying/injecting concentrated platelets to the wound site, has emerged as a promising treatment by promoting cell division, tissue regeneration, and immune response. **Objective:** This study aims to evaluate the effectiveness of PRP therapy in accelerating wound healing and reducing the need for additional surgical interventions in patients with chronic non-healing wounds. **Methods:** A randomized, interventional study was conducted at Government Doon Medical College and Hospital from September 2022 to March 2024. Forty patients with chronic wounds persisting for more than four weeks were included in the study and they received PRP therapy. The effectiveness was assessed through wound closure rates, reduction in wound size, and need for additional surgical procedures. **Results:** The majority of participants were aged 51-60. PRP treatment resulted in an 85.98% reduction in wound size. Additionally, 82.5% of patients required no further surgical intervention. PRP significantly reduced healing time, with an average of 5.93 weeks ($p < 0.01$), and demonstrated statistically significant reductions in wound breadth ($p = 0.01$) and pain levels ($p < 0.01$). **Conclusion:** PRP therapy is a safe, biocompatible, and effective treatment for chronic wounds, significantly reducing healing time and the need for additional surgeries. The findings suggest that PRP could serve as a cost-effective alternative to conventional treatments, improving patient outcomes and reducing healthcare burdens.

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INTRODUCTION

Chronic non-healing wounds pose a major challenge to healthcare systems globally, primarily because of their prolonged nature and the significant costs associated with their treatment. These wounds do not follow the normal sequence of healing within the expected timeframe, which is typically defined as one to three months depending on various clinical perspectives. Such wounds, often termed chronic, have a considerable socioeconomic impact as they result in extended hospital stays, long-term treatments, and a significant reduction in patients' quality of life. Beyond the financial strain, chronic wounds are also a leading cause of reduced productivity and long-term disability, as patients dealing with them often find themselves unable to return to work or perform daily activities, relying heavily on caregivers [1].

Platelet-Rich Plasma (PRP) therapy is one innovative approach that has gained attention for managing chronic wounds. PRP therapy involves applying a concentrated form of platelets directly to the wound site. Platelets contain growth factors that are crucial for stimulating cell division, tissue regeneration, and boosting immune responses, all of which speed up the healing process. The key benefit of PRP therapy lies in its ability to act locally, promoting healing on a cellular level by enhancing the natural repair processes within the wound [2].

Chronic wounds often result from a complex combination of underlying medical conditions, such as advanced age, diabetes, and vascular diseases, which prolong the inflammatory stage of wound healing and prevent the process from moving into the proliferative phase where tissue growth occurs. Managing such wounds requires a comprehensive approach that addresses both the local wound environment and the patient's overall health status [3].

Wound healing typically follows a sequence of four stages: hemostasis (blood clotting), inflammation, tissue proliferation, and tissue remodeling. In chronic wounds, this process is disrupted, often due to an exaggerated inflammatory response that prevents the wound from progressing to the proliferative phase where new tissue is formed. Chronic wounds are typically stuck in this prolonged state of inflammation, with an excess of proteases degrading essential growth factors and proteins in the extracellular matrix, which are necessary for healing. This hostile environment not only slows down the healing process but also increases the likelihood of microbial growth and biofilm formation, which further complicates wound management [4].

To overcome these challenges, modern wound care practices have evolved to include a range of techniques such as debridement (the removal of dead or infected tissue), advanced wound dressings, and the use of antimicrobial agents to create an optimal healing environment. Alongside these techniques, the advent of PRP therapy has provided new avenues for enhancing the healing process. PRP therapy offers a concentrated dose of growth factors that are essential for accelerating cell division and tissue repair, making it a highly effective localized treatment for chronic wounds [5].

The potential of PRP therapy to improve healing outcomes has spurred interest in its use, and this study aims to investigate its efficacy in terms of key healing indicators such as wound closure rates, infection reduction, and overall patient recovery. Understanding how this therapy performs in various clinical settings is crucial for improving clinical decision-making. The findings from this study could significantly influence the standard of care for chronic wound management by identifying the most effective strategies for treating these complex conditions [6].

In a broader context, the relevance of this research is becoming increasingly clear as the global prevalence of chronic conditions like diabetes and obesity continues to rise. Both of these conditions are major risk factors for the development of chronic wounds, making effective wound care therapies more crucial than ever. As healthcare systems face increasing demand and resource constraints, finding cost-effective, evidence-based treatments that can improve healing outcomes and reduce long-term disability is of paramount importance. This study seeks to provide clinicians with valuable insights into how best to treat chronic wounds in a variety of clinical settings [7].

This research is not only timely but also has the potential to shape future clinical practices. Chronic wounds, if left untreated or improperly managed, can lead to severe complications, including infections, amputations, and in extreme cases, death. Moreover, the costs associated with chronic wound care are substantial, placing a heavy burden on healthcare systems worldwide. It is estimated that chronic wounds affect a significant percentage of the population, and as the population ages and the incidence of conditions such as diabetes and vascular diseases increases, the prevalence of chronic wounds is expected to rise further. This underscores the importance of identifying effective treatment options that can improve healing outcomes and reduce the burden on both patients and healthcare providers [8].

This study aims to address a critical gap in un-

-derstanding how advanced wound care therapies, such as Platelet-Rich Plasma (PRP), can be utilized to treat chronic wounds. By focusing on the effectiveness of PRP therapy, the research will provide valuable insights into its therapeutic potential, aiding clinicians in making informed treatment decisions. The findings could lead to better patient outcomes, reduced healthcare costs, and improved management of chronic wounds. As the burden of these wounds increases, this research may significantly impact future wound care practices and offer hope to patients facing long-term healing challenges.

MATERIALS AND METHODS

After obtaining ethical committee approval, an interventional study titled "Role of Platelet-Rich Plasma Therapy in the Management of Chronic Non-Healing Wounds" was conducted on 40 patients of

chronic wounds at Government Doon Medical College and Hospital from September 2022 to March 2024 and they were treated with Platelet-Rich Plasma (PRP) therapy. The study included patients aged 18–80 with non-healing wounds persisting for over 4 weeks. Exclusion criteria involved malignancy, unstable fractures, and systemic corticosteroid use. This study aimed to evaluate PRP's effectiveness in promoting wound healing.

RESULTS

In our study of 40 patients aged 18 to 80, the majority were between 51–60 years, indicating that ulcers in older populations are more resistant to conventional treatment. The mean age in the PRP group was 47.40 ± 12.62 years, with no significant difference ($p = 0.74$).

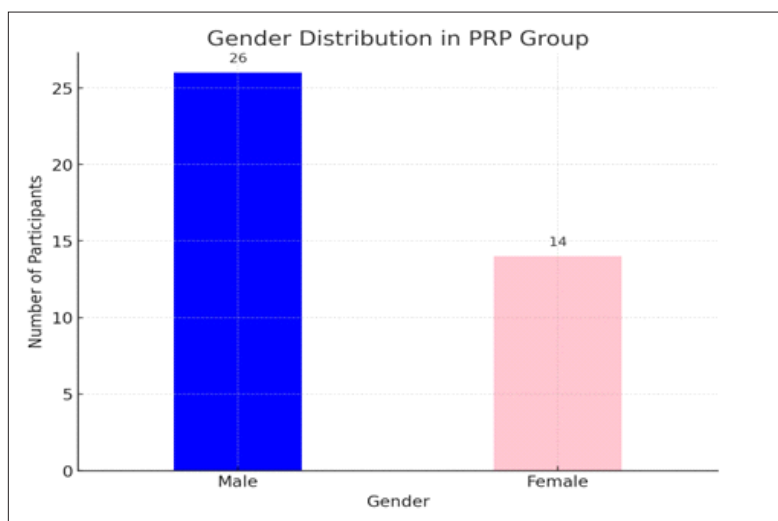


Figure 1: Gender Distribution Among the Study Participants in the Two Groups

In the PRP group, 26 participants (65%) were males, and 14 (35%) were females. No significant ass-

-ociation was found between gender and the therapy group (p -value = 0.17).

Table 1: Distribution of the Study Participants According to Diagnosis

	PRP	P-Value
Diabetic Ulcer	6 (15.0%)	0.33
Post-Traumatic Ulcer	8 (20.0%)	
Venous Ulcer	9 (22.5%)	
Arterial Ulcer	10 (25.0%)	
Pressure Ulcer	7 (17.5%)	
Total	40	

The table shows the distribution of different types of ulcers in the PRP group, where arterial ulcers had the highest occurrence (25%), followed by venous ulcers (22.5%), post-traumatic ulcers (20%),

pressure ulcers (17.5%), and diabetic ulcers (15%). There was no statistically significant difference in ulcer types (p-value = 0.33).

Table 2: Distribution of the Study Participants According to Intervention at End Point

	PRP	P-Value
None	33 (82.5%)	0.03*
SSG	6 (15.0%)	
Flap	1 (2.5%)	
Total	40	

The table shows that in the PRP group, 82.5% of participants required no further surgical intervention, 15% underwent split skin grafting (SSG),

and 2.5% required flap surgery. The difference in the need for additional procedures between groups was statistically significant, with a p-value of 0.03.

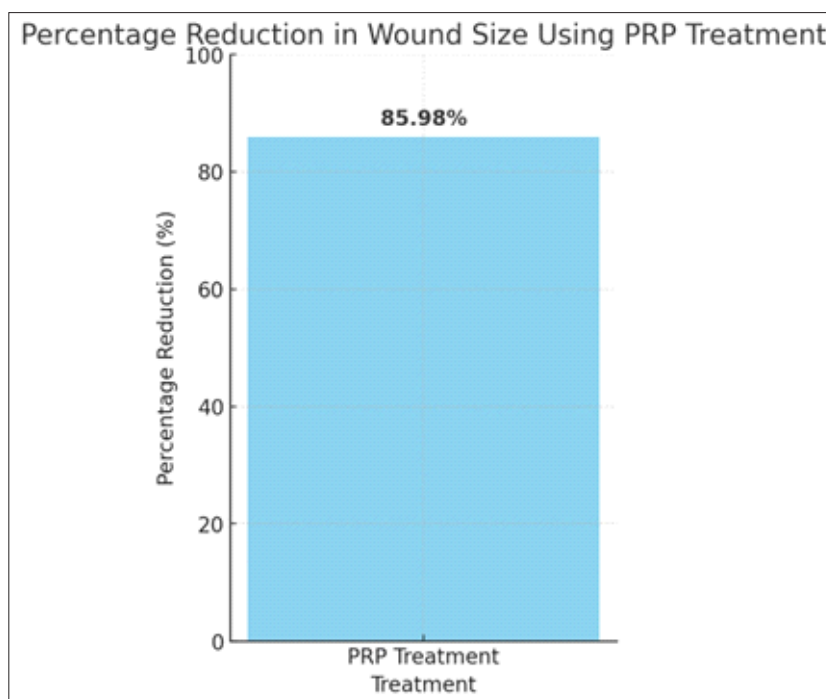


Figure 2: Percentage Reduction in Wound Size After PRP Treatment

The bar chart represents the percentage reduction in wound size using PRP (Platelet-Rich Plasma) treatment. It shows an 85.98% reduction in

wound size, indicating a highly effective outcome for PRP in promoting wound healing, as represented by the significant percentage displayed above the bar

Table 3: Wound Parameters in the Group

Wound Parameters	PRP	P-Value
Length of Wound at Day 0	4.25±0.77	0.48
Breadth of Wound at Day 0	3.33±1.11	0.01
Area of Wound at Day 0	14.13±5.39	0.08
Length of Wound at Week 6	1.45±1.06	0.08
Breadth of Wound at Week 6	0.92±0.72	0.11
Area of Wound at Week 6	2±2.03	0.26

The table presents wound parameters for PRP (Platelet-Rich Plasma) treatment, showing measurements of wound length, breadth, and area at day 0 and week 6. Significant reduction is noted in the

breadth of the wound at day 0 ($p=0.01$), while other parameters show non-significant changes with p -values above 0.05.

Table 4: Time to Wound Healing with PRP Treatment

	PRP	P-Value
Time to Wound Healing (Weeks)	5.93±0.26	<0.01

The table shows that the time to wound healing with PRP treatment is 5.93 weeks, with a standard deviation of ±0.26 weeks. The p -value is less

than 0.01, indicating that the result is statistically significant and suggesting a meaningful improvement in wound healing time with PRP therapy.

Table 5: Maximum Pain Score During PRP Treatment

	PRP	P-Value
Maximum Pain Score During Treatment	1.70±0.99	<0.01

The table shows the maximum pain score experienced during PRP treatment, which is 1.70 ± 0.99. The p -value is less than 0.01, indicating a statistically significant result, suggesting that the pain levels during treatment with PRP are notably low and consistent among participants.

wound recovery [14,15].

DISCUSSION

In underdeveloped countries like India, chronic wounds are a public health challenge due to insufficient growth factors, leading to delayed healing and reinfections. Conventional treatments, while effective, can be costly. PRP therapy offers a solution by promoting wound healing, improving blood flow, reducing microbial colonization, and maintaining an optimal healing environment, ultimately enhancing patient satisfaction and quality of life [9,10,11].

Current treatments for pressure ulcers include systemic antibiotics, surgical debridement, pressure reduction, and proper wound care. Research is exploring compression bandages combined with antimicrobial or analgesic dressings. Platelet-rich plasma (PRP), used in wound care since 1985, contains growth factors that promote healing and its increased white blood cell concentration helps prevent infections [16, 17, 18].

A Cochrane review examined hydrocolloids, foam dressings, alginates, low-adherent dressings, and hydrogels, finding no statistically significant difference in healing rates when used with appropriate compression bandages. Additionally, topical application of epidermal growth factor (EGF) to non-healing venous ulcers did not promote re-epithelialization [12,13].

In 1986, Knighton et al. found that injecting autologous platelet factors accelerated the epithelialization of granulation tissue, leading to the healing of chronic, previously refractory wounds. This clinical investigation was the first to suggest that locally active compounds derived from autologous blood could aid in healing chronic cutaneous ulcers [19].

Despite the widespread use of silver dressings and treatments for infections, evidence supporting their efficacy is limited. An experimental approach, platelet-rich plasma (PRP) therapy, can be applied topically alongside regular wound care to promote healing in chronic inflammatory wounds. PRP releases growth factors and cytokines, mimicking the body's natural healing process and accelerating

Platelet-rich plasma (PRP) promotes wound healing by releasing growth factors that enhance cell recruitment, proliferation, and extracellular matrix synthesis. PRP stimulates processes like angiogenesis, collagen formation, and immune response, accelerating wound healing. It mimics the body's natural healing process by promoting granulation tissue formation and preventing infection through leukocytes' action [20, 21, 22].

Frykberg et al. found that, in a study of 49 patients with 65 non-healing ulcers, 63 ulcers showed reduction after an average of 3.2 treatments over 2.8 weeks. Thirteen of the wounds required more than one application, with a mean of 2.2 applications and a treatment duration averaging 4.2 weeks [23].

According to Steenvoorde et al., seven of thirteen wounds required more than one PRP application, with a mean of 2.2 applications and an average treatment duration of 4.2 weeks. Kakudo et al. treated five cases of persistent skin ulcers with autologous PRP, achieving lesion epithelization in an average of six weeks, with three ulcers healing completely within four weeks [24, 25].

In a randomized, controlled multicenter study, Driver et al. treated 72 diabetic foot ulcer patients with either saline gel or autologous platelet-rich plasma (PRP) gel. Due to protocol breaches and dropouts, only 40 patients completed the study. PRP-treated patients showed a significantly higher healing rate (81.3%) compared to the control group (42.1%). However, the study faced limitations, including a small sample size and protocol issues [19].

There is no standardized PRP preparation protocol, but Marx recommends double centrifugation to concentrate platelets. While strong evidence for PRP's therapeutic benefits is lacking, some studies show promise in treating chronic wounds. PRP therapy has shown potential by enhancing blood flow, reducing exudate, and promoting granulation tissue formation [26].

CONCLUSION

Chronic ulcers pose substantial financial and health burdens on both patients and society. Our study demonstrates that platelet-rich plasma (PRP) is a safe, biocompatible, and effective treatment option for chronic wounds. Patients treated with PRP experienced less pain, and the therapy was well-tolerated without any adverse effects. These findings suggest that PRP has significant potential in managing chronic wounds, providing a promising alternative to conventional treatments. Further research is required to fully understand the efficacy of PRP in treating various types of wounds and ulcers, and to explore its long-term benefits for wound healing and patient outcomes.

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