## Medial Ulnar Collateral Ligament Reconstruction of the Elbow in Throwing Athletes


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# Medial Ulnar Collateral Ligament Reconstruction of the Elbow in Throwing Athletes

Christopher C. Dodson, MD, Adrian Thomas, MD, Joshua S. Dines, MD, Shane J. Nho, MD, Riley J. Williams III, MD, and David W. Altchek,* MD
*From Shoulder and Sports Medicine Service, Hospital for Special Surgery, New York, New York*

**Background:** Medial ulnar collateral ligament insufficiency of the elbow can be a devastating injury in the throwing athlete. Reconstruction of the medial ulnar collateral ligament was initially described by Jobe and associates; good clinical results have been described after this procedure. The authors' experience with this technique raised several concerns, and thus the "docking" procedure was developed as an alternative method for medial ulnar collateral ligament reconstruction of the elbow. The early results of the docking technique were good. The authors wish to investigate the intermediate-term clinical results of this method in a large group of athletes.

**Hypothesis:** The docking technique can return overhead-throwing athletes to sport with minimal perioperative morbidity.

**Study Design:** Case series; Level of evidence, 4.

**Methods:** During a 3-year period, 100 consecutive overhead-throwing athletes were treated with surgical reconstruction using the docking technique. The inclusion criteria were as follows: (1) a history of medial elbow pain that prevented throwing, (2) a preoperative standard noncontrast magnetic resonance image demonstrating medial ulnar collateral ligament injury, (3) clinically apparent medial ulnar collateral ligament insufficiency, and (4) an overhead-throwing athlete. At the time of surgery, all patients underwent routine arthroscopic assessment. The ulnar nerve was transposed in 22 cases. The mean follow-up was 36 months (range, 24-60 months).

**Results:** Ninety of 100 (90%) patients were able to compete at the same or a higher level than before medial ulnar collateral ligament injury for more than 12 months as noted at the follow-up interval; 7 patients were able to compete at a lower level. Only 3 patients suffered postoperative complications.

**Conclusion:** The docking technique reliably returns athletes to competitive throwing with a low perioperative morbidity.

**Keywords:** docking technique; medial ulnar collateral ligament (MUCL); valgus instability; Tommy John surgery

Studies have shown that pitching a baseball generates a valgus force at the elbow estimated at 290 N, resulting in an angular velocity in excess of 3000 deg/s.[6] The primary constraint resisting valgus stress through this range of motion is the anterior bundle of the medial ulnar collateral ligament (MUCL). The MUCL must withstand these forces through the late cocking and acceleration phases of the throw. Unfortunately, these forces may exceed the tensile strength of the ligament.[4] The microtrauma from repetitively overloading the MUCL causes inflammation and microscopic tears in the ligament and can eventually lead to ligament attenuation or failure.[2,3,8] Repetitive valgus loads in an elbow with medial ligamentous insufficiency can lead to degenerative changes,[9,14] the inability to throw effectively, and chronic disabling elbow pain.

Surgical reconstruction of the torn MUCL in the throwing athlete was initially described by Jobe et al.[8] In their described reconstruction, a harvested autograft tendon is passed through multiple bony tunnels in both the distal humerus and proximal ulna. Jobe et al described performing this procedure in association with a submuscular ulnar nerve transposition and complete elevation of the flexor mass from the medial humeral epicondyle. Their series of 71 patients demonstrated that this technique was an effective repair that allowed 68% of elite-level throwers to return to either their prior or a higher level of throwing. However, the complication rate related to postoperative dysfunction of the ulnar nerve was 21%.[3]

The experience at our institution with MUCL reconstruction prompted the authors to develop a transmuscular approach to the elbow, obviating elevation of the flexor mass, and a method of directly tensioning the inserted MUCL

*Address correspondence to David W. Altchek, MD, Chief, Shoulder and Sports Medicine Service, Hospital for Special Surgery, New York, NY 10021 (e-mail: altchekd@hss.edu).

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construct. Our personal experience with the Jobe procedure raised concerns with strength of suture fixation of the free tendon graft, adequate tensioning of the graft at the time of final fixation, and the potential for complications resulting from detachment of the flexor origin and the 3 large drill holes in the medial epicondyle. We were also concerned with the high level of ulnar nerve complications[3] resulting from transposition and the ability of the surgeon to recognize and treat concurrent intra-articular pathologic conditions. These concerns ultimately led to the development of the "docking technique," which is highlighted by (1) routine arthroscopic evaluation of the anterior and posterior compartments of the elbow to evaluate and treat lesions of valgus extension overload, (2) performing a tendon graft reconstruction of the MUCL through a muscle-splitting "safe zone" approach, (3) avoiding obligatory transposition of the ulnar nerve, (4) placing a tendon graft in bone tunnels, (5) reducing the sizes of the drill holes in the medial epicondyle, and (6) simplifying graft tensioning and fixation methods.

Early studies from our institution have shown good results with the docking technique in a small cohort of patients with early follow-up.[10] The purpose of this study is to describe the clinical results of the docking technique in a much larger group of throwing athletes at an intermediate follow-up interval.

## MATERIALS AND METHODS

From January 2000 through April 2003, 100 consecutive overhead-throwing athletes were treated with surgical reconstruction using the docking technique by 2 of the authors (D.W.A., 90; R.J.W., 10). The inclusion criteria were (1) a history of medial elbow pain that prevented throwing, (2) a preoperative standard noncontrast MRI consistent with MUCL injury, (3) clinically apparent MUCL insufficiency, and (4) an overhead-throwing athlete. The results were retrospectively reviewed and form the basis of this investigation. Our institutional review board committee approved the study.

The mean age of the patients at the time of reconstruction was 22 years (range, 16-43 years). All patients were male, and all but 1 were between 16 and 28 years of age. The study group included 4 athletes who were not baseball players: 2 tennis players and 2 quarterbacks. This group also contained the oldest patient, who was a 43-year-old competitive-ranked Masters tennis player. Of the 96 baseball players in the study group, 91 were pitchers: 16 professional baseball pitchers, 60 collegiate pitchers, and 15 high school pitchers. The 5 nonpitchers included 3 catchers (2 collegiate, 1 high school), 1 infielder (collegiate), and 1 outfielder (professional).

Ulnar nerve transposition was only thought to be indicated if preoperative clinical findings were consistent with chronic nerve instability or compression. In this study group, 22 patients (22%) underwent ulnar nerve transposition subcutaneously with an intramuscular septal sling.

The mean length of time between the onset of symptoms and reconstruction of the ligament was 7 months (range, 0.5-36 months). Three of the patients (3%) had had previous surgery on the ipsilateral elbow at a mean of 14 months before the current surgery. One patient had undergone transposition of the ulnar nerve, and the other 2 patients had arthroscopic removal of a loose body and osteophyte debridement. The majority of patients had been managed nonoperatively with rest, physical therapy, and nonsteroidal anti-inflammatory medication. We are not aware of any patients who had previously received cortisone injections.

The mean follow-up was 36 months (range, 24-60 months). In each case, the final follow-up evaluation was obtained by telephone interview. No patients were lost to follow-up. At the time of the phone call, all patients had completed rehabilitation and were throwing competitively. Patients were evaluated using the Conway classification.[3] In this classification, an excellent result is defined as a return to the preinjury level of competition for at least 1 year after MUCL reconstruction. A result is good if the patient was able to compete at a lower level for more than 12 months or was able to throw in daily batting practice. A fair result is if the patient was able to play regularly at a recreational level; a poor result is if the patient was unable to return to throwing or competition in any fashion.

## Operative Technique

All patients were examined preoperatively for the presence of a palmaris tendon. In cases in which there was no palmaris tendon present in either arm, the gracilis tendon was used instead. In addition, all patients were examined preoperatively for ulnar nerve neuropathy or instability. Our indication for ulnar nerve transposition was a history of symptoms attributable to the ulnar nerve and/or physical examination findings. Electromyography was not routinely performed.

The majority of patients had the surgery under regional block anesthesia. After the block was administered, a tourniquet was placed, and the involved upper extremity was prepped and draped in the usual sterile fashion. The patient remained supine on the operating table. With the use of an arm holder, the humerus and forearm were positioned across the patient's chest for arthroscopic evaluation of the elbow (Figure 1).

The joint was insufflated with approximately 40 to 50 mL of saline, and an anterolateral portal was then established, which facilitates arthroscopic examination of the anterior compartment. An arthroscopic stress test was typically done at this point. With the elbow at 90° of flexion, the forearm was pronated and a valgus stress applied. Our criterion for a positive result was visible opening of the medial ulnohumeral joint of approximately 1 mm or more.[7] In this series, all 100 patients had a positive test result.

The arthroscope was then removed, and a posterior portal was established lateral to the triceps. The olecranon and the humeral fossae were examined at this time for loose bodies or bone spurs. The trochlea was also examined for articular injury. Last, the posterior radiocapitellar joint was evaluated by advancing the arthroscope down the lateral gutter. If indicated, a transtriceps portal was created through the center of the triceps tendon at the level of the olecranon tip, which allows for removal of loose bodies, osteophyte debridement, and microfracture of chondral lesions.

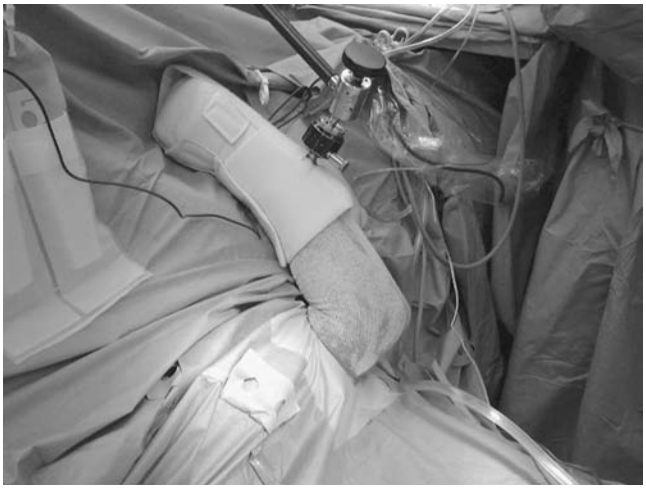


**Figure 1.** The humerus and forearm are positioned across the chest and held in an arm holder to facilitate arthroscopic examination of the elbow.

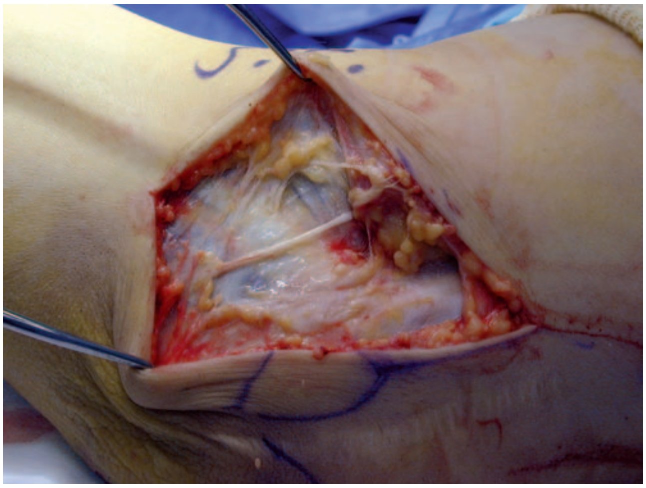


**Figure 2.** The medial antebrachial nerve is shown here; it is frequently encountered when exposing the flexor pronator mass and should be identified and protected to prevent post-operative neuropathy.

Once the arthroscopy was completed, the arm was released from the holder and placed on the hand table. The portals were briefly irrigated and closed with interrupted nylon sutures. In cases in which the palmaris longus tendon was absent, the gracilis tendon was harvested at this time. Otherwise, before tourniquet inflation, the palmaris longus tendon was harvested through a 1-cm incision in the volar flexion crease over the tendon. The tendon was then identified, delivered into the wound, and tagged with locking Krackow sutures using No. 1 braided Ethibond (Ethicon, Inc, Somerville, NJ). The end of the tendon was then truncated and harvested using a tendon stripper. The tendon was then placed on the table in a moist sponge. The incision was then irrigated and closed with interrupted nylon sutures.

With use of an Esmarch bandage, the arm was then exsanguinated to the level of the tourniquet. An 8- to 10-cm incision was then made beginning from 2 cm proximal to the medial epicondyle, in line with the intermuscular septum, to approximately 2 cm beyond the sublime tubercle. When exposing the flexor pronator mass, the medial antebrachial cutaneous nerve is frequently encountered in the operative field; this nerve was identified and protected (Figure 2). A muscle-splitting approach was then used through the posterior one third of the common flexor pronator mass within the most anterior fibers of the flexor carpi ulnaris muscle. This is essentially located at the raphe between the flexor carpi ulnaris muscle, innervated by the ulnar nerve, and the anterior portion of the flexor bundle (flexor carpi radialis, palmaris longus, flexor digitorum superficialis), which is innervated by the median nerve (Figure 3). The advantage of this muscle-splitting approach is that it uses a true internervous plane.[11] The underlying ligament was then exposed, and the anterior bundle of the MUCL was incised longitudinally to expose the joint.

The tunnel sites were then exposed. First, the anterior and posterior aspects of the sublime tubercle were exposed subperiosteally while care was taken to protect the ulnar

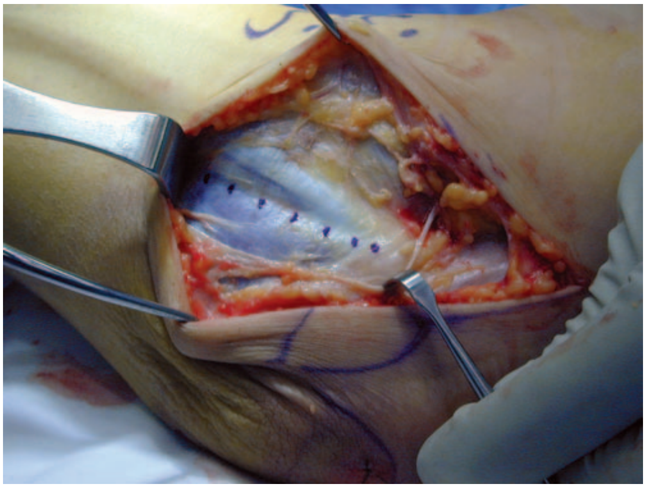


**Figure 3.** The dotted line represents the raphe between the flexor carpi ulnaris muscle and the anterior portion of the flexor bundle. This so-called safe zone facilitates exposure to the native MUCL without detaching the flexor pronator bundle. It extends from the medial humeral epicondyle to approximately 1 cm distal to the insertion of the MUCL on the sublime tubercle. MUCL, medial ulnar collateral ligament.

nerve. A 3-mm bur was then used to create tunnels anterior and posterior to the sublime tubercle. A curette was used to create an approximately 2-cm bony bridge between the 2 tunnels without violating the bridge itself.

The humeral tunnel position was located in the anterior half of the medial epicondyle in the anterior position of the existing MUCL. An incision within the native MUCL was made and extended proximally to the level of the epicondyle. A longitudinal tunnel was then created along the axis of the medial epicondyle using a 4-mm bur; care was taken not to violate the posterior cortex of the proximal epicondyle. Next, a 1.5-mm bur was used to make 2 small exit punctures, separated by 5 mm to 1 cm, on the anterior surface of the epicondyle anterior to the intermuscular septum. This allowed the sutures on each end of the graft to be passed from the humeral tunnel. With the forearm supinated and a mild varus stress applied to the elbow, the longitudinal rent in the native ligament was repaired with a running 2-0 Vicryl. The graft was passed through the ulnar tunnel from anterior to posterior. The posterior limb of the graft with sutures was then docked into the humeral tunnel with the sutures exiting through 1 of 2 exit holes in the anterior portion of the epicondyle. The elbow was again reduced with forearm supination and a varus stress. The graft was then tensioned in flexion and extension to determine what length would be optimal by placing the graft adjacent to the humeral tunnel. The graft was referenced to the exit hole in the epicondyle. This point was then marked on the graft, and another Krackow stitch was placed (Figure 4A). Final length is determined such that this second end of the graft will be completely "docked" in the humeral tunnel, but the length will be short of where the graft suture will exit the epicondyle (Figure 4B). A graft that is too long cannot be appropriately tensioned. The excess graft was then excised, and the end of the graft was securely docked in the anterior humeral tunnel (Figure 5).

The final tensioning was then done by taking the elbow through an extensive range of motion while a varus stress was applied. Once the surgeon was satisfied, the 2 suture ends were tied over the medial epicondyle with the elbow in approximately 20° of flexion. This position was chosen because it is our observation that it reduces excessive tension or laxity in either of the 2 limbs. The tourniquet was deflated, and hemostasis was achieved. If indicated, an ulnar nerve transposition was done at this time (Figure 6). Otherwise, the fascia over the flexor pronator mass was reapproximated, and the remaining wound was closed in layers. The elbow was then placed in a plaster splint at 45° of flexion, again to reduce excessive laxity or tension on either limb, and forearm supination to keep the joint reduced.

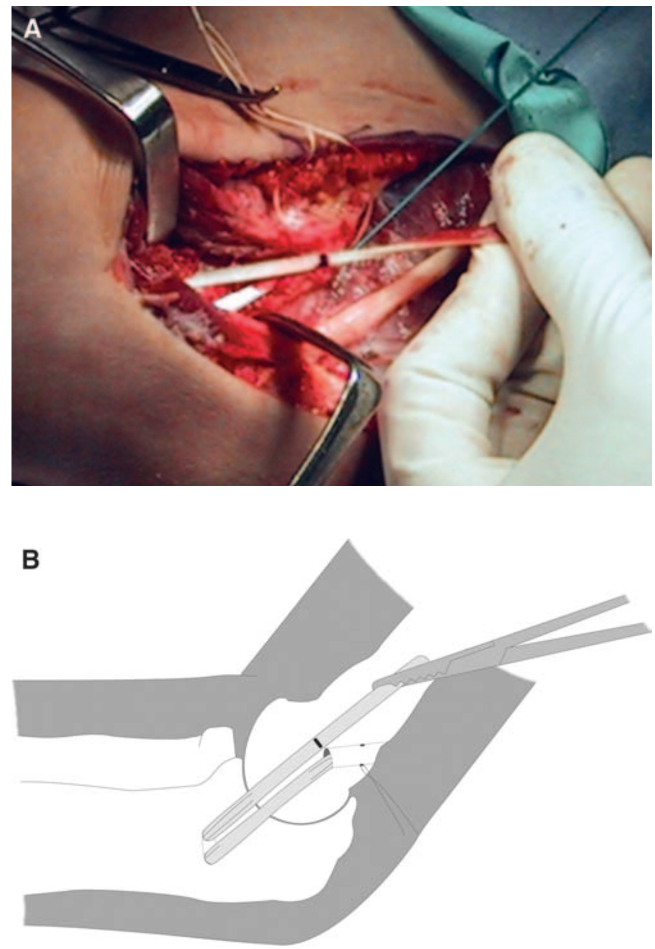


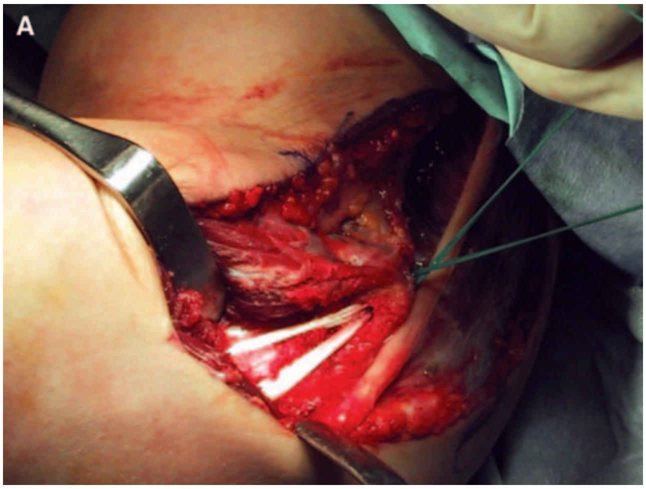

**Figure 4.** A, the graft is marked at the point of optimal length after tensioning in flexion and extension. This point is referenced to the exit hole and ensures that the length of the tendon allows for optimal tensioning. B, this is shown more clearly in this illustration. Note that the line is marked well short of the exit hole.

## Postoperative Rehabilitation Protocol

In the immediate postoperative period, the arm was maintained in a plaster splint for 1 week. The sutures were then removed, and the elbow was placed in a hinged brace. Initially, motion was allowed from 30° of extension to 90° of flexion. The patient was then reevaluated at 3 weeks postoperatively. In the third to fifth postoperative week, motion was advanced to 15° of extension and 105° of flexion. In addition, if the palmaris longus was harvested from the contralateral forearm, wrist motion was encouraged in that limb as well. At 6 weeks, formal physical therapy was begun, and the brace was usually discontinued. Gentle global rotator cuff strengthening exercises as well as forearm strengthening were instituted, and any residual loss of elbow motion was corrected. By 12 weeks, the patient was involved in an intensive therapy program, which included plyometrics, trunk strengthening, and aggressive shoulder and scapula strengthening. At 4 months, a tossing program was begun. Throwing was performed every other day, and exercises were done both before and after throwing. The patient was instructed to start tossing at 45 ft and to advance distances in intervals. If pain occurred during any stage, the patient was instructed to back up to the previous stage. Once the patient was throwing pain free from 180 ft, he was allowed to begin pitching from the mound. This was generally at 9 months postoperatively. We discouraged competitive pitching until 1 year after surgery.

## RESULTS

As previously stated, all patients underwent routine arthroscopic assessment just before graft reconstruction. In our series, all 100 patients (100%) had a positive arthroscopic stress test result, which is defined as more than 1 mm of opening between the coronoid and the medial humerus.[7] In 29 of these patients (29%), osteophytes were removed



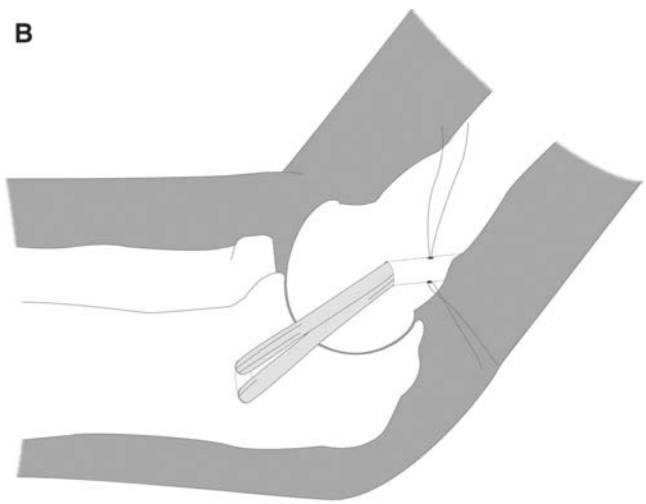



**Figure 5.** A, the posterior limb of the graft is docked in the humeral tunnel via the opposite exit hole. The excess tendon has already been cut above the reference line. The sutures are now simply tied over the bony bridge. B, illustration depicting final graft position before the sutures are tied.

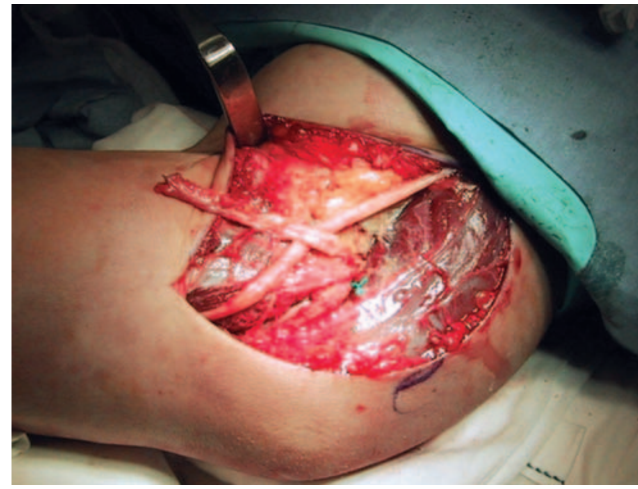


**Figure 6.** Intraoperative photograph demonstrating a subcutaneous ulnar nerve transposition with an intramuscular septal sling. The ligament has already been reconstructed.

arthroscopically from the posteromedial margin of the olecranon or the coronoid process. Another 9 patients (9%) had cartilaginous defects involving the trochlea and were treated with arthroscopic microfracture techniques. Seven patients (7%) had loose bodies removed.

All 100 patients were available for follow-up at a mean of 36 months (range, 24-60 months). Ninety patients were able to compete at the same or a higher level of competition than before MUCL injury for more than 12 months as noted at the follow-up interval. This outcome meets the Conway classification criteria of an excellent result in 90% of study patients. Seven patients (7%) were able to compete at a lower level for more than 12 months (good result). One patient (1%) was able to throw only recreationally (fair result). There were 2 (2%) poor results. Of the 3 patients who had undergone previous surgical procedures, 2 had excellent results. The remaining patient had undergone previous ulnar nerve transposition and had a good result.

A taut graft was achieved on the operating table without pullout of the Krackow stitch or suture breakage in each case. Tendon graft sources and harvesting methods resulted in more than sufficient graft length in each case, and there was no difference in outcome between the 2 graft sources. A total of 70 palmaris (59 ipsilateral, 11 contralateral) and 30 gracilis tendons were used for reconstruction. In cases in which the gracilis tendon was used, we trimmed the graft to allow a proper fit in the bone tunnels; we did not have to use a bigger drill size.

Complications occurred in 3 patients (3%). Two patients developed persistent small- and ring-finger paresthesias that required ulnar nerve transposition at 17 and 19 months, respectively. A subcutaneous transposition with an intramuscular sling was performed, and both patients made full recoveries and had excellent results at the time of follow-up. Neither patient had ulnar nerve symptoms preoperatively. The third patient required an arthroscopic lysis of adhesions 11 months after reconstruction and had a good result at the time of follow-up. There were no range of motion deficits noted at follow-up examination; however, formal measurements were not recorded.

## DISCUSSION

This study demonstrates that the docking technique reliably returned a large number of throwing athletes to their previous levels of competition and, in some instances, to a higher level. Ninety of 100 patients had an excellent result, and an additional 7 patients had a good result, which means that 97% of athletes in this study had either an excellent or good result. One patient (1%) was able to throw only recreationally, and only 2 patients (2%) had poor results. Postoperative performance was confirmed in all patients by telephone interview, and no patients were lost to follow-up. To our knowledge, this is the largest published series to date, and our results compare favorably with those in several recent series in which the Jobe technique was used.[2,5,12] Rohrbough et al,[10] from this institution, have previously reported an excellent result in 92% (33/36) of patients using the docking technique.

The goal of MUCL reconstruction is to reliably reproduce the anatomy and tension of the MUCL and reduce the risk of perioperative morbidity. In a landmark study, Dr Frank Jobe was the first to report on an MUCL reconstruction technique that used bony tunnels in the humerus and ulna to secure a free graft. The Jobe procedure detached the flexor pronator mass and transposed the ulnar nerve submuscularly to expose the MUCL. Three drill holes were made in the epicondyle, and the graft was pulled through the tunnels in a figure-of-8 fashion and secured to itself under tension.[8] Jobe originally reported excellent results in 63% of 16 patients and would later report on 71 patients who had either ligament repair or reconstruction.[3] Although 95% of these athletes were able to return to throwing, only 68% were able to return to either their prior or a higher level of competition. In addition, as previously stated, the postoperative ulnar nerve–related complication rate was 21%. Our early clinical experience with this procedure, combined with the early published results, prompted us to expand our goals to include preserving the flexor muscle origin, avoiding obligatory transposition of the ulnar nerve, minimizing the size of the bony tunnels in the humerus, and arthroscopically identifying and treating lesions of valgus extension overload.

Smith et al,[11] from this institution, first described a muscle-splitting approach through a "safe zone" that would allow for adequate exposure of the anterior bundle of the MUCL by splitting the flexor carpi ulnaris muscle. The advantage of this approach is that it is not necessary to detach the flexor pronator mass for exposure, and the ulnar nerve can be left intact in the cubital tunnel. This potentially reduces the morbidity of the surgical exposure and minimizes the risk of ulnar nerve injury. Thompson et al[12] were the first to report on a series of athletes who underwent MUCL reconstruction using this muscle-splitting approach without transposition of the ulnar nerve. They reported excellent results in 93% of athletes who had no prior surgery and a much lower ulnar nerve–related complication rate of 5%.[12] Several authors have since reported on MUCL reconstruction using a muscle-splitting approach or transposing the ulnar nerve subcutaneously and noted lower ulnar nerve–related complication rates ranging from 8% to 9%.[2,5] In our current series, 22% (22) of patients underwent a subcutaneous transposition with fascial sling at the time of surgery. None of these patients suffered postoperative complications. Two other athletes (2%) required transposition postoperatively after they had returned to throwing for at least 1 year. Neither patient had preoperative symptoms, and both had excellent results at the time of follow-up. As previously stated, our indication for transposing the ulnar nerve at the time of surgery is constant pain and numbness in the ulnar nerve distribution consistent with chronic nerve instability or compression. It is our opinion that in such cases, transposition is necessary because we believe the ulnar neuropathy is not solely caused by valgus instability and, therefore, performing reconstruction without nerve transposition will not relieve the patients' nerve symptoms.

Previous studies have identified intra-articular bony injuries that are a result of persistent valgus instability of the elbow in the throwing athlete.[1] To understand the spectrum of these lesions, it is important to understand the various stresses that occur about the elbow during throwing motion. The combination of rapid extension with high valgus forces produces tensile stress along the medial compartment restraints such as the MUCL, shear stress in the posterior compartment, and compression stresses laterally. This phenomenon has been termed *valgus extension overload syndrome*,[9,14] and it predisposes the elbow to certain pathologic lesions. These valgus and extension forces continue and, over time, may produce posteromedial olecranon osteophytes, loose bodies in the posterior compartment, or a "kissing lesion," which is an articular defect on the posteromedial trochlea.[1] We routinely use elbow arthroscopy as part of our reconstructive procedure because arthroscopic examination of both the anterior and posterior compartments allows us to recognize and treat intra-articular pathologic conditions that may not be recognized on preoperative imaging studies.[10] In our current series, 45 of 100 patients (45%) had associated intra-articular pathologic lesions that were all managed arthroscopically just before reconstruction. Of these patients, detection of the lesions on preoperative imaging studies occurred in only 25 of 45 cases. Without arthroscopy, a posterior arthrotomy is necessary to treat such pathologic lesions, which necessitates transposition of the ulnar nerve. Arthroscopy is a more minimally invasive approach and has the added benefit of avoiding obligatory transposition of the nerve. Before our use of routine arthroscopy, we have had patients in the past require repeat surgery for conditions that were unrecognized and could have been treated arthroscopically at the time of the initial procedure.

The arthroscopic valgus stress test, originally described by Timmerman and Andrews[13] and later reported on by Field and Altchek,[7] is designed to arthroscopically assess the competence of the MUCL by observing the amount of ulnohumeral joint opening during a valgus load. In this series, all 100 patients had some degree of opening, which was estimated to be more than approximately 1 mm. Our assessment of joint opening at the time of surgery is observational because we do not use a measuring device and is based on our clinical experience. We recognize that this is not always a reliable method to confirm MUCL incompetence. Multiple variables, including the lack of an accurate measuring tool and the inability to standardize the amount of force applied and the elbow flexion angle at the time of valgus force, can make the reproducibility of the measurements taken during arthroscopy and the estimation of the extent of joint opening difficult and inaccurate. Our indications for surgery are based on the history, physical examination, and MRI findings, not on the arthroscopic stress test. We do not require the arthroscopic stress test result to be positive to proceed with the reconstruction. Furthermore, we have certainly treated athletes who had a normal arthroscopic stress test result but proceeded with surgery based on our aforementioned criteria.

Perhaps the most significant technical difference between our technique and that described by Jobe is our method of graft fixation and tensioning. Our personal experience led us to change the relative size of the tunnels in the humeral epicondyle. Our technique still uses a total of 3 tunnels; however, instead of 3 large tunnels, we use 1 large and 2 small tunnels. By reducing the size of the exit tunnels to 1.5 mm, from the standard 3.5 mm using the Jobe method, we believe that the risk of epicondyle fracture is reduced. Using this technique, we have not had any fractures of the epicondyle in more than 300 cases. It should be noted that there is still a risk of fracture using 3 drill holes, and it is important not to penetrate the posterior cortex or place the humeral tunnel too medially on the epicondyle, which can weaken it. In addition, it is worth pointing out that several authors who have reported using the Jobe technique in a relatively large number of patients have not reported fracture as a complication.[2,12] The second major difference is our method of tensioning. We found it very difficult to achieve proper tendon length and tensioning when using the classic technique. In the docking method, a Krackow stitch is placed at the end of each graft limb; this allows the surgeon to maximally put tension in the graft construct before securing it over the humeral bone bridge. This ensures that we achieve the proper length of the tendon, which is important because a tendon that is too long cannot be properly tensioned. The load to failure strength of the suture sewn into the graft is a potential concern, although we have never seen a failure related to suture fixation.

In all previously reported series of MUCL reconstruction, the primary outcome measure has been the return, or lack thereof, to the player's previous level of competition.[2,3,10,12] The classification system most commonly used is the Conway-Jobe classification. Results are stratified as excellent, good, fair, or poor based on whether the athlete was able to compete at preinjury levels and for a sustained period of time. One of the limitations of this study is that success was based on a purely functional classification system that did not include physical examination or radiographic parameters. We believe, however, that this outcome measure is particularly relevant in this group of athletes. The issue here is that, preoperatively, the athlete's inability to throw, due to MUCL injury and recalcitrant pain, is not quantitated by a clear measure of elbow laxity. Ultimately, these athletes are selected for surgery if they have the following 3 criteria: (1) MRI evidence of MUCL injury; (2) a history of medial elbow pain occurring in the region of the MUCL that develops during the late cocking and early acceleration phase of throwing; and (3) pain that is severe enough to disable them from competing. Similarly, at follow-up, there is only 1 significant measure of outcome: whether athletes can return to their preoperative levels of competitive throwing. Return to elite throwing is the most stringent outcome measure because athletes with normal physical examination and radiographic findings are considered to have a poor outcome if they are unable to throw competitively.

In our current series, 2 athletes had poor results. Both patients did well postoperatively initially, but they were never able to throw competitively and complained of persistent elbow pain only during throwing activity. The MRI evaluation revealed that there was no evidence of premature rupture or failure secondary to poor graft fixation. The first patient was 26 months postoperative, underwent a second revision reconstruction, and returned to his previous level of competition. The second patient is 28 months postoperative and is still in the rehabilitation stage. The cause of these 2 failures is unknown but can be due to any number of variables including pitch count, length of time between surgery and throwing, and type of pitch thrown. Conway et al[3] noted that the chance of returning to previous levels of sports after MUCL reconstruction was diminished in patients who had previous elbow surgery. In our series, neither patient with a poor result had undergone previous surgery, and all 3 patients who did have previous surgery returned to competitive throwing. The 1 patient who had a fair result was a college pitcher who, for a variety of reasons, never returned to the collegiate level. The patient stated that he is able to throw recreationally without pain but never regained the stamina necessary to pitch at the collegiate level. He currently plays on an intramural team in college.

Our results demonstrate that the docking technique is a safe and effective procedure that reliably returns throwing athletes to sport. This method allows for excellent graft fixation and tensioning, the identification and management of intra-articular lesions, and a low incidence of ulnar nerve–related complications.

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