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The use of dermal regeneration template (Pelnac®) in a complex upper limb trauma: the first Italian case report

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Abstract. – Dermal regeneration template (DRT) has been well widely implicated in the reconstruction of full-thickness injury. We present our experience and our clinical application of Pelnac® to achieve wound closure with complex acute, upper limb, full-thickness defect post-trauma. A 22-year-old boy presented a soft tissues loss of the back of the hand and forearm with tendon's involvement and exposure. The wound was treated with Pelnac®; the silicone layer was removed at postoperative day 30 and dermal regeneration template was reapplied at the level of the residual tendon exposure; a split-thickness skin graft (0.2 to 0.3 mm) was inserted. Clinically, the reconstructed areas demonstrated good granulation tissue at 14 days with a good take of the skin graft. There were no major acute graft loss, rejection or associated infections cells through downregulating TLR4 expression.

Key Words:
Dermal regeneration, Difficult wound, Tendon exposure, Complex upper limb wound, Pelnac.

Introduction

The concept of Dermal Regeneration Templates (DRTs) was first described by Yannas and Burke in 1980[1]. The introduction of DRTs has revolutionized the management of major burn injuries as well as the reconstruction of complex open wounds. Classical teaching of Gillies' principal, "tissue losses should be replaced in a kind", can sometimes be challenging and not always beneficial due to patient factors, size and location of defect. DRTs provide an alternative option for wound closure, in the acute setting, in critically ill patients with extensive injuries where otherwise major reconstructive flaps would be considered risky and morbid. Furthermore, DRTs are able to provide long-term functional and cosmetic outcomes with improved skin texture and pliability, results that are comparable to that of autologous skin graft[2,3]. There is a fair amount of literature on Integra® use in achieving acute wound closure secondary to trauma, oncological defects and necrotizing infections[4-6]. Instead there is limited evidence available for the clinical application and efficacy of Pelnac® (Gunze Corp., Osaka, Japan). This is another DRT which was first described in Japan by Suzuki et al[7], with the aim of expanding the indications and applications of dermal regeneration templates[8]. It works on similar principles with several distinct properties regarding the composition.

Case Report

A 22-year-old boy, at our Emergency Room, presented a large traumatic loss of the soft tissues at the level of the dorsal region of the hand and forearm with disruption of the extensor tendons of the II, III, and IV finger, following a car accident. Before and after pictures were included, and clinical photography was obtained with informed consent from the patient. All photos included have been de-identified to retain patient confidentiality.

Surgical technique: during the operating session in the Emergency Room it was necessary to perform the wounds toilet and VAC therapy, waiting to plan reconstructive surgery with microsurgical flap. The patient, however, refused such procedure, and we opted then for the use of a dermal substitute. Interrupted extensor tendons were reconstructed using tendon grafts from the ipsilateral superficial palmar tendon (Figure 1). Pelnac® preparation was in accordance to manufacturer's guidelines. It was submerged into sterile saline for 20 min. The wound was

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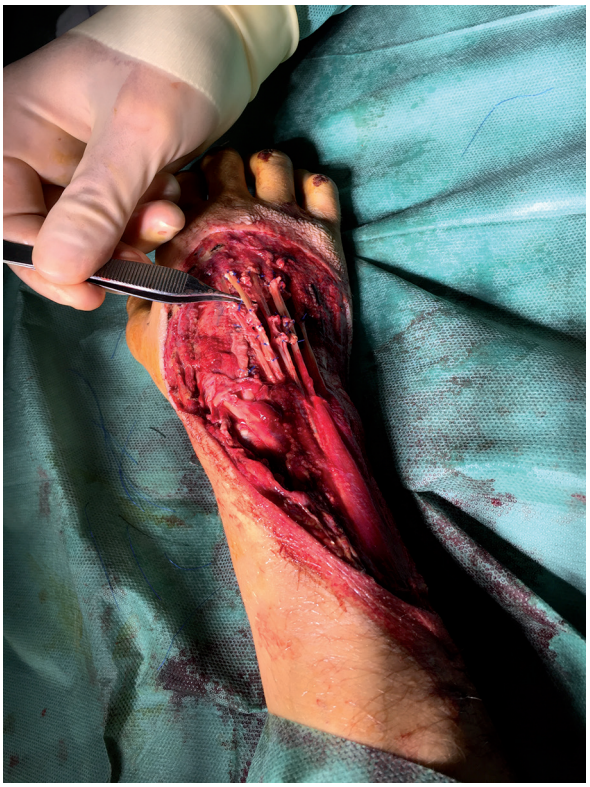

Figure 1. Reconstruction of extensor tendons of the II, III and IV finger using tendon grafts from the ipsilateral superficial palmar tendon.

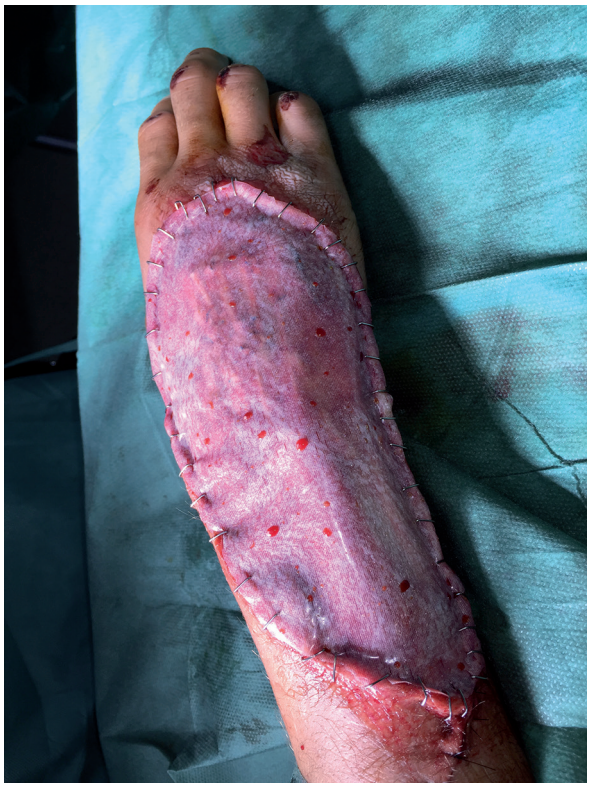

Figure 2. Application of Pelnac®.

thoroughly debrided to viable bleeding tissue and washed with hydrogen peroxide and normal saline. Meticulous hemostasis was achieved prior to application of Pelnac® that was secured to the wound with skin staples (Figure 2). At day 14, below the silicone lamina the gradual reduction of the tendons exposure was visible therefore it was decided to leave it in place for one month (Figure 3), then the silicone layer was removed (Figure 4) and thin split-thickness skin graft ranging from 0.02 to 0.03 mm was applied to the 80% of neodermis and was dressed with non-adherent dressing, gauze and crepe bandage which was left intact for 5 days. A new application of Pelnac® was necessary at the level of residual tendons exposure and after 1 month, when the tendons appeared completely covered by granulation tissue, we proceeded with silicone removal (Figure 5) and application of a full thickness graft dressed with non-adherent dressing, gauze and crepe bandage which was left intact for 5 days. Using the dermal substitute, we had a good covering of the wound bed, a good covering of the tendons without them adhering to the graft (Figure 6).

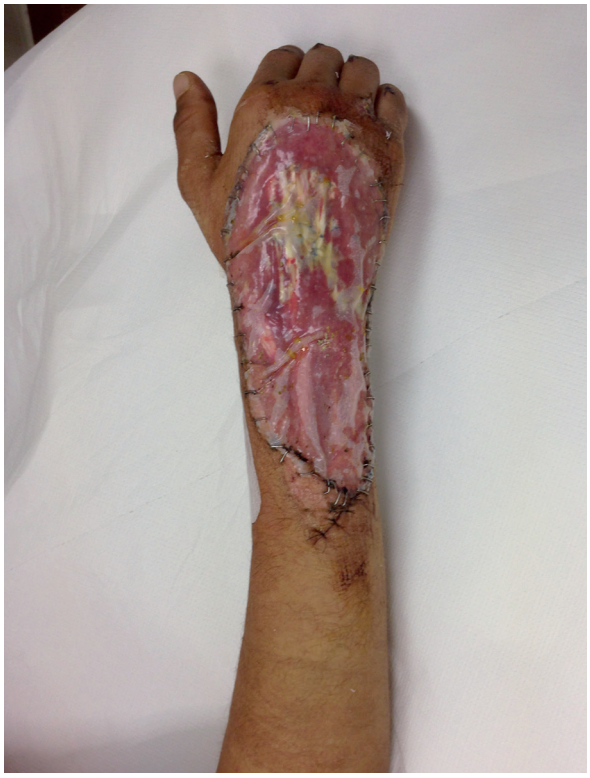

Figure 3. Wound after 30 days.

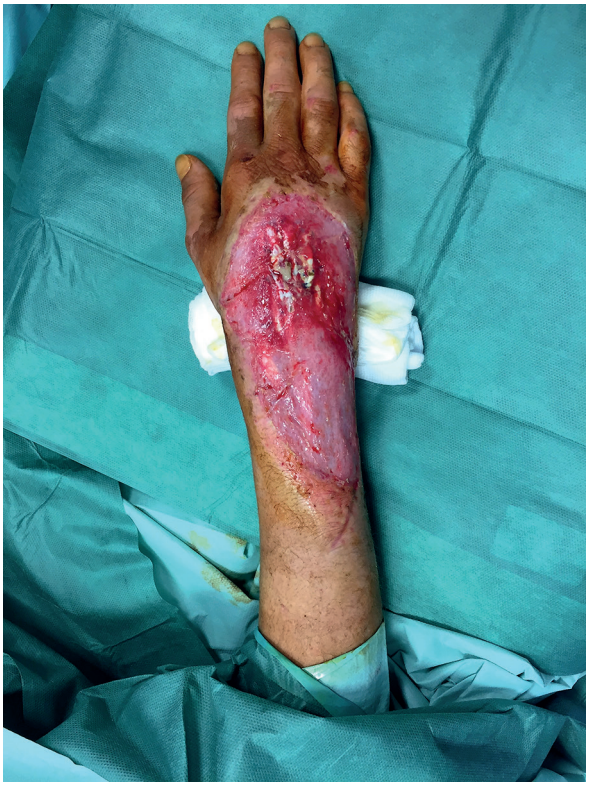

Figure 4. Wound after 30 days without Pelnac®.

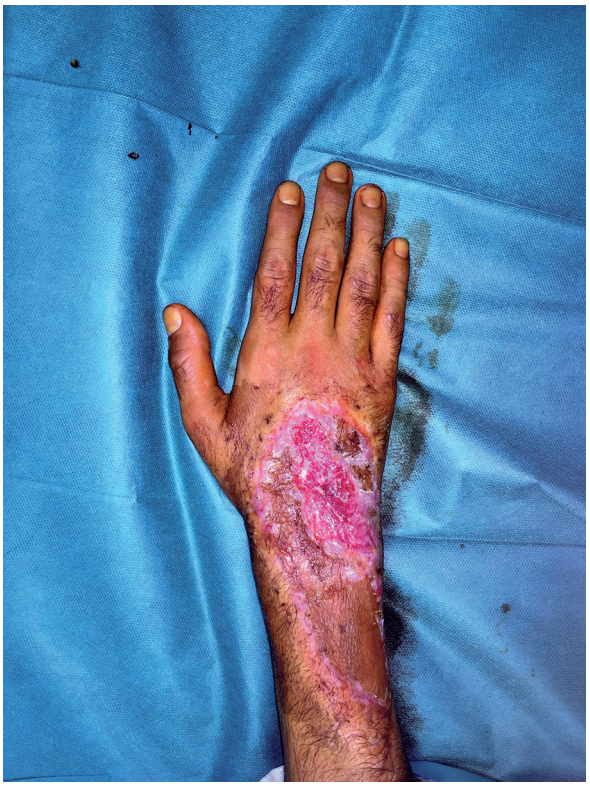

Figure 5. Wound 60 days after trauma without silicone.

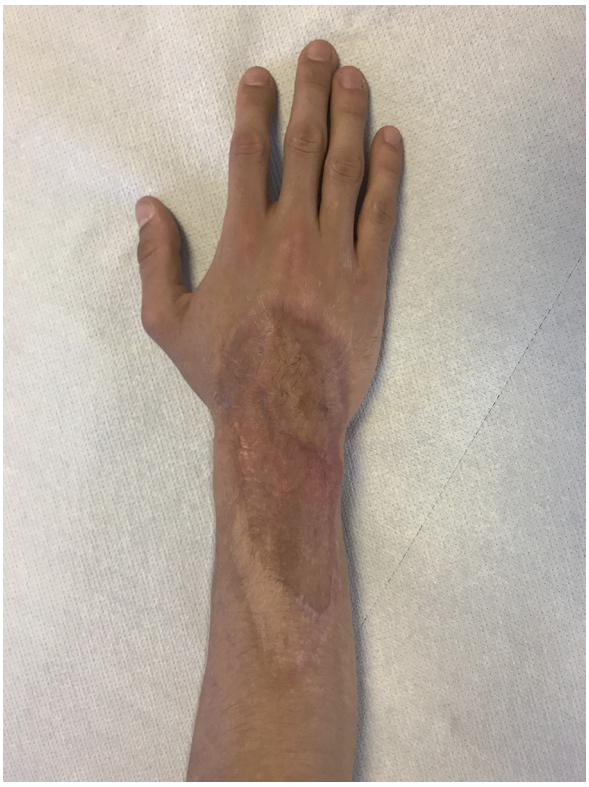

Figure 6. Result after 6 months.

Discussion

The success of Pelnac® on contaminated wounds can be attributed to its unique properties. Pelnac® is a DRT made from soluble atelocollagen which is a highly purified type 1 collagen from porcine tendon. Atelocollagen is almost identical to endogenous collagen composing of stable repeating blocks of amino acid without the highly antigenic telopeptides. During its production, pepsin is used to remove telopeptides in the collagen, which results in a reduced antigenic matrix, consequently lowering the rates of immune response, rejection and failure. Therefore, when applied to contaminated wounds, it eliminates further inflammatory response, resulting in better wound healing. When compared to Integra®, the average pore size in Pelnac® is larger, ranging from 70 to 110 µm as opposed to 30 to 120 µm. Larger average pore size prevents the formation of a tissue capsule and facilitates cell migration into the matrix, allowing the formation of a consistent and elastic neodermis[3]. This provides a final result, which mimics endogenous dermis reducing disabling scar contractures and improved cosmetic outcome[5]. In addition, unlike

Integra®, the matrix in Pelnac® is not chemically cross-linked with glycosaminoglycan (GAG) and is still able to provide similar resistance to degradation against fibroblast collagenases. The ability of Pelnac® to provide coverage on avascular wound beds relies on peripheral revascularization into the matrix highlighting the importance of aggressive debridement to well-vascularized tissue. Coverage of sizeable exposed bone and tendon defects are made possible with lateral neovascularization into the dermal matrix, which would otherwise require flap reconstruction and potentially lengthy microsurgery. A case report which follows the long-term efficacy of Pelnac® supports its ability to produce a dermis that is safe and histologically resembling true dermis in large full-thickness defects.

We believe that the microsurgical flap option is definitely the most suitable for coverage and tendon mobility; however, in this case, we had a non-compliant patient with very specific requests[9-12].

He refused long hospitalization and a surgical option, under general anesthesia, that lasted 5-6 hours. He also feared additional scars in other body sites afraid of an unsatisfactory aesthetic result.

For all these reasons we felt that the use of a dermal substitute was the ideal treatment option: it allowed an intervention under local anesthesia, lasting approximately one hour, without additional scars, aesthetically satisfactory, and, also, achieving mobility results beyond our own expectations.

Conclusions

We can say that the use of the substitute dermal proved to be an excellent solution to satisfy our patient's requests.

Conflict of Interest

The Authors declare that they have no conflict of interests.

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