Achilles Tendon Repair with Acellular Tissue Graft Augmentation in Neglected Ruptures

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Neglected Achilles tendon rupture injuries present surgical challenges because of the quality and quantity of tendon tissue during repair combined with the magnitude of mechanical forces placed on this tendon. The purpose of this study was to evaluate the effects of an acellular human dermal tissue matrix, GRAFTJACKET, as an augmentation material in neglected Achilles tendon repair. Nine patients with neglected Achilles tendon ruptures were evaluated and followed up for a minimum of 20 months. Primary repair was followed by augmentation with the graft and suturing circumferentially around the tendon. Patients were placed in an early, functional rehabilitation program with postoperative evaluation at 3, 6, and 12 months. Outcome scores were calculated based on the American Orthopaedic Foot and Ankle Society ankle-hindfoot scoring system. At 20 to 30 months postoperative follow-up range, there has been no incidence of re-rupture or recurrent pain. The average return-to-activity time was 15.2 ± 1.7 weeks. The results from this retrospective clinical series suggest that using an acellular human dermal tissue matrix to augment neglected Achilles tendon rupture primary repair offers desirable return-to-activity time points and viable surgical alternative over previously reported surgical options. (The Journal of Foot & Ankle Surgery 46(6):451–455, 2007)

Key words: acellular human dermal matrix, GRAFTJACKET, Achilles' tendon, chronic, neglected, augmentation, return to activity

The Achilles tendon is one of the most frequently ruptured tendons despite its inherent strength. Although this tendon makes up approximately 40% of all operated tendon repairs (1), the mechanical forces placed on this complex after repair and the quality of tendon tissue after a rupture make this procedure a surgical challenge and a topic of much debate. Unfortunately, approximately 20% of all Achilles tendon ruptures are misdiagnosed initially (2, 3). Neglected Achilles tendons may manifest because of the patient's delay in seeking medical attention, misdiagnosis, or conservative treatment failure (4). Beyond the immediate time of Achilles tendon rupture, it is not uncommon to find fibrous tissue ingrowth into the tendon rupture space. This fibrous ingrowth can hinder accurate diagnosis of Achilles tendon rupture because palpable tendon deficiencies are harder to detect manually (4). Neglected or chronic Achilles tendon ruptures can be defined as surgically treated ruptures with a time period greater than 6 weeks between injury and surgical management (5). In some cases, the onset of surgery may be as long as 9 months to a few years after injury. During this period of neglect, the tendon tissue will typically retract and atrophy to create a gap that will fill with fibrous tissue (6). Although the tendon may appear to have healed, the inability of the complex to produce tension in the overlengthened musculotendinous unit may impair the functional ability of this construct (7). In general, ruptured Achilles tendons have been shown to present degenerative histological changes including alterations in fiber structure, fiber arrangement, vascularity, cellular morphology, and cellular proliferation (8). When extensive debridement is merited as with many neglected Achilles ruptures, the tendon tissue may require, among many techniques, lengthening flaps, V-Y plasty, and augmentation with a tendon transfer or graft application to facilitate end-to-end anastomosis. Historically, augmentation and reconstructive procedures have used tendon transfers, flaps, or advancements such as the flexor hallucis longus, plantaris (9, 10), gracilis (11), peroneus brevis (12), triceps surae muscle tendon (13), fasciocutaneous free flaps from remote areas such as the lateral arm (14, 15), harvested fascia lata (15), Achilles tendon allograft (16), or synthetic materials (17). The problems associated with harvesting autologous tissue such as other tendons, fascia lata, or free flaps have included increased surgical time, increased surgical difficulty, de-

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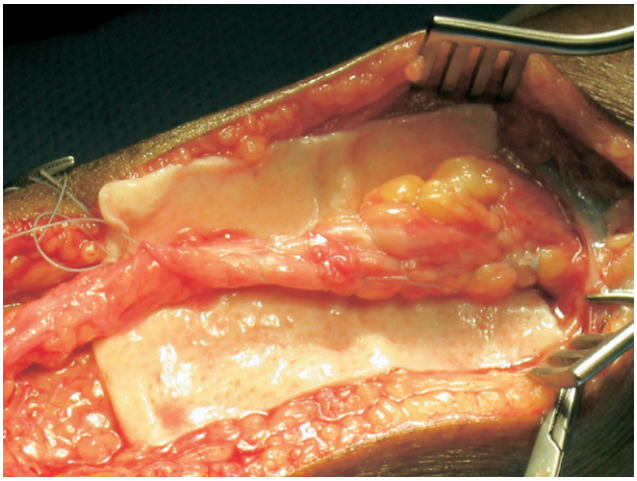

FIGURE 1 Achilles' tendon repair with acellular human dermal matrix positioned with the reticular side toward the tendon.

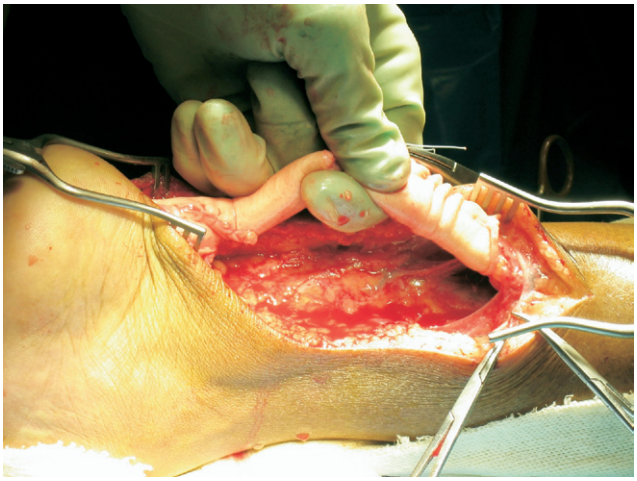

FIGURE 2 Achilles' tendon repair augmented with the acellular human dermal matrix.

creased function, decreased strength, significant donor site morbidity, sural nerve damage, and decreased cosmesis (4, 6, 9, 10, 12, 14, 15, 18–20). In light of these complications, the ideal augmentation material for an Achilles tendon rupture would omit the need for additional surgical sites and harvesting morbidity while offering a simple surgical technique, functional success, histologically quiet incorporation, a reduction in pain, and a short return-to-activity (RTA) time.

The regenerative nature of a uniquely processed acellular human dermal matrix combined with the suture retention strength properties it exhibits have made this material an attractive prospective product for tendon augmentation (21–24). This type of augmentation has been performed clinically in neglected Achilles tendon applications because chronic Achilles tendon ruptures present surgical challenges because of the high mechanical forces placed on the tendon and the poor quality and quantity of tendon tissue typically present (23). Although there has been a report of success using this material as an augment to a gastrocnemius turndown flap in a chronic Achilles tendon rupture (23), to date, there are no reports on the effectiveness and clinical outcomes of a series of augmentations to neglected Achilles tendon ruptures with this acellular human dermal matrix. The purpose of this study was to retrospectively evaluate the clinical use of an acellular human dermal tissue matrix, GRAFTJACKET Regenerative Tissue Matrix (Wright Medical Technology, Inc., Arlington, TN) as an augmentation material in a series of neglected Achilles tendon repairs followed up a minimum of 20 months postoperatively.

Methods

Patients were included in this retrospective study if they had had been surgically treated for neglected Achilles tendon rupture with an augmentation procedure using an acellular human dermal matrix (GRAFTJACKET Matrix) and had been followed up for a minimum of 20 months. This study was approved by our institution's institutional review board, and all patients gave their written, informed consent.

Once the patient was preoperatively cleared for surgery, the patient was prepped and draped in the usual sterile fashion after anesthesia was administered, and then placed in prone position on the operating table. Once hemostasis was achieved with a tourniquet, a curvilinear incision was made from medial to lateral over the Achilles tendon deficit or gap confirmed by the magnetic resonance image finding. As the incision was deepened through the subcutaneous tissues, careful attention was taken to preserve and atraumatically isolate the sural nerve and the paratenon layer. Dissection was then performed to release the tendon from any fibrosis and adhesions. Once the tendon was identified, any devitalized or fibrous tissue was carefully resected. If the gap between the proximal and distal tendon segments was too large for end-to-end anastomosis, a Z-plasty was performed to achieve necessary length and physiologic tension. The segments were reapproximated with the Krackow suture technique with nonabsorbable sutures. Careful attention was taken to maintain the same physiological tension as compared with the contralateral uninjured side. The acellular human dermal matrix was wrapped around the primary repair site, with the reticular surface toward the tendon, and a locking suture technique was used to appose the augmentation material to itself (Figure 1). The graft matrix sheath was then rotated around the tendon so that the graft seam was along the anterior aspect of the tendon to prevent friction along the posterior aspect of the ankle and leg. Once a graft matrix sheath had been formed and rotated around the primary tendon repair site, the ends were secured proximally and distally to the tendon. If multiple matrices were