

***Reconstruction of the
Ulnar Collateral Ligament Elbow
with Bio-Tenodesis System***

Surgical Technique

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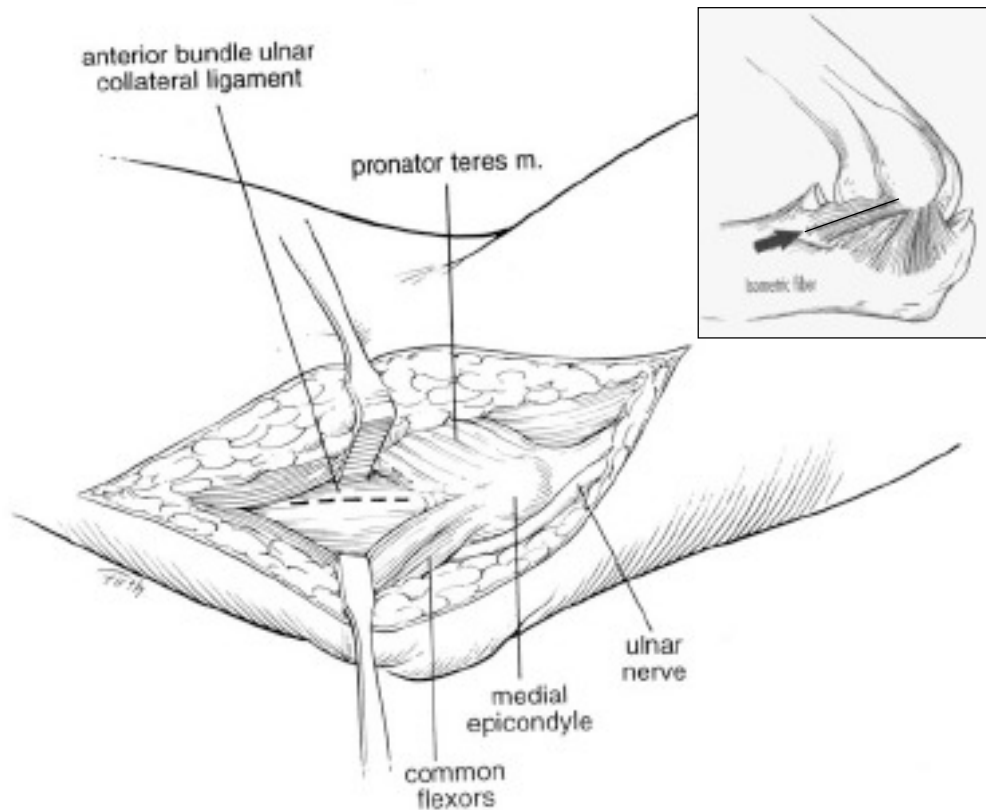
INTRODUCTION

Ulnar Collateral Ligament (UCL) reconstruction is a demanding procedure and often is performed in highly competitive athletes. The Bio-Tenodesis technique of UCL reconstruction is designed to minimize muscle dissection and risk of ulnar nerve injury while producing reliable anatomic bone tunnels. Graft placement, tensioning, and fixation are also simpler. Biomechanical evaluation of this technique has demonstrated failure strength comparable to the intact UCL and restoration of physiologic elbow kinematics over all flexion angles. The technique employs a new bio-tenodesis graft fixation and tensioning system that has application in other procedures that require soft tissue graft fixation into a blind tunnel such as lateral collateral ligament reconstruction in the knee and proximal biceps tenodesis in the shoulder.



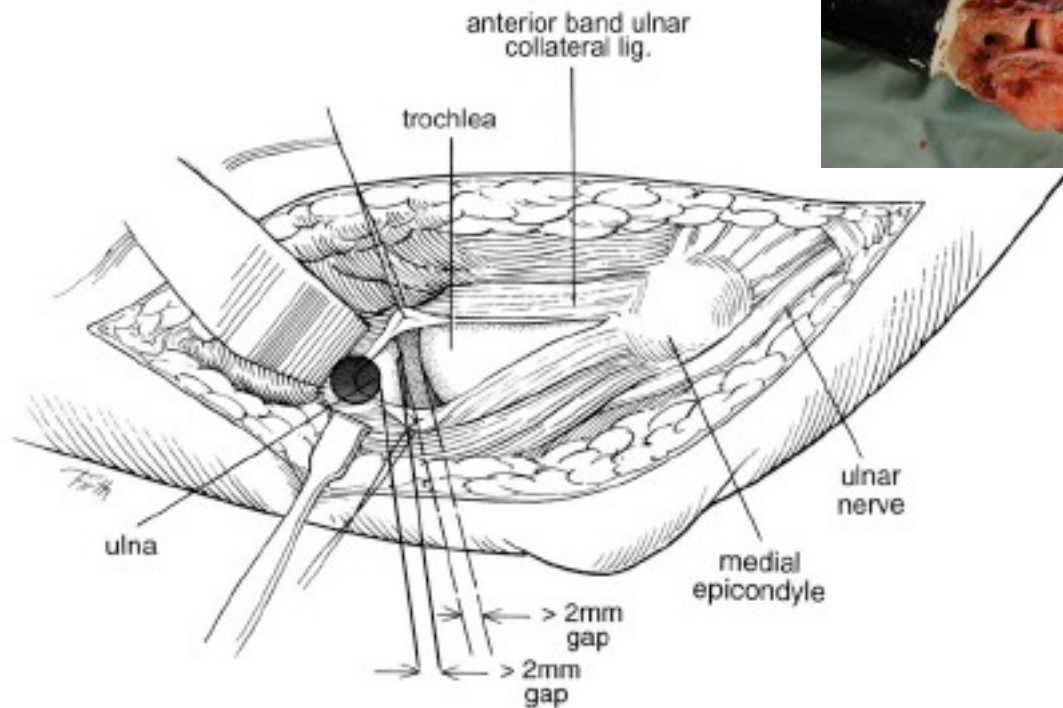
PATIENT POSITIONING

The patient is supine and the arm is positioned on an arm board. A pneumatic tourniquet is used. After prepping and draping, a consistent valgus stress is applied to the elbow using a small towel placed underneath the elbow. A skin incision extending 3 to 5 cm both proximally and distally from the medial epicondyle is made.



APPROACH TO THE UCL

A muscle-splitting approach to the UCL is employed. Dissection is carried down to the muscle fascia while protecting all sensory branches of the medial antebrachial cutaneous nerve. A longitudinal incision in the common flexor mass is made in its posterior one third adjacent to the flexor carpi ulnaris. A periosteal elevator is used to separate the flexor mass from the ulnar collateral ligament-capsular complex and blunt retractors are placed to fully expose the ligament. A longitudinal split is made in the ligament in its central most isometric portion. Valgus stress with the elbow at 30° flexion will reveal opening of the ulnohumeral articulation if the UCL is insufficient.

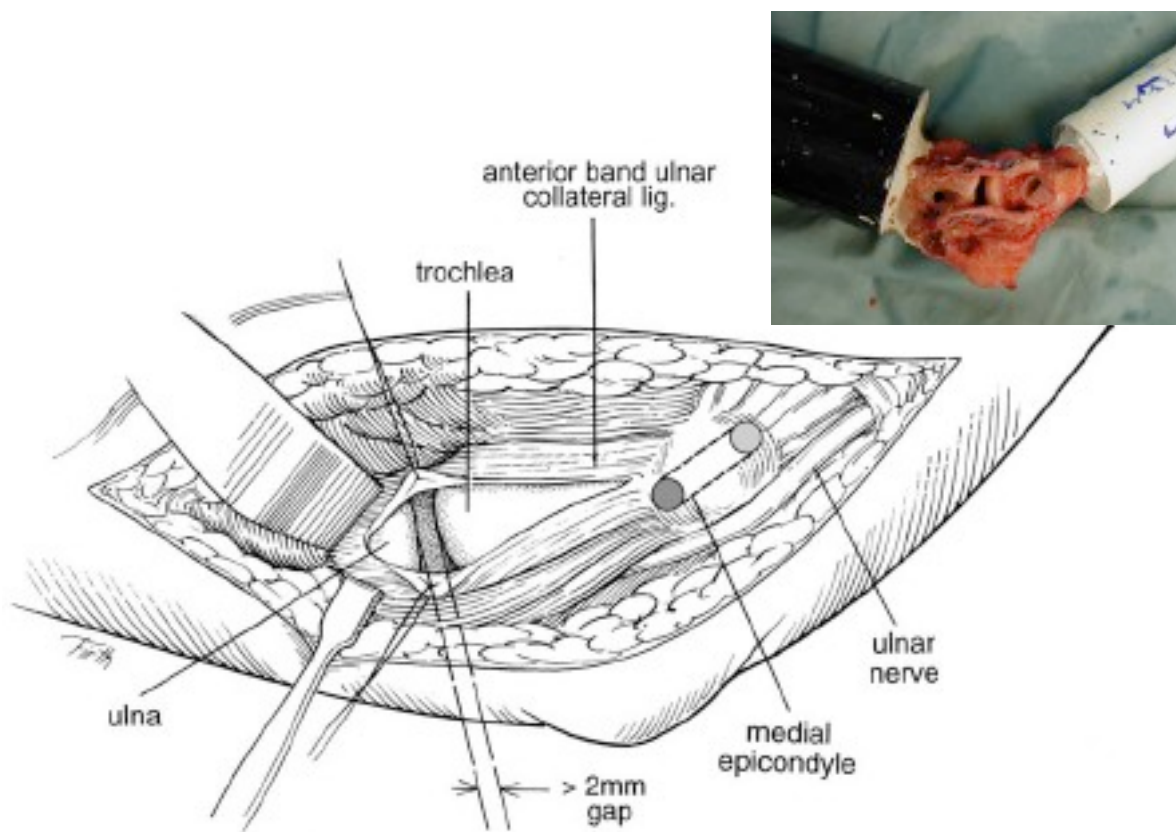


Drill and sleeve creating ulnar tunnel at 45° angle to long axis of ulna

DRILL THE ULNAR TUNNEL

The central isometric portion of the anterior bundle of the native UCL's origin and insertion are identified. At the origin on the sublime tubercle of the ulna, approximately 4.5 mm distal to the joint surface, a 5 mm diameter tunnel is drilled directed 45 degrees distally to the long axis of the ulna for a depth of 20 mm. A drill sleeve with a 20 mm stop protects the soft tissue and ulnar nerve. Maintenance of a 2 mm bone bridge from the edge of the tunnel to the joint avoids possible fracture of the tunnel into the ulnohumeral joint.

To avoid sliding of the drill, a small pilot hole can be created with the use of an awl or punch to capture the tip of the 5 mm drill.



Drill and sleeve creating tunnel with retractor protecting ulnar nerve

DRILL THE HUMERAL TUNNEL

A 5 mm drill hole is then created in the humeral epicondyle at the insertion of the central isometric fibers, 5 mm anterior from the inferior tip of the epicondyle. The drill sleeve is used to protect the soft tissues and direct the hole to exit at the superior aspect of the epicondyle. Care must be taken to avoid injury to the ulnar nerve.



MECHANISM OF DRIVER ADVANCING SCREW

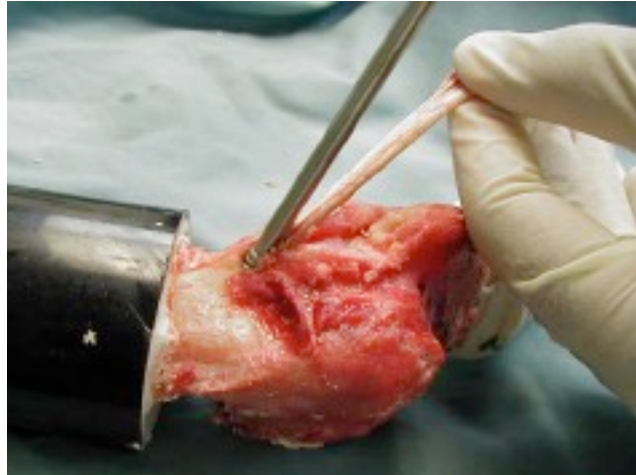
The unique Bio-Tenodesis Driver turns the screw to advance it over the driver shaft. Holding the thumb pad and turning the driver handle accomplish this. The driver shaft is used to guide the screw into the tunnel while providing constant tension on soft tissue graft.



Driver, screw, and suture are passed through cannulation using suture passer.

GRAFT PREPARATION FOR ULNAR FIXATION

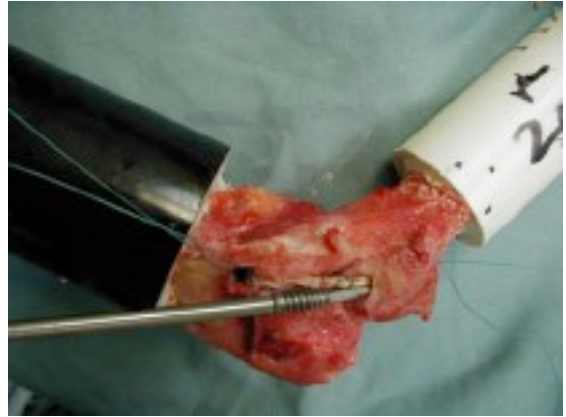
The palmaris longus tendon is harvested and folded over to create a double strand graft. A standard whipstitch with #2 FiberWire™ is placed in the folded portion of the graft. The interference screw is placed on the shaft of the Bio-Tenodesis Driver. The suture controlling the graft is then passed through the cannulation of the driver with a suture passer. Tension on the suture exiting the handle of the driver maintains the graft parallel with the tip of the driver shaft.



Screw advancing over driver shaft with constant tension of the graft into the tunnel

GRAFT INSERTION INTO THE ULNA

With constant tension on the sutures exiting the driver handle, the driver shaft and graft are inserted into the tunnel with the graft facing the ulnohumeral articulation. Turning the driver handle and holding the thumb pad fixed advances the screw over the driver shaft into the tunnel. Thus tension of the graft into the tunnel is maintained during screw insertion. The screw is advanced to the end of the shaft and the shaft is pulled free.



GRAFT PREPARATION FOR HUMERAL INSERTION

With the ulnar side secure, the proximal free ends of the graft are positioned over the humeral epicondyle tunnel and cut to length to approximate the length of the tunnel. A whipstitch is placed through the limbs of the graft with #2 FiberWire suture. The sutures are passed through the humeral tunnel with a suture passer. The elbow is flexed and extended to confirm an isometric construct with tension applied to the sutures. While the elbow is maintained in 60° of flexion and a varus force applied, the shaft of the biotenesis driver with a 5 x 15 interference screw is inserted into the tunnel adjacent to the graft. The sutures are held with appropriate tension while the driver advances the screw into the tunnel. The driver is removed from the tunnel and the limbs of the suture are brought over the epicondyle bone bridge and passed through the graft using a free needle and tied. The limbs of the suture from the ulnar tunnel are passed through the graft at its entrance into the ulnar tunnel using a free needle and tied. The native UCL may be closed with interrupted sutures over the reconstruction.

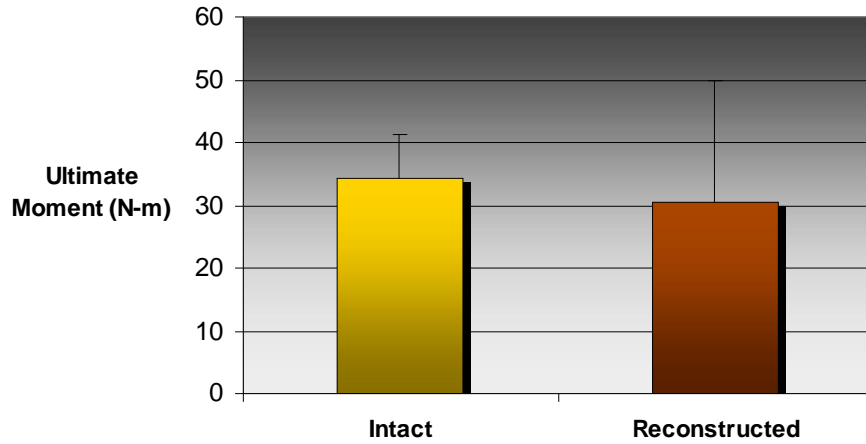


GRAFT SUTURE AND TUNNEL RELATIONSHIP

The sutures brought out from the cannulation of the screw are passed through the graft and tied to enhance graft fixation. With this method, fixation is achieved by both interference fixation and suture fixation. Suture that avoids fraying such as FiberWire is necessary to avoid suture failure at the tip of the screw.

In a cadaveric study employing the described reconstruction technique, graft fixation strength was 95% that of control intact UCL's under valgus load. Ultimate moment for native ligaments (34.0 ± 19.2 Nm) was not significantly different than reconstructed ligaments (30.6 ± 6.9 Nm). Reconstruction of the UCL also restored valgus stability to within less than one degree of the intact elbow for all flexion angles. Comprehensive biomechanical data confirms that the Bio-Tenodesis fixation technique has failure strength comparable to the intact UCL. This restores physiologic elbow kinematics over all flexion angles, a critical factor in the throwing athlete who stresses the elbow over a large range of motion.

Ultimate Moment Intact vs Reconstructed Matched Pairs



Biomechanical failure data demonstrating the strength of the reconstruction technique

PUBLICATION REFERENCES

Conway JE, Jobe FW, Glousman RE, Pink M. Medial instability of the elbow in throwing athletes: Treatment by repair or reconstruction of the ulnar collateral ligament. *Journal of Bone and Joint Surgery*, 1992; 74:67-83.

Thompson WH, Jobe FW, Yocum LA, Pink MM. Ulnar collateral ligament reconstruction in athletes: Muscle-splitting approach without transposition of the ulnar nerve. *Journal of Shoulder and Elbow Surgery*, 2001; 10:152-7.