Abstract: Reconstruction of the lateral ulnar collateral ligament of the elbow is the primary treatment for recurrent symptomatic posterolateral rotatory instability. Although a number of lateral ulnar collateral ligament reconstruction techniques have been described, the docking technique has received general acceptance. In this technique, the graft is passed through a tunnel on the ulnar side and the 2 free limbs are docked into the humerus at the isometric point on the lateral condyle. Advantages of this method of reconstruction include reduced bone removal, decreased soft tissue damage, and precise control of graft tensioning. When precise surgical steps are followed, this technique can be performed in a reliable, efficient, and reproducible manner for patients with posterolateral rotatory instability of the elbow.

Originally described in 1991,1 posterolateral rotatory instability (PLRI) of the elbow is the most commonly encountered pattern of elbow instability.2-4 Although it generally occurs after elbow trauma, other described etiologies include tardy PLRI secondary to cubitus varus deformity, severe lateral epicondylitis (especially treated with repeated corticosteroid injections), or iatrogenic injury after lateral elbow surgery.1,5-8 Regardless of the mechanism, the injury ultimately leads to posterolateral rotatory subluxation of the radial head and ulna from the humerus. Depending on injury severity, the lateral collateral ligament complex, capsule, and common extensor tendon can be involved; however, the primary restraint to PLRI is the lateral ulnar collateral ligament (LUCL).1,3,9-13 Patients with PLRI generally present with mechanical symptoms on the lateral side of the elbow with pain, clicking or locking, symptoms of instability, or difficulty forcefully extending the elbow, especially when the forearm is supinated (i.e., pushing up from the chair).

Because the LUCL is the primary restraint against PLRI, the restoration of LUCL integrity is the mainstay of surgical treatment. Although ligament repair may be a viable option for acute injuries, recurrent symptomatic PLRI generally requires LUCL reconstruction.9,10,14,15 Currently, there is no clinical evidence demonstrating the superiority of either autograft or allograft tissue. Although a number of reconstruction techniques and graft configurations have been described, the docking technique is the most common method used today.9,15,16 This technique was initially described in 2012 by Jones et al.15 and was a modification of the original figure of eight or “yoke” construct described by Nestor et al.16 in 1992. In concept, it is similar to the docking technique used to reconstruct the medial ulnar collateral ligament of the elbow.17 The docking technique has a number of advantages, including decreased bone removal compared with other techniques, controlled tensioning of the graft, and no need for implants such as anchors, screws, and buttons. Accordingly, the purposes of this Technical Note are to provide a detailed description of how to perform LUCL reconstruction using the docking technique for patients with PLRI. Special attention is paid to surgical steps, postoperative rehabilitation, and clinical outcomes (Video 1).

Technique

Patient Positioning

The patient is placed in the supine position with the arm laid across the body or on an arm board. Before beginning, an examination under anesthesia is...
performed with special attention paid to the posterolateral rotatory drawer test and the lateral pivot-shift test. If desired, a nonsterile tourniquet can be placed high on the arm out of the surgical field.

Surgical Exposure
A 7-cm incision is made from just proximal to the lateral epicondyle toward the crista supinatorius on the ulna. Once through skin and subcutaneous tissue, the interval (Kocher’s interval) between the anconeus and the extensor carpi ulnaris is identified (Fig 1). The fascia is sharply incised, and blunt dissection is carried out down to the capsule. It is important that the lateral capsule be identified and protected throughout the case because the ligament will ultimately be reconstructed in an extra-articular position. The capsule is incised in line with the LUCU, just anterior to the posterior margin of the extensor tendon so that there is thick enough tissue to suture during imbrication and closure.

Bone Preparation
Attention is turned to the supinator crest, and subperiosteal dissection is performed just posterior and proximal to its apex. The ulnar tunnel is created by converging the bases of two 3.2-mm-diameter sockets (Fig 2A). The first begins immediately posterior to the supinator crest and the second is located proximal and posterior to a bony bridge of at least 1.25 cm between the holes. Once both sockets are drilled, their bases can e1102

Fig 1. Right elbow: the patient is in the supine position with the arm at the side. The lateral side of the elbow is approached via a Kocher skin incision and the anconeus interval. This is located between the extensor carpi ulnaris (ECU) and anconeus.

Fig 2. On this right elbow, the tubercle on the supinator crest is identified and soft tissue is dissected away. A 3.2-mm drill is used to create a cortical hole adjacent to the tubercle, and another approximately 1.25 proximal to the first. (A) A Bankart awl is used to create a tunnel joining the 2 holes. (B) To locate the isometric humeral attachment, the center of the capitellum is identified as the center of a circle superimposed over the articular margin of the capitellum. (C) Isometricity is confirmed by holding the tensioned looped passing suture from the ulna on the presumed isometric point, whereas the elbow is taken through an arc of flexion and extension. (D) After the humeral socket is created, capsular repair sutures are placed before graft passage. These are tagged, set aside, and subsequently used to imbricate the capsule beneath the graft.
be connected and cleared of bone debris using a Bankart awl (Kirwan, Marshfield, MA) with a similar radius of curvature as the curved needle of the passing suture. A looped suture is passed through the tunnel using a curved needle. It is tagged and set aside for later graft passage.

Once the ulnar tunnel is created, attention is turned to creating the humeral socket. An appropriately positioned humeral attachment site should provide an isometric reconstruction that maintains the same tension throughout the flexion-extension arc. This point is typically at the geometric center of a circle superimposed on the capitellar articular margin (Fig 2B). The isometry of this point can be confirmed by pulling the free ends of the passing suture from the ulnar tunnel to this location using a hemostat once a small starting indentation has been created with the 3.2-mm drill (Fig 2C). The suture should demonstrate even tension and isometry as the elbow is flexed and extended. With a 3.2-mm drill, the humeral socket is drilled toward, but not through, the posterior cortex to a depth of 15 mm. The center of this socket is placed approximately 1 mm proximal and 1 mm posterior to the previously identified isometric point. The center of the socket is moved just proximal and posterior because once tensioned, the graft will drape along the anteroinferior rim of the socket, which brings it back to the isometric point. A second socket is drilled toward, but not through, the anterior cortex.

A 2.0-mm drill is used to create 2 holes proximally on either side of the supracondylar ridge, one posteriorly and the other anteriorly. These holes should be at least 10 mm apart to provide a strong bony bridge over which sutures can be tied at the end of the case. A looped passing suture is passed through each tunnel and tagged for later graft passage.

**Graft Preparation**

Although autograft (palmaris or split hamstring tendon) can be used, we prefer to use the allograft plantaris tendon to minimize the surgical morbidity to the patient. If semitendinosus or peroneus longus allograft tendons are used, they are split to reduce bulk. In one end of the graft, a running locked suture

**Fig 3.** (A) Using the previously placed shuttling suture in this right elbow, the graft is first passed through the ulnar tunnel. The sutured end is docked into the posterior humeral tunnel using the suture previously placed through that tunnel. The graft is tensioned and the free limb is pulled across the socket and marked a few millimeters proximal to the aperture. (B) This end is sutured and the excess graft is excised. (C) Once sutured, this limb is docked into the anterior tunnel using the suture previously placed in that tunnel. The capsulotomy is closed and imbricated. While tension is maintained on the sutures, the graft is tensioned and cycled through multiple flexion-extension cycles. (D) The sutures grasping the graft are tied over the lateral supracondylar ridge. It is important that the knot be placed on the anterior aspect of the humerus to reduce irritation.
(No. 2-0 Fiberwire; Arthrex, Naples, FL) is placed and the remaining end is initially left free. Before graft passage, imbricating “vest-over-pants” capsular sutures are placed so that the capsulotomy can be closed at a later stage (Fig 2D). These are tagged but not tied until the graft has been passed.

**Graft Passage and Fixation**

Using the passing suture, the graft is passed through the ulnar tunnel from proximal to distal (Fig 3A). The sutured end is then docked into the posterior humeral socket using the posterior passing suture that was previously placed. The free end is laid across the aperture of the humeral socket and tensioned, whereas the elbow is flexed and extended. The tendon is marked a few millimeters proximal to the aperture, and a second running, locking stitch is applied from this mark traveling 10 mm away from the free end (Fig 3B). The excess graft is excised and the free end is docked into the socket using the anterior passing suture (Fig 3C). Once again, the graft is tensioned, whereas the elbow is taken through a flexion-extension arc. Before securing the graft, the capsule is closed using the previously placed capsular sutures to ensure that the graft remains extra-articular. The graft is now secured by tying the sutures over the bone bridge. Care is taken to ensure that the knot is placed on the anterior surface of the humerus to avoid irritation under the thin posterior skin (Fig 3D). The wound is then closed in layers.

**Postoperative Rehabilitation**

Although we are not certain as to the optimum postoperative management, we immobilize the arm in a long-arm cast for 3 weeks. A removable thermoplastic splint is applied for 3 more weeks. It is removed 4 times per day to do overhead range of motion (ROM) exercises in the supine position. Anytime the elbow is moved away from the body, the weight of the forearm is supported by the other hand to prevent inadvertent varus torque during these activities. ROM is progressed as able with a goal of achieving full ROM by three months postoperative. At 3 months, focus is shifted toward strengthening the elbow flexors, extensors, pronators, and supinators. Unrestricted activity and return to sport are generally allowed 6 months after surgery.

**Discussion**

Reconstruction of the LUCL remains the primary treatment strategy for symptomatic PLRI. When precise surgical steps are followed, elbow stability is restored in the vast majority of patients. In the first report on outcomes after LUCL reconstruction by Nestor et al,16 6 of 8 patients did not demonstrate subjective symptoms of instability at a mean of 41 months postoperatively. In a larger follow-up investigation, Sanchez-Sotelo et al.9 reported on 32 cases of LUCL reconstruction. In this series, satisfactory results were noted in 84% of patients after reconstruction.7 These results have been confirmed in a number of other small case series and a recent systematic review.14 Although differing techniques for LUCL reconstruction have not been compared, this review demonstrated good to excellent results for the vast majority of patients who underwent LUCL reconstruction for PLRI with a relatively low complication rate of 11%.14 The docking technique for LUCL reconstruction, as described in this Technical Note, has a number of distinct advantages, including reduced bone removal, creation of an isometric construct, and a historically high rate of restoration of joint stability (Table 1). A few potential disadvantages include the need for precise anatomical knowledge and technical precision for accurate tunnel geometry. Additional pearls and potential pitfalls are provided in Table 2. When precise surgical steps are followed, this procedure can be performed in an efficient and reproducible manner with minimal equipment required (Table 3).

| Table 1. Advantages/Disadvantages for the Docking Technique for LUCL Reconstruction |
|--------------------------------------|---------------------------------------|
| **Advantages**                        | **Disadvantages**                     |
| - Minimal bone removal                | - Requires precise knowledge of anatomic landmarks |
| - Minimal release of extensor origin preserves tendon contributions to stability | - Requires some technical precision for tunnel creation |
| - Provides isometric reconstruction   | - Shuttle sutures can be difficult to pass if the tunnel geometry is not accurate |
| - Permits precise and controlled tensioning of the graft before final fixation | - Minimal exposure of the lateral condyle requires familiarity and precision |
| - Historically high rate of patient satisfaction and restoration of elbow stability |                                      |

LUCL, lateral ulnar collateral ligament.

**Table 2. Pearls/Potential Pitfalls for the Docking Technique for LUCL Reconstruction**

| Pearls | Potential Pitfalls |
|--------|--------------------|
| - Ensure isometry of the humeral tunnel before drilling socket | - Ensure that a robust bone bridge is maintained between the ulnar sockets to minimize fracture risk |
| - Large diameter grafts (hamstring, peroneus longus) should be split to reduce bulk | - Postoperatively, ensure that patients support the weight of the forearm when lifting the arm to avoid inadvertent varus torque to the elbow |
| - Close capsule deep to the graft to ensure that the graft is maintained in an extra-articular position | |

LUCL, lateral ulnar collateral ligament.
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Table 3. Equipment Required

- 3.2-mm drill bit for bones tunnels (Stryker, Kalamazoo, MI)
- Bankart Awl (Kirwan, Marshfield, MA)
- 2.0-mm drill bit for proximal holes of humeral tunnels (Stryker, Kalamazoo, MI)
- No. 2-0 Vicryl on a small taper needle to pass suture through the ulnar tunnel
- No. 1 Vicryl on a large needle to pass sutures through the humeral tunnels
- No. 2-0 Fiberwire suture (Arthrex, Naples, FL) for grasping ends of the graft
- Tendon graft (palmaris longus autograft, split hamstring, allograft plantaris, split peroneus longus allograft)