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# Role of Cost-Effective Innovative Autologous Skin Cell Suspension for Burn Wound Management

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## Abstract

**Introduction:** Traditional burn management involves early excision and grafting, which often necessitate extensive donor sites, leading to increased morbidity and longer recovery times. Autologous skin cell suspension has emerged as an innovative technique for addressing these challenges, offering a promising alternative for extensive burns by enhancing providing autologous keratinocyte and melanocytes and reducing donor site requirements. This study presents a novel, simple and cost-effective method for preparing autologous skin cell suspension.

**Methods:** A 37-year-old male with 15% deep thermal burns to the bilateral gluteal was treated with surgical excision and multiple grafting procedures. But due to graft loss, small thick split thickness skin graft was taken and soaked in warm water and was processed via centrifugation to create an autologous skin cell suspension. This suspension was sprayed onto the excised wound bed.

**Discussion:** The indigenous method demonstrated the potential to effectively manage extensive burn injuries with minimal donor site morbidity. Autologous melanocyte and keratinocyte stem cells within the suspension exhibited regenerative properties which enhanced wound healing. Compared to commercial systems like RECELL, this method proved to be significantly more cost-effective and feasible in resource-limited settings.

**Conclusion:** The innovative preparation of autologous skin cell suspension represents a practical and economical alternative for burn wound management.

**Keywords:** Skin Cell; RECELL

## Introduction

Burns are a significant cause of disability worldwide [1]. In 2019, India accounted for over twenty thousand fire-related deaths, representing approximately 20% of global mortality from burns [2]. The treatment of burn injuries depends on the severity of the burn. Minor superficial burns are usually managed on an outpatient basis with standard dressings, while more severe and extensive burns often require hospitalization for comprehensive care [3]. Early excision of the burn and closure with autologous split-thickness skin grafts is the standard approach for treating severe burns. However, this method increases the total body surface area (TBSA) of open wounds, making the amount of skin harvested a critical consideration during grafting. To address this challenge, various autografting techniques have been explored. One innovative method involves the use of autologous skin cell suspension, designed to minimize the amount of healthy skin required for achieving wound closure [4]. This approach not only ensures long-term closure of burn injuries but also aims to

optimize outcomes within a clinically favorable timeframe. Commercially available options, such as the RECELL® System, allow for point-of-care preparation and immediate application to the wound bed following excision [5]. We present a novel, indigenous technique for preparing autologous skin cell suspension using simple methods for point-of-care use.

## Methodology

This study was conducted in the Department of Plastic Surgery at a tertiary care centre in South India. The subject was a 37-year-old male who suffered 15% deep thermal burns caused by fall on burning pyre of leaves. To manage the injuries, all non-viable tissues were surgically excised. Wound evaluation was carried out using the Bates-Jensen Wound Assessment Tool, which scored 38 at the time of the procedure [6-8]. Patient underwent Split thickness skin grafting two times but graft loss was present (Figure 1,2). So was planned for a keratinocyte melanocyte transfer. A sterile field was established around the patient's thigh for the preparation of graft materials. A 5x5 cm split-thickness skin graft (STSG) was harvested from the same site. As compared to usual technique of cell suspension using phosphate buffer and trypsin solution, we used warm water (Figure 3) to separate the epidermis and dermal layers of the graft after centrifugation at 2500 rpm for 10 minutes (Figure 4). The resulting epidermis was centrifuged again to create a cell suspension, which was then sprayed onto the burn wound (Figure 5,6). The treated wound was subsequently covered with cyclical regulated oxygen negative pressure wound therapy (cRONPWT), which remained in place for 7 days. Afterward, secondary dressings were applied every alternate day and replaced as needed based on wound progress (Figure 9).

## Results

This indigenous method of preparing autologous skin cell suspension offers a cost-effective approach to donor cell harvesting from a single site, facilitating efficient wound management for extensive burn injuries (Figure 7,8). No device-related adverse events, serious complications, or allergic reactions were observed during its application.

## Discussion

The treatment of severe burns typically involves early excision and skin grafting, procedures that are often associated with various morbidities [9]. A newer approach preparation of autologous skin cell suspension offers notable advantages, including a reduction in the size of the donor site. Studies highlight the favorable wound-to-donor site ratio provided by this technique. For instance, Navarro et al. utilized a porcine wound model to demonstrate the efficacy of an autologous cellular suspension, where a 3:1 meshed autograft was sprayed with a culture medium instead of a cellular suspension [10]. Autologous skin cell suspension promotes rapid epidermal regeneration at the point of care, enabling restoration of the epidermis while minimizing the use of donor skin [11,12]. This method accelerates wound healing and improves the cosmetic and structural outcomes of healed wounds, all while significantly reducing postoperative complications and adverse events [13].

***Figure 1:*** *Post debridement split thickness skin grafting.*

***Figure2:*** *Post Split thickness graft loss.*

***Figure 3a,b:*** *Donor site marked for SSG harvesting and placement of graft in warm saline.*

***Figure 4a,b:*** *Mechanical separation of epidermis from dermis.*

***Figure 5a,b:*** *Centrifugation of graft at 2500rpm for 10 mins and Cell pellet collected.*

***Figure 6 a,b:*** *Cell spray applied over wound.*

***Figure 7:*** *Post cell spray wound after removal of dressing after 7 days*

***Figure 8:*** *Final wound.*

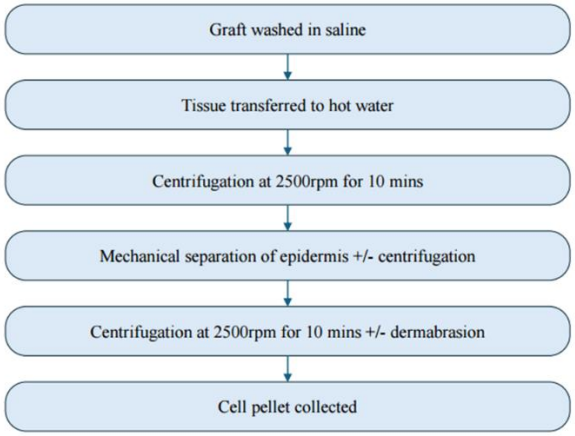


***Figure 9:*** *Modified JIPMER technique of cell spray.*

Additionally, it decreases the need for multiple surgeries, shortening hospital stays and reducing overall treatment costs [14]. Commercial technologies like RECELL facilitate the intraoperative preparation of skin cell suspensions without requiring cell culturing. However, these systems may not be practical in resource-limited settings due to their cost. An indigenous method of preparing autologous skin cell suspension using warm water presents a cost-effective alternative with additional regenerative benefits. Warm water causes peeling of skin and natural separation of epidermis and dermis when centrifuged as compared to chemical methods using trypsin and phosphate buffer. It prevents breakdown of the cells and tissue due to enzymatic digestion as done by trypsin. Growth factors such as platelet-derived growth factor (PDGF), Insulin-like growth factor (IGF), keratinocyte growth factor (KGF), basic fibroblast growth factor (bFGF), and vascular endothelial growth factor (VEGF) further enhance wound healing [15]. The combination of autologous skin cells with lip aspirate creates a synergistic effect, promoting efficient wound healing in an economical and effective manner.

## Conclusion

In conclusion, the indigenous preparation of autologous skin cell suspension presents a promising, cost-effective alternative for managing extensive burn wounds, particularly in resource-limited settings. By combining e, epidermal cells with the regenerative potential of lip aspirate, this method not only minimizes the need for extensive donor sites but also leverages the benefits of adipose-derived stem cells and growth factors to enhance wound healing and tissue regeneration.

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