

The use of artificial dermis in the treatment of chronic and acute wounds: regeneration of dermis and wound healing

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Abstract. Wounds with large loss of deep tissue can be repaired using a dermis substitute. When wounds have an irregular fund, applying a skin graft on these one can be a failure. *Integra Dermal Regeneration Template* is a bilaminar material, a collagen chondroitin-sponge overlaid with silicone. It heals wounds where conventional methods of repair fail or are too risk. This study analyzes *Integra's* use for chronic and pathological wounds in 7 patients. Applied to wounds reduces inflammation and protects it from a possible contamination or another injury. Imbibition, fibroblast migration, neovascularization, remodeling and maturation are distinct histologic phases of forming neodermis. Through the silicon layer is possible to observe the histogenesis: the change in color of the matrix is a predictor of its vascularization. When the color has progressed from pink through pale yellow and finally to peach, the neodermis is fully vascularized. The postoperative care is minimum. *Integra* is removed after three weeks regenerating a new dermal tissue. So it can be applied a thin skin graft until healing of all patients.

Key words: Artificial dermis, regeneration of dermis, chronic and acute wounds

Introduction

Chronic and acute wounds with large loss of deep tissue or exposition of tendon, muscle or bone can heal difficulty by current methodologies. Moreover, skin grafts are assigned to failure if wound's fund is irregular or deep. In these wounds healing is often slow because there is a reduction of growth factors and an increase of their inhibitors.

These wounds can be repaired by application of a dermis substitute as *Integra Dermal Regeneration Template* (Siad Healthcare, Milano, Italy).

Integra is a dermis substitute that stimulates production of endogenous collagen and a new dermis comparable to real dermis. Our preliminary experience confirmed efficacy of *Integra* in wound healing.

Materials and methods

The author's experience about *Integra* application was between March of 2004 and May of 2005. In

this study 7 patients, ranging in age from 32 to 84 years (mean 53 years), with chronic leg ulcers were included. The causes of wounds were venous illness (5 patients), trauma (1 patient) and ischaemia (1 patient).

The wounds had different sizes, ranging in diameter between 15 cm. and all leg's circumference; one wound presented exposition of tendon, the others were characterized from loss of deep tissue.

In three patients (42%), debridement was made by medical dressing before *Integra* not-fixed placing on without patient's pain and anaesthesia. In other wounds (58%), wound bed preparation was made with surgical brushing before applying *Integra*; the dermis substitute was fixed by staples.

Results

In all patients, the authors observed the regeneration of a new tissue comparable to a new dermis after fifteen days (Fig. 1).

So it was possible to apply a thin skin graft to achieve healing after three or four weeks (Fig. 1d). The authors related here about two cases of their experience.

Case study 1

A 42 year old man, obese with wounds to all left leg's circumference since two years; it was made debridement by medical dressing for three weeks, and it was used VersaJet in surgery room before *integra* applying on fixing by staples. After three weeks, it was removed silicon layer and after seven days an epidermal autograft was harvested by scalpel and meshed. The first medical check, after fifteen days showed a perfect adherence of the graft to the dermis. After one month the Authors observed the complete wound healing.

Case study 2

A 30 year old man, with a large venous leg (20 x 25 cm) wound since eight years. It was made debridement by medical silver dressing for fifteen days. So it was applied *Integra* without fixation covered with greasy gauzes and elastic bandages. Medical wound checks was every five days. After twentyfive days the *Integra's* silicone layer is removed and a thin skin graft is made. At the fifteenth day the autograft is adherenced. At the second post-operative check, after four weeks, it is healed.

Discussion

Application of *Integra* is a new method of managing acute and chronic difficult wounds. *Integra* appears to substantially minimize long-term post-operative contracture, it has unlimited availability.

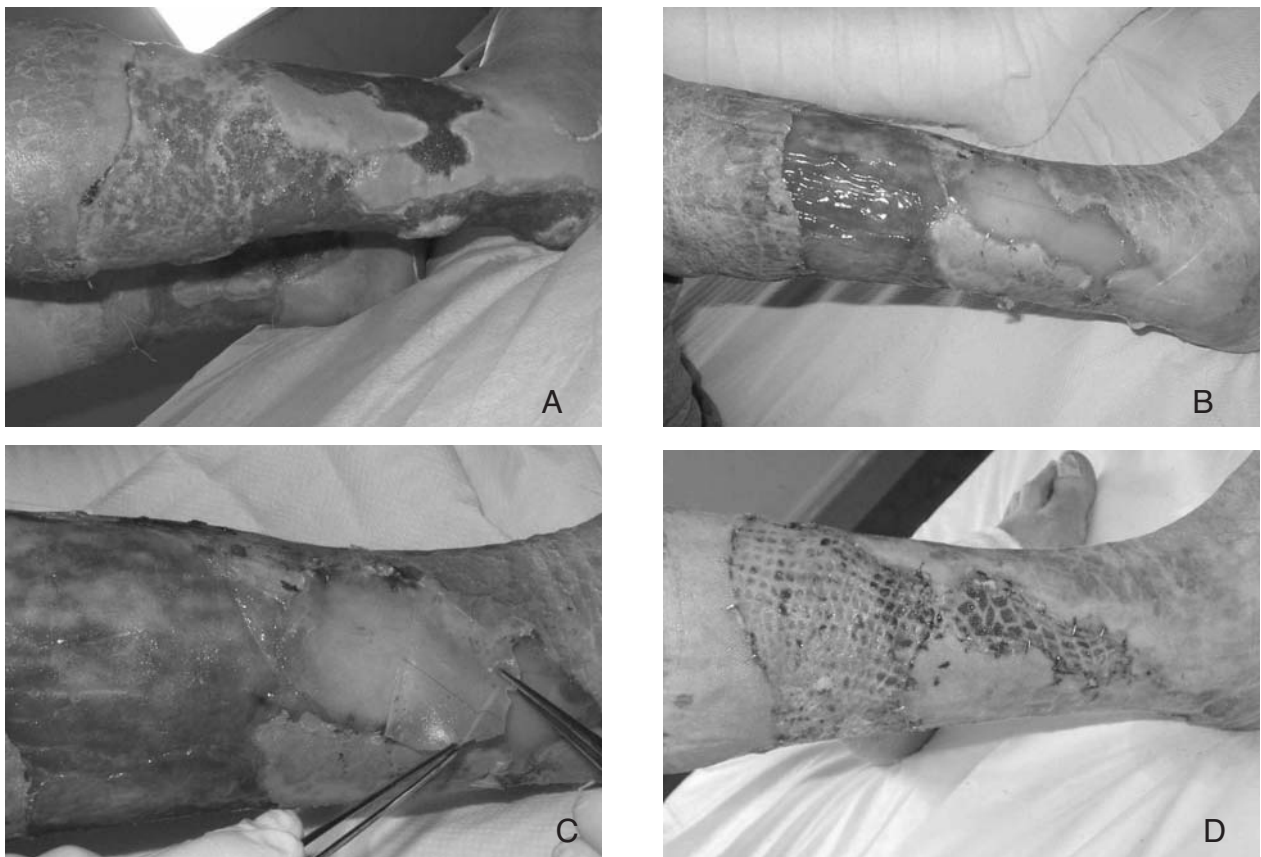


Figure 1. Pre and post-operative Gastrointestinal Quality of Life Index (GIQLI)

Integra Dermal Regeneration Template is a bilaminar material consisting of porous bovine tendon collagen and glycosaminoglycan (chondroitin-6-sulfate) overlaid with a temporary epidermal substitute made of silicone. Developed for burns, its properties make it useful for a variety of acute wounds (fasciitis, exposure of tendon, large loss of deep tissues). It is also ideally suited to chronic and/or infected wounds with slow autogenous skin regeneration.

Applied to acute wounds, *Integra* reduces inflammation and physiological reactions to injury protecting the wound and minimizing symptoms. Serial histologic examination of the matrix-forming neoderms showed four distinct phases of integration: 1) imbibition, 2) fibroblast migration, 3) neovascularization and 4) remodeling and maturation. These histologic phases corresponded to the wound-healing phases and skin graft "take".

In the first phase imbibition begins within minutes of application of the matrix to the wound.

The exudate fosters adherence of the matrix to the wound.

In the second phase, fibroblast migration settles along the interstices of the matrix and produces host collagen.

In the third phase, neovascularization starts at the end of the second week with endothelial cell migration. Lumen formation is during the third week. By the end of fourth week neovascularization is established.

In the fourth phase, remodeling and maturation is equivalent to the same phase of wound healing.

The regenerated tissue is also comparable to real dermis.

The *Integra* sponge is a trellis that guides the ingrowth of new tissue. The spongy bovine collagen dermal replacement layer acts as a matrix for the ingrowth of host fibroblasts and endothelial cells, and it is gradually replaced by host (endogenous) collagen. When *Integra* is placed on a healthy wound, histioblasts migrate into material from the base of the wound, dragging angioblasts in their wake, and then creating a living tissue. The change in color of the matrix is a predictor of its vascularization. When the color has progressed from pink through pale yellow and finally to peach, the neoderms is fully vascularized. The sili-

con layer provides a possible portal for contamination of wound.

During this stage, the autograft becomes adherent to the surface of neoderms.

Integra is packaged in 250 ml of isopropyl alcohol and it is available in three rectangular sizes.

As much as is needed, it can be opened and applied to cover wound after first rinsing out the alcohol.

The *Integra* must conform to and contact the wound surface without covering margins of wounds to avoid the possibility of the forming hypertrophic scar or keloid. It can be affixed with sutures, staples etc. Fixation and compression by elastic bandages are of paramount importance.

The post-operative care is minimum because histogenesis is observable through the silicone.

As regeneration is complete, about three weeks, the silicone is lifted and thin epidermal autografts are placed on the neo derms. After three weeks a thin skin graft can be applied with a quick healing of wounds and better aesthetic results.

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