Case Report

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Application of Amnion Allograft in Treatment of Thermal Burns

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ABSTRACT

Burn injuries are common among all age groups and can be a result of thermal, scald, or electrical sources. Currently, various scaffolds are employed to enhance the healing process and minimize scar formation. Collagen serves as a regenerative scaffold, helping in tissue regeneration and facilitating the formation of new blood vessels. Moreover, scaffolds such as amniotic membrane serve as adjunct in proper epithelialization and scar reduction, boasting unique anti-inflammatory and bacteriostatic properties. In this study, we used amniotic membrane allograft as a biological dressing for burn wounds on a adult patient's arm region.

KEYWORDS

• Amnion allograft • Wound healing • Regenerative therapy

INTRODUCTION

Wound healing is a biological response to various forms of injury, comprising pf physical, chemical, mechanical, or thermal damage. This process involves several sequential phases: homeostasis, inflammation, proliferation/granulation, and remodelling/maturation from the normal healing pathway can result in stagnation during the inflammatory phase, particularly evident in cases of burns where standard healing mechanisms may be hampered. In modern

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medicine, the utilization of scaffolds, whether natural or synthetic, has gained popularity and recognition.[1] An optimal scaffold should have specific characteristics: appropriate physical and mechanical properties, a physiological background conducive to cellular adhesion, proliferation, and differentiation, high porosity, a favourable surface area to volume ratio, flexibility to conform to wound shapes, and ideally, biocompatibility and biodegradability.[2] Collagen, whether synthetic or natural, serves as a surrogate for the dermal matrix, facilitating epithelialization during wound healing. Amniotic membrane acts as a natural scaffold, exhibits distinctive properties such as anti-inflammatory, anti-microbial, anti-fibrotic, anti-scarring, and epithelization-promoting qualities. Its low immunogenicity and presence of progenitor cells make it a preferred choice for scaffold applications in wound healing. Silicone functions as a barrier, reducing mechanical friction and trans epidermal water loss, factors associated with infection severity. In vitro studies suggest that silicone may modulate inflammatory growth factors implicated in fibrosis and support wound healing, including main inflammatory markers like TNF-α, TGF-β, IL-1, and IL-6.[3]

MATERIALS AND METHODS

This research was carried out at a Tertiary Care Centre within the Department of Plastic Surgery following approval from the department's ethical committee. Informed consent was duly obtained. The subject of this study was a forty-six-year-old male who sustained accidental second-degree thermal burns affecting the face neck and right upper limb. He subsequently developed blistering and swelling around the neck and right upper limb region the following day. Upon admission he received initial resuscitation involving intravenous fluids, analgesics, and prophylactic antibiotics. On the fifth day post-burn, a three-layer scaffold dressing was prepared and applied to the deeper burn areas following dermabrasion-assisted tangential excision. This scaffold comprised sterile amniotic membrane, dry collagen sheet, and silicone sheet. The amniotic membrane used was obtained from a freshly delivered placenta, thoroughly washed, and stored in an antibiotic solution in a refrigerator. The dressing remained in place for five days, during which time the amniotic membrane was completely absorbed (Figure 1 & 2).

Figure 1: Amniotic membrane which was harvested from human placenta

Figure 2: Amniotic membrane which was harvested from human placenta being applied over the wound over the forearmregion

RESULTS

Throughout both the intraoperative and postoperative phases, the patient experienced no notable events. Upon opening the dressing on the fifth day post-operation, substantial areas of re-epithelialization and healing were noted. BJWAT wound score improved from

32 at presentation to 25 after of amniotic membrane regenerative therapy.

DISCUSSION

Partial thickness burns injuries have the potential to heal spontaneously, whereas full-thickness burns typically mandate the use skin grafting to achieve complete wound closure. Traditionally, split-thickness skin autograft has been the preferred method for closing excised full- thickness burn wounds. However, patients with extensive burn injuries may face challenges due to limited availability of donor sites for autograft harvesting, prompting consideration of alternative options such as skin substitutes. Engineered skin substitutes offer temporary coverage for wounds until donor sites are available for autografting or, if containing autologous cells, can provide permanent closure.[4] While the availability of permanent skin substitutes remains limited, advancements in tissue engineering are anticipated to yield improved models, thus enhancing the options for managing burn wounds. For instance, the commercially available Dermal Regeneration Template comprises a two-layered system. The outer layer, composed of a thin silicone film, serves as a protective barrier against infection and regulates heat and moisture loss. The inner layer, consisting of a collagen glycosaminoglycan (GAG) thermal layer, acts as a biodegradable template facilitating dermal tissue regeneration. The porous nature of the template aids in skin regeneration by serving as a scaffold for tissue growth.[5] Following regeneration of the dermal layer, the outer layer of the template is replaced with a thin epidermal skin graft, allowing for flexible, permanent skin regeneration and promoting faster wound healing with minimal scarring. Seeking to emulate this mechanism, we have utilised an indigenous dermal regeneration scaffold using silicone sheet, dry collagen sheets, and amnion. This cost-effective scaffold can be readily prepared and utilized, particularly in hospital settings within developing countries where the affordability of commercial regeneration templates may be a concern.[6,7]

CONCLUSION

The efficacy of utilising a cost-effective regenerative scaffold dressing based on amniotic membrane in treating second degree thermal burns has been demonstrated in this study. It accelerates the overall healing process of both superficial and deep second-degree wounds to less than a week, thereby reducing hospitalization duration and infection rates. Nevertheless, further extensive multicentre, double-blinded controlled research incorporating statistical analysis is warranted.

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