DOI: 10.21088/ijmhs.2347.9981.12225.7

Indian Journal of Medical & Health Sciences
Volume 12 Number 2, July - December 2025

Case Report

Optimising Split-Thickness Skin Graft Take in a Paediatric Electrical Burn Wound Using an Autologous Lipoaspirate-Enriched Regenerative Scaffold: A Case Report

Sriram V. S[1], Ravi Kumar Chittoria[2], Amrutha J. S[3]

How to cite this article:

Sriram V. S, Ravi Kumar Chittoria, Amrutha J. S. Optimising Split-Thickness Skin Graft Take in a Paediatric Electrical Burn Wound Using an Autologous Lipoaspirate-Enriched Regenerative Scaffold: A Case Report. Jr. Med. & Health Sci. 2025; 12(2): 121–124.

ABSTRACT

Electrical burns in paediatric patients pose unique challenges due to the deep, irregular nature of tissue damage and often poor vascularity of the wound bed. These factors can compromise the success of split-thickness skin grafting (SSG), leading to partial graft loss, delayed healing, and increased risk of hypertrophic scarring or contractures. Regenerative approaches using biologically active materials are gaining interest as adjuncts to improve graft take. Autologous lipoaspirate, a minimally processed fat graft containing adipose-derived stem cells (ADSCs), growth factors, and cytokines, has shown potential in enhancing tissue repair. Combined with a biocompatible scaffold such as collagen, it may create a pro-healing microenvironment supporting graft integration and wound regeneration. We used lipoaspirate harvested from the lower abdomen, which was minimally processed, and combined with a collagen-based scaffold intraoperatively to facilitate wound healing at the SSG site, which failed to heal satisfactorily with conventional management. Such regenerative strategies may reduce complications, enhance healing, and improve long-term results, warranting further investigation through larger studies.

KEYWORDS

• Autologous lipoaspirate • Regenerative scaffold • CAMP • Paediatric burns • Electrical burns • SSG

Author's Affiliation:

[1]Senior Resident, Department of Plastic Surgery, JIPMER, Pondicherry, India.

[2]Professor and Associate Dean (Academic), Head of IT Wing and Telemedicine, Department of Plastic Surgery and Telemedicine, JIPMER, Pondicherry, India.

[3]Senior Resident, Department of Plastic Surgery, JIPMER, Pondicherry, India.

Corresponding Author:

Ravi Kumar Chittoria, Professor and Associate Dean (Academic), Head of IT Wing and Telemedicine, Department of Plastic Surgery and Telemedicine, JIPMER, Pondicherry, India.

E-mail: drchittoria@yahoo.com

➢ **Received:** 23-04-2025 ➢ **Accepted:** 05-06-2025

INTRODUCTION

Electrical burns constitute 3 to 18% of all burn admissions, and with a reported mortality rate ranging from 3.75 to 58.8%.[1] 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 often unsatisfactory, thereby necessitating the need for adjuncts for wound healing.

Autologous lipoaspirate therapy involves the use of a patient's own adipose tissue, rich in adipose-derived stem cells (ADSCs), growth factors, and cytokines, to enhance tissue regeneration and wound healing. Paracrine signalling from ADSCs, which secrete vascular endothelial growth factor (VEGF), transforming growth factor-beta (TGF-β), and other bioactive molecules, helps to stimulate neovascularisation, recruit native progenitor cells, and modulate the immune response. This creates a pro-regenerative microenvironment, improving graft adherence, re-epithelialization, and reducing fibrosis, especially in poorly vascularized wound beds like 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 after coming into contact with a live wire while playing on a rooftop (Figure 1). He was admitted to our Tertiary Burns Centre, and initial fluid resuscitation was given as per standard guidelines, along with broad-spectrum antibiotics and supportive care. He underwent tangential excision of his forehead burns under general anaesthesia using a handheld high-speed rotating head dermabrader followed by split thickness skin grafting in the same setting (Figure 1,2). The graft site was covered with a tie-over dressing. Recipient site inspection was done on POD-7, and the graft site healing was not satisfactory (Figure 3).

Figure 1: Forehead scar after initial debridement

Figure 2: SSG done

Figure 3: SSG site on POD-7

After infiltration of Tumescent solution to the infraumbilical abdominal wall, Coleman microcannula technique (3mm) was used for liposuction (Figure 4). 10ml of adipose tissue was obtained which was transferred to a centrifugation tube, and centrifuged at 3000 rpm for 3 minutes. After centrifugation, three layers formed- the top layer of oil, middle layer of compact adipose tissue and cells, and bottom layer of blood and infiltration solution (Figure 5). The bottom layer was carefully aspirated off and discarded. The oil layer was removed using a gauze wick. The middle layer was then used to prepare the regenerative scaffold.

Figure 4: Autologous lipoaspirate harvested from abdominal wall

Figure 5: Autologous lipoaspirate

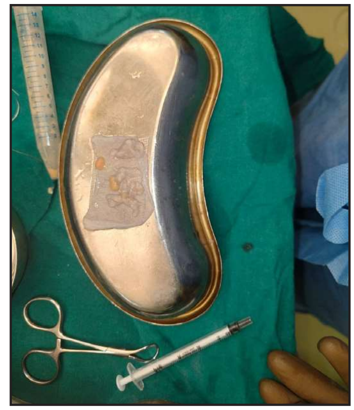

Figure 2: Regenerative scaffold prepared

A three-layered regenerative scaffold was then prepared comprising of Autologous lipoaspirate and collagen gel as first layer, CAMP scaffold of collagen in sheet form as second layer and a non-occlusive dressing as third layer (Figure 6). The collagen was of bovine origin, composed mainly of Type I collagen combined with gentamicin sulfate 0.1% (w/w) in a gel base. The scaffold was applied over the SSG recipient site with the first layer coming in contact with the graft and a tie-over dressing applied to hold the dressing in place (Figure 7).

Figure 7: Tie-over dressing applied over regenerative scaffold

RESULTS

Graft take was over 95% at 5 days after the application of the regenerative scaffold. No adverse effects were noticed during the treatment period (Figure 8).

Figure 8: SSG site 5 days after application of regenerative scaffold

DISCUSSION

Wounds that fail to progress through the normal stages of healing frequently enter a state of pathologic inflammation that is a chronic wound state. Mesenchymal stem cells (MSCs) have immunomodulatory properties that allow the wound to progress beyond the inflammatory phase and not to regress to a chronic wound state.[2] MSCs are also known to have antimicrobial properties, owing to their ability to synthesise peptides such as hepcidin, beta-defensin and lipocalin 2, which are involved in bacterial membrane degradation and cytokine release.[3,4]

Autologous lipoaspirate is the preferred source of MSCs for wound regenerative therapy due to ease of harvest, and higher yield of MSCs when compared to bone marrow (2% ADSCs as compared to 0.02% BM-MSC).[5] It has been shown that non-isolated mesenchymal cells remain viable and functional for longer without going into senescence.[6] Thus, the direct use of lipoaspirate, with minimal processing, offers a cost effective and biocompatible regenerative therapy.

The addition of a collagen based regenerative scaffold support cell attachment, migration, and proliferation, promoting tissue regeneration and has immunomodulatory effects.[7] Collagen of animal or human origin, can be used, with minimal concern regarding antigenicity. We assumed that the collagen in gel form would act as a favourable temporary ECM, helping distribute cells and growth factors evenly, while the collagen in sheet form would act as a mechanical barrier dressing to provide wound cover.

CONCLUSION

This case highlights the potential utility of autologous lipoaspirate as a safe and effective technique in enhancing SSG outcomes in paediatric electrical burns. However, as this is a single-patient study, we recommend larger prospective studies to validate our findings and refine the indications of lipoaspirate-enriched scaffold techniques. Long term effects of the therapy such as scarring should also be studied.

Conflicts of interest: None declared.

REFERENCES

1. Patil SB, Khare NA, Jaiswal S, Jain A, Chitranshi A, Math M. Changing patterns in electrical burn injuries in a developing country: should prevention programs focus on the rural population? J Burn Care Res Off Publ Am Burn Assoc. 2010;31:931–4.
2. Ennis WJ, Sui A, Bartholomew A. Stem Cells and Healing: Impact on Inflammation. Adv Wound Care. 2013;2:369–78.
3. Lei J, Sun L, Huang S, Zhu C, Li P, He J, et al. The antimicrobial peptides and their potential clinical applications. Am J Transl Res. 2019;11:3919–31.
4. Marrazzo P, Crupi AN, Alviano F, Teodori L, Bonsi L. Exploring the roles of MSCs in infections: focus on bacterial diseases. J Mol Med Berl Ger. 2019;97:437–50.
5. Kastrinaki MC, Andreakou I, Charbord P, Papadaki HA. Isolation of human bone marrow mesenchymal stem cells using different membrane markers: comparison of colony/cloning efficiency, differentiation potential, and molecular profile. Tissue Eng Part C Methods. 2008;14:333–9.
6. Guo X, Wang J, Zou W, Wei W, Guan X, Liu J. Exploring Microenvironment Strategies to Delay Mesenchymal Stem Cell Senescence. Stem Cells Dev. 2022;31:38–52.
7. Brett D. A Review of Collagen and Collagen-based Wound Dressings. Wounds CompendClin Res Pract. 2008;20:347–56.