

Application of an Artificial Dermis, PELNAC™ Mesh, for Skin Grafting of Extensive Burns



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Introduction

When using artificial dermis for treatment of extensive burns, considerations such as reduction of the risk of infection are necessary. In addition, as the use of cultured epidermal autografts (CEA) has become more popular, artificial dermis has started to be used to regenerate dermis-like tissue that acts as a graft bed for CEA. In this News Letter, we compare a mesh of frozen allogeneic skin with a mesh made of an artificial dermis, PELNAC, when implanted on autologous patch skin grafts to treat extensive burns.

Case

A male patient, aged 19 years. The patient had a history of visiting a psychiatric clinic, but the visits were irregular. The patient tried to immolate himself with kerosene and was brought to our department after visiting a local clinic. He had a severe, extensive burn with a burn surface area of 70% and burn index of 55, accompanied by inhalation injury (Fig. 1).

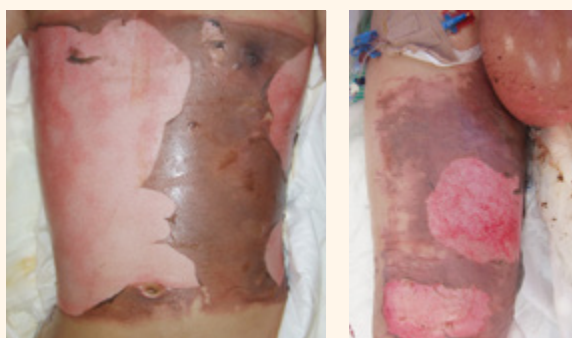


Fig. 1a.

State of the wound at the first visit.

Course

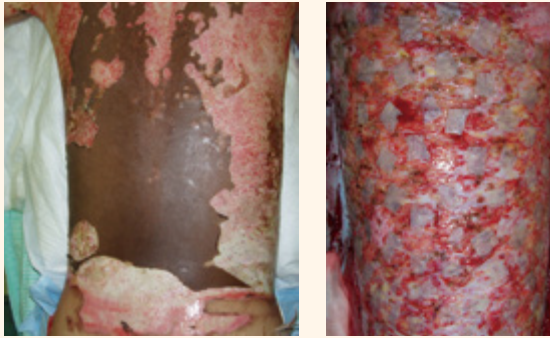


Fig. 2. Debridement and skin grafting 8 days after injury. Debridement was performed down to the subcutaneous adipose tissue, and 1×1 cm autologous patches were grafted.

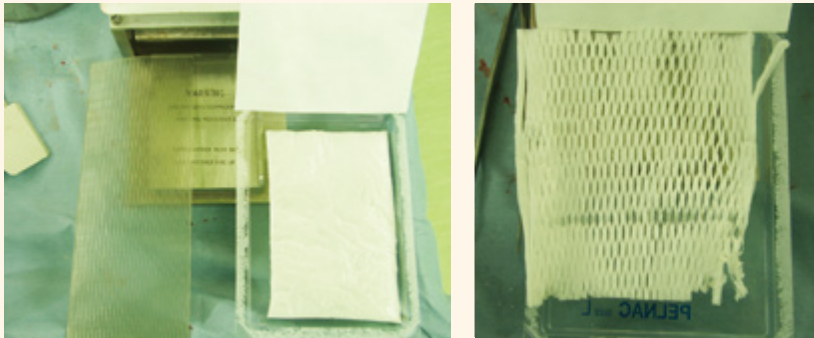


Fig. 3. PELNAC was expanded 3-fold using a mesh dermatome.

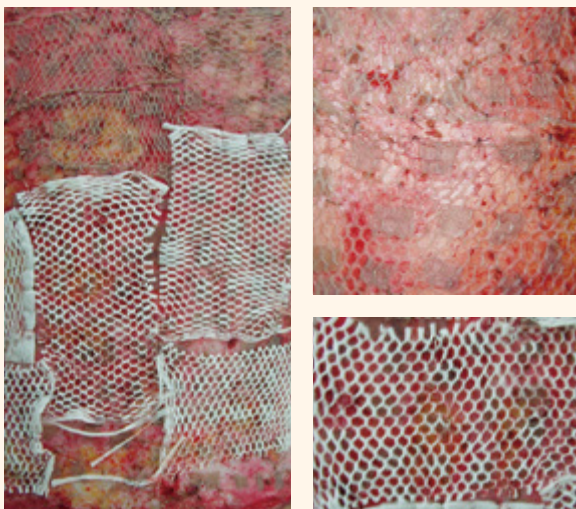
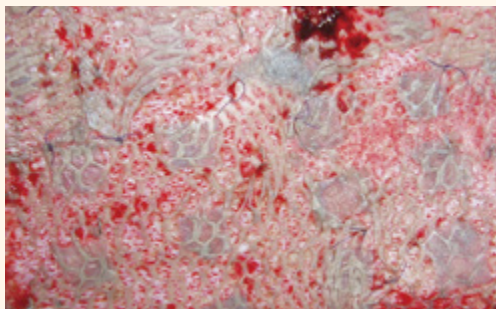


Fig. 4.

Mesher of frozen allogeneic skin and PELNAC were implanted on the autologous patches. Autologous patches and allogeneic 3-fold expanded mesh were grafted onto the upper half of the back (upper right image), while autologous patches and PELNAC 3-fold expanded mesh were grafted onto the lower half (lower right image).

Eight days after the injury, the patient underwent surgery under general anesthesia. Split-thickness skin of 12/1000 inch was collected from the posterior aspect of both thighs to prepare patches about 1×1 cm in size. The third-degree burn wound on the back was debrided down to the subcutaneous adipose tissue, the autologous skin patches graft were implanted (Fig. 2), and the 3-fold expanded meshes of frozen allogeneic skin and PELNAC (Fig. 3) were implanted on top (Fig. 4.).

Autologous patch and allogeneic 3-fold expanded mesh



Autologous patch and PELNAC 3-fold expanded mesh

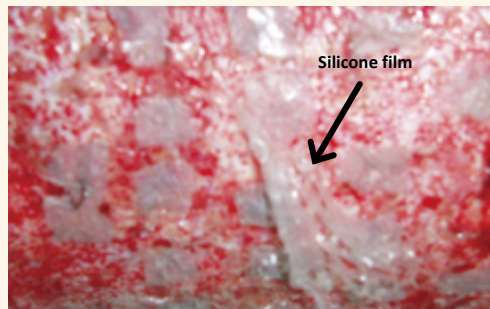
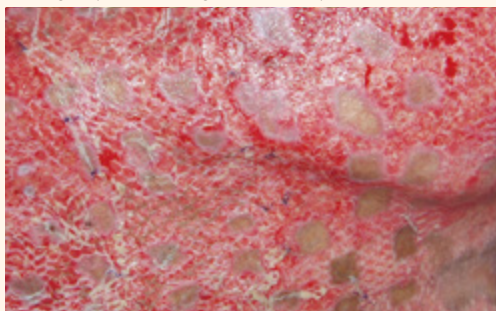


Fig. 5. State of the wound 6 days after surgery. Six days after the surgery, the allogeneic mesh survived (left image). The silicone film of PELNAC had partially peeled off (right image).

Autologous patch and allogeneic 3-fold expanded mesh



Autologous patch and PELNAC 3-fold expanded mesh

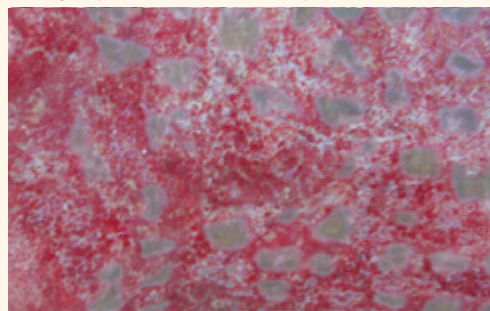
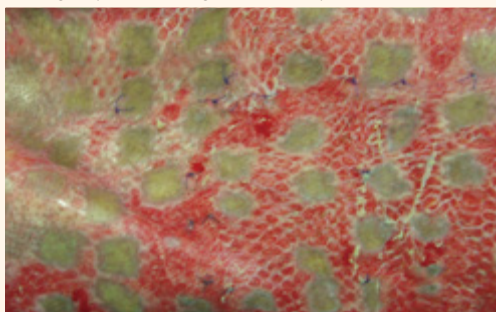


Fig. 6. State of the wound 14 days after surgery. Application of bFGF spray was started 6 days after the surgery. Two weeks after the surgery, the allogeneic epidermis had dropped off and the dermis remained (left image). The site where PELNAC was applied appeared to have started tissue formation (right image).

Autologous patch and allogeneic 3-fold expanded mesh



Autologous patch and PELNAC 3-fold expanded mesh

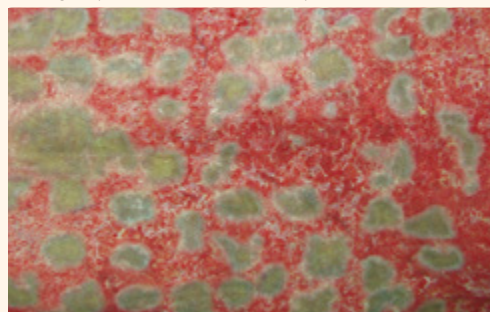
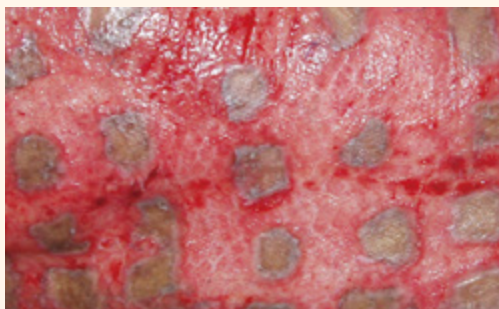


Fig. 7. State of the wound 21 days after surgery. The dermis of the allogeneic skin remained 3 weeks after the surgery (left image). In both images, the autologous patches are seen to be growing and expanding into the surrounding areas. (right image).

Six days after the surgery, the autologous patches and allogeneic skin survived, while the silicone film of PELNAC had partially peeled off (Fig. 5). Thereafter, the wound was irrigated and bFGF spray was applied every other day. Fourteen days after the surgery, the allogeneic skin epidermis started to drop off, while growth of dermis-like tissue seemed to have started in the PELNAC-implanted site (Fig. 6). Twenty-one days after the surgery, the dermis of the allogeneic skin remained, and both images showed the start of growth and expansion of the autologous patches into the surrounding areas (Fig. 7). Thirty-eight days after the surgery, the dermis of the allogeneic skin remained, and the autologous patches have grown and expanded into the surrounding areas in both images. However, the growth appeared to be faster for the PELNAC-grafted site (Fig. 8). Fifty-six days after the surgery, the autologous patches had grown and fused faster at the PELNAC-implanted site than the allogeneic skin site (Fig. 9).

Autologous patch and allogeneic 3-fold expanded mesh



Autologous patch and PELNAC 3-fold expanded mesh

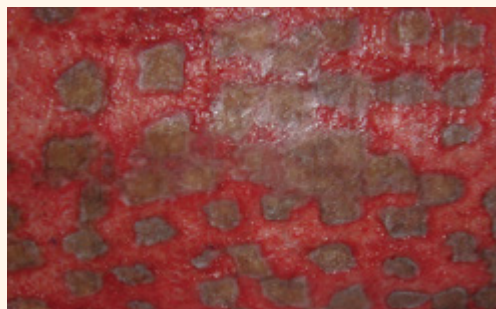


Fig. 8. State of the wound 38 days after surgery. Six weeks after the surgery, the autologous patches have grown and expanded into the surrounding areas in both images, but the growth appeared to be somewhat faster for PELNAC (right image).

Autologous patch and allogeneic 3-fold expanded mesh



Autologous patch and PELNAC 3-fold expanded mesh

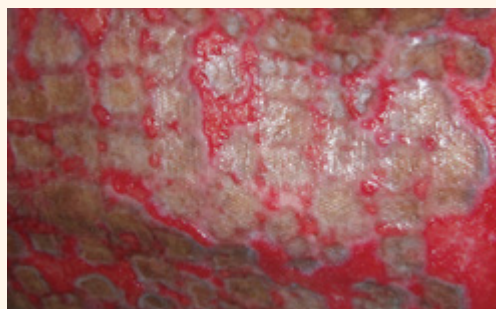


Fig. 9. State of the wound 56 days after surgery. Fifty-six days after the surgery, the fusion of skin grafts seemed to be more common for the PELNAC mesh (right image) than the allogeneic mesh (left image). However, this might have been influenced by the state of skin graft survival or infection, so it is considered necessary to analyze factors such as the distance of growth from the skin grafts.

Discussion

Artificial dermis is used in the skin grafting of extensive burns, but the potential for infection must be taken into consideration. We use PELNAC by passing it through a mesh dermatome to prepare an expanded mesh that facilitates drainage. In addition, it is thought that a more favorable dermis-like tissue will be regenerated when bFGF spray is also used.

Furthermore, the autologous patches were growing faster in the PELNAC-implanted site at 6 to 8 weeks after the surgery compared with the frozen allogeneic skin site, probably due at least in part to the presence of a rejection reaction to the allogeneic skin. In the end, allogeneic skin and PELNAC were considered equivalent in terms of the time needed to complete epithelization and the state of the epithelized skin.

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