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Efficacy of Platelet Rich Plasma in Chronic Wounds Assessed by using PWAT and VAS Score

Dr. Juhi Singhal[1], Dr. Priyanka Sant[2], Dr. Deep Shikha[3]

[1]Professor, General Surgery Department, Sarojini Naidu Medical College, Agra
Email: *juhisinghal75[at]gmail.com*

[2]Junior Resident, General Surgery Department, Sarojini Naidu Medical College, Agra

[3]Assistant Professor, General Surgery Department, Sarojini Naidu Medical College, Agra
Corresponding Author Email: *myselfdrdeepshikha[at]gmail.com*

Abstract: ***Introduction: Chronic wound present a substantial obstacle in the field of healthcare, necessitating effective treatment methods to facilitate healing and reduce the economic burden. Objective: This study aims to compare the efficacy of platelet-rich plasma (PRP) dressings with conventional wound dressings in the treatment of chronic wounds. Method: A randomized controlled study was conducted over 18 months in the Department of Surgery at S.N. Medical College, Agra. Patients with chronic wounds were assessed, and wound characteristics were documented. Weekly dressing analyses were performed on days 1, 7, 14, 21, and 28, with wound size and photographs recorded using the photographic wound assessment tool (PWAT). Result: The results showed that PRP dressings were more effective in reducing wound size, with a decrease from 67.67 cm² (±86.05) to 43.12 cm² (±53.33) by the end of the fourth week (p = 0.913). Both groups experienced significant pain reduction over time (p < 0.001), but PRP dressings demonstrated superior pain alleviation. The average total PWAT score was lower for the PRP group (11.31 ± 2.46) compared to the conventional dressing group (16.00 ± 2.35), with a p-value < 0.001, indicating the overall effectiveness of PRP dressings. Additionally, PRP dressings were more effective in minimizing necrotic tissue. Conclusion: The study concluded that PRP dressings are superior to conventional wound dressings in terms of reducing healing duration, decreasing pain, promoting healing, and minimizing necrotic tissue content in chronic wounds. But due to the limited sample size, a bigger study is recommended to come to a definitive conclusion.***

Keywords: platelets Rich Plasma, Chronic Wounds, PWAT, VAS

1. Introduction

Wound healing involves a series of overlapping stages that are divided into three distinct phases, based on the various cellular and biochemical activities. These phases include inflammation, proliferation, and maturation and all are essential for proper healing.

Chronic wounds are the wounds that have not achieved complete functional and molecular integrity within a three-month time frame. Multiple common factors can promote unfavorable wound healing conditions. Systemic factors, including malnutrition, aging, tissue hypoxia, and diabetes, play a significant role in the pathogenesis of chronic wounds.

PRP is a non-surgical, minimally invasive treatment that can be used to treat chronic wound. PRP not only promotes healing but is also effective in managing pain. The aim of the study was to analyses efficacy of platelet rich plasma in chronic wounds using PWAT and VAS score.

2. Material and Method

The present study was conducted in Sarojni Naidu medical college, Agra from 1st September, 2022 to 1st March,2024. This RCT study was conducted with 26 patients to assess the effectiveness of PRP in wound healing terms of PWAT score and VAS score.

Inclusion Criterion

- Patients who give written consent and informed consent for participation
- Patients from 18 to 75 years, both male and female
- Patients having ulcer ≥ 8 weeks,
- Patients having hemoglobin > 10 mg/dl,
- Patients having fasting Blood Sugar ≤ 110mg%
- Patients having post prandial blood sugar ≤140 mg% if diabetic.

Exclusion Criterion

- Patients who refuse to give consent for the procedure
- Patients having hemoglobin < 10mg/dl
- Patients with Ankle – Brachial Pressure Index < 0.8
- Patients having platelet count < 1.5 L/mm3
- Patients having random blood sugar ≥ 200 mg/dl
- Patients with Ischemic Heart Disease
- Patients with Immunocompromised status
- Pregnant Females
- Patient having any type of active malignancy
- Examination of the ulcer was conducted, and the wound's characteristics were assessed. Dressings were done and photographs were taken on days 1, 7, 14, 21, and 28. Further analysis was done using the photographic wound assessment tool (PWAT) and VAS Score.

Method of formation of platelet rich plasma:

- **Step 1: Collection of Blood**: Using sterile precautions, 12 mlof blood was collected intravenously from the antecubital region into two bulbs containing CPDA (0.7 milliliters each). The bulbs were thoroughly shaken to ensure that the anticoagulant was evenly mixed with the drawn blood.

- **Step 2: Preparation of Platelet rich plasma**: The process of obtaining concentrated platelet-rich plasma (PRP) from a blood sample involved several steps. First, a vacutainer was used to collect the buffy coat, which is the upper 1 mm layer of red blood cells. This layer was then centrifuged at 1000 rpm for 10 minutes, and the upper half was discarded. The remaining lower half contained the concentrated PRP (as shown in image 6)
- **Step 3: Application of PRP:** After extracting PRP, it was injected Intralesional into the wound. Approximately 1ml/cm^2 of PRP was injected into the wound (as shown in image 7)

3. Observations

This comparative study involved 26 patients who were randomly divided into 2 groups, each having 13 patients. Group A received PRP dressings while Group B received conventional dressings.

Group A consisted of 9 male patients (69.23%) and 4 female patients (30.77%). In Group B, there were 7 male patients (53.85%) and 6 female patients (46.15%). The Chi-square test resulted in a value of 0.16 with a p-value of 0.687, suggesting that there was no statistically significant difference in the distribution of gender between the groups.

Table 1: Comparison of frequency of male and female between group A and group B

		Group A		Group B		Chi sq.	p-Value
		n	%	n	%		
Gender	Male	9	69.23	7	53.85	0.16	0.687
	Female	4	30.77	6	46.15		

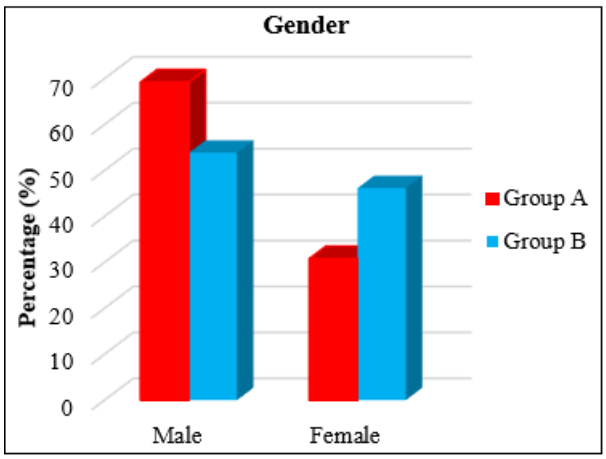


Figure 1: Comparison of frequency of male and female between group A and group B

Group A had an average wound duration of 3.521 months with a standard deviation of 0.51, while Group B had an average wound duration of 3.221 months with a standard deviation of 0.17. The t-test analysis revealed a t-value of 2.01 with a p-value of 0.056, suggesting a marginally significant difference in wound duration between the two groups.

Table 2: Comparison of mean Duration of wound (months) between group A and group B

	Group A		Group B		t	p-Value
	Mean	±SD	Mean	±SD		
Duration of wound (months)	3.521	0.51	3.221	0.17	2.01	0.056

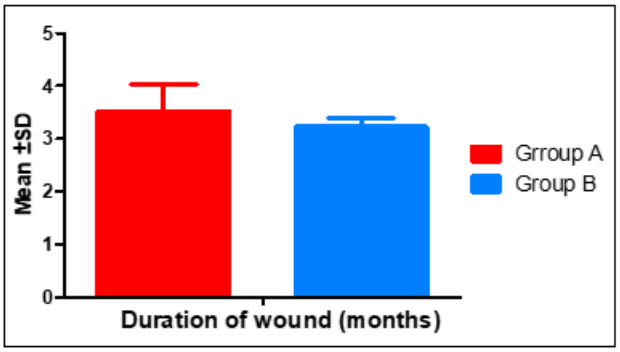


Figure 2: Comparison of mean Duration of wound (months) between group A and group

Group A observed a substantial decrease in wound area, going from 88.46 cm² (±85.77) before therapy to 12.11 cm² (±19.35) at the 4th week (p = 0.006). On the other hand, Group B (using traditional dressings) did not see a significant decrease in wound area. The size of the wound changed from 67.67 cm² (±86.05) before treatment to 43.12 cm² (±53.33) at the end of the fourth week (p = 0.913). This illustrated the higher effectiveness of PRP dressings in facilitating the process of wound healing.

Table 3: Change in mean area of wound from pre-treatment to 4th week in group A and group B

	Pre-Treatment		7th day		14th day		21st day		28th day		p-Value
	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	Mean	±SD	
Group A	88.46	85.77	59.08	63.23	36.01	47.23	22.54	31.62	12.11	19.35	0.006
Group B	67.67	86.05	63.01	80.48	58.92	72.45	50.62	62.95	43.12	53.33	0.913

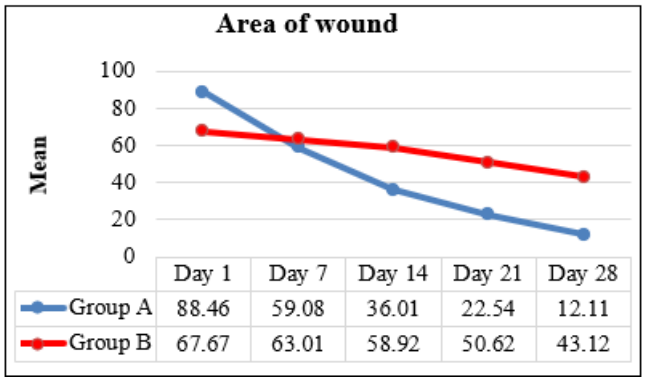


Table 3: Mean area of wound from pre-treatment to 4th week in group A and group B

At the end of the fourth week, the average VAS score for Group A reduced dramatically to 2.23 (±0.83), whereas Group B had an average VAS score of 4.31 (±0.85), with a significant difference indicating that PRP was more effective ($t = -6.28$, $p < 0.001$). Both groups showed a substantial decrease in pain over time ($p < 0.001$), however, PRP dressings proved to be more efficacious in alleviating pain.

Table 4: Comparison of mean VAS Score between group A and group B

VAS Score	Group A		Group B		t	p-Value
	Mean	±SD	Mean	±SD		
1st week	7.46	0.97	7.92	0.86	-1.28	0.211
4th week	2.23	0.83	4.31	0.85	-6.28	<0.001
p-Value	<0.001		<0.001			

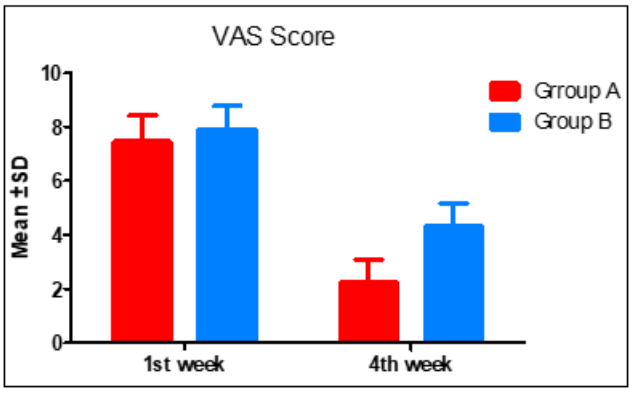
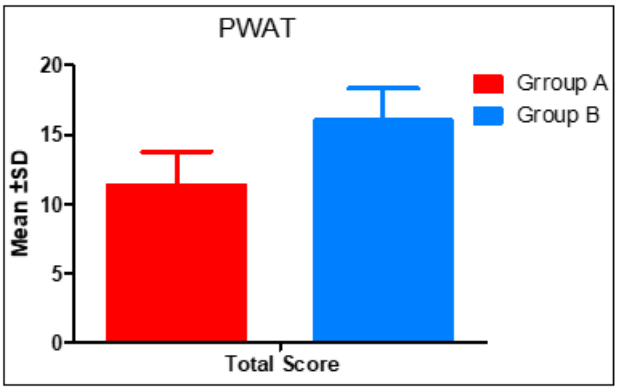


Figure 4: Comparison of mean VAS Score between group A and group B

The average wound size for Group A (PRP) was 2.15 (±1.14), which was much less than Group B (traditional) with an average wound size of 3.15 (±0.69). The difference between the two groups was statistically significant, with a p-value of 0.012. Group A exhibited a mean wound depth of 1.31 (±0.63), while Group B had a mean wound depth of 1.85 (±0.55). The p-value for the comparison between the two groups was 0.030. In Group A, the average score for necrotic tissue type was 1.23 (±0.60), whereas in Group B it was 2.08 (±0.28). The p-value was less than 0.001. The quantity of dead tissue was considerably reduced in Group A (1.31 ±0.48) compared to Group B (1.85 ±0.38), with a p-value of 0.004. The granulation tissue type in Group A had a mean score of 1.38 (±0.51), whereas Group B had a mean score of 2.08 (±0.28). The p-value was less than 0.001, indicating a significant difference between the two groups. In Group A, the average score for wound edges was 1.23 (±0.44), whereas in Group B it was 1.85 (±0.55). The p-value for the difference between the two groups was 0.004. The average total PWAT score was considerably lower for Group A, with a mean of 11.31 (±2.46), compared to Group B, which had a mean of 16.00 (±2.35). The p-value was less than 0.001, showing that PRP dressings were more effective overall.

Table 5: Comparison of mean Photographic wound assessment tool (PWAT) between group A and group B at 4th dressing

	Group A		Group B		t	p-Value
	Mean	±SD	Mean	±SD		
Size	2.15	1.14	3.15	0.69	-2.70	0.012
Depth	1.31	0.63	1.85	0.55	-2.31	0.030
Necrotic tissue type	1.23	0.60	2.08	0.28	-4.62	0.000
Total amount of necrotic tissue	1.31	0.48	1.85	0.38	-3.18	0.004
Granulation tissue type	1.38	0.51	2.08	0.28	-4.32	0.000
Total amount of granulation tissue	1.62	0.65	1.85	0.38	-1.11	0.279
Edges	1.23	0.44	1.85	0.55	-3.14	0.004
Periulcer skin viability	0.92	0.64	1.23	0.60	-1.26	0.218
Total Score	11.31	2.46	16.00	2.35	-4.98	0.000



4. Discussion

Weed et al (1) in their randomized double-blind placebo-controlled trial have shown that wound healing was 81.3% (in placebo group) vs 41.2% in control group, and demonstrated that PRP enhanced healing. In our study we also observed that in Group A (PRP dressing) there was a substantial decrease in wound area, going from 88.46 cm² (±85.77) before therapy to 12.11 cm² (±19.35) at the 4th week (p = 0.006) illustrating the higher effectiveness of PRP dressings in facilitating the process of wound healing.

Driver et al (2)conducted a multicentric clinical trial where 129 patients were screened out of which 72 completed a 7-day screening period and met the study inclusion criteria. Patients were randomized into two groups - the standard care with platelet-rich plasma gel and control (saline gel) dressing group - and evaluated biweekly for 12 weeks or until healing occurred. An independent audit led to the exclusion of 32 patients from the final per-protocol analysis because of protocol violations and failure to complete treatment. In this group, 13 out of 19 (68.4%) of the platelet-rich plasma gel and nine out of 21 (42.9%) of the control wounds healed. After adjusting for wound size outliers (n = 5), significantly more platelet-rich plasma gel (13 out of 16, 81.3%) than control gel (eight out of 19, 42.1%) treated wounds healed (P = 0.036).” In our study we also observed that Group A (PRP wound dressing) observed a substantial decrease in wound area, going from 88.46 cm² (±85.77) before therapy to 12.11 cm² (±19.35) at the 4th week (p = 0.006). On the other hand, Group B (conventional wound dressings) did not see a significant decrease in wound area. The size of the wound changed from 67.67 cm² (±86.05) before treatment to 43.12 cm² (±53.33) at the end of the fourth week (p = 0.913).

Anitua et al (3) results showed that at 8 weeks, the mean percentage of surface healed in the PRGF group was 72.94% +/- 22.25% whereas it was 21.48% +/- 33.56% in the control group (p < 0.05), suggesting that topical application of PRGF is more effective than standard therapy in helping a chronic ulcer to heal.” In our study we also observed that in Group A (PRP dressing) showed substantial decrease in wound area, going from 88.46 cm² (±85.77) before therapy to 12.11 cm² (±19.35) at the 4th week (p = 0.006) illustrated the higher effectiveness of PRP dressings in facilitating the process of wound healing.

The development of autologous platelet-rich plasma for the treatment of chronic wounds has been a theoretical and practical pursuit since 1986, when “Knighton et al (4)conducted a prospective, randomized controlled, blinded crossover study on 32 patients. 100% epithelialization was found in 81% of the PRP group and 15% of the control group by 8 weeks. After crossover all the placebo group achieved complete healing and concluded that average reduction of wound area in PRP dressing compared to normal dressing was significant with a P value= 0.001.” In our study we also observed that Group A (PRP wound dressing) observed a substantial decrease in wound area, going from 88.46 cm² (±85.77) before therapy to 12.11 cm² (±19.35) at the 4th week (p = 0.006). On the other hand, Group B (conventional wound dressings) did not see a significant decrease in wound area. The size of the wound changed from 67.67 cm² (±86.05) before treatment to 43.12 cm² (±53.33) at the end of the fourth week (p = 0.913). This illustrates the higher effectiveness of PRP dressings in facilitating the process of wound healing.

Asfaha et al (5) associated this analgesic activity to the PAR4 pathway and found that PRP treatment resulted in a statistically significant decrease in the number of pain-relieving injections used during therapy, our study is also suggestive of reduced pain and VAS score.

“Cardeñosa et al (6) in their study proposed that mean healed area 67.7%±41.5%(control) vs 11.2%±24.4%(case) (P=0.001), pain reduction (VAS) in PRP group (P<0.001)

Photographic gallery:

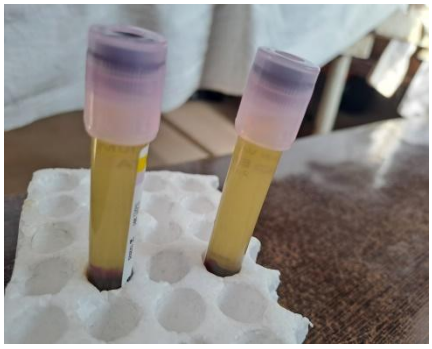


Figure 5: This photograph showing separated portion of blood cells and plasma after process of centrifugation

Figure 6: This image is depicting injection of PRP into intralesional space and margins of the wound.

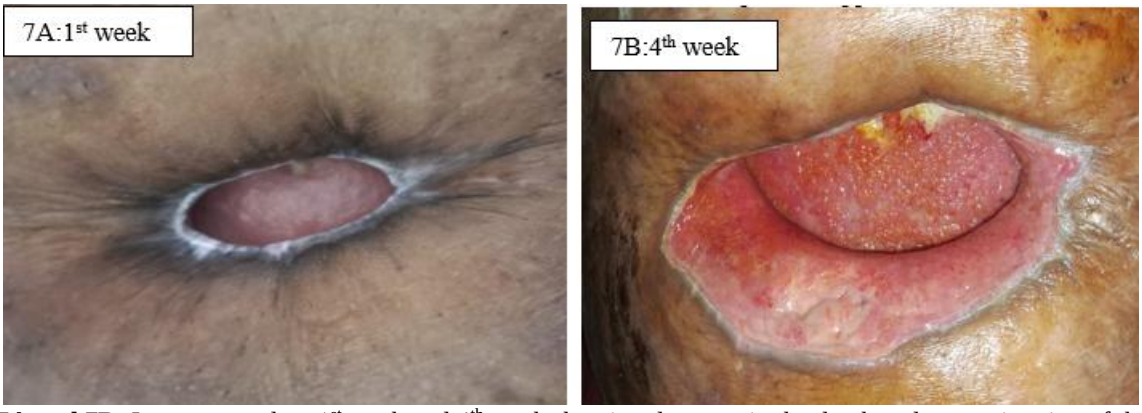


Figure 7A and 7B: Image wound at 1st week and 4th week showing decrease in the depth and approximation of the wound edges and closure of the wound.

Figure 8A and 8B: Images of the wound at 1st and 4th week depicting decrease in the necroting content, approximated wound edges along with healthy granulation tissue.

Figure 9A and B: Image of wound at gluteal region at 1st and 4th week showing decrease in depth of the wound, approximated wound edges and presence of granulation tissue.

Figure 10A and B: images of wound showing decrease in the size of the along with the approximated wound edges.

5. Conclusion

This study concludes that:

- There was a significant reduction in wound size with PRP dressings compared to conventional saline dressings, evidenced by a p-value of 0.006.
- Both treatment groups experienced a meaningful decrease in pain over time, statistically significant ($p < 0.001$); however, PRP dressings provided greater pain relief than the control group.
- The evidence strongly indicates that PRP dressings are more effective at reducing necrotic tissue compared to standard dressings, with a significant p-value of less than 0.001.
- Although disparities were observed between the two groups regarding wound size, depth, and granulation tissue type, these differences did not yield statistically significant results overall.
- The mean total PWAT score was significantly lower for PRP dressings ($p < 0.001$), indicating their superior efficacy in wound management.

These results support the potential of PRP therapy as a preferred treatment modality for chronic wounds, warranting further investigation and broader clinical application.

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