Technical Note

The Transosseous Cerclage In Situ Technique for Biceps Tenodesis

Brett Sanders, M.D.

Abstract: There are many techniques described for biceps tenodesis that vary by fixation type, location, and open or arthroscopic method. Clinical outcomes are similar regardless of repair technique; therefore, the cost and time of procedures are increasingly points of improvement to practice value-based medicine and deliver cost-effective care. The technique described in this article builds on previous arthroscopic transosseous technical knowledge to yield a cost-effective and efficient clinical method to perform biceps tenodesis in the suprapectoral location without the cost and complications of an implant. In addition, this technique provides 4 methods of tenodesis in series, which serves to decrease the risk of mechanical failure and leverages the robust method of suture cerclage for capture of the biceps.

Biceps pathology is increasingly noted to be a pain generator either in association with rotator cuff or labral pathology or as a stand-alone entity.[1,2] The final common pathway of multiple problems may lead to the need for biceps tenodesis, leading to its increased use and effect on the cost of procedures. Recently, subpectoral tenodesis has been shown to be an independent cost driver of arthroscopic shoulder procedures, in addition to suture anchors.[3] The subpectoral technique also has some disadvantages, such as the inability to accurately determine the length-tension relation of the tendon and a wound in the axilla, which is prone to dehiscence or infection, as well as fracture and/or musculocutaneous nerve injury from working in the subpectoral location.[4,5] Using the transosseous technique of arthroscopic suprapectoral tenodesis eliminates the additional cost of an open procedure, eliminates the cost and complications of hard implants, fixes the tendon in normal length-tension alignment, eliminates the wound problem in the axilla, and provides similar outcomes in terms of pain relief.[6] Previous work has shown the reliability of transosseous methods for rotator cuff repair and biceps tenodesis using retrograde passing methods.[6,7] The technique described in this article incorporates some lessons learned from previous techniques of biceps tenodesis.

In developing transosseous techniques, we have noted the benefit of unlimited fixation points in bone causing load sharing of the construct through increased fixation-point density, as well as the fact that the strength of the construct is determined by the suture number crossing the repair site.[7] The same principle applies to the suture-tendon interface of the biceps to decrease the chance of construct failure. The number of passes around and through the tendon and the length of the tendon engaged are relevant variables that influence pullout strength. The biceps has varied shapes and can be small and round, can be large and flat, or can transition more proximally into an hourglass configuration.[8] The bone may be soft or hard, and cysts may be encountered in the suprapectoral region. The heterogeneity of variables makes it difficult to reliably predict the performance of suture anchors and interference screws in this area, leading to high failure rates of 8% to 25%.[9] We have found multiple-tendon cerclage, a technique used routinely in anterior cruciate ligament surgery, to be a useful tool to optimize suture grasp on the biceps tendon given its variable size, shape,

From the Center for Sports Medicine and Orthopaedics, Chattanooga, Tennessee, U.S.A.

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Address correspondence to Brett Sanders, M.D., Center for Sports Medicine and Orthopaedics, 2415 McCallie Ave, Chattanooga, TN 37404, U.S.A. E-mail: bsanders@sportmed.com

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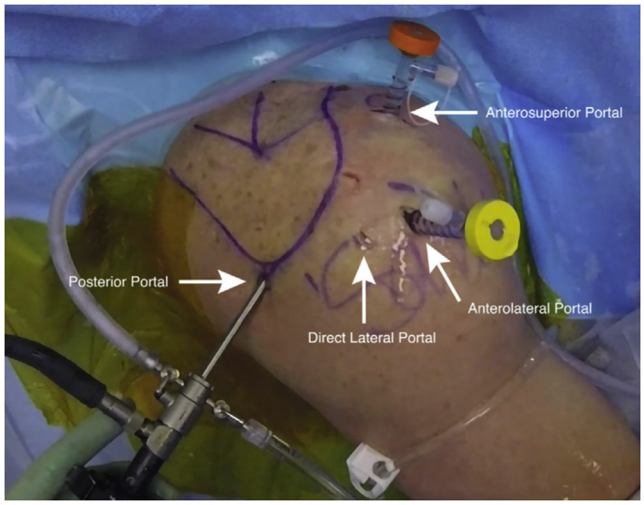

Fig 1. Portal positioning for transosseous cerclage in situ biceps tenodesis technique. A right shoulder is shown, with the patient in the beach-chair position. The direct lateral portal is used for viewing; the anterolateral portal is used for instrumentation. These are the only portals necessary for the procedure.

and characteristics. Use of the transosseous cerclage in situ (TOCIS) technique allows the biceps to be left in situ in an anatomic length-tension relation; moreover, it creates the additional advantage of incorporating

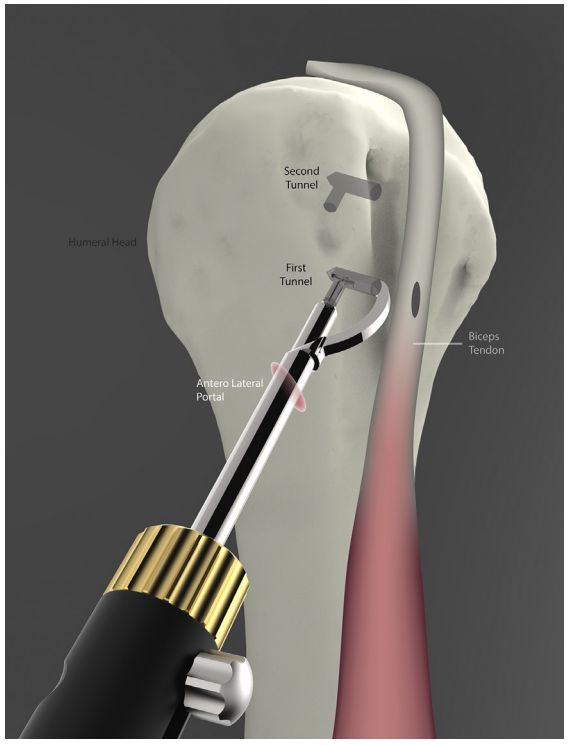

Fig 2. Introduction of a tunneling device to create a bone tunnel in the biceps groove for tenodesis, shown in a right shoulder with the patient in the beach-chair position.

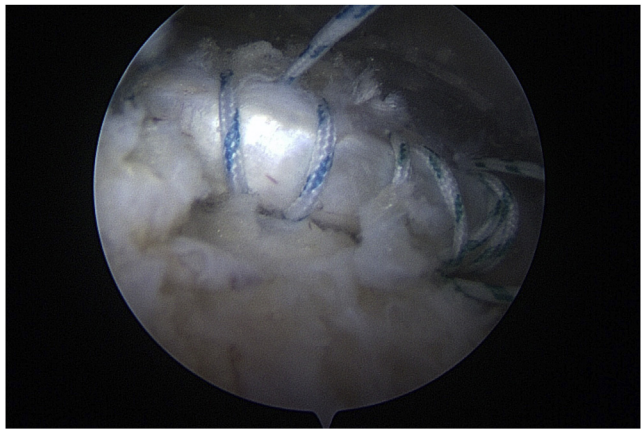

Fig 3. Biceps tendon with cerclage prior to tenodesis. A right shoulder is shown, with the patient in the beach-chair position.

additional backup fixation methods in series. The rotator interval and biceps pulley themselves may be used as a stand-alone soft-tissue suture-based tenodesis, and the intra-articular remnant is used to further prevent postoperative deformity and increase the likelihood that the biceps will scar into the interval before fixation failure occurs.[10] This effect was previously described by noting that deformities do not always occur with tenotomy because the biceps scars into the interval, an effect that increases with the proximal size of the tendon. We have observed clinically that techniques that remove the biceps from the interval tend to have higher failure rates regardless of fixation type, likely by decreasing the force of pull through.[9,10]

Technique

The patient is positioned in the beach-chair position (Video 1). The portals used are the direct lateral portal

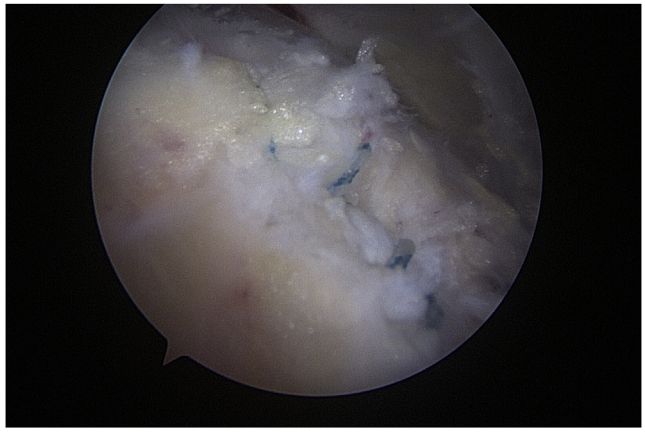

Fig 4. Cerclage sutures are tied, showing in situ tenodesis with the biceps recessed into its normal position in the groove. A right shoulder is shown, with the patient in the beach-chair position.

Table 1. Advantages and Disadvantages of TOCIS Technique for Biceps Tenodesis

Advantages
Completely anatomic length-tension relation of biceps
Elimination of hardware cost and complications
Powerful suture cerclage effect on suture-tendon interface
Multiple in-series tendon fixation methods to prevent deformity
Elimination of incision in axilla prone to dehiscence and infection
Release of biceps sheath, which is linked to pain relief
Disadvantages
Requirement for specific device
Learning curve
Bleeding from anterior circumflex artery may be encountered

TOCIS, transosseous cerclage in situ.

and the anteroinferior working portal by use of an 8.25-mm cannula, as previously described (Fig 1).[6] It is helpful to use a mechanical arm positioner (Adaptable; DJO, Austin, TX) to control rotation and place the arm in 20° of forward flexion. The biceps is left attached to the labrum until the end of the case.

Viewing from the direct lateral portal, the surgeon releases the biceps sheath inferiorly from the anterior circumflex artery to the rotator interval superiorly. The synovium is debrided with a motorized shaver. A labral Scorpion passer (Arthrex, Naples, FL) is loaded with a colored suture and is used to place 3 to 5 cerclage sutures in and around the tendon in the inferior portion of the groove. The cannula is then removed and replaced to exclude the previously placed sutures, allowing for a different colored suture to perform the same cerclage on the superior half of the tendon. At least 2 of the passes of suture in this location are used to grasp the rotator interval and biceps, thus forming a soft-tissue tenodesis in situ simultaneously. Next, a 2.9-mm awl is used to make the medial holes for the transosseous tunneling device (TransOs; Tensor Surgical, Chattanooga, TN) (Fig 2). The cannula is removed, and the same portal is used to pass the TransOs device in an inverted fashion and then twist the tip of the guide into articulation with the medial inferior hole. At this point, it is helpful to internally rotate the arm to allow ingress of the tunneling device. The tunneling device is deployed and removed, bringing with it the retrieval suture. By use of a suture retriever, 1 limb from the inferior suture is passed through the retrieval loop intra-articularly, and the loop is used to pull the suture out through the transosseous tunnel laterally. The same step is then repeated for the superior tunnel. The lateral sutures now passed through the bone tunnel are then retrieved with their respective medial tails; the suture tails are then tied through the working portal in the standard fashion, creating an in situ cerclage tenodesis of the tendon (Figs 3 and 4). Viewing from lateral, the surgeon inserts a switching stick from the posterior portal back into the intra-articular space to allow ease of insertion because there is often an associated cuff repair. With the scope in the standard posterior viewing portal, the ablation wand is brought in through the rotator interval portal and used to resect the biceps off the labrum while including a small portion of the superior labrum, thus increasing the proximal biceps diameter. The biceps intra-articular remnant is not debrided because it will provide more biological tissue to prevent the occurrence of a deformity postoperatively. Table 1 presents advantages and disadvantages of the TOCIS technique for biceps tenodesis, and Table 2 presents pearls and pitfalls.

Table 2. Pearls and Pitfalls of TOCIS Technique

Pearls
The antegrade labral passer has a hook on the lower jaw that aids in grasping the biceps when recessed in the groove.
The arm should be internally rotated to introduce the tunneling device.
The rotator interval should be incorporated into the superior tenodesis.
Excluding the first sutures from the cannula is helpful in suture management.
The biceps should be left attached until the end of the case.
Pitfalls
Caution is advised just superior to the pectoralis in the location of the anterior circumflex artery.
Colored sutures should be used to avoid difficulty with suture management.
A switching stick should be used to re-enter the intra-articular space to avoid damaging any previous repairs.

TOCIS, transosseous cerclage in situ.

Discussion

The TOCIS technique builds on previous knowledge from transosseous arthroscopic biceps tenodesis to increase the speed and efficacy of an implant-free, cost-effective technique. The transition to antegrade passing significantly reduces time in the operating room and adds to the ease of the technique while simultaneously leveraging the powerful suture cerclage technique to effectively grasp and control a tendon with highly variable characteristics along a much longer working length (3 cm) than typically used. This modification theoretically increases the mechanical grasp of the suture-tendon interface using 2 independent fixation points. Leaving the tendon in situ eliminates the guesswork of the physiological length-tension relation and facilitates stabilization of the tendon during the procedure. Finally, rotator interval suturing and biceps-labral composite release are incorporated as in-series backup methods, creating a 4-in-1 effect to reduce the chance of postoperative deformity, all while eliminating the additional cost and complications of hard implants.

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