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Case Report

CASE REPORT

What to put on (and what to take off) a wound: treating a chronic neuropathic ulcer with an autologous homologous skin construct, offloading and common sense

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Abstract

Closure of chronic lower extremity wounds is important for minimizing the risk of infection and amputation in a very high-risk population. Developments in tissue cultures and matrix therapies have shown promise in enhancing healing. The use of autologous homologous skin constructs in wound treatment may enable the regeneration of functional dermal structures. We present the case of a chronic medial heel ulcer that dehisced following intraoperative debridement, which was subsequently treated using a combination of an autologous homologous skin construct and total contact casting. This case emphasizes the importance of proper offloading for healing and preventing recurrence of lower extremity wounds.

INTRODUCTION

New methods in treating wounds with autologous stem cells may enhance healing by secondary intention and facilitate the regrowth of functional dermal structures [1, 2]. We present the case of a patient with a chronic medial heel wound who underwent unsuccessful initial debridement and closure. The patient was treated with an autologous homologous skin construct (AHSC) and different offloading methods of varying effectiveness. This AHSC is made from an autologous skin graft, which is modified by increasing the surface area to volume ratio and activating regenerative dermal stem cells [2].

CASE REPORT

An 81-year-old male (non-smoker, non-diabetes patient) with spinal stenosis-related peripheral neuropathy underwent surgical debridement for a non-healing left medial calcaneal ulcer with underlying fat exposure (Figs 1 and 2). Patient comorbidities included coronary artery disease, atrial fibrillation, lower extremity venous thrombosis, and obesity.

On Postoperative Day 12, sutures were removed due to dehiscence and maceration. The wound measured $3.0 \times 2.0 \times 0.2$ cm, without exposed tendon, bone, or signs of infection. Lower extremity examination revealed palpable pulses and brisk

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Figure 1: Preoperative ulcer.

Figure 2: Primary wound closure.

capillary refill. The wound was dressed with advanced dressings and multilayer compression. He received dressing changes from home health care between appointments.

Twenty-six days postoperatively, the wound remained uninfected. An ACell® wound matrix (ACell, Columbia, MD) was applied and he agreed to undergo a full-thickness skin graft harvest for SkinTE™ (PolarityTE, Salt Lake City, UT) AHSC. On

Figure 3: AHSC product application.

Postoperative Day 40, the graft was harvested from his left thigh and shipped for processing.

Three days later, the ulcer ($3.0 \times 2.0 \times 0.2$ cm) was debrided and lavaged prior to AHSC application, which was covered with non-adherent silicone (Fig. 3), secured using adhesive acrylate skin closures and reinforced with foam and compression wraps—following the PolarityTE dressing protocol [3]. Complete offloading is indicated for plantar foot wounds—however, fall risk, wound location and the need for additional home care precluded total contact casting (TCC) at this time. Instead, felt pads were used to provide circumferential offloading around the dressing.

Five days post-AHSC application, he was tolerating the graft well and demonstrated full-thickness skin islands throughout a sea of granulation tissue with peripheral maceration (Fig. 4). Twelve days post-application, the wound measured $3.0 \times 2.0 \times 0.2$ cm, with skin islands on the wound bed and continued peripheral maceration (Fig. 5). The wound base was approximately 90% skin graft with 10% granulation tissue. On Day 17, the wound was $2.8 \times 2.2 \times 0.1$ cm (Fig. 6), with reduction of edge maceration. At Day 24, the wound was $2.5 \times 2.2 \times 0.1$ cm with growing skin islands and moderate maceration; the wound was offloaded with additional felt pads. At 31 days, the wound was $2.2 \times 2.2 \times 0.1$ cm with epithelialized edges and skin islands on a moist fibrogranular wound base (Fig. 7); the donor site had completely healed.

Despite continued use of advanced dressings, the patient's wound remained open. Venous duplex studies showed no significant findings. A local pseudomonas infection was identified and successfully treated with topical cadexomer iodine.

Functional deficits became apparent and the patient was evaluated by physical therapy due to two falls over the previous 6 months. Functional testing demonstrated a self-selected walking speed of 0.37 m/s and a 30-second chair stand test of four repetitions—both well below age and gender norms, placing him at risk for continued falls [4, 5]. Balance and strengthening interventions were initiated temporarily until he began having difficulty swallowing and eating; the patient successfully underwent an esophagogastroduodenoscopy with balloon dilation.

Figure 4: 5 days post-application.

Figure 5: 12 days post-application.

Following this, he returned to outpatient physical therapy and was placed in a TCC EZ® (Integra, Princeton, NJ) on Post-application Day 151; the wound measured 1.5 × 1.5 cm (Fig. 8). He was provided an 'even-up' shoe balancer to minimize leg length discrepancy and balance disruption. He was also provided with physical therapy gait training following initial casting. The TCC was changed 3 days later to accommodate reduction in limb volume and further assessment of his tolerance given the fall risk and history of low back pain; the wound had decreased in size to 1.2 × 1.1 cm (Fig. 9). He was seen 1 week later for a cast change and the wound had decreased to 0.5 × 0.8 cm (Fig. 10).

He continued with weekly TCC changes for 17 more days, with full wound closure achieved 27 days after initial casting. He was referred for custom footwear and began monthly follow-up visits, continuing to report occasional pain at the site of the former wound when pressure is applied.

DISCUSSION

Finding the right blend of wound treatment modalities is dependent on both the patient and wound etiology, sometimes requiring trial-and-error to determine optimal treatment combination. Proper offloading in lower extremity wound healing is particularly important for neuropathic ulcers, as autologous stem cells and matrixes are unable to overcome tissue damage caused by high pressure secondary to impaired sensory feedback.

Figure 6: 17 days post-application.

Figure 7: 31 days post-application.

Our center uses TCCs as a primary means of offloading [6–8], though we found ourselves focusing on caring for the whole patient rather than just the 'hole' in the patient. Our decision to not initially use a TCC was based on multiple factors. The first was the patient's balance, with concern that a TCC would increase fall risk. The second was pragmatic, as showering with a TCC requires assistance. The third was wound location, as non-plantar ulcers are not traditionally treated with offloading. Unfortunately, our patient's gait abnormalities may have led to increased pressure on the medial calcaneus, as neuropathic ulcers generally occur on high-pressure (i.e. plantar) surfaces [9]. In retrospect, immediately placing this patient in a TCC may have promoted faster wound closure [10].

Figure 8: TCC Day 0.

Figure 9: TCC Day 3.

In conclusion, we present the treatment of a chronic neuropathic ulcer with a novel AHSC and traditional offloading. Going forward, the efficacy of AHSC on lower extremity wounds should be further investigated and compared to offloading-only controls. The consideration of comorbidities and treatment risks are important parts of wound care and necessary for keeping patients safe.

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CONFLICT OF INTEREST STATEMENT

Dr Armstrong receives research support from PolarityTE.

Figure 10: TCC Day 10.

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CONSENT

Written documentation of consent provided by the patient.

GUARANTOR

Dr Armstrong is the guarantor.

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