Use of Dermacell AWM® and Matrion® to Support Treatment of Charcot Osteoarthropathy and Osteomyelitis: A Limb Salvage Case Report

CASE STUDY

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INTRODUCTION

Diabetes affects approximately 537 million adults worldwide.[1] In severe cases, diabetes can result in limb-threatening clinical conditions such as Charcot osteoarthropathy, commonly known as Charcot foot, and osteomyelitis.[2,3] Patients with diabetes or peripheral vascular insufficiency suffer from these clinical conditions typically in the feet and necrotic bone, identified through nonexistent osteocytes, is common.[2-5] Charcot foot typically involves the degeneration of several joints and bones, leading to bone destruction and deformity.[3] On the other hand, osteomyelitis is an inflammation of specifically the bone caused by an infecting organism that results in bone destruction.[4,5] When these conditions are present concurrently, diagnosis and treatment can be difficult.

One difficulty that surgeons find with these clinical conditions is the resistance to antibiotic treatment. Normal, healthy bone is resistant to infection whereas trauma and the presence of a foreign body decreases this resistance.[4,5] *Staphylococcus aureus* is one frequent pathogen isolated from diabetic foot ulcers (DFUs) that adheres to bone and can survive intracellularly, manifesting the persistence of bone infection, and thus resistance to antibiotics.[4-6] As the infection persists, resulting abscesses can potentially infiltrate the vascular channels leading to impaired blood flow and increased intraosseous pressures.[4-6] To diagnose and treat effectively, the causative agent must be accurately identified.[4,5] Failure to treat the condition with the appropriate antibiotics, or resect the affected bone, allows skin deficits to persist which can potentially result in amputation, and thus increase risk of mortality.[2-6] Therefore, Charcot foot and osteomyelitis are conditions that can cause severe morbidity and mortality, so it is imperative to have efficacious treatments for these pernicious wounds.

One treatment option for chronic wounds is a matrix scaffold for new tissue generation, such as Dermacell AWM. Dermacell AWM is an acellular human dermal matrix (ADM) as reviewed by Moore et al[7] that has been used for a variety of medical procedures, primarily involving wound healing, soft tissue reconstruction, and sports medicine applications.[8-11] These dermal matrices have been demonstrated to support cellular and vascular in-growth in vitro and in vivo.[12,13] Moreover, Dermacell AWM has 97% or greater DNA removed which can reduce the potential for an inflammatory response, and is provided sterile at room temperature, ready to use for its intended application.[14]

In addition to ADMs, over the last two decades, allografts derived from the placental membrane obtained with donor consent have emerged as an important treatment option for chronic wounds.[15,16] The placenta consists of the amnion and chorion, which includes the trophoblast layer. For ease of cleaning and processing, these layers are often separated. They may or may not then be relaminated to produce an allograft that is amnion-only, amnion-chorion or other amnion-chorion combinations, such as amnion-chorion-amnion. This method of processing can adversely impact native growth factors and make the allograft difficult to handle and use due to the thinness of the graft, depending on the placental layers retained.[15-17] To retain growth factors and create a thick, easy-to-handle placental allograft, LifeNet Health® developed Matrion, the first minimally manipulated, fully intact placental membrane to include a decellularized trophoblast layer. Matrion also goes through decellularization with Matracell® technology, resulting in 90% or greater DNA removal and reducing the risk of an inflammatory response.[17,18] Like Dermacell AWM, Matrion is provided sterile at room temperature, with no need to rehydrate, thaw, or otherwise prepare prior to application.[17,18]

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CASE STUDY

The following case study describes the use of Dermacell AWM and Matrion to support treatment of a wound caused by Charcot foot and chronic osteomyelitis, whereby the application of these grafts supported soft tissue regeneration and wound closure. The patient provided consent for inclusion and the use of deidentified images.

CASE PRESENTATION

A 71-year-old female patient with diabetes (BMI = 33.7) presented with Wagner 3 DFU on the dorsal side of her left foot as a result of Charcot foot and chronic osteomyelitis. The wound persisted for over 2 years, causing the patient to be non-ambulatory. The patient was a former tobacco user and had a history of brain tumor. Previous failed treatments for the wound included debridement, pressure dressing, negative pressure wound therapy (NPWT), hardware removal, a course of antibiotics, including beads, intravenous (IV), and oral antibiotics, external fixation placement and removal, and non-weight bearing therapy.

Without evidence of improvement, the patient presented for treatment in July 2022 with a baseline wound measurement (length x width x depth) of 5.0 cm x 3.0 cm x 4.0 cm (Figure 1). The patient's infection was treated through a course of IV antibiotics and NPWT. As a result of chronic osteomyelitis, wound healing had arrested, requiring amputation of the first partial metatarsal and resection of the left medial cuneiform and partial navicular bone at this visit (Figure 1). To prevent amputation and utilize all resources possible for this limb salvage case, the surgeon decided to use both Matrion and Dermacell AWM. Following partial flap closure, Matrion was applied to the exposed remaining navicular and talus bone proximal to the amputation site (Figure 2; July 2022). Next, Dermacell AWM was sutured to the base of the wound and the remaining defect along with a non-adherent oil-emulsion dressing (Figure 2). Following the procedure, and as early as Week 2, there was evidence of wound closure (Figure 3; July 2022; wound measurement not reported). At Week 4, the reported wound measurement was 1.9 cm x 1.9 cm x 0.4 cm (Figure 3; Aug 2022).

Wound closure continued until Week 7 when the wound reopened (measurement of 4.0 cm x 2.0 cm x 1.0 cm; image not taken). The surgeon performed OR debridement to ensure the presence of healthy, viable and bleeding tissue to continue the trajectory of healing for limb salvage. Debridement was followed by an application of Matrion and various dressings. Following this procedure, the wound continued its progression of healing. At Week 12, the wound's measurement was 0.5 cm x 0.3 cm x 0.1 cm, and the patient was advised to begin to walk lightly and apply daily bandages (October 2022; image not taken). By Week 19, the wound was fully healed (Figure 4; December 2022; 100% granulation and reepithelization) and there were no reported complications. The patient was able to fully ambulate after 2 years of being non-ambulatory.

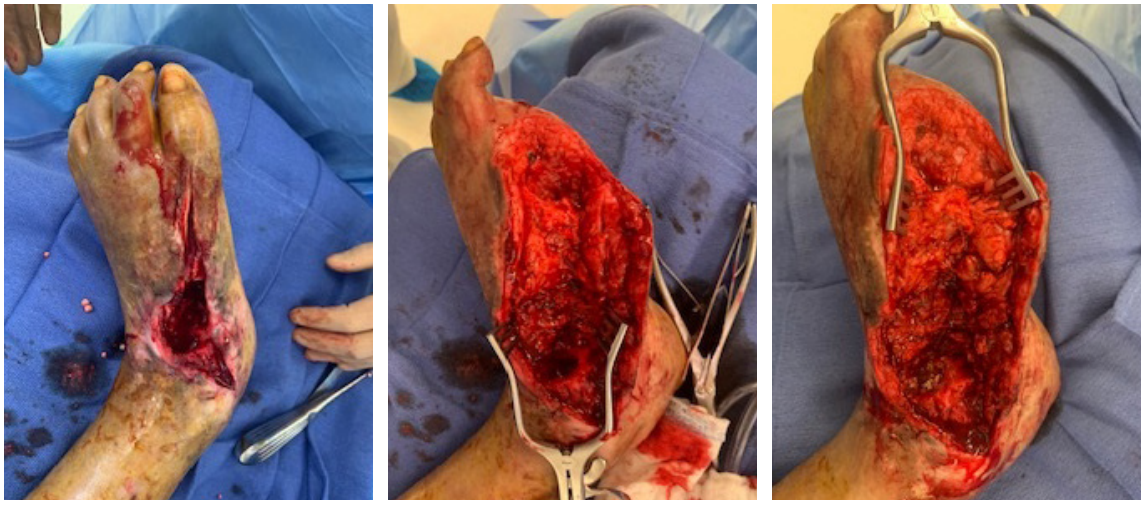

Figure 1. Baseline intraoperative view showing removal of the remaining hardware, debridement of the infected bone, and debridement of the necrotic tissue on the dorsum. The wound's baseline measurement was 5.0 cm x 3.0 cm x 4.0 cm. The first partial metatarsal was amputated at this visit as a result of chronic osteomyelitis. An external fixator was placed with negative pressure wound therapy (NPWT) in the soft tissue defect and made non weight bearing (July 2022).

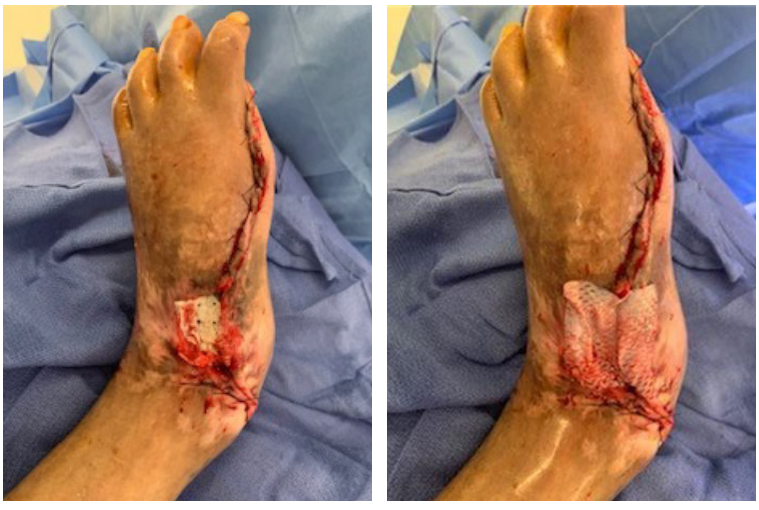

Figure 2. Baseline intraoperative view showing the 3×4 cm Matrion application (left) and a 4x4cm Dermacell AWM application (right; July 2022) following partial flap closure.

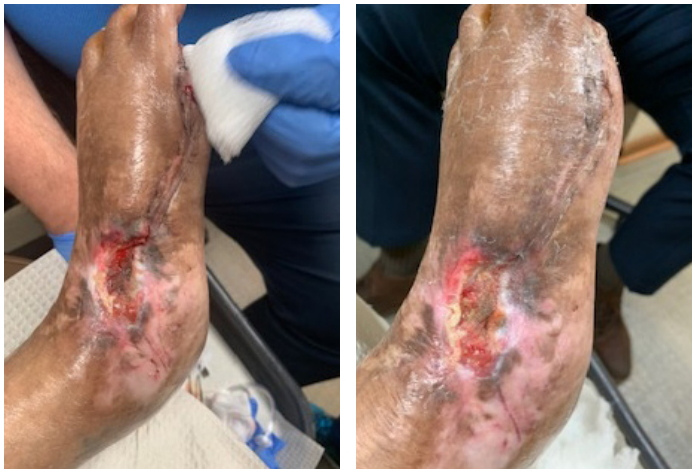

Figure 3. Patient presentation at Week 2 (left; July 2022; wound measurement not reported) and Week 4 (right; August 2022; wound measurement: 1.9 cm x 1.9 cm x 0.4 cm), showing evidence of postoperative wound healing and wound closure.

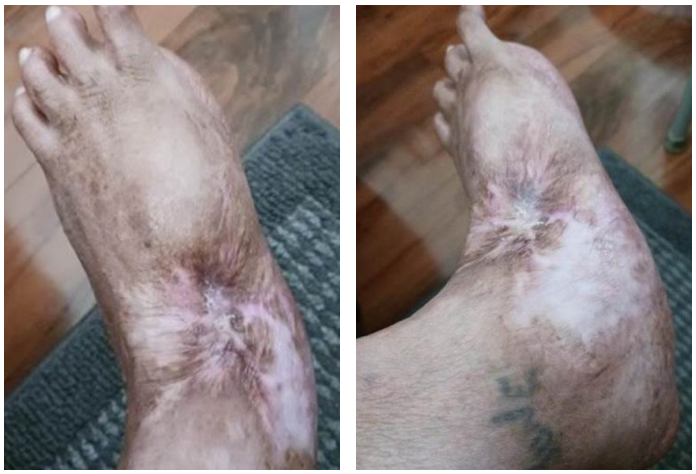

Figure 4. Representative images showing the final presentation at Week 19 (December 2022) showing evidence of full wound closure (100% granulation and reepithelization). The patient was able to ambulate after 2 years of being non-ambulatory.

SUMMARY

This case presentation demonstrates a novel and successful use of Dermacell AWM and Matrion to support full wound closure for this patient when other treatments had failed. Therefore, these results support the clinical advantages of Dermacell AWM and Matrion, both processed to minimize the risk of inflammatory reactions in patients. Although a case study cannot be used to predict how Dermacell AWM and Matrion will behave in other patients, the results demonstrate a versatile and successful use of these grafts to support wound closure.

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Please refer to the instructions for use for a complete list of indications, contraindications, warnings, and precautions.

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