

Mini-Open Distal Biceps Tendon Repair Using All-Suture Anchors



Austin G. Cross, B.S., Toufic R. Jildeh, M.D., Eric W. Guo, B.S., Luke T. Hessburg, B.S., and Kelechi R. Okoroa, M.D.

Abstract: Distal biceps tendon ruptures are uncommon injuries that can cause impairment in range of motion and function. While distal bicep tendon repair to the radial tuberosity has been demonstrated to restore function and strength, there is a lack of consensus on the optimal technique. The purpose of this Technical Note and video is to provide our preferred method of repair using an open, onlay-tissue fixation with all-suture anchors (FiberTak; Arthrex) and anatomic positioning of the biceps tendon on the radial tuberosity.

Ruptures of the distal biceps tendon are a relatively rare condition occurring largely in middle-aged men in their fourth and fifth decade of life as the result of the elbow being forcefully extended during eccentric bicep contraction.¹⁻⁵ Nonoperative management is an option for patients with sedentary lifestyles or severe morbidities⁶; however, these patients must be counseled on the associated decrease in flexion and supination strength and restrictions in activities of daily living.^{6,7}

Several surgical options have been developed for distal bicep repair. Surgeons must be mindful of the risks and benefits of single- versus double-incision exposures and anatomic- versus nonanatomic repairs.⁸⁻¹¹ The more common fixation techniques for distal bicep repairs include suspensory cortical button, bone tunnels, suture anchors, and intraosseous screw fixation, which have all proven to be effective options.^{3,8,12}

Despite the many techniques for distal biceps ruptures, there is no consensus on the ideal operative

technique. Most techniques currently used do not recreate the more posterior attachment of the distal biceps to the radial tuberosity. This nonanatomic position can lead to a loss of supination postoperatively. The purpose of this Technical Note and video is to provide our preferred method of repair with a single-incision anatomic repair using onlay fixation with all-suture anchors (FiberTak; Arthrex, Naples, FL). This technique offers several advantages over other methods. The anatomic repair placing the tendon more ulnar and posteriorly on the tuberosity has been shown to restore optimal supination cam effect on the radial protuberance and provides superior fixation strength with load to failure similar to the native tendon.¹¹ All-suture anchors have been shown to have similar clinical outcomes as other fixation options such as screws or buttons.^{2,13} In addition, all-suture anchors have been shown to have a decreased complication rate, likely due to unicortical drilling and decreased hardware prominence.¹⁴ Finally, the current method uses suture anchors that are preloaded with sutures attached to 4 needles, allowing for quicker and more efficient surgery (Table 1).

Surgical Technique

Preoperative Evaluation

Initial diagnosis of distal biceps rupture is provided by history and physician and further substantiated by advanced imaging. Findings of the physical examination will show a loss of flexion and supination strength, with a loss of the distal contour of the biceps tendon in the antecubital fossa, with proximal retraction. A hook-test, first described by O'Driscoll et al.,¹⁵ may be employed,

From the Department of Orthopaedic Surgery, Henry Ford Hospital, Detroit, Michigan, U.S.A.

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Address correspondence to Kelechi R. Okoroa, M.D., Department of Orthopaedic Surgery, Henry Ford Health System, 2799 W. Grand Blvd, Detroit, MI 48202. E-mail: krokoroha@gmail.com

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Table 1. Pearls and Pitfalls of Distal Bicep Repair

Pearls	Pitfalls
"L"-shaped incision allows for complete visualization and decreased traction-related injury to neurovascular structures	Aggressive traction can lead to injury to the LABCN
Positioning the tendon more posteriorly on the radial tuberosity allows for optimal biomechanical function	Suture anchor protuberance (traditional anchors)
Anchors preloaded with needles make suture passage easy and decrease surgical time	

LABCN, lateral antebrachial cutaneous nerve.

where an examiner is unable to hook their finger around the intact tendon when the patients' shoulder is elevated, elbow is flexed, and forearm is supinated. In a discussion of treatment options with patients, both surgical and nonsurgical modalities must be reviewed. The risks of surgery must be discussed with the patient, which include bleeding, infection, blood clot, stiffness, nerve injury, heterotopic ossification, re-tear or failure, paresthesia, need for additional surgery, nerve palsy, and any other risks related to surgery or anesthesia.

Patient Setup

The patient is laid supine on the standard operative table. A radiolucent arm table is fixed to the ipsilateral operative side (Fig 1). General anesthesia and preoperative antibiotics are administered. The operative side is then prepped and draped in the standard fashion. A sterile tourniquet is applied.

Initial Approach

An "L"-shaped incision is made with a #15 blade along the radial aspect of the forearm, with 3 cm of the L oriented proximal–distal and 2 cm oriented medial–lateral. The incision is centered over the level of the radial tuberosity, as confirmed by fluoroscopy. Dissection is carried through subcutaneous tissue and ultimately between the brachioradialis and the pronator teres, with careful consideration to the lateral antebrachial cutaneous nerve, which is identified and protected throughout the case. The distal biceps tendon stump is exposed and retrieved with finger dissection. The tendon stump is procured out of the wound using an Allis clamp (Fig 2) and a traction stitch is placed. All unhealthy-devitalized tissue is then removed using a scalpel, and adhesions are freed circumferentially around the tendon.

Suture Anchor Placement (With Video Illustration)

Blunt dissection is completed to the level of the radius. A blunt Hohmann retractor is placed on the medial and lateral side of the radial tuberosity while

the forearm is kept in hyper-supination. Fluoroscopy is then used to verify the appropriate level of the radial tuberosity. The anatomic posterior insertion of the distal biceps is identified and debrided. Next, 2 FiberTak all-suture anchors (FiberTak; Arthrex) are drilled uncortically and then placed in the biceps insertion site on the tuberosity; one superior and one inferior (Fig 3). For each corresponding anchor, one suture pair is sutured in a Krakow fashion from proximal-to-distal, with one limb as the medial row and the other as the lateral row. The remaining suture is used in a horizontal mattress fashion for additional support. The tendon is then affixed to the radial tuberosity using a tension slide technique with the forearm in 90° of flexion (Fig 4). The tourniquet is deflated to allow for biceps tension and prevent proximal retraction. The sutures are sequentially tied (Fig 5). The key steps are demonstrated in Video 1.

Closure and Postoperative Care

The arm is then placed into a posterior mold splint and a shoulder sling, which are kept in place until the first postoperative appointment at approximately 2 weeks, at which point the patient is transitioned to a hinged-elbow brace. Patients begin gentle wrist and shoulder range of motion immediately postoperatively. At the 2-week mark, patients begin active extension to 30° with no active flexion. At 6 weeks postoperatively, full active extension is permitted, and by the ninth week, the brace is discontinued. Patients begin gradual flexion strengthening at week 12.

Discussion

Currently, there is no consensus on the ideal operative technique for distal biceps ruptures. The present technique uses a single-incision anatomic repair using open, onlay fixation with all-suture anchors (FiberTak; Arthrex). This technique allows for optimal restoration of intrinsic anatomy, a theoretic decrease in complication rate, and ease of surgery.

This technique portends many benefits over other forms of repair. The anatomic positioning of the biceps

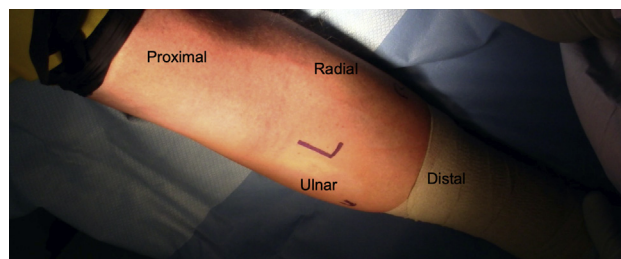


Fig 1. The patient is laid supine on the standard operative table. A radiolucent arm table is fixed to the ipsilateral operative (left) side. The operative side is then prepped and draped in the standard fashion. An "L"-shaped incision is then made with a #15 blade along the radial aspect of the forearm.

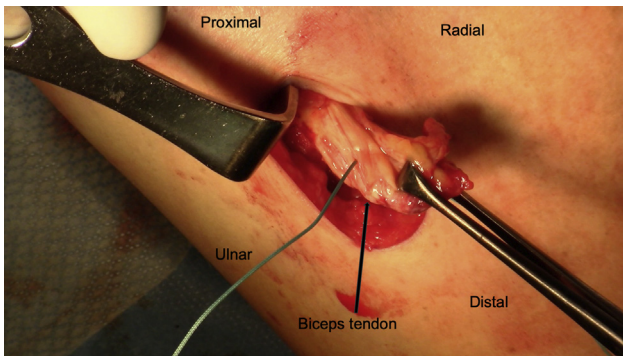


Fig 2. The distal biceps tendon stump is exposed and retrieved. The tendon is tagged using an Allis clamp. All unhealthy-devitalized tissue is then removed using a scalpel, a traction stitch is placed, and adhesions are freed circumferentially around the tendon.

tendon more posteriorly has been found to have an implication on range of motion and supination strength. In a study of 8 fresh frozen cadavers assessing strength of anatomic versus nonanatomic repairs, Prud'homme-Foster et al.¹⁶ found that when the arm was in neutral rotation, there was 15% less supination torque generated by the nonanatomic repair and when arms were tested in 45° of supination, there was 40% less supination torque generated in the nonanatomic repair ($P = .01$). The present technique positions the tendon on the posterior and ulnar aspect of the radial tuberosity. This provides optimal biomechanical positioning for the tendon to supinate the forearm.

Suture anchors have been shown to provide many benefits. In a cadaveric study, Lemos et al.¹⁷ found that suture anchor fixation using 2 suture anchors was significantly stronger than bone tunnel repair (263 newtons, N, vs 203 N, $P = .0233$). The authors further remarked on the ease of the suture anchor technique versus the bone tunnel technique, which can lead to decreased surgical time. In a cadaveric study

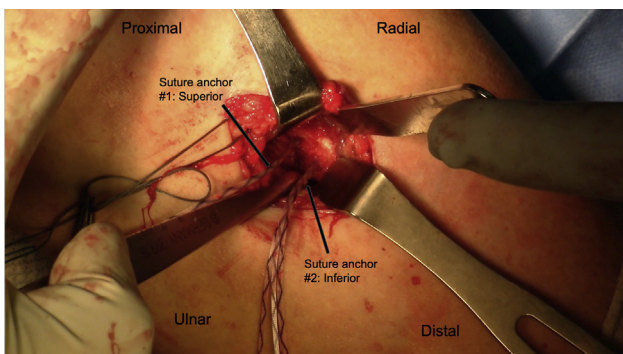


Fig 3. The radial tuberosity is exposed, and retractors are placed around the tuberosity. The tuberosity is identified, and 2 FiberTak suture anchors (FiberTak; Arthrex, Naples, FL) are drilled unicortically and placed in the biceps insertion site on the tuberosity; one superior and one inferior.

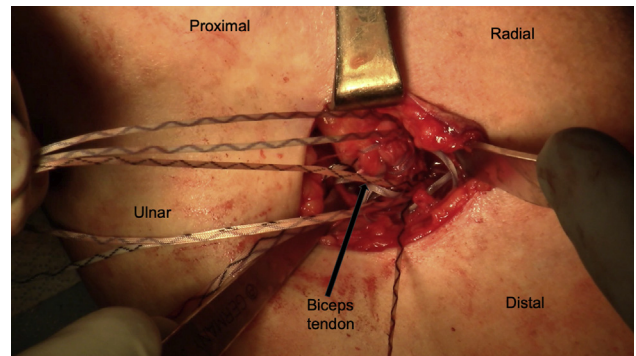


Fig 4. The biceps tendon is affixed to the radial tuberosity using a tension slide technique with the forearm in 90° of flexion.

comparing fixation strengths of suture anchors with transosseous suture tunnels, Berlet et al.¹⁸ found that, in cyclic loading, the suture anchors performed adequately to allow early passive range of motion and that transosseous sutures failed at significantly greater loads on static testing than the suture anchors. An additional benefit to suture anchors is the fact that they are preloaded with 4 needles on the sutures, allowing for quicker and more efficient surgery. Lastly, when compared with other techniques of fixation, the present technique minimizes the risk of damage to the posterior interosseous nerve due to the fact that the radial tuberosity is drilled in a unicortical manner.²

This technique is not without limitations. A study by Kodde et al.³ demonstrated increased rates of neuropraxia with a single-incision technique; however, our technique uses an “L-shaped” incision, which provides improved visualization without forceful retraction. Surgeons must be mindful of suture anchor protuberance with traditional plastic suture anchors. Suture protuberance causing pain had been demonstrated in previous studies.¹⁸ Lastly, surgeons must be mindful of common complications of distal biceps repairs, such as re-rupture, loss of strength and motion, and heterotopic

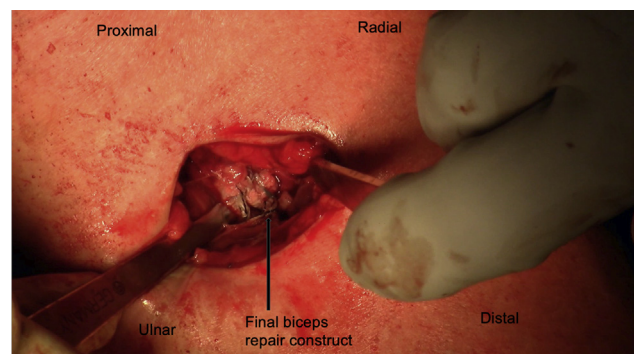


Fig 5. Final construct appearance: anatomic repair using open, onlay-tissue fixation with 2 suture anchors (FiberTak; Arthrex, Naples, FL) and anatomic positioning of the biceps tendon.

ossification. It is recommended that patients be appropriately counseled on expectations regarding postoperative course and long-term outcomes.

In conclusion, this article presents a technique for anatomic distal biceps repair using an onlay fixation with all-suture anchors. This technique allows anatomic tendon fixation while minimizing potential complications.

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