

Long-term outcome after use of an acellular collagen matrix in a finger degloving injury

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Abstract In ring avulsion injuries, replantation may not always be possible because of the extent of the injury or the loss of the severed part. Under these circumstances, other treatment options should be considered. We describe our 5-year follow-up experience after the coverage of a complete digital ring degloving injury with an acellular collagen matrix. The distal phalanx needed to be amputated. Acceptable long-term functional and cosmetic outcomes were attained.

Level of Evidence: Level V, therapeutic study.

Introduction

Ring avulsion injuries are a challenging problem in the emergency room. In favorable cases, replantation should be attempted. However, replantation may not always be possible because of the extent of the injury [1–3] or loss of the severed part. Under these circumstances, other treatment options, such as the coverage of the exposed soft tissues with pedicled or free flaps [4], subcutaneous pockets [5], or amputation of the remaining stump, should be considered [6].

Integra® (Integra®, LifeSciences Corp., Plainsboro, NJ) is a bilayered skin replacement system comprised of a porous matrix of cross-linked bovine tendon collagen and glycosaminoglycan and a semi-permeable silicone layer. It provides a scaffold for cellular invasion and capillary growth. It was used at first in the early 1980s for the treatment of major burn wounds and is approved for this use by the Food and Drugs Administration (FDA). It has recently been used with success in a variety of other situations, including hand defects. It is easy to apply and better skin pliability and functional and esthetic outcomes are achieved with it than with the use of grafts alone. Applied to wound beds with adequate blood supply, such as the paratenon, and through the revascularization of the scaffold, it provides a new vascular layer. This makes it a useful therapeutic tool in situations where a flap cover would normally be required [7].

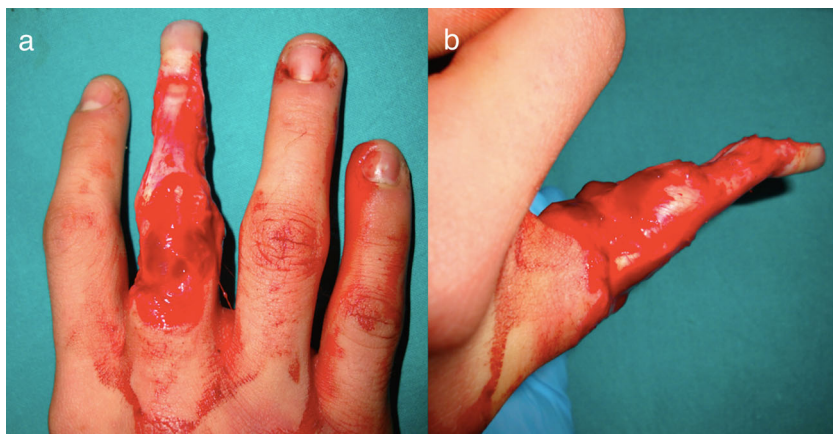
We describe our 5-year follow-up experience with a patient who sustained a grade IVi (according to Kay's modified classification [3, 8]) digital ring degloving injury with a missing avulsed fragment and was treated with Integra®.

Case report

A 23-year-old male, smoker of 20 cigarettes a day, with no relevant past medical history, who presented 5 years ago with a right third finger ring avulsion injury he sustained while climbing a fence. Physical examination revealed a complete loss of soft tissue to the level of the proximal phalanx, with intact tendons and paratenons. The radial and ulnar

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Fig. 1 Ring avulsion injury upon admission to the Emergency Department. **a** Anterior view. **b** Lateral view



neurovascular bundles were preserved to the level of the proximal phalanx and the proximal interphalangeal joint (PIPJ), respectively. His avulsed fragment was not recovered (Fig. 1). The defect—including the fingernail plate—was covered, under digital anesthesia, with a bilayered dermal regeneration template (Integra®, LifeSciences Corp., Plainsboro, NJ). Integra® was applied over the fingernail plate to assure that the degloved surface surrounding it was totally covered. Otherwise, we would have had to cut the template and complete coverage of the denuded areas around the nail would have been more difficult to achieve. The time of surgery was 30 min, and the patient was discharged home the same day.

In postoperative week 3, the patient returned to the OR to remove the silicone layer. His distal phalanx was amputated due to poor vascularization. The resulting defect was covered with a laminar split-thickness skin graft (Fig. 2) harvested from the arm.

At 5 years after the injury, active range of motion of the metacarpophalangeal joint is 0–90° and PIPJ is 0–120°. Right hand grip strength measured with a Jamar Dynamometer is 30 mmHg (left hand 32 mmHg). Pinprick and static and moving two-point discrimination tests show the patient has lost discriminative sensation, but maintains protective sensation. He has had no complications and is happy with the functional and esthetic results (Fig. 3).

Fig. 2 **a** The defect was covered with Integra® the day of injury. **b** Removal of the silicone layer on week 3. **c** Distal phalanx amputation due to poor vascularization on week 3. **d** Split-thickness skin graft placed over the neodermis on day 3

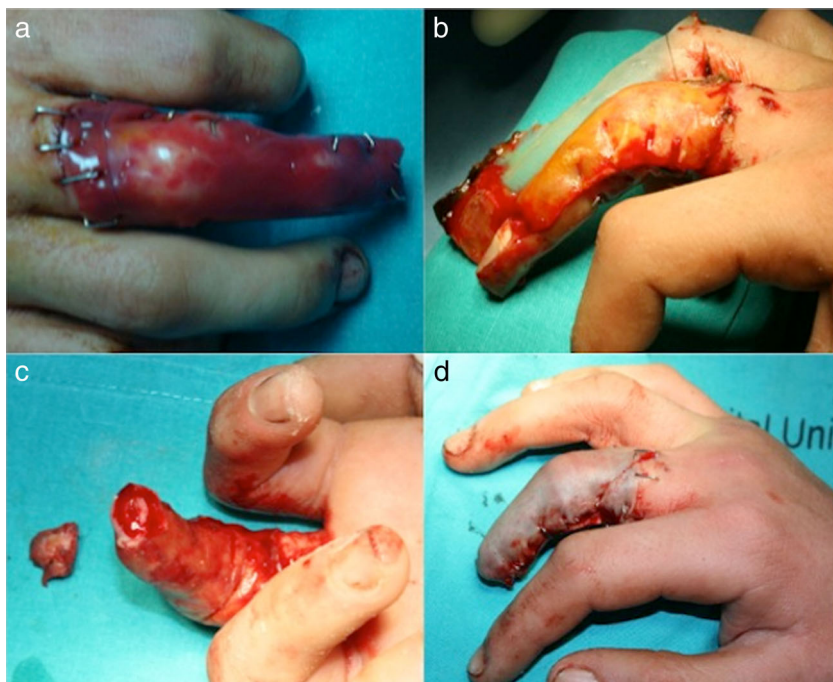




Fig. 3 Esthetic and functional results 5 years after surgery. **a** Volar view. **b** Dorsal view. **c** Lateral view. **d** Full range of movement of the PIP joint, volar view. **e** Full range of movement of the PIP joint, lateral view

Discussion

The ultimate goal of the treatment of degloving injuries of the hand is to achieve the best functional and esthetic results, with minimal donor site morbidity and a fast recovery time. Early coverage and mobilization are the basis for a successful treatment of an avulsed finger [5]. For this reason, the choice of a reconstructive surgical method adapted to the characteristics of the patient and the injury is essential.

In the case we describe, the patient arrived to the emergency room without the avulsed fragment of the finger. After discussing the surgical options with him, he did not wish to have his finger amputated and preferred not to have further scars in his hand; therefore, we decided to use Integra®.

To our knowledge, this is the second case of a complete digital avulsion injury treated with Integra® [9] and the first case with a long-term follow-up that has been reported. In both cases, the disruption of both neurovascular bundles and dorsal vascular support led to

necrosis of the distal phalanx [9]. Other authors have reported cases of burn injuries to the hands [10] and reconstruction of digital defects [7] that have been successfully managed with acellular dermal matrices (ACMs).

ACMs, such as Integra®, could be an option for coverage of a degloved digit in an emergency setting when the avulsed fragment is not available, or when a specialized team in microsurgery is not accessible. Their use implies a short operative time and does not limit other coverage options. Our case demonstrates that successful coverage of complete ring degloving injuries can be attained with an ACM, with good long-term (5-year follow-up) functional and cosmetic outcomes. Its disadvantages compared to flap coverage are that it provides a lower sensitive tactile discrimination and the risk of distal phalanx necrosis.

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Conflict of interest None.

Ethical Standards Patient gave his informed consent prior to his inclusion in the study. Details that might disclose the identity of the subject under study were omitted.

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