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Distal Biceps Repair With Acellular Dermal Graft Augmentation

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Ruptures of the distal bicep brachii tendon are typically treated surgically as a result of modern surgical fixation techniques, low complication rates, and in an attempt to avoid loss of flexion and supination strength. Most of the ruptures may be fixed primarily. On occasion, the tendon may be thinned, or may not have the elasticity to allow direct repair to the radial tuberosity. We describe a technique using acellular dermal allograft to augment distal biceps ruptures in such cases.

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Introduction

Rupture of the distal bicep brachii tendon has received significant surgical attention recently because of modern fixation techniques and low complication rates.[1-6] The fixation strength with various implants has improved progressively since the development of cortical button fixation. A recent meta-analysis suggested cortical button fixation to be the safest fixation technique.[6]

Despite increased biomechanical improvement of surgical fixation, the complication rate of distal biceps surgery is higher than previously reported.[6,7] This complication rate further increases as the time from injury to surgery increases.[8] Delayed presentation beyond 2 weeks, especially when the bicipital aponeurosis is ruptured, may even require augmentation with a graft.

In the acute setting (less than 4 weeks after injury), when the tendon is retracted but has reasonable quality, it can be successfully repaired to the tuberosity under tension or at high flexion angles.[3] However, we have encountered cases with significant tendon thinning, loss of elasticity, and atrophy. In these cases when the ruptured tendon has attritional changes or volumetric loss, we believe the tendon should be augmented to avoid a rerupture.

Biomechanical studies have shown that cortical button fixation into a tunnel with an interference screw is the biomechanically strongest repair technique,[2,9] which allows for much more aggressive rehabilitation. The disadvantage of this technique is that all the stress is placed at the tendon-bone tunnel interface. This would not be a concern if the line of pull of the tendon was only in line with the tunnel. However, with forearm rotation, the biceps tendon insertion into the tunnel increases from 0° in full supination to over 90° in full pronation. This causes edge loading of the tendon, at the bone-tendon interface, which we believe may make it more susceptible to elongation without rupture or re-tearing. The addition of a biologic tissue between the tendon-bone tunnel interface increases the stiffness (or resistance to elongation) of the repair and acts as a buffer reducing edge-loading which also may cause repair site elongation.

Acellular dermal matrix (ADM) is a dermal allograft composed of mostly type I collagen and is processed to remove donor cells while preserving the extracellular matrix. There are several commercially available ADMs with different methods of processing and sterilization, as well as handling characteristics.[10,11] In vivo studies have demonstrated that removing the cellular components allows infiltration of native cellular agents such as fibroblasts, vascular tissue, tenocytes, while causing minimal host inflammatory reaction.[11-13]

We describe a technique of augmenting the primary repair of attritional distal biceps tears with an acellular dermal graft prior to insertion into the bone tunnel to reduce the repair site

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interface, normalize the tendon stiffness, and reduce the risk of tendon elongation.

Surgical Technique

A 3-cm incision is placed distal to the antecubital crease. Blunt dissection is carried down entering the anterior compartment of the brachium. Hematoma and/or seroma, if present, are evacuated. The lateral antebrachial cutaneous nerve is protected as it courses laterally with the cephalic vein (Fig. 1). Surgical gauze may be placed under the retractors to limit compression on the cutaneous nerves to reduce the risk of paresthesia. The distal biceps tendon is identified and brought out of the incision (Fig. 1). If the lacertus fibrosis is not torn, it is surgically released to allow better mobilization of the tendon. An ArthroFlex (LifeNet Health, Virginia Beach, VA) acellular dermal graft is cut into a trapezoidal shape measuring 20 × 16 × 20 mm (Fig. 2). The graft is then wrapped around the distal tendon, with the narrow (16 mm) portion placed on the distal end, and the wider base (20 mm) on the proximal end. The graft is then secured to the tendon using a #0 FiberWire (Arthrex, Naples, FL). The needle is passed through the graft, through native tendon, and then through the other end of the graft (Fig. 3). The #0 FiberWire is sutured down the tendon by making approximately 6 or 7 "graft-tendon-graft" passes (Fig. 4). This secures the graft to the tendon and prevents it from pistoning around the tendon. Once secured, a Suture Tape (Arthrex, Naples, FL) is used to place Krakow sutures through the graft and tendon, incorporating the graft into the repair (Fig. 5). A self-locking suture loop technique (Fiberloop, Arthrex, Naples, FL) can also be used. The diameter of the graft augmented tendon is measured (Fig. 6). It is the authors' experience with over 60 cases that the overall tendon and graft diameter is 7-8 mm.

Figure 2 Acellular dermal matrix (ADM) or dermal allograft is cut in a trapezoidal shape with the shorter end to be used on the thinner distal end of the biceps. (Color version of figure is available online.)

The radial tuberosity is identified. The stump of the biceps tendon is often present and can be used to identify the proper landmark of the tuberosity. A single Hohman retractor is placed on the ulnar side of the tuberosity, and an Army-Navy

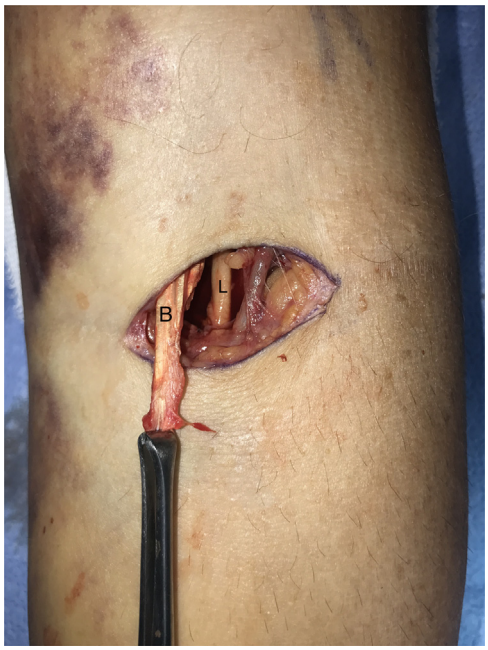

Figure 1 An attritional biceps tendon (B) is brought out of the anterior incision. The lateral antebrachial cutaneous nerve (L) should be identified and protected. (Color version of figure is available online.)

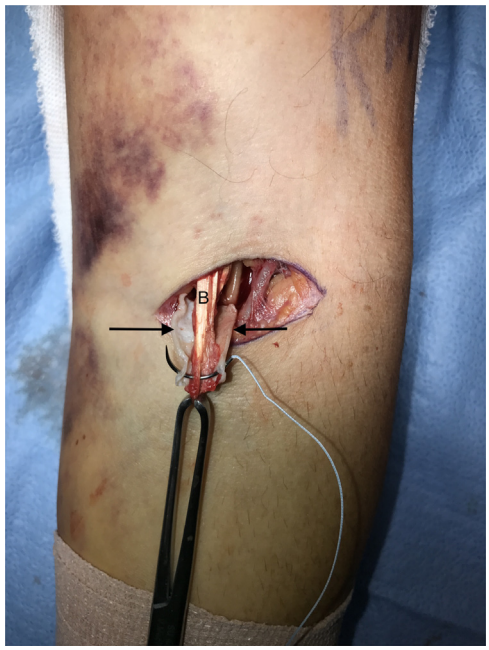

Figure 3 The ADM (black arrows) is placed around the biceps tendon (B) and secured distally with a #0 FiberWire (Arthrex, Naples, FL). (Color version of figure is available online.)