

Use of External Ring Fixation in a Full-Thickness Achilles Wound: A Case Report

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An 84 year-old male with a full-thickness Achilles ulcer for 4 months was successfully healed with split-thickness skin grafting after application of an external ring fixator as an offloading and immobilizing tool. This method allowed for weight-bearing during treatment. The use of external fixation devices for soft tissue reconstruction of the lower extremity can be a useful adjunct.

Key words: External ring fixator, Achilles ulcer, skin graft

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Management of posterior ankle wounds involving the Achilles tendon pose a reconstructive challenge due to of the paucity of soft tissue surrounding the ankle.^{1,2} It is often anecdotally thought that the perfusion in the region overlying the Achilles tendon is poor, resulting in healing delays. However, the source of blood supply to the skin has been well delineated by Ian Taylor, a plastic surgeon in Michigan, who has published much work on angiosomes and musculocutaneous/fasciocutaneous perforators, which supply the subdermal plexus and capillary network.

Perhaps, it might be said that the cushion effect of the subcutaneous tissue being absent overlying the Achilles renders the perforators more susceptible to injury. This results in relatively poor regenerative capacity when injured. To avert these challenges, wounds with exposed Achilles tendon have been treated with autologous keratinocytes,³ frozen epidermal allograft,⁴ and free flaps.⁵ Traditionally, there has been reluctance in using split-thickness skin grafts (STSG) on the Achilles tendon and past treatment involved the use local, pedicle, or free flaps. Recently, Attinger et al, demonstrated that with a properly prepared wound bed, skin grafting is as effective as local or free flaps in healing Achilles tendon wounds.⁶ The requirement for offloading and immobilization is paramount in these wounds with exposed Achilles tendon and is achieved with casting or windowed total contact casting.⁷ We present a method to achieve these goals utilizing external ring fixation allowing weight-bearing during treatment.

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Figure 1 Full-thickness necrotic ulcer with exposed Achilles tendon.

Case Report

An 84 year-old white male presented with a full-thickness Achilles tendon ulcer. The injury resulted from shearing trauma against a bed rail while at home. The patient's past medical history was significant only for hypertension. The ulcer had been present for 4 months and treated with variety of topical antimicrobials and regular clinic debridement. The wound failed to progress in a timely manner and eventually cellulitis developed. The patient was referred to the emergency department at our facility. The Achilles tendon was visible and desiccated at the base of the wound. (Fig. 1)

With ankle motion, the tendon could be seen sliding in and out of the intact paratenon. The periwound area was fibrotic with patches of necrotic tissue. Erythema extended for 2 cm around the wound but no purulence was present. Noninvasive vascular studies revealed an ABI of 0.94 on the ulcerated extremity. After a 5 day hospital admission for treatment of cellulitis with parenteral antibiotics, the patient underwent surgical debridement of the tendon and application of an external fixator.



Figure 2 External ring fixator in place with a post-operative shoe drill-mounted into the tibial ring for ambulation.

A Wound V.A.C.® (Kinetic Concepts, Inc. or KCI, San Antonio, TX) was utilized over the exposed tendon. Pin care consisted of application of povidine-iodine solution soaked gauze around the pin sites. A standard post-operative shoe was drilled and mounted to an Ilizarov ring and connected plantar to the foot plate. (Fig. 2) This allowed the patient to ambulate in a method similar to that described by Roukis and Zgonis.⁸

The patient was admitted to a short-term rehabilitation center. After 15 days, the patient was brought back to the operating room for a repeat debridement and Apligraf placement under the Wound V.A.C. ® Twenty days passed until the granulation tissue thoroughly formed over the tendon.

At this time, the patient returned to the OR for application of a STSG donated from his ipsilateral thigh. The STSG was secured with staples and the Wound V.A.C. ® was replaced for 4 days. After 28 days approximately 50% of the graft had incorporated. (Fig 3) The decision was made to harvest a second STSG and apply it to the remaining wound. Within the next 4 weeks the wound had completely epithelialized.



Figure 3 Twenty-eight days after application of a split-thickness skin graft showing 50 percent graft incorporation.

The patient remained active and was allowed to bear weight and ambulate throughout treatment. The external fixator was removed after 90 days of use. The patient remained in the rehabilitation center for 2 weeks after removal of the fixator, then discharged home.

At 10 months the patient remained fully healed and an active ambulatory community. (Fig 4) Eleven months after the post external fixation was removed, the patient developed a superficial blister to the posterior ankle. The area was examined closely and appeared to be free of infection. He was sent home with topical becaplermin gel and a walking Multipodos®. The wound healed uneventfully after 3 weeks and the patient successfully returned to his previous lifestyle.

Discussion

External ring fixation has been described primarily for osseous fixation, but there are reports in the literature for soft tissue conditions.⁹ There are descriptions of its use to gradually reduce soft tissue contractures such as ankle equinus deformity¹⁰ and flexion contractures of the knee.¹¹



Figure 4 The ulcer over the Achilles tendon is completely healed. The graft site is shown here at 10 months after removal of external fixator.

Noack, et al, described the use of external fixation after a reverse flow sural artery flap to provide strict immobilization of the affected leg.¹² Roukis, et al, has used it for pressure relief after soft tissue reconstruction of heel defects.¹³ Specifically in the Achilles tendon, external fixation has been used to offload the tendon repair and may lead to a lower re-rupture rate.^{14,15,16} The external fixator in our case served several purposes: It elevated and offloaded the posterior ankle, allowed for daily inspection of the wound, immobilized the ankle and Achilles tendon, and more importantly, it allowed the patient to ambulate during treatment. In this example, negative pressure wound therapy (NPWT) was initiated to enhance granulation tissue and ease the transition to wound closure. The Wound V.A.C.® device was also used as a bolster dressing after applying the bilayer skin replacement and meshed STSG. Although difficult, the external fixation device allowed us to combine NPWT with our immobilization, which could not be accomplished in a cast. External ring fixation may prove a useful tool in difficult to heal wounds involving the Achilles region.

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