

The Role of Platelet-Rich Plasma in Reducing Pain, Pruritus, and Improving Wound Healing of Skin Graft Donor Site

MUHAMMAD TAHIR¹, SHAHZAD SHAIKH², AAMNA SANOB³, YASIR ARFAT MEMON⁴, MUJTABA PERVEZ KHAN⁵

¹MBBS, FCPS, Consultant Plastic Surgeon, Ghulam Muhammad Mahar Medical College Hospital, Sukkur

²MBBS, FCPS, Senior Registrar, Department of Plastic Surgery, Bilawal Medical College for Boys, LUMHS, Jamshoro

³MBBS, FCPS, Assistant Professor, Department of Plastic Surgery, Bilawal Medical College for Boys, LUMHS, Jamshoro

⁴MBBS, M. S., Senior Registrar, Department of Plastic Surgery, Suleman Roshan Medical College, Tandoadam

⁵MBBS, Medical Officer, Department of Plastic Surgery, Liaquat University Hospital Hyderabad/ Jamshoro

Corresponding author: Muhammad Tahir, Email: dr-tahir26@yahoo.com Cell: +92 335 746 5515

ABSTRACT

Background: Wound healing is an intricate and interactive process. As a result, no single operator can efficiently and successfully help to resolve all attributes of healing process. The goal of the study that PRP was to systematically perceive the stimulatory effect at multiple stages during wound healing and trying to identify tissue repair mechanisms, lower pain, itching skin and healing time.

Study design: This was a cross sectional study and carried out at plastic surgery department of Ghulam Muhammad Mahar Medical College Hospital, Sukkur for the duration of six months from June 2022 to December 2022.

Methods: 120 participants which include male n=80 and female included n=40 who under the observation of split skin grafting due to reason of injuries, burning, accidents and traumas. These participants divide into two category of treatment for example, paraffin gauze dressing and platelet rich plasma (PRP). The age of participants between >20 and <50 years. To examine the preparation method of PRP, raw area dressing and clinical outcome for the assessment of pain, pruritus before and after comparison of gauze dressing and PRP. The data was analyzed by SPSS 21 version.

Results: The total participants are 120 in this study and the age group between 20 and 50 with an average age was 35 years. The affected area was left leg was 25% and right leg 75%. The raw area in 54.1% participants was burn and 46% participants were by road accident. The dressing was changed alternate weeks. The treatment with PRP showed significant changing in the effective participants as compared to paraffin gauze dressing (p<0.05).

Conclusion: PRP serves as a delivery system for growth factors, making this blood product extremely useful for use in a variety of indications in plastic and reconstructive surgery. Intradermal injection of platelet rich plasma is a secure and efficient option for minimizing pain, adverse reactions, and ability to heal multiple injuries in patients with burns and radiation injuries.

Keyword: Platelet rich plasma, wound healing, itching skin, growth factors

INTRODUCTION

The skin is the largest organ in vertebrates, accounting for 10% of total body weight and occupying the entire contact area. It plays a significant role in defending and preservation because it has the capacity to rebuild and revive itself, creating a barrier between both the outer and inner environments. A wound can be described as instability in the anatomical and functional structure and the functional integrity of the skin.^{1, 2} Healing process is a multifaceted issue because of the many transcription factors and cellular components that are involved. Damage causes vasculature disturbance, that also gives rise to fibrin formation and platelet accumulation. Blood coagulation then forms a stable blood clot. Following that, platelets and other cells release several growth factors into the damaged tissues, which stimulate and sustain ability to heal and epithelial forming.³ Because PRP behaves similarly, the presence of thrombin and calcium chloride, which leads to the release of a cascade of growth factors from the alpha granules, activates it. PRP volume clot formation activates the secretion of these growth factors, which begins clotting.⁴ PRP also contains proteins like fibrin, fibronectin, vitronectin, and thrombospondin, which are established to act as cell adhesion molecules and are important for osteoblast, fibroblast, and epithelial cell migration.⁵ As a result, the growth factors in platelet concentrates may initiate numerous cellular components responsible for wound healing and elicit soft tissue repair and bone renewal.⁶ Because of its high growth factor composition, PRP has been widely used in various surgical interventions and clinical therapeutic approaches. PRP can boost the development of new blood vessels in an injected and functional recovery of a wound.^{7, 8} Platelet-rich plasma (PRP) has received a lot of attention in a variety of medical fields, such as orthopaedics, dermatology, gynaecology, oro-maxillofacial surgery, and plastic surgery. Given its presence of growth factors and cytokines, PRP has been used in a wide range of clinical settings on the presumption that this really enhances tissue regeneration, among other postulated potential benefits. The anticipated effect on tissue repair drives increased interest in using PRP to treat chronic wounds, severe

burns, and scar tissue, attempting to establish a promising supplemental approach in reconstructive plastic surgery. PRP is also being employed more quite often in cosmetic surgery, such as facial rejuvenation and alopecia treatment.^{9, 10} PRP, as a carrier-containing anti-inflammatory intermediary, is assumed to inhibit inflammatory response in osteoarthritis, promoting cartilage repair and alleviating pain. Furthermore, PRP is used in bone grafting to enable bone regeneration and keep increasing treatment outcome. However apart from its potential health benefits, it is also simple to obtain and cheap.¹¹ PRP into four major categories based on the presence of white blood cells and fibrin network. The platelet concentration and the presence or absence of leucocytes are the most important factors in this classification and platelet concentration and activation, application to injured tissue, and finally therapy outcome assessment. As a result, comparing and validating the efficacy of PRP therapy for the treatment of various diseases is difficult. Although PRP therapy is generally regarded as a promising method for treating tissue injuries, the lack of standardised preparation procedures and methods of PRP application raises a number of questions and controversies.¹² The goal of the study that PRP was to systematically perceive the stimulatory effect at multiple stages during wound healing and trying to identify tissue repair mechanisms, lower pain, itching skin and healing time.

METHODS

This was a cross sectional study and carried out at plastic surgery department of Ghulam Muhammad Mahar Medical College Hospital, Sukkur for the duration of six months from June 2022 to December 2022. The total participants were 120 which include male n=80 and female included n=40 who under the observation of split skin grafting due to reason of injuries, burning, accidents and traumas. These participants divide into two category of treatment for example, paraffin gauze dressing and platelet rich plasma (PRP). The age of participants between >20 and <50 years. According to inclusion criteria: age above 20, raw area 150-250 cm² require for single sheet graft comparison, thick skin grafting,

and able to follow up. Exclusion criteria: Unable for interview, immuno-compromised participants and chronic pain. To analyzed the preparation method of PRP, raw area dressing and clinical outcome for the assessment of pain, pruritus before and after comparison of gauze dressing and PRP. The Ethical approval letter was obtained from hospital. The data was analyzed by SPSS 21 version.

RESULTS

The total participants 120 in this study and the age group (20-50) with an average age was 35 years. The affected area was left leg 25% and right leg 75%. The raw area in 54.1% participants was burn and 46% participants was by road accident. The dressing was changed alternate weeks till 27 days.

Table 1: Demographic Variables

Variables		Frequency N= 120 (%)
Gender	Male	60(50%)
	Female	40(33.3%)
Etiology	Burn	65(54.1%)
	Accident	55(46%)
Affected area	Left leg	30(25%)
	Right leg	90(75%)
Treatment	Platelet rich plasma (PRP)	100(83.3%)
	Paraffin gauze dressing	20(17%)

Mean±SEM: ANOVA SPSS 21 Test *p<0.01; **<0.001; ***p<0.0001

The total participants were 120 which divided into male 50% and female 33.3%. Affected area was treated with PRP 83.3% and gauze dressing 17% but highly prefer to the PRP as compared to the gauze dressing treatment were seen in Table 1.

Table 2: Compare PRP with Paraffin gauze dressing to evaluate the pain of participants on different time periods by Visual analog scale (VAS) rating

Days of. Obs	PRP	Gauze dressing	P=value
3	7	9	P=0.56
7	2	6.76	P=0.04*
14	1	5.5	P=0.02*
21	0.5	5.3	P=0.01*

Mean±SEM: ANOVA SPSS 21 Test *p<0.01; **<0.001; ***p<0.0001

To analysis day 3, the pain score (VAS) of PRP and gauze dressing group was 7 and 9 shows highly painful. On day 7 the PRP group was pain score 2, (p=0.04*) as compared to gauze group still show pain score 6.76. On the day 14 and 21 days show 1 and 0.5 score, (p=0.02*; 0.01*) it shows maximum reduced pain till 21 days as compared to gauze group were shown in Table 2.

Table 3: Evaluate the allergic reaction on skin of participants on different time periods by pruritus numerical rating scale (PNRC) compare PRP with Paraffin gauze dressing.

Days of Obs.	PRP	Gauze dressing	P=value
3	3	9.5	P=0.21
7	2.6	8.15	P=0.56
14	1.3	7.81	P=0.002**
21	1	7.3	P=0.001**

Mean±SEM: ANOVA SPSS 21 Test *p<0.01; **<0.001; ***p<0.0001

Table 4: Evaluate the healing of participants at different time periods

Days of Obs.	Healing groups		Gauze dressing n=60	P=value
	PRP n=60	P=value		
3	17(28.3%)	0.08	3(5%)	0.33
7	32(53.3%)	0.65	6(10%)	0.33
14	50 (83.3%)	0.005**	10(17%)	0.35
21	55(92%)	0.001**	15(25%)	0.54

Mean±SEM: ANOVA SPSS 21 Test *p<0.01; **<0.001; ***p<0.0001

The PNRC score was used to determine the severity of pruritus that represents worst imaginable itching. According to PNRC, on day 3 show maximum itching skin on both group and show non-significant changes. But on day 7 show mild itching or

allergic reaction in PRP as compared to other. On day 14, 21 show significantly reduced itching skin in group PRP, (p=0.002**; 0.001**).

On day 14 and 21 show healing time of group PRP participants 83.3% and 92% was lower and show significantly change (p=0.005** , 0.001**) as compared to gauze group were shown in Table 4.



Figure 1: (a) Show the separate of PRP from blood by using centrifuge apparatus. (b) show the improvement of effected area of leg by PRP apply.

DISCUSSION

PRP therapy produces a physiological internal conditions for tissue homeostasis renovation by having to deliver several signaling cytokines and growth factors to the damaged site, which play a key role in the tissue repair process by trying to regulate inflammatory response, stimulating angiogenesis, and synthesis, as well as remodeling newly formed tissue. PRP promote proliferation which lead to repair damage part of body and lower adverse effects. Platelet-rich plasma (PRP) management protocols are regarded as a new era of adjuvant treatment administration in wound healing procedures. The majority of PRP studies were confined to scientific investigations and its effect on animal models. Recent times, few research on the efficiency of PRP in facial burn healing have been published. They revealed promising outcomes in terms of enhanced burn healing with PRP management.^{13, 14}

In our study to found that dressing changes, it was also observed that the wound healing was faster in the PRP participants on day 14 show significant healing 83.3%; p=0.005 but the overall healing time was nearly the day 21 was highly improvement 92%; p=0.001** as compared to gauze dressing. Complete wound healing would have occurred in PRP group as seen on day 14 and 21, but since frequent dressings were not done for wound assessment to avoid disruption of epithelization, this is a pitfall of our study.^{15, 16} The use of developing cellular therapies, such as PRP, has become increasingly popular in a broad range of conditions and setup for its potential use as a therapeutic approach in the regenerative medical field and therefore can perform an adjuvant therapy importance in a normalized, quality treatment protocol. The medical field is making progress more towards the progression with less aggressive and expense treatment options to help enhance recovery. Although the use of PRP has the ability to lower financial consequences for standard medical treatments, it should not deemed as a therapeutic interventions that substitutes specific integral treatment options, such as necrotized tissue wound management, instead as a treatment modality.^{17, 18, 19}

In the previous study to PRP may play a vital role in infection control measures. Platelets in PRP can communicate with various bacterial strains and immune cells via their surface receptors. Platelets can incorporate with neutrophils to form composites, which can lead to the release of reactive oxygen species or the formation of neutrophil extracellular traps. Besides this, activated blood platelets some microbicides molecules.^{21, 22} In our research to found that, the significant reduction in severity skin itching infection or pruritus and pain in the PRP group as compared with gauze dressing. According to VAS score, on 3rd day show maximum pain as compared to 7 and 8 day. The PRP group was pain score 2, (p=0.04*) as compared to gauze group still show pain score 6.76 on day 7 and show 1 and 0.5 score, (p=0.02*; 0.01*) it shows to maximum reduced pain till 21 days as compared to gauze group.²³ According to PNRC, on day 3 show maximum

itching skin on both group and show non-significant changes. But on day 7 show mild itching or allergic reaction in PRP as compared to other. On day 14, 21 show significantly reduced itching in skin 1.3, 1 score in group PRP, ($p=0.002^{**}$; 0.001^{**}).²⁴ Through early interaction with the innate immune response, these biomolecules should provide premature prevention against pathogenic bacteria. PRP enables the delivery of platelets, leucocytes, growth factors, and other proteins to person receiving sites. As a direct consequence, it is beneficial in reducing subdural hematoma, trying to promote immediate stable adherence of skin wounds, controlling local inflammatory reactions, encouraging patients have an increased, and fight infection.²⁵

CONCLUSION

PRP serves as a delivery system for growth factors, making this blood product extremely useful for use in a variety of indications in plastic and reconstructive surgery. Intradermal injection of platelet rich plasma is a secure and efficient option for minimizing pain, adverse reactions, and ability to heal multiple injuries in patients with burns and radiation injuries.

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