Orthopedics and Rheumatology
Open Access Journal
ISSN: 2471-6804

Research Article
Volume 19 issue 3 - January 2022
DOI: 10.19080/OROAJ.2022.19.556020

Ortho & Rheum Open Access J


# Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation

**Taylor L Simonian and Peter T Simonian***

*Simonian Sports Medicine Clinic Clovis, CA, USA*

**Submission:** January 10, 2022; **Published:** January 20, 2022

***Corresponding author:** Peter T Simonian, Associate Professor, University of Washington Department of Orthopaedic Surgery and Sports Medicine, Simonian Sprots Medicine Clinic 729 N Medical Center Drive West, Suite 101 Clovis CA, 93611, USA

## Introduction

The triceps tendon inserts on the olecranon and controls elbow extension. It is made up of the long, lateral and medial head, all of which the radial nerve innervates. Triceps tendon tears usually occur from a traumatic eccentric flexion load to the elbow. Injury to the triceps tendon causes a loss of strength in elbow extension [1]. Triceps injuries appear to be more common in males compared to females [2]. The rupture of the triceps is relatively uncommon. Less than 1% of upper limb tendon injuries involve the triceps tendon [3]. Triceps tendon ruptures are most frequent at the osseous-tendon intersection [4]. Complete or partial rupture of the triceps tendon can occur [4]. However, certain systemic diseases and comorbidities, such as hyperparathyroidism, and use of anabolic steroids, may increase the risk of this injury [5,6].

For complete tears, immediate surgical reattachment is indicated. Prompt diagnosis and surgical treatment increases outcome of successful recovery [3]. Approximately 89% of patients return to preinjury mobility after surgical repair [6]. Several techniques have been described utilizing a variety of suture anchors and bone hole fixation. The unique anatomy of the olecranon and the distal triceps tendon present limitations and constraints to fixation. There is also concern for fixation prominence because of the subcutaneous prominence of the dorsal olecranon secondary to limited muscular coverage in the area.

We present a unique technique that combines direct bone fixation thru bone tunnels with augmentation utilizing a tension band construct with a single knotless anchor. We also incorporate the unique features of continuous loop permanent sutures that have a straight Keith needle attached. The continuous loop allows for ease and efficiency of secure placement of a knotless locking suture in the triceps tendon for direct fixation to the olecranon. The attached straight Keith needle allows for ease of passage of the straight needles thru the longitudinal bone tunnels, and ease of placement of the sutures in the triceps tendon transversely to complete the tension band construct. A single knotless anchor is used to secure a second tension band to the olecranon, minimizing subcutaneous prominence. This construct is economically feasible with the use of only one single knotless anchor. The technique is efficient utilizing the attached straight Keith needles for multiple steps of the construct.

## Technique

This redundant fixation technique utilizes two, #2 Fiberloop (Arthrex, Naples FL) sutures with attached Keith needles and a single knotless anchor. A 2.0 mm drill, burr or rongeur, and an appropriate knotless anchor drill and tap are required.

One Fiberloop suture with the Keith needle is placed along the medial border of the disrupted triceps tendon and the other on the lateral border. The suture begins approximately 3 – 4 cm proximal along the medial and lateral borders of the tendon. The suture is initially locked with the closed suture loop (Figure 1). The suture then is placed in a whip-stitch fashion from proximal to distal and can be locked within the loop of the suture (Figure 2). The ulnar nerve must be protected along the medial border of the triceps tendon.

The insertion site of the triceps tendon is derided on the olecranon with a motorized burr or rongeur. Two, 2mm drill holes are placed parallel to one another (Figure 3). The starting point is at the triceps insertion site on the olecranon and exiting the dorsal cortex of the ulna distally, one hole placed more medial and the other more lateral, with a substantial cortical bridge left between the two exit holes. The drill holes are angled in a manner to avoid articular penetration.

The two Keith needles from the Fiberloop sutures are passed thru each of the olecranon bone tunnels (Figure 4). The arm is extended, and the triceps tendon is secured to the olecranon with a single throw square knot of the 2 Fiberloop sutures (4 strands) across the cortical bridge on the distal olecranon (Figure 5). Only a single throw knot is utilized to minimize prominence on the dorsal olecranon surface (another option is to tension the sutures with no knot to avoid the slightest prominence). The Keith needles are not cut from each of the Fiberloops. This completes the direct fixation of the triceps tendon to the olecranon.

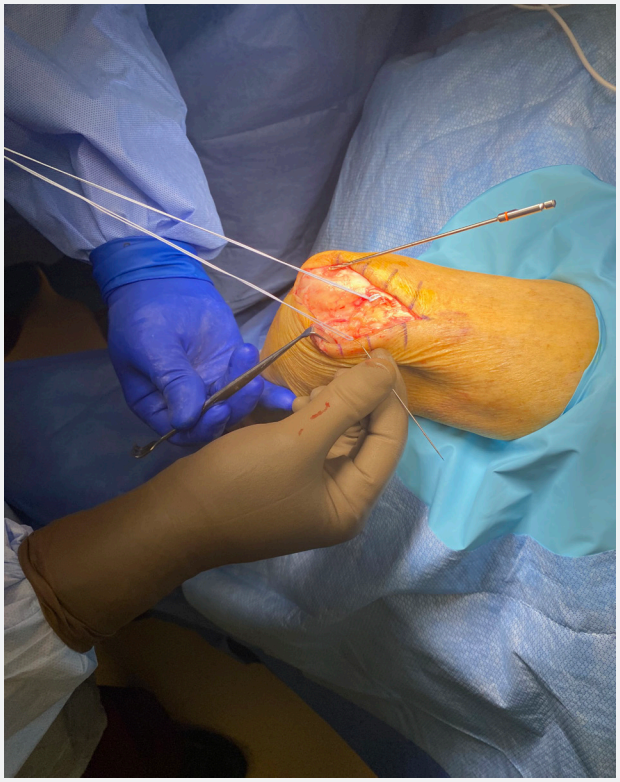

**Figure 1:** #2 Fiberloop suture locked in the proximal lateral border of the ruptured triceps tendon.

**Figure 2:** The suture is placed in a whip stitch fashion from proximal to distal and can be locked within the loop of the suture. The ulnar nerve must be protected along the medial border of the triceps tendon.



**How to cite this article:** Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020

**Figure 3:** Two, 2mm drill holes are placed parallel to one another. The starting point is at the triceps insertion site on the olecranon and exiting the dorsal cortex of the ulna distally, one hole placed more medial and the other more lateral, with a substantial cortical bridge left between the two exit holes. The drill holes are angled in a manner to avoid articular penetration.

**Figure 4:** The two Keith needles from the Fiberloop sutures are passed thru each of the parallel olecranon bone tunnels.



**How to cite this article:** Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020

**Figure 5:** The arm is extended, and the triceps tendon is secured to the olecranon with a single throw square knot of the 2 Fiberloop sutures (4 strands) across the cortical bridge on the distal olecranon. This completes the direct triceps tendon fixation to the olecranon. (The Keith needles are not removed from the Fiberloops).

**Figure 6:** The Keith needles of each Fiberloop are then placed transversely thru the triceps tendon approximately 3-4 cm proximal. One is placed medial to lateral and the other is placed lateral to medial. The ulnar nerve must be protected at all times.



How to cite this article: Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020

**Figure 7:** A single knotless anchor is then used to fix the 4 Fiberloop strands distal to the previously drilled longitudinal drill holes on the dorsal ulnar surface, the drill hole is angled distally to prevent penetration of the deep cortex on the ulna.

**Figure 8:** The knotless anchor secures the Fiberloop tension band construct with the arm in extension.



**How to cite this article:** Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020

The Keith needles of each Fiberloop are then placed transversely thru the triceps tendon approximately 3-4 cm proximal in a Bunnell fashion. One is placed medial to lateral and the other is placed lateral to medial (Figure 6). The ulnar nerve must be always protected. A single knotless anchor is then used to fix the 4 Fiberloop strands distal to the previously drilled longitudinal drill holes on the dorsal ulnar surface, the drill hole is angled distally to prevent penetration of the deep cortex on the ulna (Figure 7). This example utilizes a Healicoil Knotless suture anchor (Smith and Nephew, Mansfield, MA). The cortical bone must be tapped prior to anchor placement. Similar knotless anchors could be utilized, a shorter anchor construct would be preferrable. The tension band is tensioned with the arm in extension. This completes the redundant tension band construct (Figure 8).

An alternative fixation technique could be employed with deletion of the single knotless suture anchor and use of a single tension band construct rather than redundant tension bands. After the direct bone fixation as described above, a single tension band could be simply tied at the triceps tendon after the Bunnell sutures are passed, rather than making a redundant tension band and adding a knotless anchor to secure the second tension band.

## Discussion

Several techniques using transosseous tunnels and suture anchors have been described to repair triceps tendon injuries [2,4-7]. These techniques may result in large suture knots located underneath thin subcutaneous tissue, and potentially cause discomfort in patients [7]. A 21% re-rupture rate has been seen in transosseous cruciate repair technique [5,8]. Displacement can occur with the transosseous repair technique and limit proper healing [2]. Another technique using bone tunnels and a knotless anchor appears to be less effective than the traditional transosseous cruciate repair technique in regard to load failure [5]. Additionally, the suture bridge technique can result in joint stiffness, heterotopic ossification and chance of traumatic re-rupture [2]. The triceps pulley-pullover technique is a successful triceps tendon repair technique; however, it can result in discomfort due to large superficial knots bordering the triceps tendon [4].

We present a unique technique that combines direct bone fixation thru bone tunnels with augmentation utilizing a tension band construct with a single knotless anchor. This combined redundant fixation construct is durable and secure. The ease of placement allows for efficient and reproducible surgical technique. The construct is low profile with minimal prominence. A modification of the technique can be employed deleting the requirement for a suture anchor by deleting one of the redundant tension bands.

The key features of this construct include the continuous loop suture that allows for knotless locking in the triceps tendon; the attached straight Keith needle allows for ease of passage of the straight needles thru the longitudinal bone tunnels, and ease of placement of the sutures in the triceps tendon transversely to complete the tension band construct; and a single knotless anchor (or none) to secure the redundant tension band to the olecranon, minimizing subcutaneous prominence and cost.

## References


1. Bennett JB, Mehlhoff TL (2015) Triceps Tendon Repair. J Hand Surg Am 40(8): s1677-1683.
2. Edelman D, Ilyas AM (2018) Triceps Tendon Anatomic Repair Utilizing the “Suture Bridge” Technique. J Hand Microsurg 10(3): 166-171.
3. Kocialkowski C, Carter R, Peach C (2018) Triceps tendon rupture: repair and rehabilitation. Shoulder Elbow 10(1): 62-65.
4. Dimock RAC, Kontoghiorghe C, Consigliere P, Salamat S, Imam MA, et al. (2019) Distal Triceps Rupture Repair: The Triceps Pulley-Pullover Technique. Arthrosc Tech 8(1): e85-e91.
5. Scheiderer B, Lacheta L, Imhoff AB, Sebastian Siebenlist (2017) V-shaped double-row distal triceps tendon repair: a novel technique using unicortical button fixation. Eur J Med Res 22(1): 9.
6. Dunn JC, Kusnezov N, Fares A, Sydney Rubin, Justin Orr, et al. (2017) Triceps Tendon Ruptures: A Systematic Review. Hand 12(5): 431-438.
7. Sarokhan AK, Leung NL (2019) Acute Triceps Tendon Repair: A Technique Utilizing 3 Curved Tunnels and Proximal Knots. Arthrosc Tech 8(7): e705-e712.
8. Van Riet RP, Morrey BF, Ho E, O’Driscoll SW (2003) Surgical treatment of distal triceps ruptures. J Bone Joint Surg Am 85(10): 1961-1967.




How to cite this article: Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020

DOI: 10.19080/OROAJ.2022.19.556020





**How to cite this article:** Taylor S, Peter T S. Triceps Tendon Repair – Combined Direct Fixation with Tension Band Augmentation. Ortho & Rheum Open Access J. 2022; 19(4): 556020. DOI: 10.19080/OROAJ.2022.19.556020