

Efficacy of Platelet Rich Plasma Dressing versus Normal Saline Dressing in the Management of Diabetic Foot Ulcers

Rajeshwar Kamineni¹, Gopi Tupkar²

¹Assistant Professor, Department of General Surgery, MNR Medical College and Hospital, Sangareddy, Telangana, India.

²Assistant Professor, Department of General Surgery, MNR Medical College and Hospital, Sangareddy, Telangana, India.

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Corresponding author: Dr Gopi Tupkar

Conflict of interest: Nil

Abstract

Introduction: Diabetes mellitus and its associated foot ulcers are at alarming pace in India. Conventional dressing with normal saline and other techniques of ulcer wound healing including platelet rich plasma have gained great importance due to their rapid healing rate by synthesizing local active growth factors. The present study was designed to assess the efficacy of plasma rich platelet dressing versus normal saline dressing in the management of diabetic foot ulcers.

Materials and Methods: A source of 64 participants with diabetic foot ulcers admitted in the Department of General surgery above 40 years of age were recruited. Participants were randomly divided into group 1 (n=32) treated with normal saline dressing and group 2 (n=32) with platelet rich plasma (PRP) dressing and followed up for 6 weeks duration to check the status of the wound (length, width) and reduction area.

Results: The mean wound contraction rate after 4 weeks of treatment was 8.41 ± 1.65 and 17.82 ± 5.18 , wound reduction was 10.53 ± 2.84 and 36.26 ± 6.20 and duration of wound healing was 6.97 weeks and 4.12 weeks in normal saline group and PRP group respectively. In PRP group, early rate of healing was observed in 18.75%, 25%, 34.38% and 15.62% at 1, 2, 3 and 5 weeks respectively.

Conclusion: PRP dressing was effective treatment option for the management of diabetic foot ulcers than the normal saline dressing group in terms of higher rates of wound contraction, wound reduction and duration of healing.

Keywords: Platelet Rich Plasma, Normal Saline Dressing, Diabetic Foot Ulcers, Efficacy.

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Introduction

Diabetic foot ulcers are common complication of diabetes and major public health concern that led to limb amputation. Chronic ulcer wounds are greatly disrupting the quality of life of patients [1,2]. Around 15% of the diabetics exhibited diabetic foot ulcers during their lifetime and 88% of lower limb amputations were due to diabetic foot ulcers [3]. The prevalence of diabetic foot ulcers ranges from 4-10% and

infections are common cause of mortality and morbidity in 40-80% of the subjects [4]. The management options for diabetic foot ulcers are cost effective, which accounting for 20% of total health care costs [5]. Conventional methods including normal saline dressing was commonly used technique but has limitations in terms of delayed healing rate, and higher incidence of infection [6]. Several novel ulcer wound

management methods are emerging including cellular therapies, which includes platelet rich plasma and collagen wound dressing.

Platelets synthesize epidermal growth factors, platelet derived growth factor and platelet derived angiogenesis factor. PRP is an autologous serum that derived from whole blood that promotes. Several studies have been reported that PRP used for enhancing wound healing were compared to conventional dressing [7]. With above reference, the present study was designed to assess the efficacy of plasma rich platelet dressing versus normal saline dressing in the management of diabetic foot ulcers.

Material and Methods

This prospective randomized control study comprises 64 participants with diabetic foot ulcers admitted in the Department of General surgery, MNR Medical College and Hospital during April 2021 to October 2022. Written informed consent was obtained from all the participants. Study protocol was approved by the institutional ethics committee.

Selection criteria:

Participants with type 1 and type 2 diabetes mellitus, above 40 years of age, with non-

healing foot ulcers (size ranging from 4-7cm), with controlled blood sugars, and willing to participate were included. Participants with history of conventional skin grafting, cardiovascular complications, osteomyelitis, hepatitis, HIV, with ulcers below 2 cm and not willing to participate were excluded.

All the participants were subjected to detailed clinical examination and necessary laboratory investigations including random blood glucose, blood grouping, renal function test and complete blood profile. The study participants were randomly divided into two groups. Group 1 (n=32) was treated with normal saline dressing and group 2 (n=32) participants were managed with platelet rich plasma dressing and it was changed after every 4 days.

Treatment was followed up for 6 weeks duration to check the status of the wound (length, width) and reduction area was recorded and compared. Data analysis was conducted using SPSS version 23.0. Categorical variables were expressed in frequency and percentages.

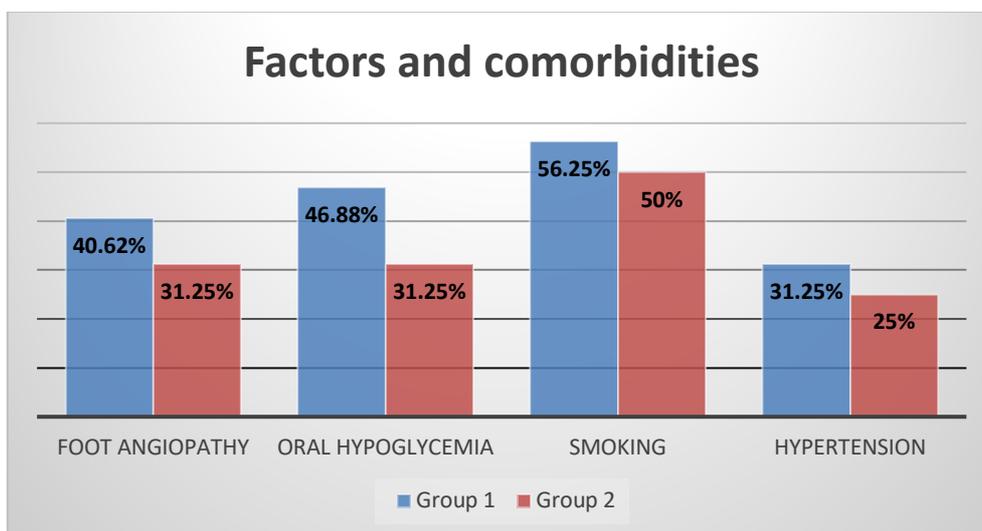
Comparative analysis was conducted using Unpaired student t test. The statistically significant outcome was considered if $P < 0.05$.

Results

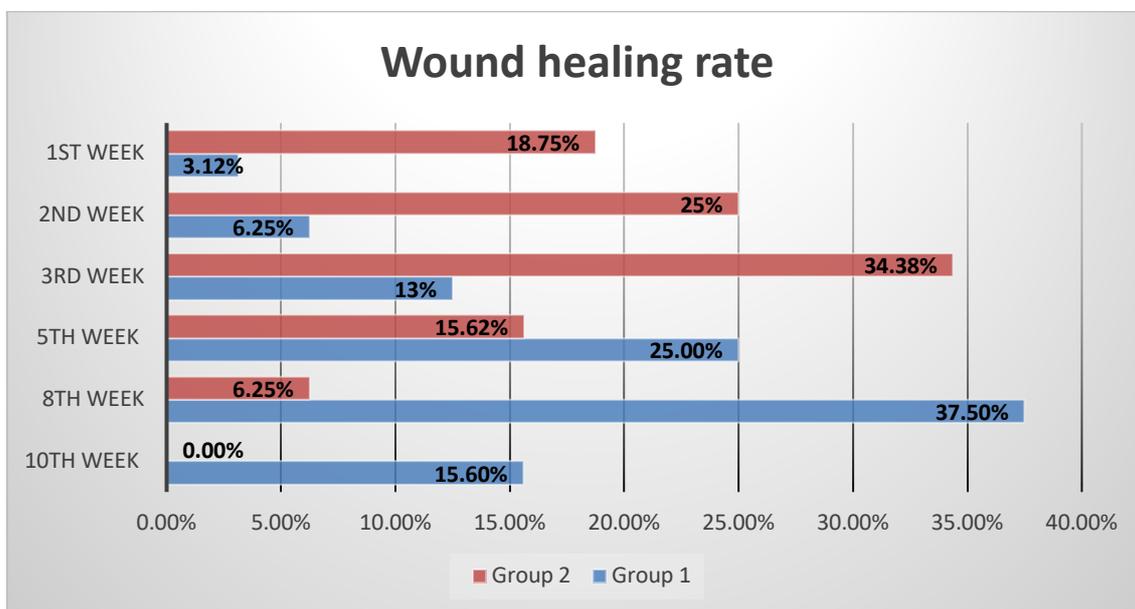
Table 1: Clinico- demographic details of study participants

Parameters	Total no of participants (n=64)	
	Group 1 (n=32)	Group 2 (n=32)
Age (In years)		
Below 50	07 (21.88%)	05 (15.62%)
51-60	16 (50%)	17 (53.12%)
Above 60	09 (28.12%)	10 (31.25%)
Gender		
Male	24 (75%)	22 (68.75%)
Female	08 (25%)	10 (31.25%)
Duration of diabetes		
<8 years	07 (21.88%)	05 (15.62%)
>8 years	25 (78.12%)	27 (84.38%)
Site of the wound		
Dorsum of foot	06 (18.75%)	09 (28.12%)
Sole of foot	26 (81.25%)	23 (71.88%)

Onset of ulcer		
Traumatic origin	18 (56.25%)	21 (65.62%)
Spontaneous origin	14 (43.75%)	11 (34.38%)
Anti-diabetic medication		
Oral drugs	08 (25%)	10 (31.25%)
Insulin	24 (75%)	22 (68.75%)



Graph 1: Factors affecting the healing in both study groups.



Graph 2: Rate of wound healing in both study groups

Table 2: Details of wound contraction and surface reduction among study participants

Wound contraction/ reduction	Group 1	Group 2	p-value
	Mean±SD	Mean±SD	
Rate of wound contraction (After 4 weeks)	8.41±1.65	17.82±5.18	0.001
Wound area of reduction	10.53±2.84	36.26±6.20	0.001
Duration of wound contraction	6.97±1.02	4.12±0.89	0.0263

Discussion

Majority of the participants have diabetes more than 8 years (78.12% in G-1 and 84.38% in G- 2). Ulcer wounds are common on sole of the foot in both study groups (81.25% in G-1& 71.88% in G-2). Ulcer wounds are commonly traumatic in origin (56.25% in G-1 & 65.62% in G-2) and majority participants were under insulin (75% in G-1 & 68.75% in G-2) (Table 1). A study by Orban YA *et al.*, on comparing conventional dressing with PRP dressing in diabetic patients noticed that the mean age was 56.03 and 58.69 years in PRP and conventional groups, with more male participants.

The chronicity of the diabetes was 46.64 weeks and 46.67 weeks, wound size was 3.33 cm and 3.23 cm in in PRP and conventional groups respectively. Wound ulcers were common on sole of the foot (72.2% in PRP & 66.6% in conventional) in both study groups [8]. Abd El-Mabood *et al.*, found that majority participants showed wounds on sole of the foot (83.75%) with a mean duration of diabetes was 7.5 years and size of the wound was 6.4 cm [9].

Smoking (56.25% & 50%), followed by oral hypoglycaemia (46.88% & 31.25%), foot angiography (40.62% & 31.25%) and hypertension (31.25% & 25%) were the common risk factors and comorbidities delaying the healing of ulcer wounds in both study groups respectively (Graph 1). A study by Abd El-Mabood *et al.*, found that oral hypoglycaemia, smoking, foot angiopathy, hypertension, insulin, nephropathy and retinopathy are the common comorbidities and risk factors impair healing of ulcer wounds [9]. The present study findings were similar to the above study where oral hypoglycaemia, smoking, foot angiopathy, hypertension were the common comorbidities and risk factors.

In normal saline group, rate of wound healing was comparatively prolonged and took 5 weeks, 8 weeks and 10 weeks in

25%, 37.50% and 15.60% respectively. While in PRP group, early rate of healing was observed in 18.75%, 25%, 34.38% and 15.62% at 1, 2, 3 and 5 weeks respectively (Graph 2). A study by Orban YA *et al.*, reported high wound healing rate in PRP group (87.11%) than conventional group (63.89%) [8]. A study by Abd El-Mabood *et al.*, found that PRP group was exhibited to be more effective than conventional dressing after 2nd week and 4th week (9). A systemic review by Takashi Hirase *et al.*, reported a significantly higher rates of healing (0.68 ± 0.56 cm²/week vs 0.39 ± 0.09 cm²/week; $p < 0.001$), faster healing duration (7.8 weeks vs 8.3 weeks) and less incidence of adverse events were observed in PRP dressing than conventional dressing group [10]. Similarly, present study reported early healing rate in PRP group than conventional group.

The mean rate of wound contraction after 4 weeks of treatment was 8.41 ± 1.65 and 17.82 ± 5.18 , wound reduction was 10.53 ± 2.84 and 36.26 ± 6.20 and duration of wound healing was 6.97 weeks and 4.12 weeks in normal saline dressing group and PRP group. The mean difference of wound contraction, wound reduction and duration of healing between study groups was statistically significant ($p < 0.001$) (Table 2). A study by Orban YA *et al.*, found early healing duration in PRP dressing group (10.90 weeks) than conventional dressing group (13.48 weeks) and difference was statistically significant ($p < 0.05$) (8). A study by Abd El-Mabood *et al.*, reported that that total rate of healing was 6.8cm²/week in conventional group and 7.3 cm²/week in PRP group [9]. A study by Ullah A *et al.*, observed significantly higher rate of wound reduction in injected PRP group (80%) than conventional dressing group (46.25%) ($P < 0.001$) [11]. A study by Singh SP *et al.*, observed complete healing in 36.7 days of PRP group and 60.6 days in conventional group and no adverse effects were observed in the PRP group [14].

Ahmed M *et al.*, found a significantly higher healing rate per week in PRP dressing (86%) than local antiseptic dressing (68%) for first eight weeks [15].

A study by Elsaid A *et al.*, found that the percentage of reduction in the ulcer wound dimensions was significantly high in PRP group (43.2%) than normal saline group (42.3%) and duration for maximum healing was significantly low in PRP group (6.3 weeks) than normal saline group (10.4 weeks) [16]. Similarly, in present study, wound contraction, wound reduction and duration of healing was high in PRP group as reported by the above studies.

Orban YA *et al.*, stated that autologous PRP was effective and claimed higher rate of wound healing in less duration than conventional dressing [8]. A study by Abd El-Mabood *et al.*, stated that PRP therapy was effective in the management of diabetic ulcers in terms of rapid healing, lower infection and minimizes the amputation rates [9]. A study by Ullah A *et al.*, found a significantly high rates of wound reduction in participants aged above 55 years, with normal BMI and concluded that injected PRP was significantly better than conventional dressing [11].

A systemic review reported that topical application of PRP was reported significantly higher healing rates than conventional dressing for diabetic foot ulcers [12]. Malekpour Alamdari N *et al.*, reported that PRP dressing was significantly enhances the healing rate irrespective to age, gender, smoking status and blood pressure levels [13]. Singh SP *et al.*, concluded that PRP dressing was effective management modality with better wound score in terms of debridement and dressing than conventional dressing for diabetic foot ulcers [14]. Ahmed M *et al.*, state that autologous platelet gel was effective and claimed better healing rate than local antiseptic dressing [15].

Elsaid A *et al.*, stated that PRP gel was effective and significantly reduces the

wound size in diabetic foot ulcers compared to normal saline dressing [16]. The present study findings were similar to the above findings where PRP dressing group showed better outcome than conventional dressing group. The present study limitations in terms of low participants size, lesser duration of treatment follow up and did not assessed details of recurrence. Further long-term follow-up studies are required to assess the multiple treatment options with possible recurrence rate in the diabetic foot ulcers.

Conclusion

In conclusion, PRP dressing was effective treatment option for the management of diabetic foot ulcers than the normal saline dressing group in terms of higher rates of wound contraction, wound reduction and duration of healing.

References

1. Kapp S, Miller C, Santamaria N. The quality of life of people who have chronic wounds and who self-treat. *J. Clin. Nurs.* 2018;27: 182-192.
2. Yazdanpanah L, Shahbazian H, Nazari I, *et al.* Incidence and risk factors of diabetic foot ulcer: a population-based diabetic foot cohort (ADFC Study—two-year follow-up study). *Int J Endocrinol.* 2018; 2018:7631659.
3. Alvarsson A, Sandgren B, Wendel C, Alvarsson M, Brismar K. A retrospective analysis of amputation rates in diabetic patients: can lower extremity amputations be further prevented? *Cardiovasc Diabetol.* 2012; 11:18.
4. Yerat R, Rangasamy V. A clinicomicrobial study of diabetic foot ulcer infections in South India. *Int J Med Public Health.* 2015; 5:236.
5. Sinharay K, Paul UK, Bhattacharyya AK, Pal SK. Prevalence of diabetic foot ulcers in newly diagnosed diabetes mellitus patients. *J Indian Med Assoc.* 2012; 110:608–611.

6. Hirase T, Ruff E, Surani S, Ratnani I. Topical application of platelet-rich plasma for diabetic foot ulcers: A systematic review. *World J Diabetes*. 2018; 9(10): 172-179.
7. Salem, A, Tawfik AM. Role of Platelet Rich Plasma in Treatment of Diabetic Foot Ulcers. *Surgical Science*. 2016;7: 272-277.
8. Orban YA, Soliman MA, Hegab YH, Alkilany MM. Autologous platelet-rich plasma vs conventional dressing in the management of chronic diabetic foot ulcers. *Wounds*. 2022;33(2):36-42.
9. Abd El-Mabood, El-Sayed A, Ali, Hazem E. Platelet-rich plasma versus conventional dressing: does this really affect diabetic foot wound-healing outcomes? *The Egyptian Journal of Surgery*. 2018;37(1):16-26.
10. Takashi Hirase, Eric Ruff, Salim Surani, Iqbal Ratnani. Topical application of platelet-rich plasma for diabetic foot ulcers: a systematic review. *World J Diabetes*. 2018; 9(10): 172-179.
11. Ullah A, Jawaid S I, Qureshi P, *et al*. Effectiveness of Injected Platelet-Rich Plasma in the Treatment of Diabetic Foot Ulcer Disease. *Cureus*. August 23, 2022; 14(8): e28292.
12. Meznerics FA, Fehervari P, Dembrovszky F, Kovacs KD, Kemeny LV, Csupor D, Hegyi P, Banvolgyi A. Platelet-Rich Plasma in Chronic Wound Management: A Systematic Review and Meta-Analysis of Randomized Clinical Trials. *Journal of Clinical Medicine*. 2022; 11(24):7532.
13. Malekpour Alamdari N, Shafiee A, Mirmohseni A, Besharat S. Evaluation of the efficacy of platelet-rich plasma on healing of clean diabetic foot ulcers: A randomized clinical trial in Tehran, Iran. *Diabetes Metab Syndr*. 2021;15(2):621-626.
14. Singh SP, Kumar V, Pandey A, Pandey P, Gupta V, Verma R. Role of platelet-rich plasma in healing diabetic foot ulcers: a prospective study. *J Wound Care*. 2018;27(9):550-556.
15. Ahmed M, Reffat SA, Hassan A, Eskander F. Platelet-Rich Plasma for the Treatment of Clean Diabetic Foot Ulcers. *Ann Vasc Surg*. 2017; 38:206-211.
16. Elsaid A, El-Said M, Emile S. Randomized Controlled Trial on Autologous Platelet-Rich Plasma Versus Saline Dressing in Treatment of Non-healing Diabetic Foot Ulcers. *World J Surg*. 2020; 44:1294–1301.