

Management of the deeper wound with Integra® tissue regenerative products

Wounds and burns that penetrate deep into the skin present major clinical problems for patients and healthcare professionals alike. Transplantation of the patient's own skin by way of a split-thickness skin graft remains the 'gold standard' in the treatment of major skin loss. However, this incurs significant donor site morbidity and harvest sites are limited. Advances in tissue engineering mean that there is now a limitless supply of skin through the development of innovative products such as Integra®, a matrix designed to provide immediate wound closure and permanent regeneration of the dermis.

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KEY WORDS

Wounds
Integra®
Dermal substitute
Topical negative pressure
(TNP) therapy

Wound healing is a complex and dynamic process and the wound's environment can change according to the varying health status of the individual patient. Optimal management of full-thickness soft tissue trauma and chronic wounds requires a thorough knowledge of wound healing principles and practices.

In the absence of underlying disease, almost every full-thickness wound will heal with minimal intervention, however, the process can be enhanced by judicious wound management. The first clinical decision to be made is whether

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to repair the wound or to allow it to heal by secondary intention (Rivera and Spencer, 2009). There are four phases to the healing process:

- ▶▶ The inflammatory phase involves bleeding, immediate narrowing of the blood vessels and clot formation
- ▶▶ The proliferative phase is where new

skin cells and blood vessels are formed

- ▶▶ The remodelling phase takes place after 2–3 weeks and involves the replacement of the collagen layer
- ▶▶ Finally, the skin forms a protective barrier (epithelial cells) between the outer environment and the body.

Advances in wound care have resulted in a vast range of products that can accelerate healing, regenerate the dermis and reduce bacterial inflammation. Furthermore, in complex full-thickness wounds, the use of skin substitutes such as Integra® Dermal Regeneration Template (Integra) (Figure 1) is gaining popularity. Dermal regeneration templates have been used for three decades in the management and reconstruction of complicated wounds (Yannas et al, 1982).



Figure 1. Integra wound dressing.

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Specifications

Integra is an artificial dermis manufactured as a synthetic bilaminate composed of a bovine collagen lattice covalently linked to chondroitin-6-sulfate and covered with a semi-permeable polysiloxane (silicone) layer.

Indications

Integra™ Bilayer Matrix Wound Dressing (Integra) is indicated for the management of wounds, including:

- ▶▶ Partial and full-thickness wounds
- ▶▶ Pressure ulcers
- ▶▶ Venous ulcers
- ▶▶ Diabetic ulcers
- ▶▶ Chronic vascular ulcers
- ▶▶ Surgical wounds (donor sites/grfts, post-laser surgery, podiatric, wound dehiscence)
- ▶▶ Trauma wounds (abrasions, lacerations, second-degree burns and skin tears)
- ▶▶ Draining wounds.

The device is intended for one-time use and its benefits include:

- ▶▶ Immediate wound coverage
- ▶▶ High conformability for various anatomical sites
- ▶▶ Excellent performance in deep donor sites
- ▶▶ Strength and flexibility
- ▶▶ Patients are left with a healed wound created from their own tissue
- ▶▶ Patients can begin rehabilitation with an Integra wound dressing in place.

Integra also provides excellent coverage over exposed bone, tendon, cartilage and joints. In one study of 166 exposed internal structures that would ordinarily be closed with flaps, Integra closed 90% of them (Gottlieb and Furman, 2004).

Mode of action

As skin cells migrate into the matrix, the collagen is slowly absorbed and replaced with collagen produced from the person's own cells. In approximately 14–21 days, the scaffold is eventually remodelled as the patient's cells rebuild the damaged site. Complete wound closure occurs as epidermal cells migrate from the wound edges. For larger wounds, a thin skin graft of the

person's epidermis may be applied to the wound area to facilitate complete wound closure. Wound closure is typically complete within 30 days.

Pre-treatment

Patients must have an accurate assessment of any underlying disease and risks. There must be thorough pre-operative control of inflammation, ulceration, debris and bioburden, and oedema (as far as the disease and available treatments permit).

Day 1: debridement and application

Regardless of how healthy the wound looks, clinicians should use standard methods to ensure it is free of debris and necrotic tissue. The wound dressing is applied to the excised wound bed. Fluids invade the matrix within minutes of application, adhering it to the wound.

Day 7–14: cellular invasion and capillary growth

Cells begin migrating into the matrix and establish a new vascular network. The scaffold is eventually remodelled as the patient's cells rebuild the damaged site. When using either the Matrix (Integra without silicone layer) or Bilayer Matrix (Integra with silicone layer) template, the collagen template biodegrades and is absorbed into the body.

Day 21–56 and beyond: wound closure

Epidermal cells migrate from the wound edges to complete wound closure. For larger wounds, a thin epidermal auto graft may be considered to facilitate this process. A thin 0.004–0.006 inch (0.1016–0.1524mm) epidermal auto graft may be applied over the new remodelled skin.

At the end of the process, epidermal coverage over the wound will represent permanent and lasting wound closure.

Contraindications

Integra is not indicated for use in third-degree burns.

Precautions

The following complications are possible with the use of any wound dressings. If any of the following

conditions occur, the device should be removed:

- ▶▶ Infection
- ▶▶ Chronic inflammation (initial application of wound dressings may be associated with transient, mild, localised inflammation)
- ▶▶ Allergic reaction
- ▶▶ Excessive redness
- ▶▶ Pain
- ▶▶ Swelling.

Storage specifications

Integra, which has a life of two years, should be stored at room temperature.

Case report one

Ms X, a 59-year-old female, was admitted to hospital with a subarachnoid haemorrhage and intra-cerebral haematoma following rupture of a right middle cerebral artery aneurysm. She underwent an emergency craniotomy with evacuation of haematoma and clipping of the aneurysm. This employed a fronto-temporal incision parallel to the hairline. However, 48 hours later, post-operative ischaemia necessitated a decompressive craniotomy.

The area of skin between the incisions subsequently became necrotic, leaving a 14x20cm triangular area of full-thickness scalp defect with no bony cover over the dura layer. There were no local flap options due to the size of the defect and Ms X was unfit for free flap reconstruction due to ongoing medical complications and a guarded prognosis. Therefore, a decision was made to reconstruct the defect with Integra, together with a V.A.C.® Therapy (KCI) dressing.

The area of necrotic scalp was debrided (Figure 2), and a single layer of Integra was applied to the edges of the exposed dura, which was secured with non-absorbable sutures (Figure 3). The wound was dressed with Acticoat™ (Smith & Nephew) and V.A.C. Therapy was applied at 50mmHg. The V.A.C. Therapy was *in situ* for 28 days and was changed regularly. A meshed split-thickness skin graft was also applied after the Integra silicone layer and V.A.C. Therapy had been removed. There was a

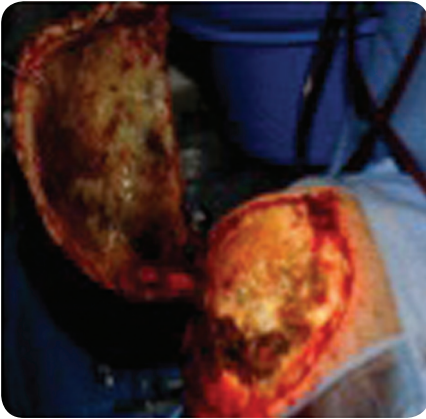


Figure 2. Surgical debridement of area of scalp necrosis.



Figure 3. Integra® is applied to the defect, before the application of V.A.C. Therapy.



Figure 4. Successful graft take and wound closure.

100% graft take and good contouring of the defect (Figure 4) (Khan et al, 2010).

The reconstruction of scalp defects combined with calvarial loss poses a reconstructive dilemma, especially in a medically and neurologically challenged

patient. Khan et al (2010) believe that in selected cases, the Integra and V.A.C. Therapy combination is a good reconstructive option for complex scalp defects when other options (e.g. local flaps or tissue expanders) may be contraindicated.

In this case, the patient made a full recovery and was discharged. There were no local complications related to Integra or V.A.C. Therapy, although the 50mmHg negative pressure used by the V.A.C. Therapy did induce a headache, which was managed with analgesia. This is likely to be due to dural tug as a result of the dural repair that had been performed.

The main benefit of using Integra in this patient was that it conformed to the contours of the wound and minimised dressing changes and nursing input. In a case with limited options, Integra was used successfully for reconstruction of a full-thickness scalp and calvarial defect with exposed dura.

Case report two

This case featured Ms D, a 62-year-old African American female who was referred to the Graduate Hospital Wound Care Center in Philadelphia, USA. She had ulceration to both of her feet and anterior ankles (Figure 5). The wounds had previously been treated with operative debridement, followed by V.A.C.® Therapy.

Initial treatment at the author's centre included debridement of the wounds with incisional skin biopsy, followed by application of a split-thickness skin graft. The right foot healed without any further problems, but the skin graft on the left foot did not take.

Ms D's pathology report suggested that the aetiology of the wounds was likely to be vasculitis (unidentified type). At this point, the tendons in Ms D's wound were exposed and the decision was made to undertake further debridement with excision of the tendons (Figure 6), followed by the application of Integra (Figure 7).

Three weeks later, the Integra had



Figure 5. Patient presented with ulceration on her feet.



Figure 6. Tendons in the wound exposed.



Figure 7. Application of Integra.



Figure 8. After three weeks Integra was flush with the skin.



Figure 9. Skin graft took on the second attempt.

taken and was flush with the skin. Therefore, a further split-thickness skin graft was attempted (Figure 8). At this second attempt, the skin graft did take (Figure 9) (Gottlieb and Furman, 2004). Ms D had been treated for approximately six years with compression dressings and skin grafts. However, approximately six months after her operation (and after applying Integra) she had recovered without any ulceration.

Conclusion

Integra® provided relatively thick and robust soft tissue cover for the body and a reasonably aesthetic and durable outcome. In some selected cases, such as complex scalp defects, a combination of Integra and V.A.C.® Therapy is a good reconstructive option when others are contraindicated (Khan et al, 2010).

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Key points

- ▶▶ Integra® is an artificial matrix designed to provide immediate wound closure and permanent regeneration of the dermis.
- ▶▶ Integra is indicated for use in partial and full-thickness wounds, pressure ulcers, venous ulcers, diabetic ulcers, chronic vascular ulcers, surgical wounds, trauma wounds and draining wounds.
- ▶▶ Integra provides excellent coverage over exposed bone, tendon, cartilage and joints.

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