

# Platelet-Rich Fibrin Matrix as a Biological Adjunct in Paediatric Electrical Burn Care: A Clinical Evaluation

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## ABSTRACT

Electrical burns in children, particularly from high-voltage sources, often lead to deep tissue injury and pose significant challenges in wound healing and graft acceptance. This case report highlights the application of Platelet-Rich Fibrin Matrix (PRFM) as a biological adjunct to enhance skin graft outcomes in paediatric electrical burns. PRFM, being rich in growth factors and matrix proteins, promoted tissue regeneration and vascularization. This report underscores PRFM's potential as a low-cost, autologous option to support graft viability in complex paediatric burn wounds.

## KEYWORDS

• Platelet Rich Fibrin Matrix • Skin grafting • Electrical burns • Paediatric burns

## INTRODUCTION

Electrical burns are a significant health concern in the developing world, constituting 3 to 18% of all burn admissions, and with a reported mortality rate ranging from 3.75 to 58.8%.<sup>1</sup> the incidence of electrical injuries has increased in the past few years. This study attempts to identify the causative and demographic risk factors that can help in formulating a targeted

prevention program. The study was conducted prospectively and retrospectively from 2004 to 2009. Eighty-four consecutive patients with electrical burn injuries were analyzed for their demographic profile, age, sex, occupation, rural-urban distribution, mode of injury, and place of injury. The patients were asked to fill out a questionnaire regarding their awareness about electrical burn injuries, and the results

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were tabulated. The age of presentation ranged from 3 to 61 years. The most frequently affected age group was the second decade of life (33.3%). Electrical burn-induced wounds are notorious for involving deeper tissue and being slow-healing and require complex multimodality management, including early wound debridement with skin grafting. The graft take results following electrical burns are also variable.

Platelets secrete various growth factors such as platelet-derived growth factor, Transforming growth factor, Vascular endothelial growth factor, etc., along with cell adhesion molecules like fibrin, fibronectin, and vitronectin.<sup>2</sup> Autologous platelet concentrates (APC) are derived from the patient's blood and help optimise wound healing and prepare the wound bed for grafting. Their ability to produce supraphysiologic amounts of growth factors stimulates tissue repair in wounds with low healing potential.<sup>3</sup> These growth factors promote revascularisation, fibroblast proliferation, and mesenchymal cell

proliferation.<sup>4</sup> Most commonly used forms of APC in clinical practice are Platelet-rich Plasma (PRP) and Platelet-rich Fibrin (PRF).

Here we describe a cost-effective technique using platelet-rich fibrin matrix as an adjunct to skin grafting in a paediatric patient with electrical burns.

## MATERIALS AND METHODS

This study was conducted in a Tertiary Care Centre in the Department of Plastic Surgery after getting the departmental ethical committee approval. Informed consent was obtained. The patient was a 12-year-old male child who had sustained high voltage electrical burns of mixed second degree to his face, neck, and both lower limbs involving 15% total body surface area (*Figure 1*). He was admitted to our Tertiary Burns Centre, and initial fluid resuscitation was given as per standard guidelines. He underwent tangential excision of his forehead burns under general anaesthesia using a handheld high-speed rotating head dermabrader.



**Figure 1:** Mixed second degree burns to his face, neck, and both lower limbs involving 15% total body surface area

Under strict aseptic precautions, 10 ml of venous blood was drawn, added to a sterile centrifugation tube without the addition of any anticoagulant. Centrifugation was done at 3000 rpm for 10 minutes. Three layers were obtained: upper straw coloured platelet poor plasma (PPP), the middle fraction containing the gel-like PRFM, and the red-coloured lower fraction containing red blood cells (RBC). The upper straw-coloured layer (PPP) was discarded. PRFM gel was separated from red corpuscles at the base using a sterile forceps and scissors, preserving a small RBC layer measuring around one mm in length, which was transferred onto a sterile gauze (Figure 2). The PRFM gel was applied over the forehead raw area (Figure 3). The raw area was covered with a split skin graft in the same sitting, with graft harvested from the left thigh, and a tie-over dressing applied to secure the graft (Figures 4,5).



Figure 4: Split thickness skin graft applied over PRFM gel



Figure 2: PRFM prepared



Figure 5: Tie-over dressing applied after STSG



Figure 3: PRFM gel applied to the forehead scar after dermabrasion



Figure 6: STSG site on post-operative day 7

## RESULTS

Satisfactory wound healing was noted with good graft take on 7<sup>th</sup> post operative day (Figure 6).

## DISCUSSION

Electrical burn injuries pose significant challenges to achieving optimal wound healing due to extensive tissue damage and the risk of chronic complications, often necessitating serial wound debridement with skin grafting. This is increasingly concerning in the paediatric patient population, where restoration of skin integrity is crucial to prevent infections and due to a relative scarcity in donor surface area, furthermore emphasising the need for good graft take results.

Platelets are known to secrete seven fundamental protein growth factors that support wound healing.<sup>2,5</sup> The active secretion of these factors begins as early as 10 minutes of their activation.<sup>6</sup> Autologous platelet concentrates (APC), such as platelet-rich plasma (PRP) and platelet-rich fibrin (PRF), are derived from the patient's blood and may support wound healing via various mechanisms. Ehrenfest classified platelet preparations into 4 families depending upon their constitution.<sup>7</sup>

1. Pure Platelet-Rich Plasma (P-PRP) leucocyte poor PRP
2. Leucocyte and PRP (L-PRP) products
3. Pure platelet-rich fibrin (P-PRF) or leucocyte poor platelet-rich fibrin
4. Leucocyte- and platelet-rich fibrin (L-PRF)

PRP is prepared by differential centrifugation with the addition of a non-autologous anticoagulant to prevent platelet activation before its use. PRF is a second-generation APC with similar effects, but unlike PRP, it is prepared at a lower centrifuge speed and without the addition of an anticoagulant, which results in the formation of a fibrin matrix gel. This provides the advantage of a slow and sustained release of growth factors into the wound bed. The omission of external anticoagulants prevents the risk of hypersensitivity reactions.

APC derivatives have been employed as an adjunct in various medical fields such as joint, ligament, and tendon repair surgeries,

osteoarthritis, skin conditions like vitiligo and psoriasis, and maxillofacial surgery.<sup>4</sup> PRP has also been investigated in the management of erectile dysfunction.<sup>8</sup> Recent systematic reviews and meta-analyses encourage the use of Platelet derivatives in burn wounds for accelerating epithelialisation as well as to improve skin graft take rates. Their application is also extended to improve healing at graft donor sites.

The mode of delivery of APC derivatives also differs in the existing literature. They may be applied topically to wounds directly or may be incorporated into a dressing. Perilesional injections of PRP and lyophilised PRP in powder form have also been employed.<sup>9</sup>

## CONCLUSION

Platelet-Rich Fibrin Matrix (PRFM) as an adjunct to skin grafting in paediatric electrical burns appears to be a promising, cost-effective technique that enhances graft take and promotes wound healing. In this study, the application of PRFM resulted in satisfactory early outcomes with no complications, suggesting its potential role in improving surgical results in complex burn injuries. However, as this is a single case report, larger studies with control groups and long-term follow-up are essential to validate the efficacy, safety, and reproducibility of PRFM in the broader paediatric burn population.

**Conflicts of interest:** None

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