Effectiveness of Autologous PRP Versus Conventional Mechanical Fixation on Wounds in Terms of Skin Graft Adhesion & Complications

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Abstract

Objective: To determine the efficacy of autologous PRP on wounds in terms of skin graft adhesion and complications as compared to conventional fixation techniques.

Materials and Methods: This study was conducted at the Department of Plastic & Reconstructive Surgery, PIMS, Islamabad, over a period of six months from August 21, 2019 to February 28, 2020. The research was authorized by the Ethics Review Board and Committee ERB no. (F.1-1/2015/ERB/SZABMU/456). Patients were allocated into two groups: Group A received PRP-assisted graft adhesion, obtained through aseptic blood draw, centrifugation, and application to the wound area; Group B underwent conventional fixation with sutures or staples. Graft evaluation and dressing adjustments were performed with dressing changes on the 5th postoperative day.

Results: In Group A (mean age: 34.03±11.07 years) and Group B (mean age: 30.55±11.81 years), Group A exhibited significantly higher efficacy (89.7%) compared to Group B (66.7%) with a p-value of 0.000. Age and gender differences were minimal, except in the subgroup of patients aged 31-40 years and males.

Conclusion: Autologous PRP treatment (Group A) demonstrated superior efficacy in promoting graft adhesion compared to conventional fixation (Group B). The study recommends the clinical adoption of autologous PRP in wound resurfacing procedures to expedite healing.

Keywords: Adhesion, Complications, Conventional, Efficacy, Fixation, Platelet-Rich Plasma (PRP), Skin graft.

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Introduction

Patients often face significant challenges when dealing with open wounds. There are a variety of options for wound coverage, but split thickness skin grafting is the most commonly used technique in plastic surgery to cover wounds.[1] The effectiveness of a skin graft relies on various factors, including the local blood supply, microbial environment of the wound, blood clotting, and the attachment of the graft to the wound surface. Historically, skin grafts have been secured to the edges of the wound using sutures or staples, and anchored to the wound surface to prevent shifting and fluid buildup underneath the graft. Nevertheless, these techniques can be both costly and time-intensive.[2] Platelet-rich plasma (PRP) is a source of growth factors that are necessary for vascularization and regeneration. PRP contains up to 300% of the normal platelet levels found in blood, and the degranulation of platelets releases growth factors such as platelet-derived growth factor, vascular endothelial growth factor, transforming growth factor-beta[1], and insulin-like growth factor.[3] PRP also

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contains over 30 bioactive proteins, many of which play a crucial role in tissue healing. Additionally, PRP contains three proteins that act as cell adhesion molecules: fibrin, fibronectin, and vitronectin.[4] Research has shown that using PRP in wound beds can have significant benefits over traditional methods.[5] Waiker et al. conducted a study to examine and compare the effectiveness of conventional mechanical fixation techniques with the application of autologous platelet-rich plasma (PRP) in wound beds. The findings revealed that 95% of patients in the PRP group received their initial post-graft dressing after one week, and 94% underwent their first graft inspection within 10 to 12 days after grafting.[6,7] According to another clinical trial the graft was found to be well-adhered and dry in the PRP group, compared to none in the control group ($p<0.001$). Additionally, graft edema was observed in 68% of patients in the control group and only 10% in the PRP group ($p<0.001$). In the control group, sero-purulent discharge occurred at the graft site in 17%, whereas in the PRP group, it was observed in only 2% ($p<0.001$). Additionally, hematoma beneath the graft leading to notable graft loss and requiring secondary grafting was experienced by 15% of control group patients, compared to only 4% in the PRP group ($p<0.008$).8 Scar hypertrophy was seen in 25.8% of the control group and only 4.7% of the PRP group ($p<0.001$).9Another study by Fakiha K et al. focused on the use of PRP for the fixation of skin grafts in forty post-burn patients.[10] Gupta et al.'s study showcased that PRP's adhesive properties render it safe and efficacious for skin graft fixation.[11] Drawing from the existing research it is evident that PRP has the potential to expedite the regeneration of epithelial, endothelial, and epidermal tissues, trigger angiogenesis, enhance collagen production, facilitate soft tissue recovery, reduce dermal scarring, and improve hemostasis.[12] PRP also facilitates immediate adherence of the graft to the wound bed, preventing any accumulation beneath the graft, enhancing graft acceptance, and decreasing the incidence of complications.[13,14] As there is still a lack of local studies and practice regarding PRP in wound treatment, better management may be provided in the future by further research in this area. This research provides valuable insights into the comparative effectiveness of autologous PRP and conventional fixation methods in promoting skin graft adhesion and minimizing complications, contributing to the advancement of wound care practices in plastic surgery.

Material and Methods

This study was conducted at the Department of Plastic & Reconstructive Surgery, Islamabad, over a period of six months from August 21, 2019 to February 28, 2020. The research was authorized by the Ethics Review Board and Committee ERB no. (F.1-1/2015/ERB/ SZA BMU/456). The procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000. The study involved 174 participants aged between 18 and 60 years. The population proportion of hematoma in the control group was 0.15[(4)], while the population proportion of hematoma in the PRP group was 0.04[(4)]. The power of the test was 80%, and the level of significance was 5%. The sample size was 87 in each group, making the total sample size 174. This sample size also covered the required sample size to test other complications such as sero-purulent discharge and graft loss. The participant were assigned the groups after, taking informed consent, by simple random sampling technique into Group A (autologous PRP) or Group B (conventional fixation). Aseptic precautions were taken during PRP collection, where blood was centrifuged to separate PRP. In Group A, PRP was applied to the wound bed, and graft adhesion was assessed. Group B received conventional fixation with sutures/staples. Dressings were maintained until the 5th postoperative day, followed by an assessment for complications. The inclusion criteria were traumatic and post-burn wounds, while exclusion criteria were specific with the participants having prior wound treatments, pregnancy or lactation, non-compliance and severe co-morbidities. A meticulous approach to PRP collection was followed, involving aseptic measures, and subsequent data analysis utilized SPSS 20. The primary focus of the study was to compare the efficacy of graft adhesion between the two groups, with complications assessed on the 5th post-operative day. Autologous PRP is effective as compared to conventional fixation in terms of skin graft adhesion and complications.

A biological substance characterized as a segment of the plasma fraction derived from one's own blood, possessing a platelet concentration exceeding the baseline attained through centrifugation.[3] Case was said efficacious when there is no complications were evaluated with 5th post-operative day and instant adhesion (pre-operatively).[9] It was defined as immobility of graft over wound bed. It will be seen per operatively.[1] They

were evaluated on opening first dressing at 5th postoperative day. All these were measured on clinical examination.

1. Infection (sero-purulent discharge)
2. Seroma: collection of fluid on physical examination
3. Hematoma: collection of blood Graft loss[7]

Results

In Group-A 8(9.2%) patients and in Group-B 15(17.2%) patients had infection, 16(18.4%) patients in Group-A and 21(24.1%) in Group-B had seroma, none of the patients had hematoma in both treatment groups and 15(17.2%) patients in Group-B had significant graft loss while none of the patients had graft loss in Group-A patients. (Table-1) The efficacy of Group-A treatment was significantly higher compared to Group-B treatment, i.e., Group-A: 89.7% vs. Group-B: 66.7%, p-value=0.000.For male patients' efficacy was higher in Group-A but it did not reach statistical significance while for female patients efficacy was significantly higher in Group-A patients i.e. Male=0.095 & Female = 0.000. The efficacy of Group-A treatment was significantly higher compared to Group-B treatment, i.e., Group-A: 89.7% vs. Group-B: 66.7%, p-value=0.000. For male patients' efficacy was higher in Group-A but it did not reach statistical significance while for female patients efficacy was significantly higher in Group-A patients i.e. Male= 0.095 & Female= 0.000.

Group-A: PRP: **Group-B:** Without PRP

Table 1: *Complications among patients*

		Group-A	Group-B	Total
Infection	Yes	8(9.2%)	15(17.2%)	**15**
	No	79(90.8%)	72(82.8%)	**159**
Seroma	Yes	16(18.4%)	21(24.1%)	**21**
	No	71(81.6%)	66(75.9%)	**153**
Hematoma	Yes	0(0%)	0(0%)	**0**
	No	87(100%)	87(100%)	**174**
Significant Graft loss	Yes	0(0%)	15(17.2%)	**15**
	No	87(100%)	72(82.8%)	**159**

Table 2: *Efficacy of Treatment in relation to age and gender of patients*

Age	Efficacy	Group		pvalue
		Group-A	Group-B	
17-30 Years	Yes	30(100%)	35(70%)	0.001
	No	0(0%)	15(30%)	
31-40 Years	Yes	29(76.3%)	14(100%)	0.045
	No	9(23.7%)	0(0%)	
>40 Years	Yes	19(100%)	9(39.1%)	0.000
	No	0(0%)	14(60.9%)	
Male		57(86.4%)	44(74.6%)	0.095
Female		21(100%)	14(50%)	0.000

Fig-1: *Significant graft loss without PRP*

Fig-2: *Instant adhesion of skin graft with PRP*

Discussion

Skin grafting is a surgical procedure that transfers skin from one part of the body to another to cover open wounds.[15] There are two types of skin grafts: split thickness and full thickness. Split thickness skin grafts include the epidermis and a piece of the dermis, while full thickness skin grafts include the entire dermis.[16] This investigation used a split thickness graft to cover a body region where skin had been lost. Post-traumatic wounds and serious burns are two of the most common reasons for skin grafts.[17] After the skin was carefully removed from the donor site, it was put over the recipient region and fixed with PRP (group A) & with stitches/staplers (group B). The majority of grafts were meshed to stretch the skin and allow fluid to flow. Infection, fluid or blood accumulation under the graft, or too much movement of the graft on the site caused graft absorption to not occur.[18] Flat surfaces demonstrated better absorption

than curved surfaces, and graft rejection increased morbidity, hospital stay, and expense.[1,20] This investigation found that PRP is much more effective than traditional mechanical fixation. Group A scored 89.7% compared to Group B with a p-value of 0.000. The findings from another study indicate that autologous PRP led to faster and more substantial rates of healing, along with immediate graft adherence. The occurrence of hematoma, graft oedema, drainage, graft loss, and scar hypertrophy was reduced in the PRP group. PRP might diminish cytokine release and curb inflammation in chronic wounds through interactions with macrophages, promoting tissue repair and regeneration.[21] Regardless of the underlying cause, the use of autologous PRP can enhance the success of graft integration on wounds.[22] Nonetheless, autologous PRP faces challenges such as susceptibility to contamination and platelet over-activation triggered by external stimuli, posing difficulties in its clinical utilization.[23] Autologous PRP serves as a beneficial adjunct in wound management because of its safety, affordability, ease of preparation, hemostatic properties, adhesive nature, and healing attributes.[24]

Conclusion

In conclusion, this investigation underscores the efficacy of autologous PRP as a superior alternative to traditional mechanical fixation methods in skin grafting. With a notable 89.7% success rate in Group A compared to Group B, the study demonstrates PRP's capacity for quicker healing, immediate graft adhesion, and reduced complications. While acknowledging challenges such as potential contamination and platelet over-activation, the study advocates for the frequent use of autologous PRP as a cost-effective, safe, and beneficial adjuvant in wound treatment across diverse age groups and wound types.

Conflict of Interest: *None*

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Authors Contribution

FR: Conceptualization of Project
AKM: Data Collection
BQ: Literature Search
QANZ: Statistical Analysis
AY: Drafting, Revision
ZD: Writing of Manuscript