Ulnar Collateral Ligament Reconstruction of the Elbow: The Docking Technique

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Abstract: Reconstruction of the ulnar collateral ligament (UCL) is one of the most commonly performed surgical procedures in overhead throwing athletes. Since its initial description, the procedure has undergone a number of technical modifications and advancements. This has resulted in multiple described techniques for UCL reconstruction. One of the most commonly performed UCL reconstruction methods is the docking technique. It has the advantages of minimizing injury to the flexor-pronator mass, avoiding the ulnar nerve, allowing robust graft tensioning, and reducing the amount of bone removed from the medial epicondyle compared with previously described techniques. This article provides a detailed description and video demonstration of how to perform this technique. When precise surgical steps are followed and postoperative rehabilitation appropriately progresses, this procedure has a well-documented history of reliably returning athletes to competitive throwing.

The ulnar collateral ligament (UCL) is the primary restraint to valgus force exerted on the elbow during the late cocking and early acceleration phases of throwing.[1-4] Repetitive overhead throwing can result in attenuation, insufficiency, or rupture of the UCL, which typically manifests as medial elbow pain and decreased throwing performance evidenced by reduced velocity, poor control, and decreased endurance.[1,2] Since UCL reconstruction was first described in 1986,[5] the surgical technique, rehabilitation, and clinical outcomes have been studied greatly.[1,2] Despite targeted prevention programs, the rates of elbow injury and UCL reconstruction surgery continue to rise in overhead athletes of all ages.[3] In an attempt to improve functional outcomes in patients requiring UCL reconstruction, a number of surgical techniques have been developed.[3,5-7]

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Initially described in 2002, the docking technique is one of the most commonly used methods of UCL reconstruction.[3] It was developed in an attempt to reduce disruption of the common flexor origin by using a muscle-splitting approach and reduce the risk of injury to the ulnar nerve by avoiding routine transposition. This technique allows robust tensioning of the graft because it is tied over a bone bridge, and it reduces the amount of bone removed from the medial epicondyle compared with prior techniques. When precise surgical steps are followed, approximately 90% of patients are able to return to their preinjury level of activity after UCL reconstruction with the docking technique.[4,8] The purpose of this work is to provide descriptive and video step-by-step instructions on how to perform the docking technique for UCL reconstruction (Video 1). It is our hope that a full understanding of this technique will allow surgeons to perform UCL reconstruction in a safe, effective, and efficient manner that maximizes the return-to-play potential for their patients. In this particular demonstration, tunnels are drilled in a freehand fashion. Alternatively, a UCL Docking Technique Instrument Set (Arthrex, Naples, FL) can be used if desired.

Technique

Patient Positioning and Anesthesia

Generally, the procedure is performed with the patient under regional anesthesia with sedation. Once the

regional blockade is administered, the patient is placed in the supine position. A nonsterile tourniquet is placed high on the arm. If concomitant arthroscopy is indicated (loose body removal, posteromedial olecranon osteophyte debridement, and so on), this is performed before the UCL reconstruction with the arm across the chest in an arm holder. Once completed, the arm is removed from the holder and placed on a hand table. The surgeon is positioned at the axilla of the patient. The limb is exsanguinated and the tourniquet inflated for the duration of the case.

Harvest of Palmaris Longus Autograft

Although our preferred graft choice is ipsilateral palmaris longus, gracilis autograft or other allograft tendon can be used. To harvest the palmaris longus, a 1-cm incision is centered over the tendon at the proximal volar wrist crease. A Krackow stitch is placed in the distal end of the tendon using a No. 1 Ethibond suture (Ethicon, Somerville, NJ). The tendon is sharply released distal to the suture, and a tendon stripper is used to procure the tendon proximally. Once free, sutures are not placed in the proximal end, which is left free for now (Fig 1A). The tendon is placed on the back table in a saline solution–soaked sponge, and the volar wrist wound is closed. Attention is then turned to the medial side of the elbow.

Incision and Exposure

An 8-cm incision is created just anterior to the center of the medial epicondyle. This incision extends from the medial intermuscular septum to approximately 2 cm distal to the sublime tubercle of the ulna (Fig 1B). Care is taken to ensure that the incision does not cross the path of the ulnar nerve. Branches of the medial antebrachial cutaneous nerve are identified and preserved throughout the case. The fascia of the common flexor-pronator mass is sharply incised in line with the UCL (Fig 1C). Blunt dissection is carried out through the anterior-most fibers of the flexor carpi ulnaris down to the UCL and joint capsule. The anterior band of the UCL is incised longitudinally (in line with its fibers) down to the level of the joint. The native ligament is tagged with 2 No. 0 Vicryl sutures (Ethicon) for later repair.

Preparation of Ulnar Tunnel

Attention is then turned to the UCL insertion site on the sublime tubercle. Bone is subperiosteally exposed 5 mm anterior and 5 mm posterior to the apex of the sublime tubercle, which is typically 7 to 10 mm distal to the ulnohumeral joint line. Two 3.5-mm-diameter converging tunnels are drilled on either side of the tubercle (anterior and posterior). The tunnels should be at least 1 to 2 cm apart at the cortex and should coalesce at

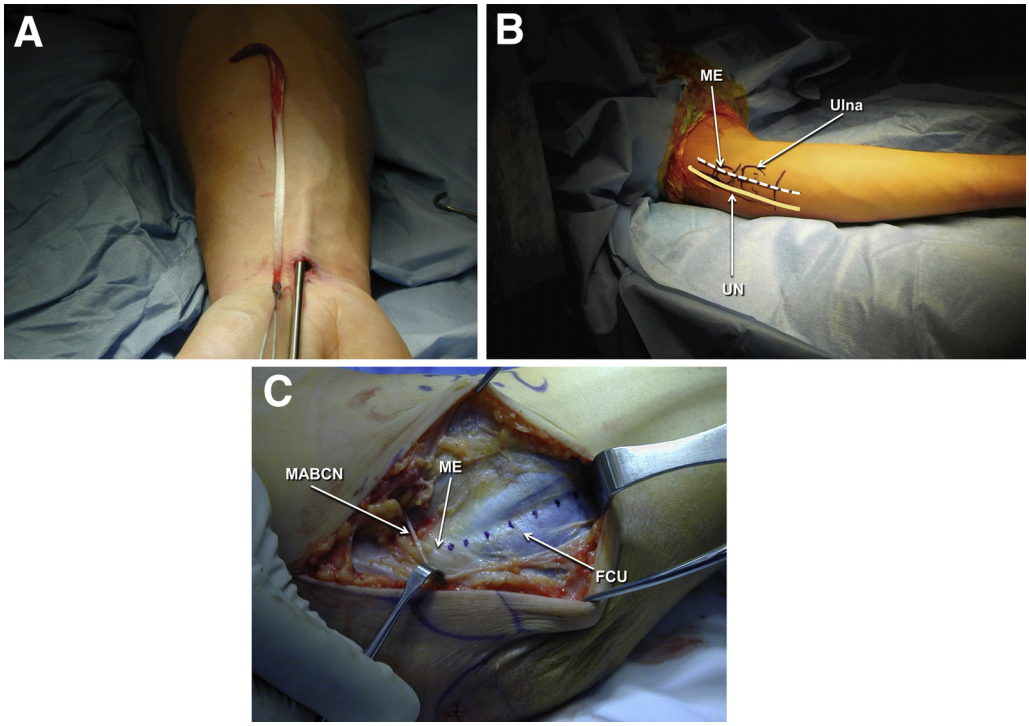

Fig 1. Our preferred graft is the ipsilateral palmaris longus. (A) With the patient supine and the left arm on an arm table, the graft is harvested through a single incision in the distal forearm. (B) As shown on this left elbow, the incision (dotted line) is approximately 8 cm long, travels just anterior to the center of the medial epicondyle (ME) toward the sublime tubercle, and does not cross the path of the ulnar nerve (UN). (C) The medial antebrachial cutaneous nerve (MABCN) is preserved, and the fascia is incised at the anterior aspect of the flexor carpi ulnaris (FCU).

their base. To confirm tunnel convergence, a curved curette is inserted into 1 tunnel and visualized through the other (Fig 2A). A looped stainless steel wire on a curved needle is used to pass a looped No. 0 Vicryl suture from 1 tunnel to the other. This suture is tagged for later graft passage.

Preparation of Docking Site on Medial Epicondyle

The humeral footprint of the UCL on the anterior-inferior surface of the medial epicondyle is subperiosteally identified. A 4.5-mm drill or burr is used to create a socket in the center of the footprint to a depth of 15 mm (Fig 2B). This socket is directed proximal and posterior, but great care is taken to protect the ulnar nerve and prevent penetration of the far cortex. Two 1.5-mm sockets that converge with the single 4.5-mm socket are drilled. The two 1.5-mm sockets should be just anterior to the medial intermuscular septum and at least 5 to 10 mm apart from one another (Fig 2C). As before, a suture passer on a curved needle is used to pass a looped suture from one of the 1.5-mm sockets to the 4.5-mm socket. The same is performed for the other 1.5-mm socket. It is critical that the looped end of each suture remain on the side of the 4.5-mm socket while the free ends are retrieved through the 1.5-mm sockets. These sutures are tagged separately.

Graft Passage

After all sockets have been placed but before graft passage, the native UCL and capsule are closed with the elbow in 30° of flexion as a slight varus load is applied. The elbow should remain in this position for the remainder of the procedure. The tag sutures previously placed at the posterior aspect of the UCL can be used to formally close the native ligament and capsule. Now, by use of the looped suture, the graft is passed through the ulnar tunnel. The distal end of the palmaris graft (the end with the previously placed Krackow stitch) is passed into the 4.5-mm socket on the medial epicondyle, and the graft suture is retrieved through the anterior 1.5-mm socket. The graft docks as it encounters the 1.5-mm socket, but the sutures are easily retrieved.

Graft Tensioning and Length Determination

Tension is applied and maintained on the sutures exiting the anterior 1.5-mm socket. The other limb of the graft is tensioned toward the 4.5-mm socket. The graft is marked at this entry point (Fig 3A). Another No. 1 Ethibond suture is placed in the graft in a Krackow fashion. This suture begins at the marked entry point and travels toward the free end of the graft for 1 cm. Excess graft is cut, and the suture is passed through the

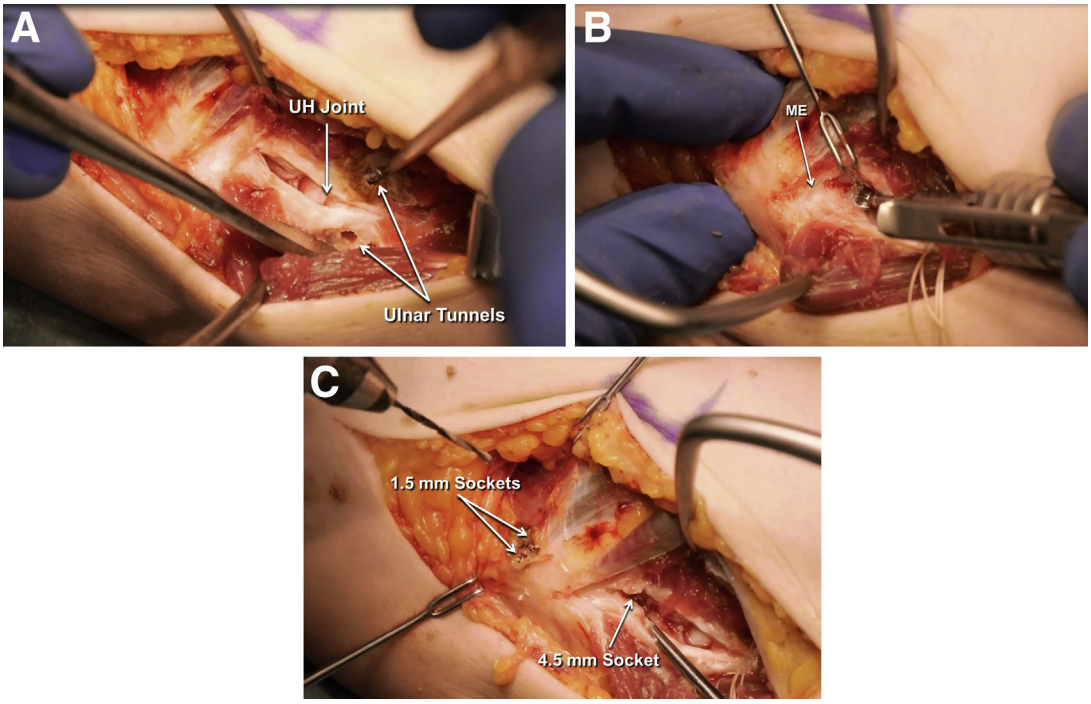

Fig 2. (A) When viewing the medial aspect of this left elbow, once the capsule and native ulnar collateral ligament have been split longitudinally, the ulnohumeral (UH) joint is easily visualized. The 2 ulnar tunnels are anterior and posterior to the sublime tubercle and coalesce at their bases. (B) Proximally, the humeral socket is created at the origin of the ulnar collateral ligament at the anterior-inferior aspect of the medial epicondyle (ME). (C) Two 1.5-mm sockets are created proximally that connect to the base of the 4.5-mm socket. Sutures are later retrieved through these sockets to dock the graft in the 4.5-mm socket.

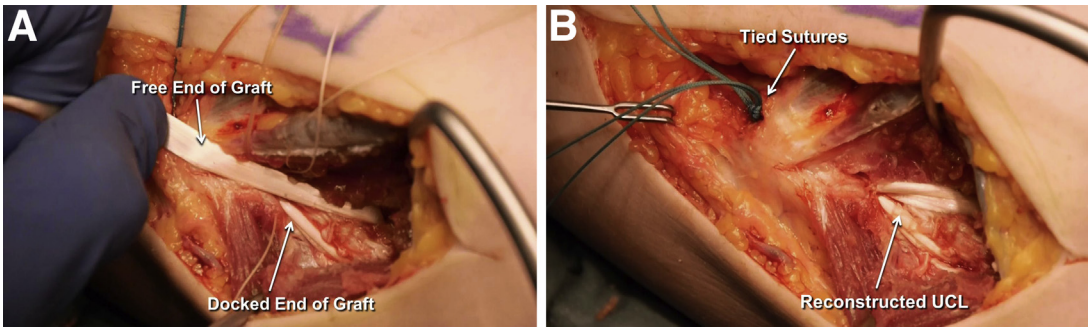

Fig 3. (A) Viewing this left elbow from the medial side, one can see that the graft has been passed through the ulna and the sutured end is docked in the 4.5-mm socket. The free end is then tensioned across the entry site of the socket, and the length is marked at this location. A Krackow suture is placed at this location, and the excess graft is trimmed. This suture is passed into the 4.5-mm socket and retrieved through the empty 1.5-mm socket. (B) After both ends are docked, the graft is tensioned and the sutures are securely tied over the bone bridge between the two 1.5-mm sockets. (UCL, ulnar collateral ligament.)

4.5-mm socket exiting the other 1.5-mm socket. The surgeon should tension both sutures to ensure that the graft is taut across the joint and that both ends are secured in the 4.5-mm socket.

Final Fixation

Cycling of the graft is performed by repetitively flexing and extending the elbow while holding tension on the sutures. Afterward, the elbow is placed in 30° of flexion, gentle varus, and supination. Sutures are tied securely over the bone bridge (Fig 3B). The knot is buried beneath the fascia of the common flexor mass. Finally, the tourniquet is released and hemostasis is obtained. The wound is closed in layers, and the elbow is splinted in approximately 75° of flexion.

Postoperative Rehabilitation

The splint is removed 1 week postoperatively, and the patient is placed into a hinged elbow brace. While in the brace, elbow range of motion (ROM) is allowed from 30° to 90° initially, and this is advanced to 15° to 105° between weeks 3 and 5. The brace is discontinued at 6 weeks, and formal physical therapy is initiated. From weeks 6 to 12, the focus of physical therapy is on elbow ROM and shoulder and wrist strength and ROM. This is advanced as tolerated. Beginning at 16 weeks, a formal throwing program is initiated. Throwing begins at a distance of 45 ft on flat ground and is slowly advanced as tolerated. If the patient is able to throw 180 ft on flat ground without pain at the 7-month mark, throwing from the mound is permitted. This is slowly advanced over the next 3 months with the goal of returning to competitive pitching at 1 year.

Table 1. Advantages, Limitations, and Potential Pitfalls of Technique

Advantages
The need for routine ulnar nerve exposure and/or transposition is avoided.
Bone loss is reduced.
Damage to the flexor-pronator origin is minimized through a muscle-splitting approach.
Precise and controlled tensioning of the graft is permitted.
The technique has a historically high rate of return to throwing and an elite level of performance.
Limitations and potential pitfalls
The ulnar nerve is not visualized, so the surgeon must remain mindful of its location, especially when drilling.
Precise knowledge of anatomic landmarks is required.
As with all techniques, patients without a palmaris longus will require an alternative graft source.
Technical precision is required to ensure that the tunnels coalesce at their bases.
A looped suture/wire may be difficult to pass if tunnel geometry is not appropriate.

Discussion

Although disruption of the UCL was previously a career-ending injury for overhead throwers, many advances have been made in the past 25 years. In an attempt to reduce the number of pitchers having elbow pain and decreased performance, injury-prevention programs are being implemented at all levels of baseball. Despite these efforts, the rates of UCL injuries continue to rise.[1] For patients with failure of

Table 2. Key Points for Ulnar Collateral Ligament Reconstruction

Identify and preserve the medial antebrachial cutaneous nerve when present.
Use a muscle-splitting approach through the flexor pronator mass.
Be mindful of the ulnar nerve when drilling tunnels and sockets.
Space all tunnels and sockets at least 1 to 2 cm apart to provide a stable bridge.
Use precision when trimming the second limb of graft to ensure it is long enough to reach the socket without bottoming out prematurely (resulting in laxity).
Tension the graft with the elbow in 30° of flexion, varus, and supination.

Table 3. Equipment Required

Tendon stripper for graft harvest
4.5-, 3.5-, and 1.5-mm drills or burrs
No. 2-0 Ethibond and No. 0 Vicryl suture
Looped stainless steel wire on a curved needle (suture passer)

nonoperative treatment who desire to return to competitive levels of play, UCL reconstruction is a viable option. The docking technique, as described in this report, has allowed up to 90% of players to return to competition after UCL reconstruction.[4,8] It has the benefits of minimizing damage to the flexor-pronator origin, avoiding the ulnar nerve, reducing bone loss to the medial epicondyle, and allowing robust tensioning of the graft (Table 1).[3,4] Potential limitations and pitfalls include inadvertent injury to the ulnar nerve if the surgeon is not mindful of its location while drilling, possible difficulty passing the looped suture or wire if tunnel coalescence is not properly achieved, and the need for alternative grafts in patients without a palmaris longus. Despite these potential limitations, when precise surgical steps are followed (Tables 2 and 3) and an appropriate graduated rehabilitation is completed, patients can generally anticipate excellent outcomes and a return to competitive throwing 1 year after surgery.

References

1. Bruce JR, Andrews JR. Ulnar collateral ligament injuries in the throwing athlete. *J Am Acad Orthop Surg* 2014;22:315-325.
2. Jones KJ, Osbahr DC, Schrumpf MA, Dines JS, Altchek DW. Ulnar collateral ligament reconstruction in throwing athletes: A review of current concepts. *J Bone Joint Surg Am* 2012;94:1-12.
3. Rohrbough JT, Altchek DW, Hyman J, Williams RJ, Botts JD. Medial collateral ligament reconstruction of the elbow using the docking technique. *Am J Sports Med* 2002;30:541-548.
4. Dodson CC, Altchek DW. Ulnar collateral ligament reconstruction revisited: The procedure I use and why. *Sports Health* 2012;4:433-437.
5. Jobe FW, Stark H, Lombardo SJ. Reconstruction of the ulnar collateral ligament in athletes. *J Bone Joint Surg Am* 1986;68:1158-1163.
6. Dines JS, ElAttrache NS, Conway JE, Smith W, Ahmad CS. Clinical outcomes of the DANE TJ technique to treat ulnar collateral ligament insufficiency of the elbow. *Am J Sports Med* 2007;35:2039-2044.
7. Andrews JR, Jost PW, Cain EL. The ulnar collateral ligament procedure revisited: The procedure we use. *Sports Health* 2012;4:438-441.
8. Dodson CC, Thomas A, Dines JS, Nho SJ, Williams RJ, Altchek DW. Medial ulnar collateral ligament reconstruction of the elbow in throwing athletes. *Am J Sports Med* 2006;34:1926-1932.