

Biceps Tenodesis: Options for Fixation

Scientific Update



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A variety of options exist for fixation in performing biceps tenodesis. Options range from soft-tissue tenodesis alone, in which the biceps is sewn to the remaining rotator cuff, or anchor-based fixation. The latter is superior from a biomechanical standpoint and has been clinically shown to improve outcomes. Anchor-based options include suture anchors, interference screws, and buttons. Anchor-based fixation can also be divided into onlay and inlay techniques. With an onlay technique, the tendon lies on the cortical surface of the humerus (eg, unicortical button). With an inlay technique, a portion of the tendon is delivered into the socket (eg, interference screw technique). In recent years, onlay techniques have become more popular based on ease of the procedure and biomechanical and clinical data.

Soft-Tissue Tenodesis Compared To Anchor-Based Fixation

[Arthroscopic soft-tissue tenodesis vs bony fixation anchor tenodesis of the long head of the biceps tendon.](#) *Am J Sports Med.* 2011;39(5):1046-1052. doi:10.1177/0363546510390777

- This was a prospective evaluation of 57 arthroscopic biceps tenodeses comparing method of fixation.
 - 24 soft-tissue tenodeses
 - 20 anchor-based tenodeses with a suture anchor
- Postoperative Constant scores were the same between the two groups.
- The long head of the biceps (LHB) score (a scoring system to assess the biceps based on cramping, cosmesis, and elbow flexion strength) was improved in the anchor-based group.
- Healing was improved in the anchor-based group.
 - 25% healing with soft-tissue fixation
 - 65% with anchor-based fixation
- **Takeaway: Healing and LHB scores are improved with an anchor-based technique compared to a soft-tissue method for biceps tenodesis.**

Hwang JT,
Yang CJ,
Noh KC,
Yoo YS,
Hyun YS,
Lee YB,
Liu X

Which is better for arthroscopic tenodesis of the long head of the biceps: soft-tissue or bony interference fixation? *Arthroscopy*. 2016;32(4):560-567. doi:10.1016/j.arthro.2015.10.024

- This was a randomized controlled trial of soft-tissue tenodesis to anchor-based biceps tenodesis with an interference screw.
 - 25 soft-tissue tenodesis
 - 28 anchor-based tenodesis with a 5.5 mm interference screw
 - 2-year follow-up
- ASES scores were similar between groups.
- Elbow flexion strength was higher in the anchor-based group ($P = .006$).
- Healing by ultrasound was higher in the anchor-based group ($P = .046$).
 - 93% interference-screw group
 - 72% soft-tissue group
- **Takeaway: Biceps healing and postoperative elbow flexion strength are higher with an anchor-based tenodesis compared to a soft-tissue tenodesis.**

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(3):461-469. doi:10.1016/j.jse.2018.09.005

- This was a retrospective evaluation of 1526 patients who underwent biceps tenodesis in the Kaiser Health System.
 - 996 tenodeses were done “out of the groove” (subpectoral)
 - 209 soft-tissue based
 - 6 keyhole
 - 781 anchor-based (anchor, tenodesis screw, or button)
 - 530 tenodeses were done “in the groove” (arthroscopic)
 - 144 soft-tissue based
 - 386 anchor based
- There was no difference in postoperative pain based on location.
- Soft-tissue tenodeses had higher new onset post-op pain (11.9% compared to 2.6%; $P < .001$) and subjective weakness (8.5% compared to 3.9%; $P < .001$) compared to the use of an anchor.

Takeaways

- **Postoperative pain does not vary based on location of tenodesis.**
- **Tenodesis performed with an anchor is more reliable than soft-tissue tenodesis alone.**



Chiang FL,
Hong CK,
Chang CH,
Lin CL,
Jou IM,
Su WR

Anchor-Based Options

[Biomechanical comparison of all-suture anchor fixation and interference screw technique for subpectoral biceps tenodesis.](#) *Arthroscopy*. 2016;32(7):1247-1252. doi:10.1016/j.arthro.2016.01.016

- This was a biomechanical evaluation of subpectoral tenodesis with 2 inlay techniques in 16 cadaveric shoulders.
 - An all-suture anchor placed bicortically
 - Near cortex reamed to 5 mm to allow tendon to dock in the canal
 - An 8 mm interference screw
- Cyclic displacement was slightly higher in the all-suture anchor group (8.1 mm compared to 3.4 mm; $P = .0002$).
- Load-to-failure was equal between the 2 groups (239 N compared to 254 N; $P = .878$).
- **Takeaway: Cyclic displacement is slightly higher (5 mm) with a bicortical all-suture anchor technique compared to an interference screw. However, there is no difference in load-to-failure between techniques.**

Cagle PJ, Jr.,
London DA,
Gluck MJ,
Morel S,
Parsons BO

[Long head of biceps tenodesis at the superior aspect of the biceps groove: A biomechanical comparison of inlay and onlay techniques.](#) *Shoulder Elbow*. 2020;12(1):12-17. doi:10.1177/1758573218815281

- Biomechanical evaluation of proximal biceps tenodesis in 6 cadavers.
- Tendons were whipstitched and secured at the articular margin.
 - Inlay technique with a 7 mm interference screw
 - Onlay technique with a 4.75 SwiveLock® anchor
- No difference in load-to-failure between the groups.
- **Takeaway: An onlay technique has equivalent biomechanical strength to an inlay technique with an interference screw for proximal biceps tenodesis.**

Buchholz A,
Martetschläger F,
Siebenlist S,
et al

[Biomechanical comparison of intramedullary cortical button fixation and interference screw technique for subpectoral biceps tenodesis.](#) *Arthroscopy*. 2013;29(5):845-853. doi:10.1016/j.arthro.2013.01.010

- Biomechanical comparison of subpectoral tenodesis in 10 matched paired cadavers.
 - Onlay technique with a unicortical button (BicepsButton™ technique)
 - Inlay technique with an interference screw
- No differences in load-to-failure or cyclic displacement between groups.
- **Takeaway: A unicortical onlay button technique has equivalent biomechanical strength to an inlay technique with an interference screw.**



Park JS,
Kim SH,
Jung HJ,
Lee YH,
Oh JH

[A prospective randomized study comparing the interference screw and suture anchor techniques for biceps tenodesis.](#) *Am J Sports Med.* 2017;45(2):440-448. doi:10.1177/0363546516667577

- This was a randomized controlled trial of interference screw fixation compared to suture anchor fixation for biceps tenodesis.
 - 33 interference screws (8 mm interference screw)
 - 34 suture anchors
 - Postoperative MRI or ultrasound was used to assess healing
- There were 7 failures in the screw group (21%).
- There were 2 failures in the anchor group (6%).
- In a multivariate analysis, interference screw fixation and higher work level were associated with failure
- **Takeaway: While biomechanically robust, there is risk of clinical failure with an interference screw technique likely secondary to the screw cutting into the tendon during insertion and the sharp angle (90°) of fixation.**

Tan H,
Wang D,
Lebaschi AH,
Hutchinson ID,
Ying L,
Deng XH,
Rodeo SA,
Warren RF

[Comparison of bone tunnel and cortical surface tendon-to-bone healing in a rabbit model of biceps tenodesis.](#) *J Bone Joint Surg Am.* 2018;100(6):479-486. doi:10.2106/JBJS.17.00797

- This was a rabbit study of biceps tenodesis to evaluate inlay compared to onlay technique.
 - Rabbits were harvested at 8 weeks and healing was evaluated
- Healing was similar between groups.
- Healing occurred at the cortical surface in both groups with tendon-bone interdigitation.
- There was minimal tendon-bone healing within the bone tunnels in the inlay group.
- **Takeaway: In the rabbit model, the majority of the healing of biceps tenodesis occurs to the cortex. This data supports an onlay technique assuming biomechanical equivalence.**

Lacheta L,
Rosenberg SI,
Brady AW,
Dornan GJ,
Millett PJ

[Biomechanical comparison of subpectoral biceps tenodesis onlay techniques.](#) *Orthop J Sports Med.* 2019;7(10):2325967119876276. doi:10.1177/2325967119876276

- This was a biomechanical evaluation of 2 techniques for unicortical onlay biceps tenodesis in 10 cadavers.
 - Metal button (BicepsButton™ button)
 - All-suture anchor (1.8 mm FiberTak® anchor)
- There was no difference in load-to-failure between groups.
- The failure modes differed.
 - Metal button: 100% tendon tearing
 - All-suture anchor: 56% tendon tearing; 44% knot failure

Takeaways

- **Biomechanical properties are similar between onlay techniques using a button or all-suture anchor.**
- **Tissue quality, stitch configuration, and knot security are greater limiting factors in biceps tenodesis than anchor pull-out.**



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(6):2325967118779786. Published 2018 Jun 26. doi:10.1177/2325967118779786

- Retrospective evaluation of 59 patients treated with an onlay technique.
 - Loop 'N' Tack suture fixation
 - Knotless anchor
- Zero postoperative popeye deformities.
- 5% of patients had biceps cramping with overuse.
- 97% of patients were satisfied.
- **Takeaway: An onlay technique for biceps tenodesis, in this case with a Loop 'N' Tack suture configuration, is associated with excellent clinical outcomes.**