

The Loop 'N' Tack Biceps Tenodesis: An All-Arthroscopic, Intra-Articular Technique



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Abstract: Tenodesis and tenotomy of the long head of the biceps are treatment options for a wide range of pathologies without clear superior technique or site of fixation. Clinical outcomes comparing numerous techniques for tenotomy versus tenodesis have resulted in similar pain relief; however, tenotomy may result in a cosmetic "Popeye" deformity and fatigue pain. We present a quick, simple, and knotless technique for tenodesis of the long head of the biceps at the proximal aspect of the bicipital groove that can be completed entirely arthroscopically. This technique uses suture to secure a tenotomized proximal biceps tendon to a knotless anchor just proximal to the subscapularis tendon at the proximal biceps groove. The tensionless repair allows the biceps to scar within the biceps groove, thereby reducing subsidence and formation of a "Popeye" deformity and fatigue pain in the biceps seen with tenotomy alone while eliminating the ability to overtension.

The long head of the biceps is a common cause of shoulder pain. Surgical management for tendinopathy of the long head of the biceps brachii tendon is well-described in the literature. Biceps tenotomy and tenodesis are the most common procedures used to address lesions of the long head of the biceps.^{1,2} While the tenotomy versus tenodesis debate continues, biceps tenodesis is often preferred over biceps tenotomy for younger and more active patients to mitigate cosmetic deformity and cramping while maintaining supination strength.^{3,4}

All-arthroscopic techniques for biceps tenodesis have been described previously.⁵⁻¹⁰ Multiple methods for suprapectoral tenodesis have been described, including both soft-tissue and humeral fixation with suture anchors, interference screws, and other implants.⁹ In a recent review of 1526 shoulders with an average follow-up of 10.8 months, no significant differences were found

between suprapectoral (in the bicipital groove) versus subpectoral (out of the bicipital groove) location in regards to persistent or new-onset anterior shoulder pain, cramping, deformity, or subjective weakness.¹¹ However, nerve injury was cited to be significantly greater (1.70% vs 0.19%) in the subpectoral location.

In this technique article, we describe the loop 'N' tack biceps tenodesis, a simple knotless, all-arthroscopic intra-articular technique with a high rate of patient satisfaction, significant improvement in shoulder outcome scores, and a low incidence of postoperative groove pain.¹²

Surgical Technique (With Video Illustration)

The patient is placed in the beach-chair or lateral decubitus position, based on surgeon preference for shoulder arthroscopy (Fig 1). Diagnostic arthroscopy through the posterior portal is completed (Video 1). An 18-gauge spinal needle is used to localize the anterior portal within the rotator interval, directly centered on the biceps tendon. Positioning is essential to ensure instruments can easily access above and below the biceps tendon, as well as ease of access to the intra-articular groove, just proximal to the subscapularis tendon. A cannula is used through the anterior portal for suture management.

With the use of a ring suture grasper, a suture with a looped end is inserted through the anterior portal (FiberLink SutureTape; Arthrex, Naples, FL) (Fig 2A). The suture is passed looped end first superior to the biceps tendon (Fig 2B), released, and retrieved inferior to the biceps tendon within the joint (Fig 2C). The

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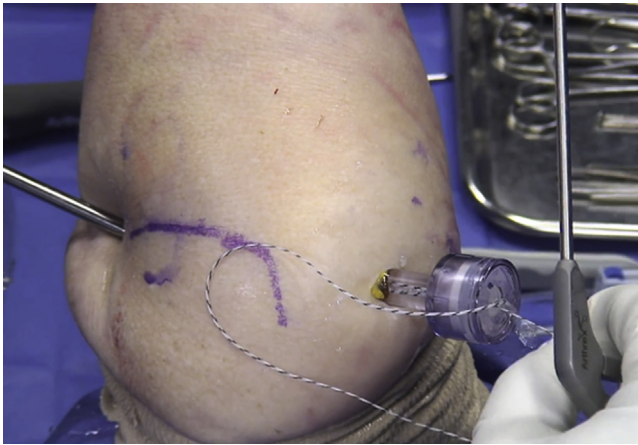


Fig 1. Demonstration of the loop ‘N’ tack arthroscopic surgical knot portal placement with posterior viewing portal and anterior working portal in a left shoulder.

looped end of the suture is withdrawn through the anterior cannula and a looped hitch (“luggage-tag”) knot is created by passing the free end of the suture through the loop and pulling to tighten the “luggage tag” around the biceps firmly.

The tension on the eventual tenodesis can be set by adjusting the location of the “luggage-tag.” The tenodesis will be eventually anchored at the superior border of the subscapularis, at the most distally visualized portion of the intra-articular groove. If the surgeon desires to replicate the native tension on the biceps, the luggage tag should be placed more distal on the biceps (closer to the biceps groove).

We recommend taking the biceps slightly off tension to minimize the load seen on the biceps. In such cases, the “luggage tag” should be tightened around the biceps a few millimeters distal to its insertion on the superior labrum as possible. It is important to not place the suture too close to the superior labrum insertion of the biceps to make sure the loop does not slip off then end of the biceps once it is cut. Once the “luggage-tag” has been placed in the desired position, the free end of the suture is placed through the cannula with a grasping suture retriever inferior to the biceps tendon. A tissue-penetrator is inserted through the cannula to pierce through the midportion of the biceps distal to the luggage-tag knot (Fig 2D). With the tissue-penetrator, the free end of the suture is grasped and pulled through the biceps tendon and withdrawn from the cannula (Fig 2E). This completes the loop ‘N’ tack stitch (Fig 2F).

A curved arthroscopic scissor is inserted through the anterior portal and the biceps tendon is cut at the insertion on the superior labral junction (Fig 2G). Again, it is extremely important to leave enough biceps tendon distal to the loop to prevent the loop to slip off the end of the biceps. The free end of the suture is loaded into a suture anchor of the surgeon’s choice. A pilot hole is drilled at the

most distally visualized portion of the intra-articular bicipital groove, just superior to the subscapularis tendon (Fig 2H). When visualized from a posterior portal, this pilot hole can be difficult to visualize. We therefore recommend placing a small nitinol wire to “mark” the hole, to aid in anchor placement. The anchor is seated with all slack taken out of the suture, allowing the tendon to translate distally within the bicipital groove, “tacking” the biceps in place. Radiofrequency is used to debride the residual stump of the biceps as well as the superior labrum (Fig 2H). The portals are closed using standard arthroscopic portal closure techniques.

Postoperative Management

Patients with isolated biceps tenodesis are placed into a sling for comfort and encouraged to participate in active range of motion at the shoulder and elbow immediately. When used in combination with other arthroscopic techniques, it is recommended to defer to the rehabilitation protocol for the additional procedures.

Discussion

The authors present a simple, knotless, quick, and reproducible technique for tenodesis of the long head of the biceps at the proximal aspect of the bicipital groove that can be completed arthroscopically and with or without an intact rotator cuff.¹³ Technique-associated pearls and potential pitfalls are detailed in Table 1. This technique is directing a tenotomized biceps tendon to scar proximal to the subscapularis tendon, thereby reducing incidence of “Popeye” deformity and fatigue pain in the biceps seen with tenotomy alone while eliminating the ability to overtension. A complete list of advantages and disadvantages can be found in Table 2.

Tenodesis of the long head of the biceps has been widely accepted as a treatment methodology for a wide range of pathologies. However, numerous studies have failed to elucidate clear superiority of outcomes and minimizing complications with a single technique or site of fixation. While clinical outcomes of biceps tenotomy versus tenodesis result in similar pain relief, tenotomy may result in a cosmetic “Popeye” deformity with uncertain predictability. After arthroscopic tenotomy, Gill et al.¹⁴ found a “Popeye” deformity rate of 3%, whereas Kelly et al.¹² found a rate of 70%. The described procedure reduces the risk for deformity by tenodesis the biceps tendon proximal to the subscapularis tendon.

Subpectoral tenodesis of the biceps tendon gained popularity after increased revision rates (21% vs 7%) were demonstrated with proximal tenodesis that failed to address groove pain and pathology.¹⁵ Previous techniques of biceps tension involve various methods of burying the tendon within a tunnel. These techniques may lead to overtensioning or transection of a frayed tendon, which can lead to poor outcomes in a patient with concomitant groove pathology. Our technique

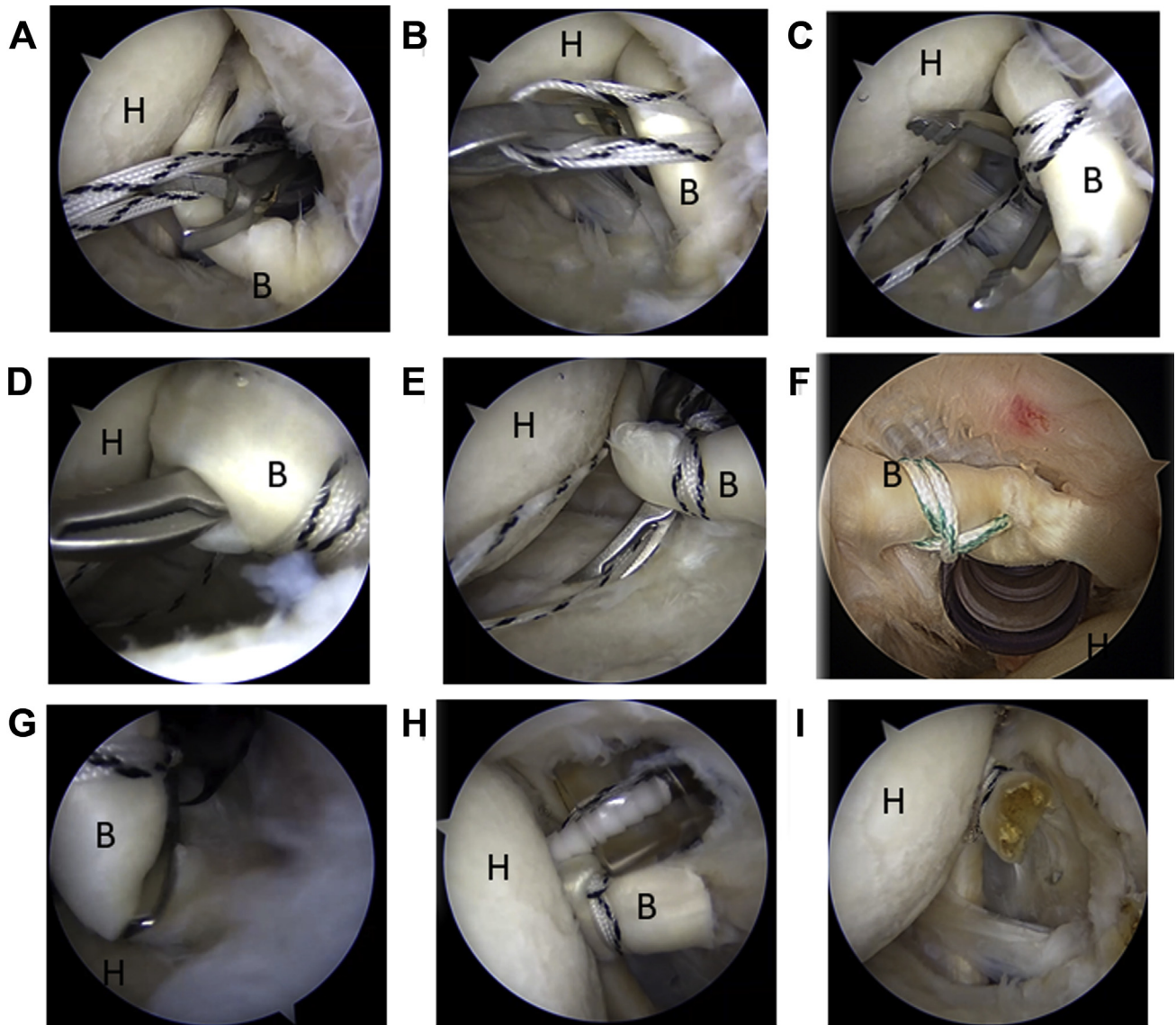


Fig 2. Demonstration of the loop 'N' tack arthroscopic surgical knot in a left shoulder as viewed from the posterior portal with the patient in the lateral decubitus position using a 30° scope. (A) Passing of the looped end of suture superior to biceps tendon. (B) Looped suture grasped from inferior aspect and retrieved through cannula, cinching the suture to the biceps tendon. (C) Free end of suture is passed into the joint inferior to the biceps tendon. (D) Arthroscopic tissue penetrator is passed through central aspect of the biceps tendon distal to the loop. (E) Grasping the free suture end with the tissue penetrator, pulling suture through the tendon. (F) Loop 'N' tack knot. (G) Biceps tendon cut with a curved arthroscopic scissor at insertion on superior labrum. (H) Placement of suture anchor at distal most visualized portion of intra-articular groove just proximal to supraspinatus tendon. (I) The end of the tendon is cauterized back, ensuring ample stump proximal to the suture. (B, biceps tendon; H, humeral head.)

addresses groove pain in 2 ways. First, the technique is an onlay technique that does not bury the tendon within a tunnel, preventing overtensioning. Second, biceps tendon tension can be varied based on the placement of the loop 'n' tack suture on the proximal end of the biceps. This gives tension control to the surgeon without allowing for over tensioning within a tunnel. Our preferred technique is to take the biceps off tension, therefore immobilizing the biceps within the groove and allowing scar formation. This renders any groove pathology irrelevant.

The main advantage of this technique is the ease of use. Standard arthroscopic portals are made with the posterior viewing portal used for the entirety of the procedure without entering the subacromial space.^{8,10,11} Suture passing, tenodesis, and anchor placement at the distal end of the biceps groove above the subscapularis tendon are completed arthroscopically and under direct visualization. This eliminates the need for an additional distal incision (either arthroscopic or subpectoral). In cases with concurrent rotator cuff tears, the tenodesis anchor placement may be incorporated into the

Table 1. Technical Pearls and Pitfalls

Pearls	Pitfalls
Anterior portal placement that allows for ease of access above AND below biceps tendon.	Inability to access proximal aspect of biceps groove with anterior portal placement.
Suture loop placed as close to insertion on labrum as possible (allows for tensionless tenodesis).	Suture loop placed adjacent to proximal end of the tenotomized biceps tendon (could lead suture pull-out)
Tenotomize biceps at insertion on the superior labrum.	Avoid multiple passes with penetrating grasper through biceps tendon to prevent damage.
Use marking wire to maintain drill hole location while inserting knotless anchor.	
Radiofrequency ablation of proximal tip of biceps tendon to promote “mushrooming” and reduce potential for suture loop pull out.	

anteromedial anchor of a supraspinatus repair or the superior anchor in a subscapularis repair.

Biceps pathology is a common problem, with multiple surgical management options.² Numerous techniques have been proposed without clear evidence of a superior technique.¹¹ We present an all intra-articular technique for proximal biceps tenodesis with knotless fixation and tensionless repair to prevent “Popeye” deformity associated with tenotomy. This technique has

Table 2. Advantages and Disadvantages

Advantages	Disadvantages
Technical ease with simple, intra-articular technique under direct visualization from posterior portal.	Learning curve for new surgeons.
Prevents “Popeye” deformity with proximal fixation.	Potential risk for intra-operative suture pullout off the proximal biceps tendon if the suture is placed too close to the cut tip of the biceps.
ONLAY technique prevents overtensioning the tendon.	Reliant on suture anchor fixation until tendon scars within the groove.
Renders biceps groove pathology irrelevant.	Pain to palpation at anchor site (resolves over 1-2 months).
Flexibility to incorporate tenodesis into rotator cuff repair.	
Does not require finding the biceps in the subacromial space.	
Early active and passive range of motion (isolated biceps tenodesis).	
Versatility in anchor choice (authors have used 2.9 PushLock, 3.5/4.75 SwiveLock (Arthrex, Naples, FL) anchors with success)	

shown good results in early clinical outcome studies.¹³ Further research is needed to better elucidate long-term outcome data and complication profile.

References

1. Frost A, Zafar MS, Maffulli N. Tenotomy versus tenodesis in the management of pathologic lesions of the tendon of the long head of the biceps brachii. *Am J Sports Med* 2009;37:828-833.
2. Hsu AR, Ghodadra NS, Provencher CMT, Lewis PB, Bach BR. Biceps tenotomy versus tenodesis: A review of clinical outcomes and biomechanical results. *J Shoulder Elbow Surg* 2011;20:326-332.
3. Friedman JL, FitzPatrick JL, Rylander LS, Bennett C, Vidal AF, McCarty EC. Biceps tenotomy versus tenodesis in active patients younger than 55 years: Is there a difference in strength and outcomes? *Orthop J Sports Med* 2015;3:232596711557084.
4. Gurnani N, van Deurzen DFP, Janmaat VT, van den Bekerom MPJ. Tenotomy or tenodesis for pathology of the long head of the biceps brachii: A systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* 2016;24:3765-3771.
5. Nair R, Kahlenberg CA, Patel RM, Knesek M, Terry MA. All-arthroscopic suprapectoral biceps tenodesis. *Arthrosc Tech* 2015;4:e855-e861.
6. Saper D, Li X. A Simple, All-arthroscopic, knotless suture lasso loop technique for suprapectoral biceps tenodesis. *Arthrosc Tech* 2017;6:e635-e639.
7. Haupt ET, O’Keefe K, Farmer K. Arthroscopic all-inside biceps tenodesis: Technique and outcomes. *Arthrosc Tech* 2019;8:e1485-e1489.
8. Daggett M, Stepanovich B, Meyers A, Geraghty B. Arthroscopic on-lay biceps tenodesis: The loop-lock technique. *Arthrosc Tech* 2019;8:e935-e939.
9. Werner BC, Holzgrefe RE, Brockmeier SF. Arthroscopic surgical techniques for the management of proximal biceps injuries. *Clin Sports Med* 2016;35:113-135.
10. Kerschbaum M, Alt V, Pfeifer C. The all-inside arthroscopic loop tenodesis procedure to treat long head of biceps tendon pathologies. *Arthrosc Tech* 2019;8:e1551-e1554.
11. McCrum CL, Alluri RK, Batech M, Mirzayan R. Complications of biceps tenodesis based on location, fixation, and indication: A review of 1526 shoulders. *J Shoulder Elbow Surg* 2019;28:461-469.
12. Kelly AM, Drakos MC, Fealy S, Taylor SA, O’Brien SJ. Arthroscopic release of the long head of the biceps tendon: Functional outcome and clinical results. *Am J Sports Med* 2005;33:208-213.
13. Duerr RA, Nye D, Paci JM, Akhavan S. Clinical evaluation of an arthroscopic knotless suprapectoral biceps tenodesis technique: Loop ‘n’ tack tenodesis. *Orthop J Sports Med* 2018;6:232596711877978.
14. Gill TJ, McIrvin E, Mair SD, Hawkins RJ. Results of biceps tenotomy for treatment of pathology of the long head of the biceps brachii. *J Shoulder Elbow Surg* 2001;10:247-249.
15. Sanders B, Lavery KP, Pennington S, Warner JJP. Clinical success of biceps tenodesis with and without release of the transverse humeral ligament. *J Shoulder Elbow Surg* 2012;21:66-71.