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Treatment of severe burn with DermACELL®, an acellular dermal matrix

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Abstract

For treatment of skin burn injuries, there exist several methods of treatment related to tissue regeneration, including the use of autograft skin and cryopreserved skin. However, each method has drawbacks. An alternative method for tissue regeneration is allograft acellular dermal matrix, with potential as a biocompatible scaffold for new tissue growth. One recently produced material of this type is DermACELL®, which was used in this case presentation for treating a scar resulting from second- and third-degree burns in a 33-year-old female patient. The patient presented with significant hypertrophic scarring from the elbow to the hand and with limited wrist and elbow motion. The scarring was removed, and the patient was treated with a 1:3 mesh of DermACELL. The wound was resurfaced with a split thickness skin graft, and postoperative care included application of pressure garment and silicone sheet, as well as range of motion exercise and massage. At 30 days after DermACELL application, the wound appeared well-healed with little scar formation. At 180 days post-application, the wound continued to appear healed well without significant scar formation. Additionally, the wound was supple, and the patient experienced significant improvement in range of motion. In the case presented, DermACELL appears to have been a successful method of treatment for scarring due to severe burns by preventing further scar formation and improving range of motion.

Keywords: Acellular dermal matrix, deep burn treatment, DermACELL®, scar prevention, wound healing, skin, contracture

Introduction

Burn injuries to the skin can be painful, and, if not healed properly, lead to issues such as abnormal scarring, limited range of motion, chronic non-healed wounds, and entry points for infection. In treating burns, while autograft skin is a common grafting material, it may be of limited supply and has associated comorbidities. Also, cryopreserved skin is an acceptable short-term covering for burns, but can need frequent replacement. Ultimately, a new host matrix must still be generated for optimal clinical results. An alternative matrix scaffold for new tissue generation is allograft acellular human

dermal matrix as reviewed by Wainwright and Bury [1]. In theory, decellularization of human dermis serves to remove potentially immunogenic material and cellular remnants. This provides a clean, biocompatible scaffold for host cellular and vascular in-growth and, ultimately, new tissue regeneration. In addition to the treatment of burns, decellularized human skin has been used for a variety of medical procedures; primarily wound healing, soft tissue reconstruction, and sports medicine applications [2-21].

A new decellularized dermal allograft has recently been introduced, trade-named DermACELL®. The patented [22] process used to prepare DermACELL includes the use of anionic detergents and endonuclease, resulting in a material with over 97% nucleic acid removal and acellular histological appearance. It is also terminally sterilized to a Sterility Assurance Level of 10^{-6}. In addition, DermACELL is preserved and stored at room temperature allowing the allograft to be maintained and delivered fully hydrated at ambient temperature to the surgical suite. Rapid in vivo cellular infiltration and vascularization of DermACELL has previously been demonstrated [23]. Both properties are advantageous in the treatment of wounds [24].

The following case presentation involves treating a severe burn scar contracture with this human acellularized dermal matrix, DermACELL®.

Materials and methods

The patient, a 33 year old female, suffered deep second to third degree burn injuries. Initial treatment consisted of antibiotic ointment and wound dressings. This resulted in a less than satisfactory outcome (see Figure 1), with significant scarring and poor range of motion. She presented three years later for additional treatment. Upon examination, as shown in Figure 1, the patient exhibited: hypertrophic scar from upper arm, elbow, whole forearm, wrist to dorsal hand; limitation of elbow and wrist motion; elbow extension lag 45°; wrist extension lag 30°. The patient underwent the following treatments: excision of hypertrophic scar; and release of elbow and wrist contracture. DermACELL (1:3 mesh) was applied and trimmed to fit the wound (see Figure 2). DermACELL (LifeNet Health, Virginia Beach, VA, USA) is an acellular human dermal matrix, prepared using a combination of non-denaturing anionic detergent (N-Lauroyl sarcosinate, NLS), recombinant endonuclease (Benzonase®), and antibiotics (Polymixin B, Vancomycin, and Lincomycin). Following processing, it is terminally sterilized on dry ice using a low dose of gamma irradiation to achieve a sterility assurance level of 10^{-6}. The wound was resurfaced with thin split-thickness skin graft (4/1000 inch) Figure 3. Postoperative application of a pressure garment and silicone sheet was performed to prevent scar formation. Post-operative rehabilitation, including range of motion exercises and massage were executed.

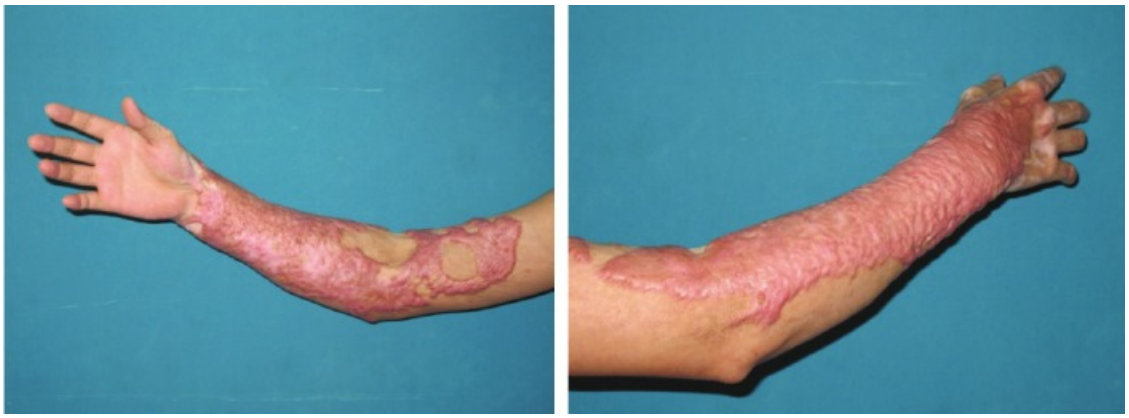

Figure 1

Pre-operative. Note the hypertrophic scarring on upper arm, elbow, forearm, wrist, dorsal hand. Demonstration of elbow and wrist motion limitation with elbow extension lag 45° and wrist extension lag 30°.

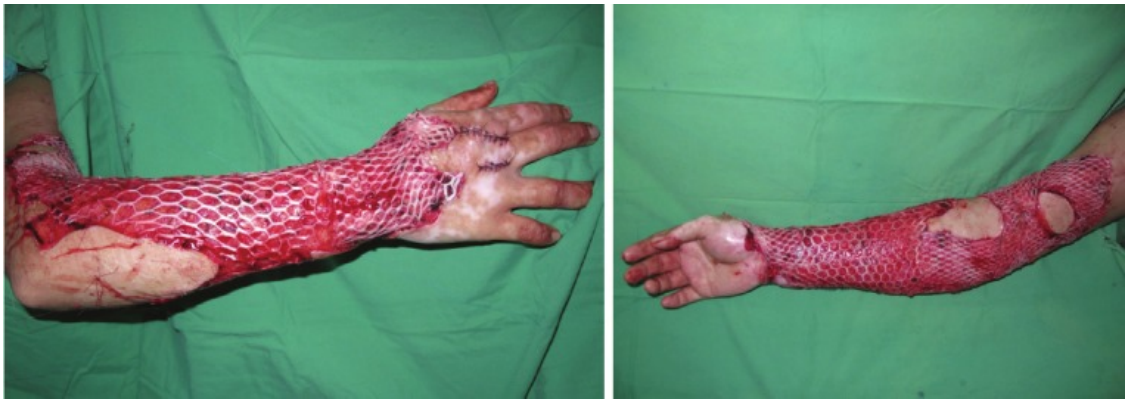

Figure 2

Intra-operative. Application of DermACELL (1:3) mesh and split thickness skin graft.

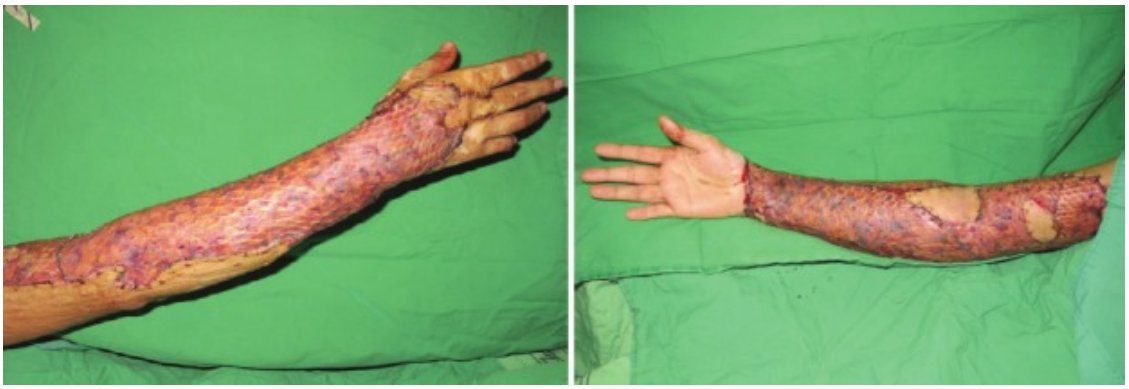

Figure 3

Seven days post-operative. Complete take of DermACELL and autograft skin.

Results

The patient condition at Day 30 is shown in Figure 4. As seen, the wound has healed well without significant scar formation and with good appearance, consistent with rapid cellular infiltration and revascularization as previously demonstrated in vivo with DermACELL [23]. As seen in Figure 5 at 180 days post-DermACELL application, the wound heals well without significant scar formation. The wound is supple, and the patient has experienced dramatically improved range of motion.

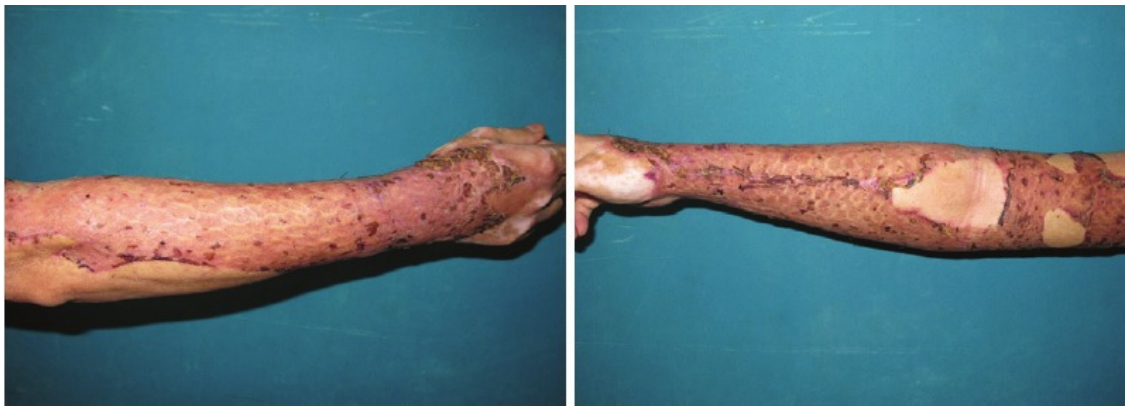

Figure 4

30 days post-operative. Note well-healed wound with little scar formation.

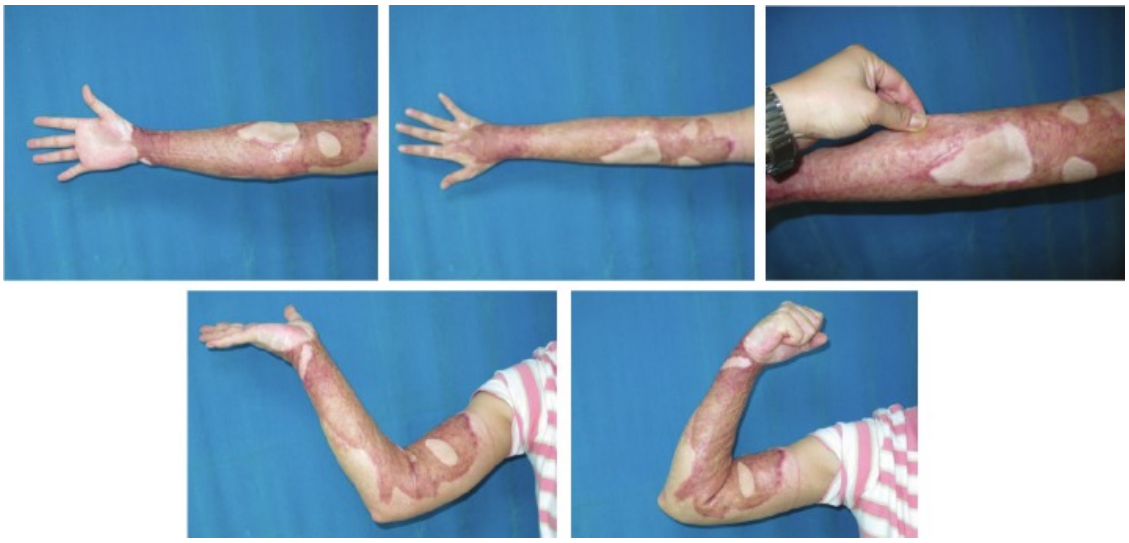

Figure 5

180 days post-operative. Note well-healed, supple wound without significant scar formation as well as markedlyimproved range of motion.

Conclusions

In the case presented, DermACELL, a fully sterile and acellular human dermal matrix, was successfully used in conjunction with a thin split-thickness skin graft. This not only provided wound resurfacing for a scarred burn, but also prevented further scar formation and improved range of motion.

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