SINGLE INCISION TECHNIQUE FOR DISTAL BICEPS TENDON REPAIR: USING THE ENDOBUTTON

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Techniques have been described in the literature for the repair of distal biceps tendon ruptures. This technique uses a single incision approach with an Endobutton (Acuflex; Smith & Nephew Endoscopy, Mansfield, MA) for fixation. This fixation allows for early active range of motion and minimizes the risk of radioulnar synostosis. We have had success with this easily reproducible technique and no incidence of synostosis or neurologic complications.
KEY WORDS: elbow, biceps tendon, Endobutton, single incision

A multitude of techniques have been used to treat distal biceps tendon ruptures. This article will detail a single incision technique using a titanium fixation device (Acuflex Endobutton fixation button; Smith & Nephew Endoscopy, Mansfield, MA). This technique was first described in 1997.[1]

DIAGNOSIS/PHYSICAL EXAMINATION

The typical patient who experiences a biceps tendon rupture is a male between 40 and 60 years old who experiences a single traumatic event loading the elbow in flexion or from an eccentric contraction.[2,3] The diagnosis is generally made on clinical examination. There is a palpable defect in the anterior cubital fossa. There may be a palpable retracted biceps tendon more proximal in the arm. The most obvious examination finding is weak supination and to a lesser degree weak elbow flexion.

INDICATIONS

Studies comparing operative and conservative management of these injuries have shown with operative repair results in improved elbow flexion and supination strength and endurance.[4,5] Our choice is surgical treatment in most middle-aged patients. In particular those who place significant demands on their upper extremity should have surgery to maximize their elbow function.

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TECHNIQUE

Approach

The patient is positioned supine on the operating room table. The arm is placed on an arm board. A sterile tourniquet is available if needed. An anterior longitudinal Henry approach is used with extension along the antecubital crease. Tenotomy scissors are used for subcutaneous dissection to avoid injury to the lateral antebrachial cutaneous nerve. The lacertus fibrosis and other surrounding tissues may need to be divided to allow adequate mobilization of the distal biceps tendon. Next, the intermuscular interval between the pronator teres and brachioradialis is developed. It is common to encounter the large venous tributaries of the basilic and cephalic system at this point. If necessary, these are hemoclipped and divided to facilitate exposure. The radial recurrent branch of the radial artery is also encountered in this area. If necessary, it can be ligated.

Preparing the Biceps Tendon

A pseudosheath from the distal end of the ruptured tendon to the bicipital tuberosity is frequently encountered. This is a useful guide to trace distally to identify the radial tuberosity. When the injury is acute, it is almost always present and makes the dissection to the tuberosity much easier. The end of the biceps tendon must be located. When dealing with acute ruptures the pseudosheath may lead one to the retracted tendon. "Milking" the tendon out of the arm to deliver it into the operative field is often required.

Once the end of the biceps tendon has been identified, a no. 2 Fiberwire (Arthrex Inc., Naples, FL) suture is placed in a locking Kessler-type suture, starting from the distal end of the tendon. The suture is started about 1 cm from the distal end of the tendon (Fig 1) and is run longitudinally in a retrograde direction up the tendon for 3 cm. Next it is run down the other side of the tendon. The Endobutton is then affixed to the end of the prepared

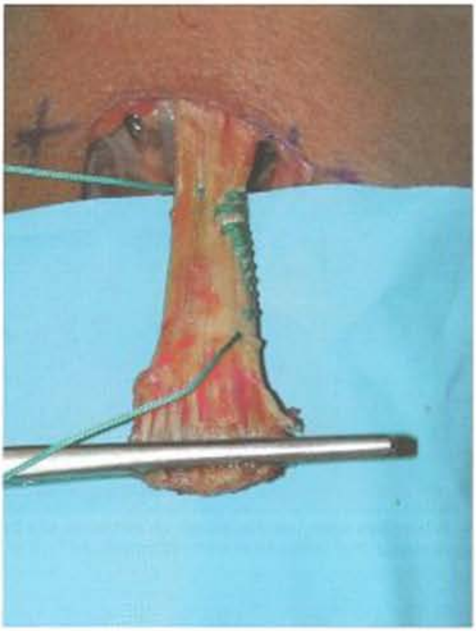

Fig 1. The starting point of the locking Kessler sutures is 12 mm from the distal end of the biceps tendon and is passed retrograde up one side of the tendon.

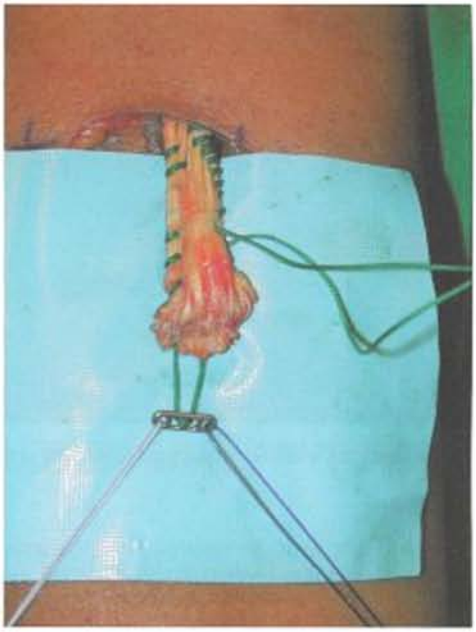

Fig 2. The second limb of the suture is run down the other side and then passed through the center two hole of the Endobutton. Then it is passed back up the other side and tied onto itself.

biceps tendon by passing the suture through the middle two holes of the Endobutton. Then suture limb is then passed back up the first side of the biceps tendon and tied back onto itself (Fig 2). A gap of approximately 5 mm is left between the end of the tendon and the button (Fig 3). This provides enough length for the Endobutton to pass through the drill holes in the proximal radius and then allow it to "flip." The two "pull through" sutures should be different colors and/or consistency that they can be identified from each other. They are placed in the leading and trailing holes of the Endobutton. These will be used to manipulate and engage the Endobutton during passage through the tuberosity of the proximal radius.

Preparation of Radial Tuberosity

The arm is positioned so the elbow is in full extension and supination, which will place the tuberosity into the surgical field. The proximal radius is then prepared to expose the tuberosity. The soft tissue is retracted with superficial retractors, not by deep retractors placed along the radius. A slotted 1.5-mm Beath pin is then drilled through both cortices in the proximal radius. The starting point is not directly through the tuberosity, rather it is at the junction of the tuberosity and the radial shaft. The pin must be perpendicular in two planes to the forearm, or even directed in a slight ulnar direction. The forearm is held at 90° of supination (Fig 4). In this position the posterior interosseous nerve is furthest from the exit point of the Beath pin, minimizing injury to this structure. The pin penetrates the far cortex of the radius and is then tapped through the soft tissue to avoid wrapping up any soft tissue structures

Fig 3. The Endobutton is positioned to allow 5 mm of clearance between itself and the end of the tendon.

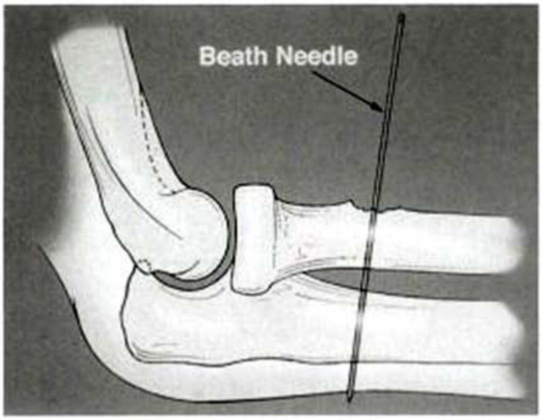

Fig 4. The Beath pin is drilled through the tuberosity at 90° to the radius.

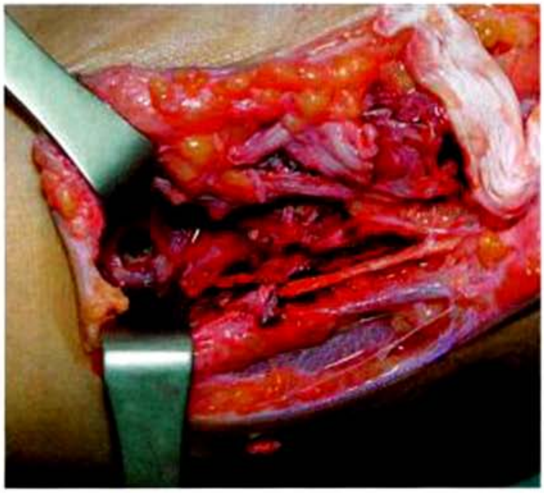

Fig 6. A burr has been used to create an entrance site for the biceps tendon.

with the drill. The 4-mm cannulated drill supplied with the Acufex Endobutton fixation device kit overdrills the Beath pin (Fig 5).One should use a soft tissue protector when using the drill. A high-speed burr is used to decorticate the anterior cortex to create a defect for acceptance of the tendon. This is shaped like a oblique slot (Fig 6). It is essential to use a copious amount of irrigation and suction during this portion of the procedure to limit the amount of bone debris left in soft tissue. The "pull through" sutures are then threaded through the Beath pin, and the pin is withdrawn, via the leading "pull through" suture, through the posterior aspect of the forearm pulling the sutures with it.

At this point, intraoperative fluoroscopy is used. The leading "pull through" suture is tensioned and this is used to pull the Endobutton through the bone tunnel (Fig 7). As soon as the Endobutton passes the posterior cortex, the other "pull through" suture is tensioned, flipping the Endobutton and engaging it on the far cortex of the radius. The elbow is extended, firmly engaging the button. Motion is assessed and the "pull through" sutures are easily removed (Fig 8).

The wound is then closed with 3.0 Vicryl and 4.0 Monocryl sutures. A bulky dressing is then applied maintaining 90° of flexion and neutral forearm rotation (Fig 9).

Rehabilitation

Therapy is initiated within the first week. A long arm splint blocking the final 30° of extension is fitted. Patients are allowed to perform active, active assisted, and passive range of motion, including flexion, extension, and full forearm rotation. Splinting is discontinued between 4 and 6 weeks, allowing full extension at this time. Light strengthening can begin 6 weeks postoperatively, and full use is allowed at 3 months postoperatively.

REVIEW OF RESULTS

We have used this technique in 21 patients. To date there have been no neurologic deficits or radioulnar synostosis.

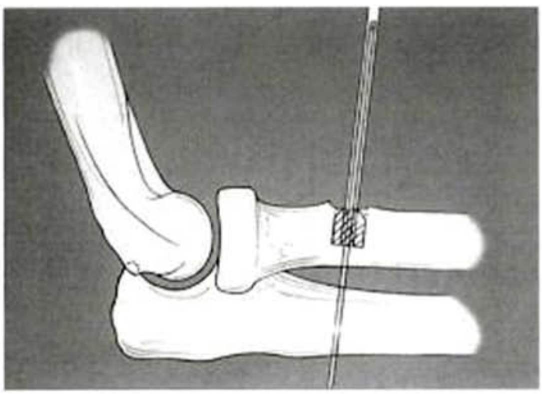

Fig 5. A cannulated reamer is passed through the radius.

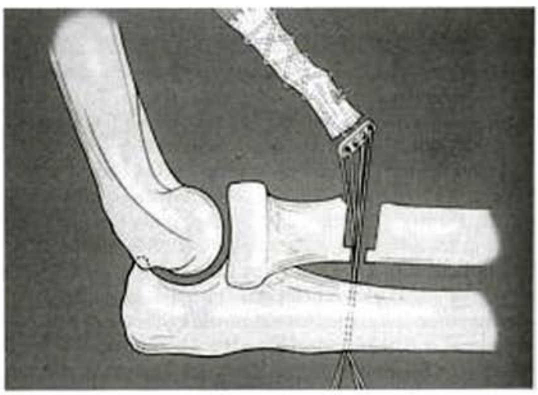

Fig 7. The Endobutton is pulled into the radius.

Fig 8. The biceps tendon is secured into the radius.

Fig 9. Radiograph of repaired biceps tendon which shows the position of the Endobutton.

Range of motion has been nearly symmetric with no contractures. Strength testing has been performed and these results along with a more detailed report will be reported soon.

Biomechanical Results

Biomechanical testing was performed to compare the pull-out strength of various biceps tendon anchoring techniques including a conventional bone bridge similar to that described by Boyd and Anderson,[6] an intraosseous anchor (Mitek G4 SuperAnchor; Mitek Surgical Products, Norwood, MA), and the Endobutton.[1] The average pull-out strength was 177 Newtons for the conventional bone bridge, 253 Newtons for the anchor, and 584 Newtons for the Endobutton technique. The Endobutton was three times stronger than the bone bridge ($P = 0.0001$) and two times stronger than the anchor ($P = 0.0007$) (Fig 10).

Tips and Pearls

When performing the approach to the radius, do not place retractors such as a Hohmann retractor along the side of the radius as this places the posterior interosseous nerve at risk. When positioning to drill the Beath pin, do not place it directly through the tuberosity, but rather at the tuberosity shaft junction, as the tuberosity actually is directed in a ulnar direction instead of directly into the wound when the forearm is supinated. Fluoroscopy is used when passing the pin so it can be flipped as soon as it clears the posterior cortex and is not pulled too far into the soft tissue.

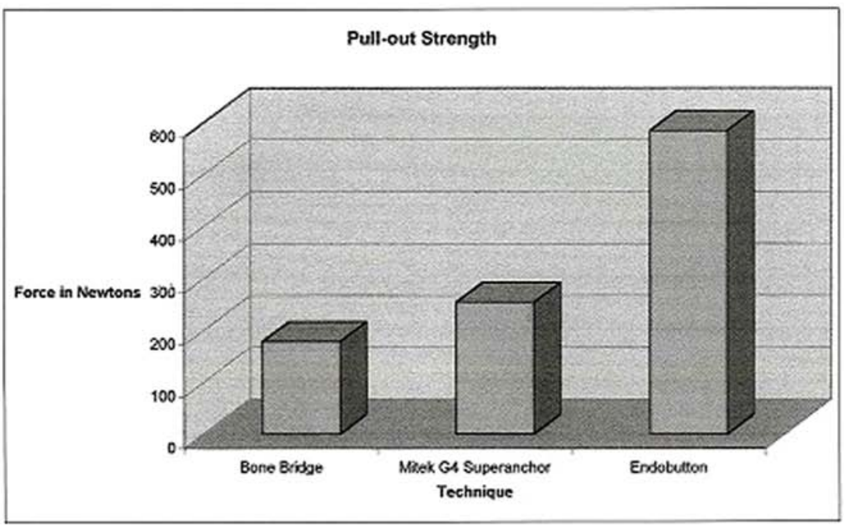

Fig 10. Graph illustrating the pull-out strength of various fixation techniques.

DISCUSSION

The Endobutton fixation is our choice for fixation of acute biceps tendon ruptures. It is effective in our hands and allows an acceleration of the rehabilitation, which supports tendon healing.[7,8] This technique allows the tendon to rest in the medullary canal similar to the two-incision technique, but does not violate the interosseous membrane.

Bain and coworkers[9] reported their clinical results on biceps repair with an Endobutton. Twelve patients were followed with no neurologic injuries, no re-ruptures, no clinical or radiologic evidence of radioulnar synostosis reported, and all had a return of grade 5 power. The patients were allowed early active range of motion. We have had a similar experience with no neurologic complications or synostosis in our series and have had no reruptures.

CONCLUSION

Repair of distal biceps ruptures can be performed using many different techniques. Our preference is to use the Endobutton technique because we have had no cases of heterotopic bone causing motion loss, the technique is easy and reproducible, and we can accelerate rehabilitation.

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