Pan-African Journal of Plastic Reconstructive and Aesthetic Surgery Vol. 3 No. 1 March 2026
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SUMMARY

We reconstructed a toddler's 10 × 12 cm temporal scalp degloving injury with exposed bone using a Biodegradable Temporising Matrix (BTM), providing a straightforward, low-morbidity reconstructive pathway to healing.

INTRODUCTION

Scalp degloving injuries in children pose formidable reconstructive challenges due to extensive tissue loss, exposed calvarium, and limited local coverage options although injuries resulting in total or subtotal scalp avulsions are rare and life-threatening (1,2). Standard treatment in these cases includes attempts at replantation or free tissue transfer; however, these procedures may not always be possible. An alternative treatment option involves the use of dermal substitutes, such as Integra (Integra LifeScience Corporation. Conventional strategies such as free flaps (1) or loco-regional flaps are technically demanding, resource-intensive, and carry significant morbidity in young patients.

Dermal substitutes have expanded reconstructive options, with the Biodegradable Temporising Matrix (BTM) emerging as a promising solution for large, avascular defects. The NovoSorb® Biodegradable Temporising Matrix (BTM; PolyNovo Biomaterials Pty Ltd., Port Melbourne, VIC, Australia) is a fully synthetic, bilayer construct composed of a polyurethane open-cell foam that integrates with the wound bed, overlaid by a non-biodegradable sealing membrane. BTM provides a synthetic scaffold that fosters vascularised neodermis formation, enabling reliable grafting (1–4).

While widely used in high-income settings, access in Kenya remains limited. We present the case of a massive temporo-occipital scalp degloving injury with exposed bone, managed with donated BTM. This report highlights the reconstructive potential of BTM in complex paediatric scalp trauma.

CASE PRESENTATION

A 1-year-9-month-old girl was referred to our facility with a degloving wound on the left temporal region and an amputated left ear, one week after a road traffic accident involving a Public Service Vehicle commonly known as a matatu that rolled several times. The initial wound care (surgical toilet and debridement) was done at a level 5 hospital before referral.

The wound scored in the mixed wound (both degenerative and regenerative features) range on the Bates-Jensen scale (5), consistent with a deep degloving/friction-type wound in the early proliferative healing phase. We used the Bates-Jensen Wound Assessment Tool to provide a standardised baseline description of wound features; however, this single-case score is presented for descriptive purposes only and does not imply validation of the tool for acute traumatic scalp degloving.

Figure 1 shows an extensive degloving injury involving the left facial, temporal, and occipital scalp regions, measuring approximately 8 × 10 cm (≈80 cm^2). It is full-thickness with deep tissue exposure, consistent with a depth score of 4. The wound edges are not attached to the base, with visible sides and a deeper floor (score 3). Minimal undermining is present, limited to <2 cm in less than a quarter of the circumference (score 2). Necrotic tissue consists mainly of adherent black eschar over the posterior scalp (score 4), covering <25% of the surface (score 2). Exudate is serosanguineous, thin, and pale red (score 3), with scant volume leaving the surface moist but not draining freely (score 2). Surrounding skin is erythematous and hyperaemic within 4 cm

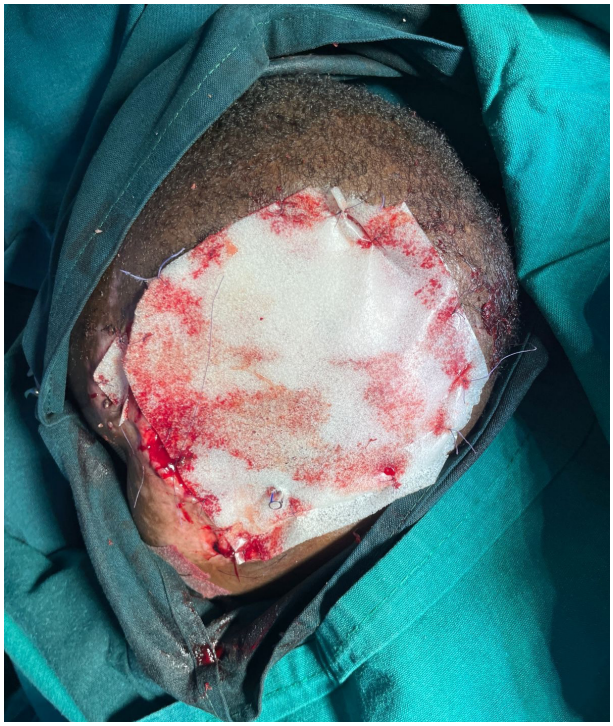
of the margin, indicating inflammation (score 2). Non-pitting oedema and mild induration extend <2 cm beyond the edges (scores 2 each). Granulation tissue occupies 25–50% of the bed, appears healthy, red, and granular, and is mainly located in the inferior facial portion (score 3). No epithelialisation is visible (score 1). Facial nerve function and hearing remain intact, as evidenced by the child using the affected ear when speaking on the phone.

Figure 1: Left facial–scalp degloving wound exposing the temporal bone with amputated left ear (Bates-Jensen ≈34).

The surgical team debrided the wound and used a handheld drill with paediatric perforators to decorticate the parietal and temporal bone (Figure 2). The wound was then irrigated thoroughly with copious amounts of betadine in saline (diluted 1:10) before the BTM was applied and secured. To prevent ingrowth of granulation tissue into the external auditory canal, a sterile endotracheal tube was positioned at the external auditory meatus and secured in place (Figure 3).

Figure 2: Scalp following debridement and decortication.

Figure 3: Scalp after BTM application and secure fixation.



She was discharged postoperatively with instructions for wound care in Murang'a and advised to return after 21 days. The patient re-presented on day 26 with an infected BTM over the left temporo-facial defect, showing purulent exudate but preserved integration and stable adherence, and the endotracheal tube had dislodged during dressings (Figure 4).

Figure 4: Infected BTM with purulent exudate but preserved integration

She was managed with debridement and split-thickness skin grafting (Figure 5) and subsequently discharged with plans for follow-up at the outpatient clinic. Unfortunately, the patient suffered some degree of partial graft failure, for which the parent declined further operative techniques to cover the raw areas.

Figure 5: Split-thickness skin graft at 1-week (a), 4th (b), 5th (c) month and 6th (d) month review

DISCUSSION

One classifies skin substitutes in several ways. By components, they may be epidermal, dermal, or bilayer (composite). By duration of cover, they are temporary, semi-permanent, or permanent. By biomaterial type, they include biological (autologous, allogeneic, xenogeneic), synthetic (biodegradable or non-biodegradable), and semi-synthetic constructs (synthetic membranes seeded with proteins or cells). Within this framework, surgeons classify the BTM as a fully synthetic, biodegradable, bilayer dermal or dermal regeneration template substitute. BTM provides temporary cover, promotes the formation of a vascularised neodermis, and creates a reliable bed for subsequent split-thickness skin grafting (1–4).

We use two-stage dermal substitutes such as BTM to cover full-thickness skin defects after extensive lesions. We followed the principle of a two-stage dermal substitute: first, wound bed preparation with BTM application, and second, removal of the sealing membrane followed by autografting. These substitutes offer several advantages: they remain stable on the shelf, are easy to handle in the operating room, and pose a low risk of immunogenic response or disease transmission. They also enable robust granulation tissue formation, which supports high rates of graft take and delivers good long-term cosmetic and functional outcomes (1–4).

Despite these benefits, surgeons also recognise limitations. Fibrovascular ingrowth may fail when seroma, haematoma, or shearing forces disrupt the wound bed, particularly in less experienced hands. Infection risk remains significant. The requirement for two separate operations increases morbidity and logistical burden. Finally, the high cost (1–3) of these products ($10.50 per cm2 for BTM) restricts their availability in many low- and middle-income settings, including Kenya, where donated BTM provided a unique opportunity to explore its reconstructive potential.

We opined that the surgical team could best manage the extensive temporo-facial scalp degloving defect with exposed calvarial bone—where direct grafting was not feasible, and flap reconstruction would carry high morbidity—by using BTM, thereby establishing a vascularised neodermis and creating a straightforward, low-morbidity pathway to closure. BTM is a highly effective and versatile option for scalp reconstruction following degloving injuries, especially when exposed bone is present or traditional flap techniques are not feasible (1,4,6,7).

Surgeons have successfully used BTM for scalp reconstruction following degloving injuries, including near-total avulsions and wounds with exposed calvarium. Case reports and series demonstrate that BTM enables robust granulation tissue formation, allowing subsequent split-thickness skin grafting with high rates of graft take and stable, long-term coverage. Both paediatric and adult cases document excellent healing, durable coverage, and satisfactory cosmetic outcomes, even in large or complex wounds (1–3).

In contrast to our case, graft failure is uncommon; a 2024 systematic review / meta-analysis (202 patients) found that 92% of patients had >95% STSG survival after BTM, indicating low graft failure rates (8). BTM's resistance to infection is a significant advantage over biologically based dermal substitutes in contaminated or previously infected wounds (4). While infection remains the most common complication, occurring in approximately 12.6% of cases (9), clinicians deliberately delay grafting when infection is present and manage infection conservatively with irrigation, evacuation of the bacterial colonisation, topical antimicrobials, and maintenance of the original matrix; eventually, integration is still achieved (4,9,10). Our deviation from this staged pathway by debriding infected BTM and grafting in the same sitting effectively bypassed the temporising phase and likely accounts for the partial graft loss observed.

Comparative studies suggest that BTM offers outcomes similar to or superior to those of free flaps for large defects, with less morbidity and shorter operative times (6,7). BTM has also been successfully used to treat limb degloving injuries and other complex wounds, demonstrating its versatility and high reconstruction rates. Long-term follow-up shows stable coverage, good scar quality, and minimal contracture formation (1–4,6,7).

CONCLUSION

BTM is a safe and effective option for scalp reconstruction in complex cases, but there is no published evidence of its use in Kenya. Local research and case reporting are needed to establish its role in Kenyan surgical practice.

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