

NEWS LETTER

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Wound Management Using Artificial Dermis and Negative-pressure Wound Therapy



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Introduction

Artificial dermis is an "artificial graft" that binds to the connective tissue of a wound bed to form a dermis-like tissue. By adapting to and closely adhering to the vascularized wound bed, capillaries are newly formed in the atelocollagen, creating a three-dimensional dermis-like tissue. This is advantageous since a structure similar to the skin can be generated by applying skin graft onto that tissue. However, tissues such as subcutaneous fat are not regenerated.

On the other hand, the first treatment considered for an open wound is a simple skin graft. However, since the mechanism of grafting is similar to adhesion, there are a number of problems.

Problems arising from skin graft to various types of wounds

● Tendon-exposed wounds

Tendon adhesion → Dysfunction
Poor graft take → Direct grafting to tendon is difficult

● Nerve-exposed wounds

Nerve adhesion → Pain/irritability/CRPS

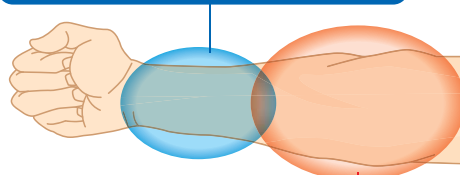
● Vessel-exposed wounds

Vascular adhesion → Fragility/ulcer formation

● Muscle-exposed wounds

Basically treatable by skin graft. However, at the site of the muscle–tendon transition, "muscle fixation" may occur due to skin graft, with restriction of movement.

For tendon/nerve/vessel exposed wounds, skin flaps are more suitable than skin graft.



For muscle-exposed wounds, wound closure can be achieved with a full-thickness skin graft / split-thickness skin graft.

Scope of applications of artificial dermis

● Muscle-exposed wounds

These wounds are a good indication for the use of an artificial dermis. After a dermis-like tissue forms on the muscle, skin graft can be performed, and the muscle fixation can be mitigated. Muscles do not have to slide like tendons do, and it is only necessary that their contraction not be impeded.

● Nerve-exposed wounds

If perineural tissue is present, dermis-like tissue will form. However, since subcutaneous tissue does not exist after skin grafting to the dermis-like tissue, additional treatment such as nerve detachment will become difficult.

● Tendon-exposed wounds

The circulation will be poor if the paratenon which is the vascular network around the tendon does not survive. As a result, dermis-like tissue will not form even if artificial dermis is applied.

Case 1 : PELNAC with PICO

Skin defect with median nerve/flexor tendon exposure following excision of the left forearm tumor

The method used for wound closure is generally determined by the location. Considering the site characteristics of this patient, flap surgery was performed at the tumor excision on the distal forearm (Fig. 1). Artificial dermis and full-thickness skin graft was planned for the donor site on the proximal forearm.

Treatment strategy

Proximal forearm:

Only muscle was exposed even when the skin flap was harvested

artificial dermis +
full-thickness skin
graft indicated

skin graft

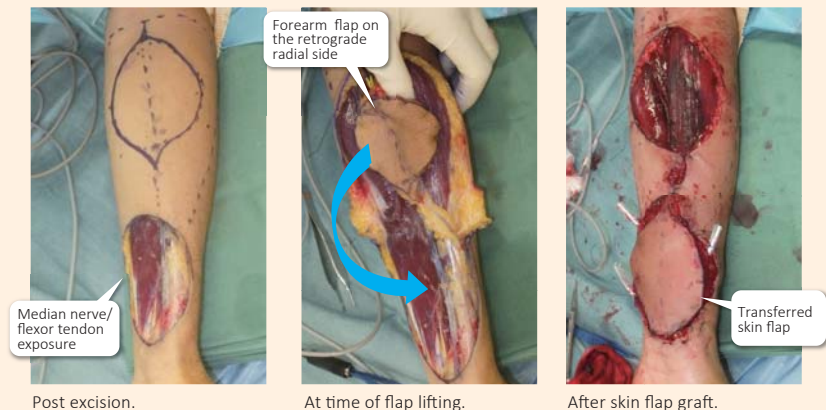
Distal forearm:

Exposure of nerves/tendon

Skin flap was selected
due to adhesion and
required additional
treatment

skin flap

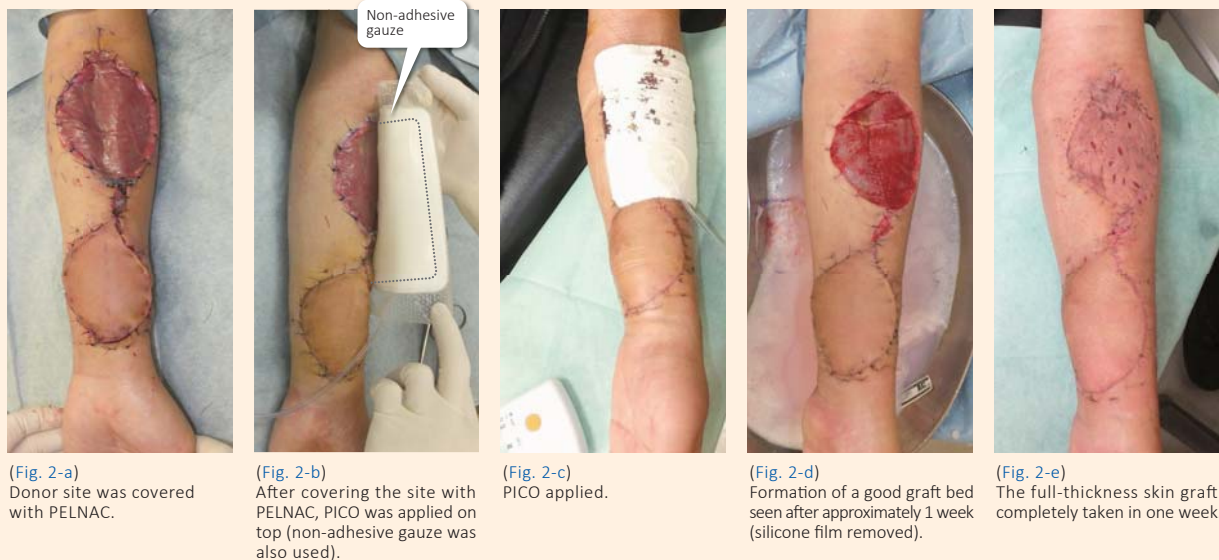
Fig.1 Time of surgery



Technique for donor site : Artificial dermis + NPWT

Take of skin flap was successful one week post-op. However, the donor site was covered with artificial dermis (hereinafter, PELNAC Fenestrated type) as a two-stage graft was necessary due to problems with texture and adhesion (Fig. 2-a). Range-of-motion exercises were performed, but due to exudate from the donor site, dressing change was necessary and PICO® Single Use Negative Pressure Wound Therapy System (hereinafter, PICO) was used to manage exudate (Fig. 2-b,c). A good graft bed was formed in approximately 10 days, and the silicone film was removed (Fig. 2-d). Full-thickness skin graft was performed, and the skin graft was completely taken within one week (Fig. 2-e).

Fig.2 Donor site management



Summary

By using PELNAC at the donor site, a dermis-like tissue formed, and the flexibility of the skin was maintained even after grafting. PELNAC itself is soft, making it suitable for use on and around joints.

Managing exudate from the wound using PICO was possible during the time until skin graft. In this case, the advantages using PICO of were as follows: 1. Protection of wound and comfort at home 2. No impediment of elbow movement and allowed aggressive range-of-motion training.



Case 2 : PELNAC used as supplement for wound closure

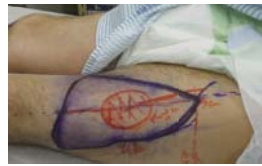
PELNAC, Shoelace method and NPWT were performed together to manage the donor site for incomplete right-hand laceration.

In this case, anterolateral thigh-flap surgery was performed after initial treatment, debridement and internal fixation (Fig. 1). The condition after one month was good (Fig. 2).

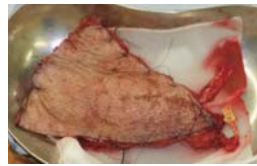
Fig.1 Anterolateral thigh-flap surgery



Debridement and internal fixation.



Before harvesting the anterolateral femoral flap.



Harvested flap.

Fig.2 Condition 1 month after skin flap



Fig.3 Donor site management



(Fig. 3-a)
After harvesting the flap.



(Fig. 3-b)
Donor site was covered with PELNAC, and Shoelace method was applied.



(Fig. 3-c)
Management with RENASYS.



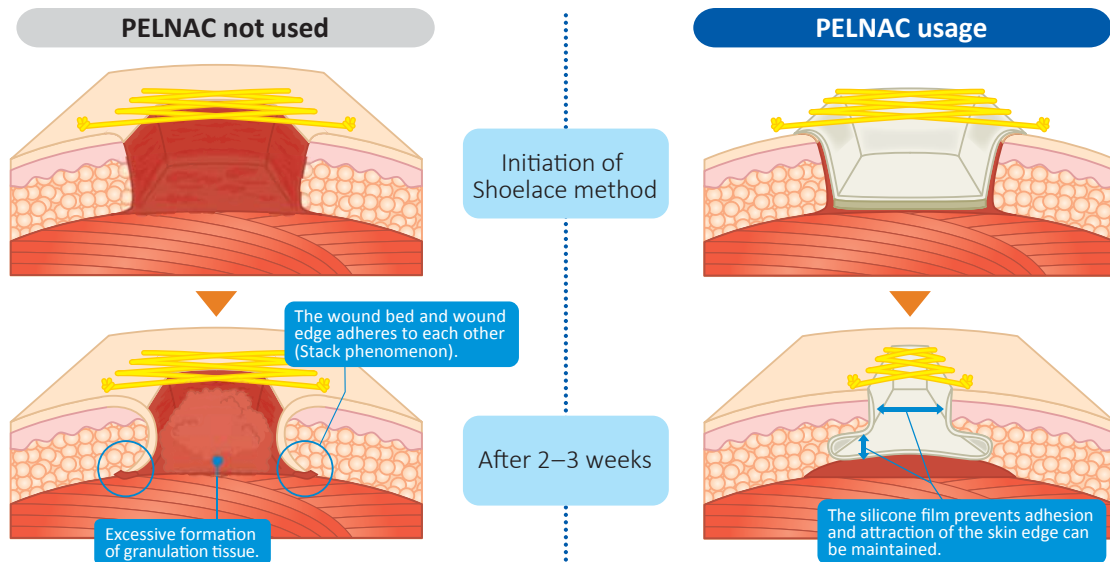
(Fig. 3-d)
Gradual plication and silicone film removed.



(Fig. 3-e)
7 days after skin graft. Full-thickness skin graft applied on a Dog Ear created by pulling the skin.

The donor site was managed applying PELNAC using the Shoelace method (Fig. 3-b) and RENASYS Negative Pressure Wound Therapy (Fig. 3-c). The wound gradually plicated (Fig. 3-d) and full-thickness skin graft was applied on a Dog Ear created by pulling the skin.(Fig. 3-e)

Technique for wound contraction applying Shoelace method + NPWT



Although the shoelace continues to be in place and the wound is pulled together by NPWT, at times the wound surface and edge of the skin is fixed and cannot be drawn together.

When pressure is drawn from above where PELNAC is applied, the wound surface and free edge is not adhered so there is no stack phenomenon. As a result, a large distance can be pulled together and contraction of a broad area can be expected.

Summary

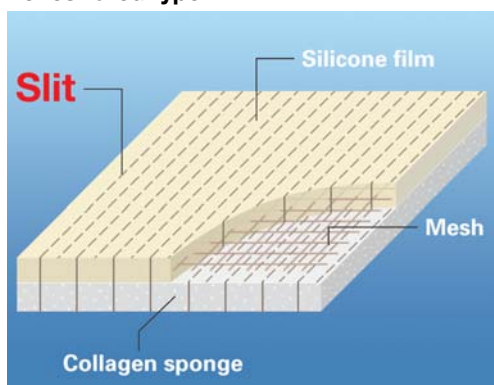
By combining PELNAC with the Shoelace method and NPWT for open wounds, contraction can be maintained and the possibility of wound closure is high. The key point is to maintain mobility of the wound margin and accelerate wound closure before scarring occurs.

Product image

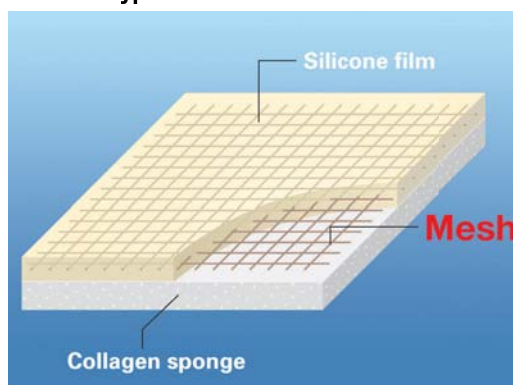


Variation

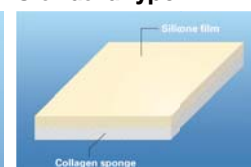
Fenestrated type



Fortified type



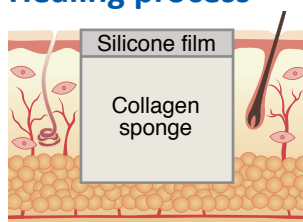
Standard type



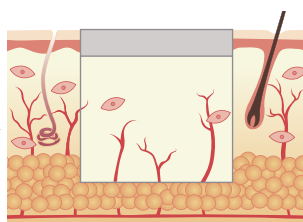
Single layer type



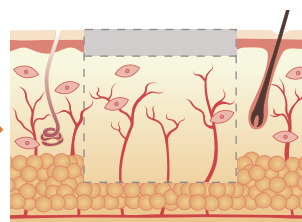
Healing process



PELNAC is applied to full-thickness skin defects.

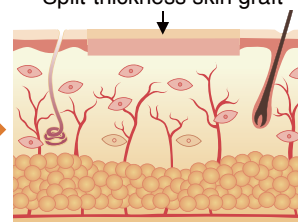


Fibroblasts and capillaries invade and infiltrate into the spaces in collagen sponge.



Collagen sponge is gradually replaced by newly synthesized collagen into dermis-like tissue.

Split-thickness skin graft



After 2-3 weeks, the silicone film is peeled off, leading to wound closure with split-thickness skin graft.

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