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Original Article

COMPARISION OF AUTOLOGOUS PLATELET GEL AND CONVENTIONAL DRESSING IN THE HEALING OF CHRONIC WOUNDS

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ABSTRACT

Objective: The aim of the present research is to compare the effectiveness of autologous platelet gel with conventional technique for epithelialization and wound reduction in chronic wounds.

Methods: The out-patient who attended on regular basis for the treatment or those who were admitted as inpatients for the management of chronic wounds in a tertiary care teaching hospital from October 2019 to October 2021 were included in the study. A total of 120 patients were examined; 60 cases received betadine dressing for chronic wounds and 60 cases were randomly selected for investigation with autologous platelet gel.

Results: Autologous platelet gel demonstrated quicker and better rates of healing in the present study. In the study group, the mean area wound reduction was statistically significant. The study group has no negative side effects or responses from using autologous platelet gel.

Conclusion: This study provided solid evidence that autologous platelet gel dressings are a safe and affordable way to speed up the healing of chronic wounds while lowering hospital costs and morbidity.

Keywords: Wound healing, Platelet gel, Betadine dressing, Epithelialization, Cytokines

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INTRODUCTION

Wound healing is the end result of a complicated process in which cellular, immunological, and hormonal elements interact. An individual's ability to survive depends on the health of his tissues and organs. A restoration process is swiftly started if continuity is lost after illness or accident. Young people heal wounds more quickly and frequently, and they also have more keloids and hyperplastic scars [1]. Compared to wounds in more ischemic locations, those on the face heal more quickly in highly vascular regions. Hypoperfusion owing to systemic causes (low volume or heart failure) or local causes (arterial insufficiency, local vasoconstriction, or high tension on tissues) are major variables impacting local oxygen delivery. A wound's healing might be slowed down or even stopped by bacterial infection. Local tissue loss and subsequent impairment of healing are caused by bacterial growth, subsequent bacterial enzymation, and extension of the inflammatory phase of healing [2, 3]. In chronic wounds, the existence of host response aids in the distinction between infection and colonisation. Cellulitis, aberrant discharge, change in pain, abnormal granulation tissue, odd colour, and scent are among the host responses that aid in the diagnosis of wound infection. Poor nutritional intake or lack of individual nutrients significantly alters many aspects of wound healing. Large doses or chronic usage of glucocorticoids reduce collagen synthesis and wound strength. Diabetes mellitus is the best known of the metabolic disorders contributing to increased rates of wound infection and failure. Uncontrolled diabetes results in reduced inflammation, angiogenesis and collagen synthesis [4, 5]. Additionally, the large and small vessel disease that is the hallmark of advanced diabetes contributes to local hypoxemia. Wound healing takes place in three phases: Phase of preparation or Phase of inflammation followed by Phase of Proliferation and Phase of Maturation or Phase of Remodelling. Wounding by definition, disrupts tissue integrity, leading to the division of blood vessels and direct exposure of extracellular matrix to platelets. The basis and first stage of the healing process are hemostasis. When platelets are exposed to extravascular collagen, the wounded artery vasoconstrictes, and this causes the platelets to aggregate [6, 7]. Adenosine diphosphate, which is released by platelets when they attach to collagen, is stimulated by calcium to cause additional platelet aggregation. Fibrinogen, Fibrinonectin, Thrombospondin, and Von Will brand Factor are the four adhesive glycoproteins that mediate platelet adherence to collagen and to other platelets. Cytokines that are stored in granules are also released as a result of platelet aggregation. These include Transforming Growth Factor (TGF), Platelet Derived Growth Factor (PDGF), and which are vital in the final stages of recovery. The wound healing process is further aided by the growth factors epidermal growth factor (EGF), vascular endothelial growth factor (VEGF), and insulin-like growth factor (IGF). Recombinant technology, blood bank platelet concentrate, or autologous blood can all be used to create platelet extract. Autologous platelet gel promises to be a straightforward and affordable means of treating chronic wounds because not all patients can afford commercially available recombinant platelet gel or blood bank platelet for dressing [8-10]. Since there aren't many research on this topic, an effort has been made to determine the therapeutic effectiveness of using autologous platelet gel while contrasting it with traditional dressing for usage in chronic wounds. The purpose of this study is to compare the effectiveness of autologous platelet gel with traditional methods of treatment for epithelialization and wound reduction in chronic wounds.

MATERIALS AND METHODS

Study design

This a prospective randomized controlled study, to test the efficacy of autologous platelet gel in epithelialization and wound reduction in chronic wounds.

Study place

The study was conducted in the department of surgery, Dr. Patnam Mahendar Reddy Institute of Medical Sciences, Chevella.

Study period

The study was conducted for a period of one year from October 2019 to October 2021.

Study sample

The source of data were patients attending the outpatient on a regular basis or those admitted as inpatients for the management of chronic wounds. One hundred twenty patients were studied. 60 cases were randomly chosen for study with autologous platelet gel and 60 cases received betadine dressing for the chronic wounds.

Methodology

Under all aseptic precautions, 12 ml of blood was drawn intravenously from the antecubital region into 2 test tubes containing ACD as an anticoagulant. The test tubes were shaken thoroughly to ensure mixing of anticoagulant withdrawn blood. The blood centrifuged at 3000 rpm for 10 min. The supernatant formed is Platelet Poor Plasma (PPP) and buffy coat. 2 ml of PPP was aspirated and kept aside for use in the preparation of autologous thrombin. Remaining PPP, Buffy coat (upper 1 mm of RBC) layer is collected in another vacutainer and again centrifuged at 1000 rpm for 10 min. The upper half is discarded and the lower half yields concentrated platelet-rich plasma. 2 ml of PPP, which was kept aside is thoroughly mixed with 0.08 ml of 10% Calcium gluconate. This resulted in clot formation and a supernatant, which is the autologous thrombin, after 20 min. 0.5 ml of the autologous thrombin is added to the concentrated PRP, which forms a transparent PRP gel after a few minutes.

Data collection

Detailed history was taken in all cases regarding the duration, mode of onset, progression and associated symptoms. The etiological factor that might be responsible for chronicity was also elicited. Ulcer examination was done in all cases and wound assessed of its characteristics, include peri-wound edema, peri-wound erythema, limb pitting edema, limb brawny edema, wound purulence and wound granulation. Four dressings were done 3-4 d apart for each patient (Day 1,4,7,10). Size of the ulcer was plotted over a graph and a photograph was taken of the wound at the beginning and at the end of the study (Day 1 and Day 14) and photographic wound assessment tool (PWAT) used in this comparison.

Statistical analysis

Unpaired student's "t" test and paired "t" test were used to find out the statistical significance. P<0.05 was taken as significant.

RESULTS

Table 1 showed the age-wise distribution of cases ranged from 18 y to 78 y. Majority of the cases were reported in the age group 51-60 (36.6%) years followed by 41-50 y 25%). Table 2 showed the Gender-wise distribution of cases and most of the reported cases were males 88.3% and the female prevalence is less 11.7%. The mean age of cases was 47.93±15.86 y and the mean age of controls was 47.20±14.45 y. The difference in mean age between cases and controls was not statistically significant. In this study, 49.1% of the wounds were of non-specific traumatic etiology with no statistical difference between cases and controls. The next most common wounds were pressure sores at 17.5%. There is no statistical difference between cases and controls with regard to the etiology of the wounds (table 3). From the table 4 it was revealed that, 41.6% of all the wounds were present in the leg and 31.6% in the foot. There was no statistical difference between cases and controls with regard to site of the wound. 60% of the total wounds were on the right side, which was the dominant limb in the patients and 46.6% on the left side (fig. 1) and there was no statistical difference with P>0.05. The duration of wound was more with cases 67% than control (fig. 2) with the significant statistical difference (P<0.05). The mean duration of wound in cases was 103.73±130.75 w and 52±98.2 w in the control group. The difference of mean duration of wound in cases and controls was not statistically significant. The mean area at the beginning of the study was 518.73±383.02 mm^2 in the cases and 517.73±506.91 mm^2 in the controls. There was no statistical difference between the two groups (p = 0.995) before initiation of treatment. There were no much more differences in the lab investigations of both cases and controls (fig. 3). There was a statistically significant difference between the area before the treatment and area after the treatment among the cases, whereas no statistical difference between the area before the treatment and after the treatment was present for the controls. Mean reduction in area of ulcer, 237.67 mm^2 for the cases was more than that of controls,17.04 mm^2 after the initiation of treatment and the difference was statistically significant (p<0.001) (table 5). The percentage reduction in cases was 46.95%±15.16% and 2.28%±2.54% in controls, which was statistically significant (P<0.05). The difference in the percentage area reduction of the wounds due to traumatic etiology between cases and controls was statistically significant (P<0.05). Statistical comparison of the difference in the percentage area reduction between cases and controls could not be accurately done due to the relatively fewer cases in the remaining etiologies. There was a statistical mean reduction in the PWAT score before and after treatment and was more for the cases than that of controls (fig. 4). Fig. 5 showed before and after PDF dressing.

Table 1: Age-wise distribution of the cases

Age group (in y)	Number of Patients	Cases n= 60(%)	Controls n= 60 (%)
1-10	3	0 (0%)	0 (0%)
11-20	1	1 (1.6%)	3 (5%)
21-30	12	7 (11.6%)	5 (8.3%)
31-40	15	8 (13.3%)	7 (11.6%)
41-50	26	15 (25%)	11 (18.3%)
51-60	45	22 (36.6%)	23 (38.3%)
61-70	9	3 (5%)	6 (10%)
71-80	9	4 (6.6%)	5 (8.3%)
Total	120	60	60
P>0.05 (Insignificant)			

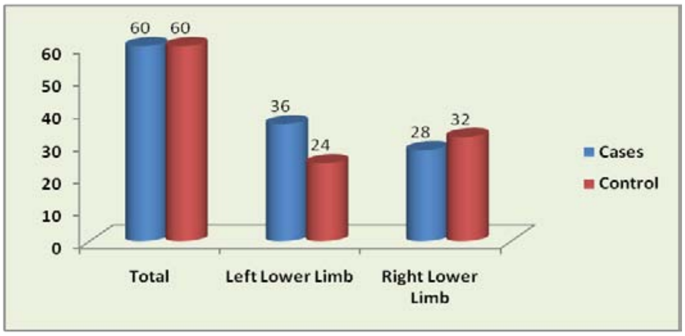

Fig. 1: Wound side

Table 2: Gender-wise distribution of cases

Sex	Number of patients	Cases n= 60(%)	Controls n= 60 (%)	P-value
Male	104	53 (88.3%)	49 (81.6%)	>0.05 (Insignificant)
Female	16	7 (11.7%)	11 (18.4%)	
Mean age		47.93±15.86	47.20±14.45	
Total	120	60	60	

Table 3: Etiologies of wounds

Etiology	Cases n= 60(%)	Controls n=60 (%)	Total (%)
Non specific traumatic	35(58.3%)	24(40%)	59(49.1%)
Pressure sore	14(23.3%)	7(11.6%)	21(17.5%)
Diabetes	12(20%)	4(6.7%)	16(13.3%)
Other infected ulcers	9(15%)	7(11.6%)	16(13.3%)
Varicose veins	5(8.3%)	3(5%)	8(6.7%)
P=0.78 (Insignificant)			

Table 4: Site of wound

Site	Cases n= 60(%)	Controls n=60 (%)	Total (%)
Leg	26(43.3%)	24(40%)	50(41.6%)
Dorsum	18(30%)	20(33.3%)	38(31.6%)
Sole	4(6.7%)	8(13.3%)	12(10%)
Gluteal	8(13.3%)	4(6.7%)	12(10%)
Sacrum	4(6.7%)	4(6.7%)	8(6.7%)
P=0.91 (Insignificant)			

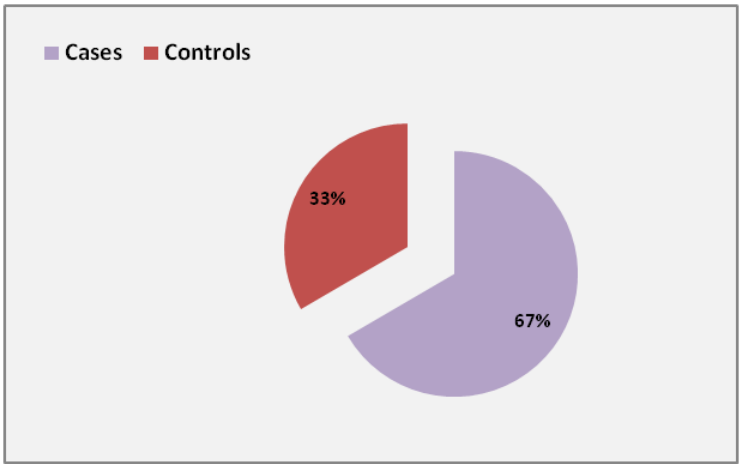

Fig. 2: Wound duration

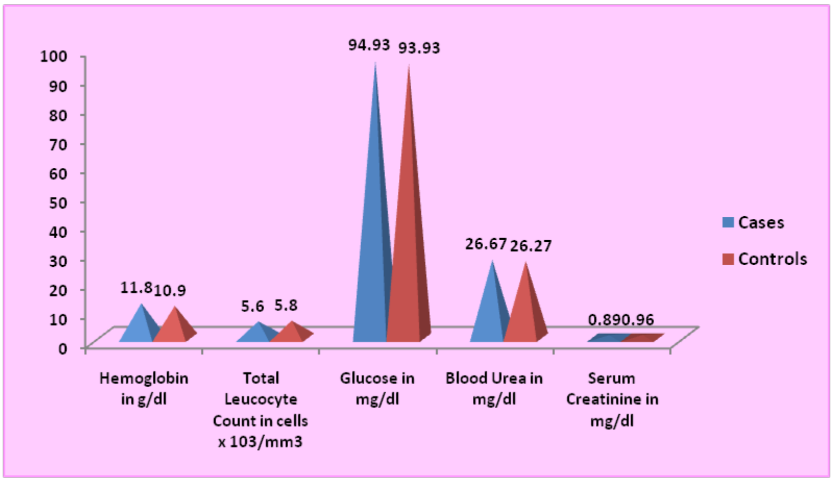

Fig. 3: Lab investigations for cases and controls

Table 5: Showing comparison of before and after area in mm²

	Area before		Area after		P-value
	Mean	SD	Mean	SD	
Cases	578.73	396.02	301.07	245.18	0.001
Controls	529.73	504.91	492.67	499.86	0.07

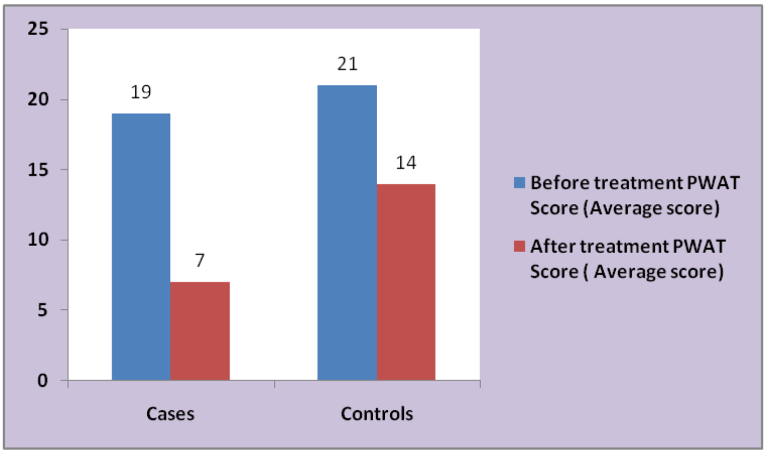

Fig. 4: Comparison between case and control according to PWAT score

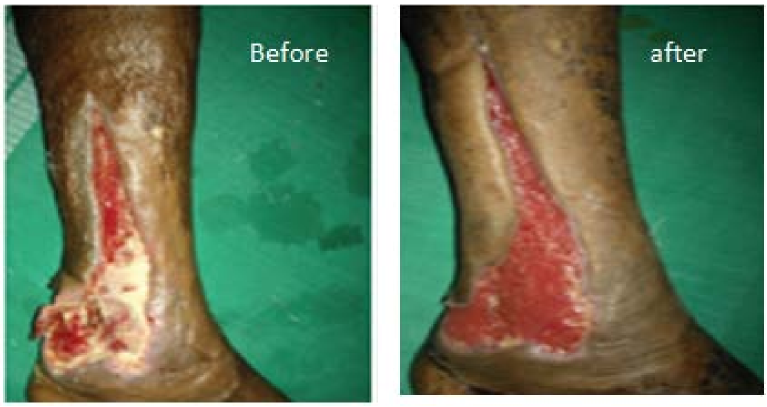

Fig. 5: Before and after PDF dressing

DISCUSSION

PRP enhances wound healing by promoting the healing process secondary to its GFs. These include platelet-derived GF (αα, ββ, and αβ), fibroblast GF, vascular endothelial GF, epidermal GF, insulin-like GF, and transforming GF. These GFs stimulate mesenchymal cell recruitment, proliferation, extracellular matrix degeneration, and cell differentiation for tissue regeneration. These factors are released from α-granule in response to platelet activation by inducers of platelet aggregation. The anti-inflammatory factors in PRP also play a role in wound healing because of the presence of leukocytes, which are at high levels in PRP. In addition to the GFs, platelets release numerous other substances (e. g., fibronectin, vitronectin, and sphingosine 1-phosphate) that are important in wound healing. An advantage of PRP over the use of single recombinant human GF delivery is the release of multiple GFs and differentiation of factors upon platelet activation [11, 12]. Majority of the cases were reported in the age group 51-60 (36.6%) years, followed by 41-50 y 25%). Most of the reported cases were males 88.3% and the female prevalence is less 11.7%. The mean age of cases was 47.93±15.86 y and the mean age of controls was 47.20±14.45 y. The results were agreed with the findings of Orban *et al.* (2022) [13] showed the mean age group was 45 y. Unlike the other studies, the present study had a sizable proportion of the wounds of non-specific traumatic etiology–nearly 49.1% in both cases and controls. Some wounds in each group were due to snake bites, the chronicity a sequelae of the local toxin. 41.6% of all the wounds were present in the leg and 31.6% in the foot. 60% of the total wounds were on the right side, which was the dominant limb in the patients and 46.6% on the left side. Knighton (1990), [14] Krupski (1991) [15] and Weed (2004) [16] studied wounds only of the lower limb. There was a statistically significant difference between the area before the treatment and area after the treatment among the cases, whereas no statistical difference between the area before the treatment and after the treatment was present for the controls. In the Krupski study, the control group presented with a larger wound area than the experimental group (29 cm² versus 13 cm²). The remaining studies Knighton (1990) [14], and Weed (2004) [16] showed comparable wound size between cases and controls. Mean reduction in area of ulcer, 237.67 mm² for the cases, was more than that of controls, 17.04 mm² after the initiation of treatment. Whereas In the Krupski trial [15], the rate of healing in cm²/week was studied as a secondary outcome.

The rate of healing in the control group was 1.9±2.7 cm²/week. In contrast, the wounds in the platelet group increased in size and thus, the values are recorded as negative numbers-4.3±12.2 cm²/week. The difference in the percentage area reduction of the wounds due to traumatic etiology. Serra *et al.* [17] compared the effect of platelet-rich gel with 32 patients serving as controls. Healing rates were 96.15% in patients receiving platelet-rich gel against 59.37% in patients not receiving platelet-rich gel. Using the PWAT to assess wound appearance has several advantages, but has some limitations as well, a photographic image is merely a 2-dimensional representation of a 3-dimensional problem. There was a statistical mean reduction in the PWAT score before and after treatment and was more for the cases than that of controls.

CONCLUSION

The purpose of the current study was to compare the effectiveness of autologous platelet gel with traditional methods of treatment for epithelialization and wound reduction in chronic wounds. The following results were drawn from the usage of autologous Platelet-Derived Growth Factor (PDGF) in comparison to the betadine dressings for the treatment of chronic ulcers. The research group's recovery rates with PDGF were quicker and better. In the study group, there was a statistically significant area reduction. When autologous platelet-derived growth factors (platelet gel) were put over the ulcer, there were no negative effects or reactions noticed. It is a reasonably priced treatment that facilitates early skin transplantation and shortens hospital stays.

FUNDING

Nil

AUTHORS CONTRIBUTIONS

All the authors have contributed equally.

CONFLICT OF INTERESTS

Declared none

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