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Role of Autologous Platelet-Rich Plasma (APRP) in Take of Graft

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Abstract

Autologous platelet-rich plasma (APRP) has gained attention as a promising adjunct in skin grafting procedures, particularly in enhancing the take and healing of grafts in burn patients. This study focuses on the application of APRP to improve the adherence of split-thickness skin grafts (STSG) in a pediatric patient with scald burns. APRP is prepared by concentrating the patient's platelets from a small volume of blood, which is rich in growth factors essential for tissue repair and regeneration. The study describes the preparation process of APRP and its application before STSG to promote graft take. Results showed that the use of APRP significantly improved graft adherence, reduced pain, accelerated healing, and minimized scarring. APRP's role in wound healing is attributed to the release of growth factors, such as platelet-derived growth factor (PDGF), transforming growth factor beta-1 (TGF-β1), and vascular endothelial growth factor (VEGF), which contribute to faster epithelialization and angiogenesis. Furthermore, studies have demonstrated that PRP accelerates wound healing, with superior outcomes compared to traditional methods like sutures or staples. The findings suggest that APRP is a safe, effective, and cost-efficient method for enhancing graft take, offering the additional benefits of a shorter hospital stay and reduced morbidity.

Keywords: APRP, Autologous platelet-rich plasma, skin graft, take of graft,

INTRODUCTION

Autologous platelet-rich plasma (APRP), as the term implies, is a concentrated preparation of the patient's own platelets suspended in a small volume of plasma (Figure 1) [1]. This preparation is rich in growth factors and functions as a fibrin sealant, offering several beneficial properties [2]. One of its significant applications is in skin grafting, where it not only serves as a fibrin sealant but also enhances graft take by providing growth factors and encouraging angiogenesis [3, 4]. Skin grafting remains the gold standard for managing raw areas in burn wounds [5]. The success of skin grafting, particularly in challenging cases, is influenced by several critical factors, including the nutritional status of the wound bed and the stability of the graft itself. Ensuring optimal conditions for graft adherence and subsequent healing is paramount for achieving favorable outcomes, especially in pediatric patients who may face unique challenges due to their physiology and limited donor site availability. This case report examines the use of APRP as an innovative addition to support split-thickness skin grafts (STSGs) in a pediatric patient with severe scald burns.

APRP, made from the patient's own blood, is

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Figure 1. Application of APRP prior to grafting.

packed with growth factors that promote tissue repair and wound healing. By combining APRP with traditional grafting methods, the study explores its potential to improve graft adherence, speed up skin regeneration, and reduce complications. This approach could be especially beneficial when donor sites are limited, or health conditions make standard grafting more challenging. By combining APRP with pixel grafting techniques, this case highlights its efficacy in reducing patient morbidity, enhancing recovery outcomes, and offering a viable solution for managing complex burn wounds (Figure 2) [6].

Figure 2. Allografting.

METHODOLOGY

This study was carried out in the Department of Plastic Surgery at a tertiary care hospital in South India. The patient was a 7-year-old boy who had sustained accidental scald burns involving genitalia, both thighs, and lower abdomen. The skin graft was obtained from his mother and used to treat the child's burn injuries. To improve graft, take, APRP was prepared and applied before the placement of the STSG as described below:

- *Step 1:* A sample of 10 mL of the patient’s venous blood was drawn and anticoagulated with heparin.
- *Step 2:* The blood sample was centrifuged at 3600 rpm for 10 minutes, resulting in the separation of the contents into three distinct layers: the top layer containing plasma and

platelets, the middle layer comprising the buffy coat with white blood cells (WBC) and some platelets, and the bottom layer consisting of red bloods (RBC).

- *Step 3:* The uppermost layer, containing plasma and platelets, was carefully extracted using a sterile syringe and transferred to a new sterile vial.
- *Step 4:* The extracted plasma underwent a second centrifugation at 4000 rpm for another 10 minutes.

After this process, the sample separated into two layers: the upper layer containing platelet-poor plasma (PPP) and the lower layer enriched with platelet-rich plasma (PRP). The PRP was then aspirated using a sterile syringe and sprayed over the exposed wound areas. Following this, a STSG was applied, and the wound was dressed appropriately.

RESULTS

The use of APRP at the STSG site significantly improved graft take, promoted faster healing, reduced pain, and resulted in minimal scarring (Figure 3).

Figure 3. Wound healed with minimal scarring.

DISCUSSION

Platelets are crucial for hemostasis at sites of vascular injury and are rich in growth factors and cytokines that play a key role in inflammation and tissue repair [7]. The growing understanding of platelets' role in tissue repair and regeneration has spurred significant interest in harnessing them as therapeutic agents to enhance wound healing. Platelets are not only crucial for hemostasis but also serve as reservoirs of growth factors and cytokines that drive the repair process. Among the various applications of platelet-derived therapies, APRP has emerged as a particularly promising solution.

APRP is prepared by drawing approximately 10 mL of the patient's blood, which is then subjected to a centrifugation process to separate and concentrate platelets. This procedure yields 3–5 mL of PRP, a highly concentrated plasma enriched with platelets, effectively eliminating any risk of cross-infection due to its autologous nature. The process involves accessing a peripheral vein and using plasmapheresis to elevate the platelet concentration to approximately 300% of its normal level.

Clinical studies have demonstrated the effectiveness of PRP in accelerating wound healing, particularly in cases of acute trauma. Compared to traditional dressing techniques, PRP promotes faster recovery by delivering an optimal concentration of growth factors directly to the wound site. This not only enhances tissue repair but also reduces the risk of complications, making PRP a valuable tool in modern regenerative medicine and wound care practices [8].

APRP contains a range of growth factors, such as platelet-derived growth factor (PDGF), transforming growth factor beta-1 (TGF-β1), and vascular endothelial growth factor (VEGF) [9]. These growth factors are thought to play a key role in promoting faster epithelialization and providing pain relief at wound sites.

Skin grafting continues to be the fundamental approach for wound management, with the successful integration of the graft progressing through three distinct phases:

1. Imbibition phase.
2. Inosculation phase.
3. Revascularization phase.

PRP supports the advancement of these stages by functioning as both a tissue sealant and a delivery system for growth factors. The platelets within PRP aid in wound healing by releasing growth factors through the degranulation of α-granules [10]. Recent studies have extensively investigated the application of APRP at STSG sites, highlighting its remarkable benefits. APRP has been shown to significantly enhance immediate graft fixation, creating a stable environment for the graft. Furthermore, it facilitates inosculation—the connection of graft and host blood vessels by providing a nutrient-rich plasma environment. This process accelerates graft integration, improves wound healing, and ensures better graft take, ultimately reducing complications [11].

A study by Gibran et al. on burn patients found that APRP is both safe and effective for securing skin grafts, owing to its adhesive properties. The use of PRP has yielded better results compared to traditional methods like sutures, staples, or glue [12].

CONCLUSIONS

APRP proves to be an effective medium for enhancing graft take, particularly in patients and offers the advantage of being free from significant side effects. This approach is cost-efficient and contributes to a shorter hospital stay, making it a valuable option in wound management.

Authors' Contributions

All authors contributed to the research and manuscript.

Availability of Data and Materials

Not applicable.

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Conflicts of interest

The authors declare no conflicts of interest.

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