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Role Of Autologous Platelet Rich Plasma As A Preparative For Resurfacing Chronic Non-Healing Wounds Before Ssg.

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ABSTRACT:
INTRODUCTION: Platelet rich plasma is produced by concentrating platelets in a small amount of plasma. Autologous therapy is an intervention that uses an individual's cells or tissues, which are processed outside the body, and reintroduced into the donor. Recently, autologous platelet rich plasma has been used to treat chronic wounds, hair transplantation, cartilage regeneration, etc
AIM: To analyze the efficacy of Autologous Platelet Rich plasma when used as a preparative on chronic non healing wound before split skin grafting.
METHOD: This study was done in a prospective manner, 100 patients were included between March 2020 and October 2022, who presented with non-healing ulcers at Index medical college and underwent Split skin grafting after regular dressings and wound preparation and divided randomly into control and PRP group.
RESULTS: On comparing the two groups it was observed that, the group that underwent PRP compared to the control group have an accelerated period of healing and the preoperative time was reduced.
CONCLUSION: The response of patients with non-healing chronic ulcers given autologous PRP treatment prior to SSG was significantly better than those who were given only conservative preoperative treatment prior to grafting.

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I. INTRODUCTION :

Platelet-rich plasma (PRP) (syn. autologous platelet gel, plasma-rich growth factors and platelet-concentrated plasma) means "abundant platelets that are concentrated into a small volume of plasma." The most accepted definition at present states PRP as a volume of autologous plasma that contains a platelet concentration above basal concentration (150000- 350000/L). i.e., 3 to 5 times greater than normal platelet count.

The platelet, leukocyte, and growth factor concentrations vary according to the method used in the preparation for PRP products: Plasma rich growth factors (PRGF), Platelet-rich plasma and growth factors (PRPGF), Platelet-rich plasma (PRP), platelet-poor plasma (PPP), Leukocyte-rich platelet-rich plasma (LR-PRP), and Leukocyte-poor platelet-rich plasma (LP-PRP).

Hematologists created the term PRP in the 1970s to describe plasma with a platelet count above that of peripheral blood, which was initially used as a transfusion product to treat patients with thrombocytopenia. Ten years later, PRP started to be used in maxillofacial surgery as PRF. Fibrin had the potential for adherence and homeostatic properties, and PRP with its anti-inflammatory characteristics stimulated cell proliferation.

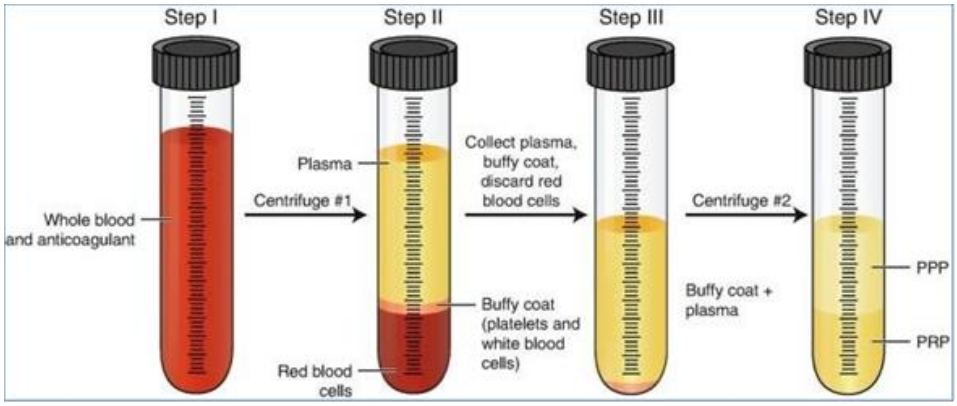
PRP is a natural source of signaling molecules, and upon activation of platelets, the Platelet granules are degranulated and release the growth factors and cytokines that will modify the pericellular microenvironment of the wound. Some of the most important growth factors released by platelets in PRP include vascular endothelial GF, fibroblast GF (FGF), platelet-derived GF, epidermal GF, hepatocyte GF, insulin-like GF 1, 2 (IGF-1, IGF-2), matrix metalloproteinases 2, 9, and interleukin 8.

Platelets contain several secretory granules that are crucial to platelet function. There are 3 types of granules: dense granules, alpha granules, and lambda(lysosomes) granules. In each platelet there are approximately 50-80 granules. Alpha granules contain fibrinogen, PDGF, thrombospondin and Von Willebrand factors. Dense granules contain calcium, ADP, ATP, serotonin, histamine and pyrophosphatase. Platelets are primarily responsible for the aggregation process. The main function is to contribute to homeostasis through 3 processes: adhesion, activation, and aggregation. During a vascular lesion, platelets are activated, and their granules release factors that promote coagulation. Platelets were thought to have only hemostatic activity, although in recent years, scientific research and technology has provided a new perspective on platelets and their

functions. Studies suggest that platelets contain an abundance of GFs and cytokines that can affect inflammation, angiogenesis, stem cell migration, and cell proliferation.

There are several techniques used to obtain autologous PRP, although some are not standardized or approved. The most common technique is to obtain a sample of blood from the patients themselves (autologous); this blood is then centrifuged to separate the platelets from red and white blood cells. A 30-cc venous blood draw will yield 3-5 cc of PRP depending on the baseline platelet count of an individual, the device used, and the technique employed. The blood draw occurs with the addition of an anticoagulant, such as citrate dextrose A to prevent platelet activation prior to its use. These platelets rich in growth factors are highly concentrated and suspended in a small volume of plasma. Because most individuals have a baseline blood platelet count of 200,000 (±75,000)/μL, a PRP platelet count of 1 million/μL has been postulated as the ideal therapeutic dose of PRP (Marx 2004).

There are two methods to liberate growth factors from the platelets. The first is to add thrombin or calcium which activates the platelets and release the growth factors. The second approach is to bring about physical lyses of the platelets (lysate) by freezing (Weed 2004), or by using other methods such as sonication, or to disrupt cell membranes and release cellular content with ultrasounds (Stacey 2000). The final product is applied locally to the wound as a gel or a solution. How the intervention might work PRP contains high concentrations of growth factors which are thought to facilitate healing



II. PRINCIPLES OF PRP PREPARATION

PRP is prepared by a process known as differential centrifugation. In differential centrifugation, acceleration force is adjusted to sediment certain cellular constituents based on different specific gravity.

There are many ways of preparing PRP. It can be prepared by the PRP method or by the buffy-coat method. In the PRP method, an initial centrifugation to separate red blood cells (RBC) is followed by a second centrifugation to concentrate platelets, which are suspended in the smallest final plasma volume.

III. MATERIALS AND METHODS:

This study was done in a prospective manner, 100 patients were included between March 2020 and October 2022, who presented with non-healing ulcers at Index medical college and underwent Split skin grafting after regular dressings and wound preparation.

Inclusion Criteria:

All males and females above 18 years of age who had chronic ulcers for more >4 weeks and were candidates for SSG were included in the study.

Patients with comorbidities such Diabetes mellitus type II were included if/after the glycemic control was established in the patient.

Exclusion criteria:

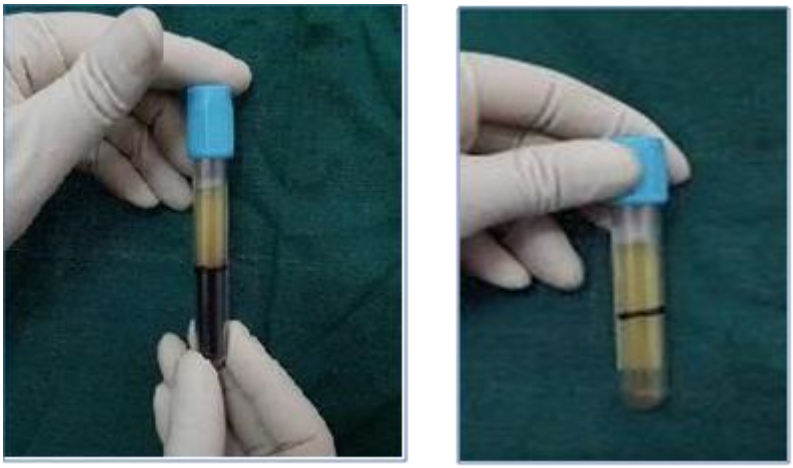
Patients who were medically unfit for Spinal/ General anesthesia due severe cardiovascular compromise, were excluded.

Patients with severe anemia, hematological disorders, hepatic and renal impairment that could impede the natural healing phenomenon severely of the patient were excluded.

Immunocompromised patients were excluded as well.

Methodology:

100 patients were included in the study and randomized into two groups, the control group (50) underwent conventional dressings and wound preparation before being taken for SSG, the second group (50) were given PRP therapy during the preoperative period. The PRP used was prepared from the patient's own sample. A sample of about 50 ml was obtained from the patient in Acid citrate dextrose tubes and immediately centrifuged at 1500 rpm 'soft spin' for 9 minutes, following which separation into Platelet poor plasma, RBCs and buffy coat takes place. The top layer containing the plasma and the buffy coat is taken separately into sterile tubes and spun a second time at 2500 rpm for 7 minutes. This results in generating an upper layer of platelet poor plasma and a lower layer of platelet rich platelet that is used for injection into the subcutaneous layer of the wound within 30 minutes.



SAMPLE SEPARATION INTO PPP, RBCs, AND BUFFY COAT AFTER SOFT SPIN; PRP AND BUFFY COAT AFTER HARD SPIN

Technique of Infiltration: Under aseptic precaution using a 21 and 1 1/2-inch needle, 1ml PRP is injected needle is made in the subcutaneous tissue (peppering technique) of the ulcers. The remaining 1 ml of platelet rich plasma was injected in surrounding tissue.

This cycle was carried out twice in a week on wounds and the effects were recorded. When the wound was prepared for split skin grafting, with healthy granulation tissue, minimal cell debris with no signs of infection.

FOLLOW UP:

The subjects were followed up for 3 months and the outcomes were recorded at post operative 1st week, 3rd week, 6th week and 12th week.

IV. OBSERVATIONS:

1. Age wise distribution of patients and % Reduction in ulcer Size (Mean ± SD):

100 patients were included in the study, and they were segregated into chronological age groups and the highest incidence was observed in 41–50-year age group and lowest incidence in 31–40-year age group.

2. Sex wise distribution of patients and % Reduction in ulcer Size (Mean ± SD): The subjects were also segregated into Male and Female groups to calculate the incidence of non-healing ulcers in both the genders. 72 % were male and 28% were females.

3. Distribution of subjects w.r.t size into two groups:

The subjects were also distributed into 4 grades based on sizes. Highest incidence of ulcers belonged to II (10-20 cms) grade in both groups and lowest in grade IV (30-40 cms).

4. Distribution of subjects based on the type of ulcer: The subjects were distributed into 4 categories of ulcers and highest incidence in the OTHER group and lowest in the arterial categories.

5. Mean pain score of both groups based on the type of ulcers.

Mean pain score of subjects were recorded at the time of instillation and afterwards. They were scored out of 10. 1 being no pain and 10 being the maximum amount of pain the patient could endure. For the control group, arterial ulcers were least painful and others were the most, however the difference wasn't significant. The PRP group subjects observed similar pain scores.

6. Distribution of Grades with Initial Ulcer Size with % reduction in Ulcer size (Mean ± SD)

When the reduction percentage was recorded for different sizes/grades of ulcers, maximum reduction was observed in grade III and IV. It indicates maximum reduction in sizes of ulcers and maximum growth following PRP therapy in large sized ulcers.

Distribution of Grades with Initial Ulcer Size with % reduction in Ulcer size (Mean ± SD)

Initial Ulcer Size	N (%)	Mean ± SD
I	15 (15 %)	7.233 ± 4.3706
II	52 (52 %)	9.867 ± 6.0839
III	19 (19 %)	13.395 ± 5.7701
IV	14 (14 %)	13.857 ± 4.8652
Total	**100**	**10.701 ± 5.9932**

7. Comparison of % Size Reduction of Ulcers Between PRP & Non PRP Groups
The non PRP control group had lesser size % reduction of ulcers compared to the PRP group and by 4%. However, the average % size reduction was about 10%.

Comparison of % Size Reduction of Ulcers Between PRP & Non PRP Groups

PRP DONE	N (%)	Mean ± SD
No	50 (50 %)	8.800 ± 5.3194
Yes	50 (50 %)	12.602 ± 6.0745
Total	**100**	**10.7015.9932**

8. Comparison of Control and PRP group based on characteristics
Both the groups were compared based on 4 characteristics and we found that the PRP group had significantly better results in terms of size reduction of ulcers and duration of treatment. They had similar acceptance rates and mean pain scores.

Features	Control	PRP
Size reduction (%)	8.8	12.602
Duration of treatment(mean)	34.22	29.26
Acceptance rate (%)	84	86
Mean pain score	5.64	5.44

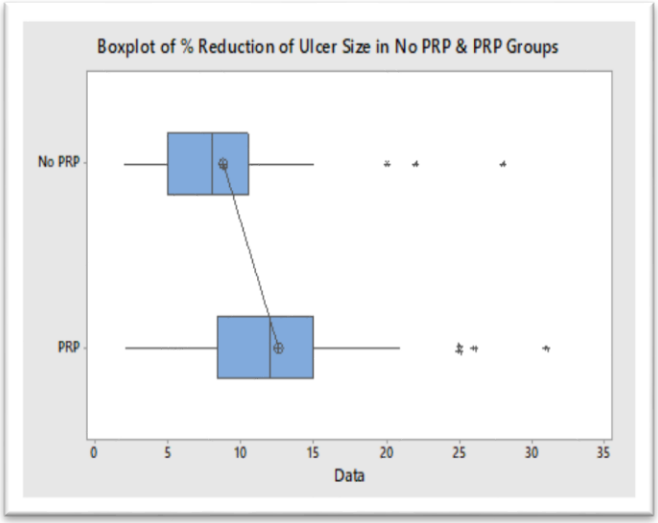
Comparison of Control and PRP group based on characteristics

The mean % Reduction of ulcer size shows Significant Improvement in PRP Group than No PRP Group with p-value= 0.001 at 5 % L.O.S. (One tailed) (Unpaired t-test)

Variable	PEARSON'S CORRELATION COEF.	P-Value	Sig.
% Reduction of Size of Ulcer	0.271	0.006	Sig.

Correlation is significant at the 0.05 (5%) level of significance with pvalue=0.006.

Correlation Between Duration of treatment and % reduction of Size of Ulcer



Chi square (Exact)-test for Association Between Mean pain score and Type of Ulcers

		Type of Ulcer				Total
		Arterial	Diabetic	Other	Venous	
Mean Pain Score	**Mild**	0	0	1	0	**1**
	Moderate	9	25	34	11	**79**
	Severe	1	7	10	2	**20**
Total		**10**	**32**	**45**	**13**	**100**

The p-value =0.904 which shows significant association between Mean pain score & Types of Ulcers.

V. RESULT:

This was a prospective trial by study design conducted on 100 patients with chronic non-healing ulcers which included 50 patients undergoing conventional dressings and 50 patients undergoing PRP therapy before SSG. Both groups of patients were selected based on the inclusion criteria and exclusion criteria described. Patients having chronic inflammatory conditions like rheumatoid arthritis, blood coagulopathies and severely immune compromised patients were excluded from the study. On comparing the two groups it was observed that, the group that underwent PRP compared to the control group have an accelerated period of healing, the preoperative time was reduced. All the patients in PRP group had similar form of treatment given that is single intralesional autologous PRP injection by peppering technique. Platelet rich plasma was prepared by a double centrifugation method initially at 1500 rotations per minute for 9 minutes and later at 2500 rotations per minute for 7 minutes. 5 ml of PRP was obtained from 50ml of blood. It was found that group PRP patients had about 5% less preoperative stay compared to the control group, 4% more ulcer size reduction %. The mean pain score was tabulated for both groups and for different types of ulcers and no significant difference was found amongst the two groups, however, significant association was found between MPS and type of ulcers.

Duration of stay and % reduction of ulcer was found to have significant correlation at 0.05(5%) with p value 0.006. Finally, it was concluded that intralesional autologous platelet rich plasma injection was safe and useful in the treatment of chronic ulcer benefit.

VI. CONCLUSION:

Autologous PRP injection is a safe and useful modality of treatment as a preparative of non-healing wounds prior to SSG. The response of patients with non-healing chronic ulcers given autologous PRP treatment prior to SSG was significantly better than those who were given only conservative preoperative treatment prior to grafting.

However, more trials are required to optimize the technique for separating platelet rich plasma.

REFERENCES:

[1]. Lazarus GS, Cooper DM, Knighton DR, Percoraro RE, Rodeheaver G, Robson MC: Definitions and guidelines for assessment of wounds and evaluation of healing. Wound Repair Regen 1994, 2(3):165-170.

[2]. Bouwer W, Laurens I, Snyman JR. The in vitro properties of and in vivo results obtained via series of case studies demonstrating effect of platelet rich plasma (PRP) extracted and activated with the cellu Vance™ PRP kit improvement of different aesthetic and injury related cases.

[3]. Li ZJ, Choi HI, Choi DK, Sohn KC, Im M, Seo YJ, et al. Autologous plateletrich plasma: A potential therapeutic tool for promoting hair growth. Dermatol Surg 2012;38:1040-6.

[4]. Carter MJ, Fylling CP, Parnell LK. Use of platelet rich plasma gel on wound healing: a systematic review and meta-analysis. Eplasty. 2011;11:e38. Epub 2011 Sep 15. PMID: 22028946; PMCID: PMC3174862.

[5]. Huang H, Sun X, Zhao Y. Platelet-rich plasma for the treatment of burn wounds: A meta-analysis of randomized controlled trials. Transfus Apher Sci. 2021 Feb;60(1):102964. doi: 10.1016/j.transci.2020.102964. Epub 2020 Oct 16. PMID: 33127309.

[6]. Bolton L. Platelet-Rich Plasma: Optimal Use in Surgical Wounds. Wounds. 2021 Aug;33(8):219-221. PMID: 34357880.

[7]. SanGiovanni TP, Kiebzak GM. Prospective Randomized Evaluation of Intraoperative Application of Autologous Platelet-Rich Plasma on Surgical Site Infection or Delayed Wound Healing. Foot Ankle Int. 2016 May;37(5):470-7. doi: 10.1177/1071100715623994. Epub 2015 Dec 17. PMID: 26683126.

[8]. Zhang W, Guo Y, Kuss M, Shi W, Aldrich AL, Untrauer J, Kielian T, Duan B. Platelet-Rich Plasma for the Treatment of Tissue Infection: Preparation and Clinical Evaluation. Tissue Eng Part B Rev. 2019 Jun;25(3):225-236. doi: .1089/ten.TEB.2018.0309. Epub 2019 May 15. PMID: 30712506; PMCID: PMC6589492.

[9]. Cao Y, Zhu X, Zhou R, He Y, Wu Z, Chen Y. A narrative review of the research progress and clinical application of platelet-rich plasma. Ann Palliat Med. 2021 Apr;10(4):4823-4829. doi: 10.21037/apm-20-2223. Epub 2021 Mar 2. PMID: 33691459.

[10]. Xie Y, Xing Q, Wang S, Yang Z, Hu A, Wu Q. Can platelet-rich plasma enhance the effect of meniscus repair? A meta-analysis of randomized controlled trials Platelet-rich plasma and meniscus repair. J Orthop Surg (Hong Kong). 2022 Sep-Dec;30(3):10225536221131483. doi: 10.1177/10225536221131483. PMID: 36278428.

[11]. Akbarzadeh S, McKenzie M, B, Rahman M, M, Cleland H: Allogeneic Platelet-Rich Plasma: Is It Safe and Effective for Wound Repair? Eur Surg Res 2021; 62:1-9. doi: 10.1159/000514223