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Management of traumatic soft tissue defects with dermal regeneration template: A prospective study

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ABSTRACT

Introduction: Traumatic soft tissue defect is a common issue for the trauma surgeon. The aim of this study was to evaluate the use of a dermal regeneration template (DRT) associated to a split-thickness skin graft (STSG) to cover severe traumatic wounds involving exposure of deep functional structures.
Materials and methods: Patients with severe traumatic defects, either open fractures or full-thickness skin wounds involving exposure of tendons without paratenon, bones without periosteum or joints without articular capsule, managed in the authors' trauma centre, were included in a prospective fashion. They were treated by DRT, associated to STSG within a month and followed up to 18 months. The primary outcome was STSG percentage of take at 18 months. The secondary outcomes included complications rate, functional results, scar retraction rate at 18 months and aesthetic results.
Results: A total of 15 patients were included, with 100% follow-up at 18 months. The mean age was 44.3 years, with nine men. Eighty percent of the wounds were located on the lower limb. After 18 months, the mean STSG take rate was 99.3%. Between the placement of the template and the STSG procedure, the reported complications were template unsticking, seroma, local infection and local oedema. There was no reported haematoma. In terms of functional outcome, percentages of patients undergoing rehabilitation from the time of the skin graft until the end of the follow-up decreased from 80% to 20%. There was 8.7% of retraction in length, and an 8.2% retraction in width. The Vancouver Scar Scale score constantly decreased until 2.5 at 18 months. The final functional and aesthetic subjective scores showed the marks to be located above the 'Satisfying' threshold, either by the surgeon or by the patients.
Discussion and conclusion: Eighteen months' follow-up demonstrated that DRT reconstruction is a simple, reliable, efficient tool to treat complex traumatic soft tissue defects.
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Traumatic injuries with extensive soft tissue defects require the search for new materials that may serve as skin replacements for definitive wound closure. Skin substitutes have been used to manage these wounds. They should resemble functional and aesthetic properties of the dermis and the epidermis. A skin substitute consists of a layer of animal type one collagen serving as a dermal regeneration template (DRT), and it is covered with an adherent layer of silicone membrane functioning as a temporary artificial epidermal barrier. As the dermal regeneration matrix brings a new vascular layer through the revascularisation of the template, it should be used in situations where flap cover would normally be required.

The aim of this study was to evaluate the use of a DRT associated to a split-thickness skin graft (STSG) to cover severe traumatic wounds.

Patients were included with institutional ethical committee approval requiring written informed consent for follow-up, in accordance with the Declaration of Helsinki.

Materials and methods

Study design

This study was performed in a prospective fashion. Inclusion criteria included trauma patients between 5 and 65years of age, with severe traumatic wounds, either open fractures or full-thickness skin wounds, involving exposure of deep functional structures, including tendons without paratenon, bones without periosteum and joints without articular capsule, eligible for an 18 months' follow-up. Exclusion criteria included life-threatening conditions, diseases or medications leading to wound healing

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disorders, bovine collagen allergy, autoimmune diseases and pregnancy. The decision to place the DRT to close the defect was left to the discretion of the attending surgeon. All patients were treated with the bilayered Renoskin® DRT (Perouse Plastie Corp., Bornel, France), which consists of a porous resorbable matrix of about 2 mm thickness made of stabilised native collagen type one and a silicone sheet of about 200 μm thickness mechanically reinforced with a polyester fabric.

The silicone membrane was later removed and replaced by a STSG. Patients were included between December 2006 and September 2008. Follow-up was attempted at the following times:

- between the DRT placement and the STSG procedure at 7, 14 and 21 days;
- at the time of the skin graft; and
- after the STSG procedure at 30 days; 3, 6, 12 and 18 months.

Data compiled at each time of the follow-up are shown in Table 1. The primary outcome was STSG percentage of take at 18 months, which was analysed by visual examination and measured with a ruler (length × width). The secondary outcomes included complications rate, functional results, scar retraction rate at 18 months and aesthetic results. The last were analysed with the Vancouver Scar Scale.[1] At the end of the follow-up, a subjective evaluation, by both surgeon and patient, was performed in terms of functional and aesthetic outcome. It consisted in grading the result from 1 to 4 (1 – very disappointing; 2 – disappointing; 3 – satisfying; 4 – very satisfying).

Surgical procedure description

The osteosynthesis of open fractures was never performed at the same operating time but always before the DRT placement.

At the time of the dermal substitute placement, patients were given prophylactic intravenous (IV) antibiotics (cefazolin or cefuroxime). Wound bed preparation started, by irrigation and complete wound debridement to viable tissue and meticulous haemostasis without tourniquet. The DRT was then cut to fit the wound without wrinkles or bubbles. The template was never meshed. Dressings were changed every 3–4 days and the surgical site was examined for signs of complications. After evidence of neodermis formation judged on the basis of progressive colour change up to orange/peachy or vanilla, the patient was brought back to the operating theatre for silicone removal and application of a thin STSG (0.012 in.). All surgical procedures were performed by the same surgeon.

Results

Population

Fifteen patients admitted to our University trauma centre were prospectively enrolled in this study. Follow-up of 100% was achieved at 18 months. The mean age was 44.3 years (range 20–63 years), with nine men (60%). Eighty percent of the wounds were located on the lower limb. Almost half of the wounds involved the leg or the foot (46.7% each). Percentages may add up to 100% since locations could be associated. Indeed, three patients had an injury of both leg and foot and one patient of both thigh and foot. Patients

Table 1
Compiled data.

Type	Compiled data
Patients	
	Gender
	Age
	Size
	Weight
	Location and size of wound (width × length)
	Mechanism of injury
	Time from injury to dermal regeneration template placement
	Medical history
Dermal regeneration template placement	
	Per operative complications
	Type of wound dressing – Use of negative pressure therapy
Between the DRT placement and the STSG (7–14–21 days)	
	Time of discharge from the hospital
	Dermal template characteristics: haematoma, infection, seroma, bubbles, unsticking, tear of silicone, necrosis, local oedema
	Colour
Split thickness skin graft	
	Time since DRT placement
	Dermal template characteristics: percentage of take, aspect (clean/infected), silicone layer unsticking ease
	STSG characteristics: donor site, meshed graft (1.5 ratio), suture method, type of wound dressing
	Per operative complications
	First dressing: time between graft and first dressing (days), STSG characteristics (aspect: solid/fragile/damaged, percentage of take, infection)
	After STSG (1–3–6–12–18 months)
	STSG take rate (comparison of the surface to the initial surface)
	Size of wound (width × length)
	Scar retraction (yes/no and comparison of scar surface to initial surface)
	Skin sensitivity (0–3)
	Vancouver scar scale
	Rehabilitation: type, frequency
	Need for another graft
At 18 months	
	Functional and aesthetic subjective outcome score

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