CQ HAND + UPPER LIMB
SPECIALIST ORTHOPAEDIC SURGEON

EVIDENCE SUMMARY

Elbow Ligament Reconstruction (Stabilisation)

Overview

- An all-arthroscopic technique for reconstruction of the lateral ulnar collateral ligament (LUCL) is reproducible and avoids residual instability [1].
- Open posterolateral ligament plication and LUCL repair using an all-suture construct allows for complete posterolateral stabilization of the elbow with a single implant and bone preservation [2].
- A suture-augmented LUCL and radial collateral ligament reconstruction method provides a reproducible, anatomically based construct that restores posterolateral elbow stability [3].
- The suture-augmented LUCL and radial collateral ligament reconstruction method addresses the complex spectrum of lateral-sided injuries observed in posterolateral rotatory instability (PLRI) [3].
- An arthroscopic LUCL plication/reconstruction with augmented lateral collateral ligament imbrication is a minimally invasive method that allows effective management of elbow instability [4].
- The arthroscopic LUCL plication/reconstruction with augmented lateral collateral ligament imbrication promotes quicker patient recovery and long-term functional restoration [4].
- The use of suture button fixation for repair of the lateral ulnar collateral ligament in terrible triad injuries has not been previously described [5].
- Reconstruction of the lateral ulnar collateral ligament with a tendon graft offers an alternative that restores stability through a dynamic “sling effect” rather than rigid constraint [6].

Anatomy & Pathophysiology

BONY ANATOMY

- The elbow is a trocho-ginglymoid joint consisting of medial and lateral articulations that provide bony stability [11].
- The trochlea articulates with the ulna within the greater sigmoid notch to create the ulnohumeral, hinged, or trochoid portion of the elbow joint [11].
- The ulnohumeral articulation has highly congruent anatomy through almost 180° of articular contact, except for the bare area of the greater sigmoid notch which is devoid of cartilage [11].

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- The coronoid has a medial and lateral facet which buttresses the trochlea anteriorly [11].
- The sublime tubercle is located just distal and medial to the coronoid and provides the attachment site for the anterior bundle of the medial ulnar collateral ligament [11].
- The medial epicondyle forms the attachment site for the origins of the flexor pronator mass and is larger and more posteriorly oriented than the lateral epicondyle [11].
- The capitellum and radial head form the radiocapitellar joint [11].
- The radius is held in close approximation to the ulna at the proximal radioulnar joint by the annular ligament [11].
- The area of the ulna which articulates with the margin of the radial head at the proximal radioulnar joint is known as the lesser sigmoid notch [11].
- The radial head is a concave elliptical structure covered with articular cartilage along the radiocapitellar joint and approximately 270° of the articular margin [11].
- The radial head articulates with both the capitellum and the lesser sigmoid notch [11].
- The lateral epicondyle is the origin of the lateral extensor musculature [11].
- The origin of the lateral ulnar collateral ligamentous complex is located just distal to the lateral epicondyle at the geometric center of the radiocapitellar articulation [11].
- The distal humeral articulation is angled 30° from the longitudinal axis [11].
- The anterior humeral line should pass through the center of the axis of rotation [11].
- The axis of rotation is 5° to 7° angulated in the coronal plane to the epicondylar axis, with the medial side more distal than the lateral side [11].
- The angulation of the distal humeral articulation accounts for the change from a valgus carrying angle to a more varus position as the elbow is flexed [11].
- There is a high correlation between the size of the radius and capitellum on the left and right sides in the same individual [11].
- The olecranon allows for a broad attachment site of the triceps [11].
- The ulna medially bends approximately 8° at 8 cm from the tip of the olecranon [11].
- The articulation to the tip of the coronoid is approximately 30° from the long axis of the ulna in the sagittal plane [11].
- The radial head should line up with the capitellum at all arm positions on all radiographic views [12, 13].
- Tensile forces are present at the medial elbow and compressive forces are present at the lateral elbow [12, 13].

LIGAMENTS & STABILITY

- Elbow stability is conferred by bony articular anatomy and ligamentous structures on the medial and lateral sides [9].
- The three primary stabilizers of the elbow are the ulnohumeral articulation, the medial ulnar collateral ligament, and the lateral ulnar collateral ligament complex [9].

- Secondary stabilizers of the elbow include the radiocapitellar articulation, the common flexor tendon, the common extensor tendon, and the joint capsule [9].
- The lateral ulnar collateral ligament is the posterolateral stabilizer of the elbow [12, 13].
- The medial or ulnar collateral ligament is the primary valgus stabilizer of the elbow [12, 13].
- The anterior bundle of the medial ulnar collateral ligament is the most important component for stability [12, 13].
- The posterior bundle of the medial ulnar collateral ligament has the greatest change in length and becomes taut at flexion beyond 120 degrees [12, 13].
- The lateral ulnar collateral ligament arises from the epicondyle and inserts on the annular ligament [18].
- A separate band of the lateral ligamentous complex, the lateral ulnar collateral ligament, arises at the lateral epicondyle and blends with fibers of the annular ligament before inserting on the tubercle on the crest of the supinator of the ulna [18].
- The lateral ulnar collateral ligament is described as the main lateral stabilizer, taut in flexion and extension [18].
- Disruption of the lateral ulnar collateral ligament results in posterolateral rotatory instability [18].
- The lateral collateral ligament contributes 14% of the varus stability of the elbow with the joint in full extension [18].
- The lateral collateral ligament contributes 9% of the varus stability of the elbow with the joint in 90 degrees of flexion [18].
- The remainder of varus stability is contributed by the bony articular surfaces and the anterior capsule, with the bony surfaces providing the stability [18].
- The ulnar collateral ligament plays an important role in valgus stability [18].
- Valgus stability is divided equally among the ulnar collateral ligament, the anterior capsule, and the bony articulation with the elbow in full extension [18].
- At 90 degrees of flexion, the ulnar collateral ligament provides 55% of the stability to valgus stress [18].
- The anterior bundle of the ulnar collateral ligament is the primary stabilizer for valgus stress at 90 degrees of flexion [18].
- The primary stabilizers of the elbow are the anterior band of the medial ulnar collateral ligament and the lateral collateral ligament complex, consisting of the lateral collateral ligament, annular ligament, and the lateral ulnar collateral ligament [18].
- Secondary stabilizers consist of the capsule, the ulnohumeral and radiocapitellar articulations, and dynamic stabilizers consisting of all muscle-tendon units that cross the elbow joint [18].
- Dynamic stabilizers include the biceps, brachialis, triceps, wrist flexors, and wrist extensors [18].
- Insufficiency of one or more stabilizers may result in a spectrum of instability from subtle valgus or posterolateral rotatory instability to recurrent dislocation [18].
- The typical injury pattern for traumatic elbow dislocation involves a fall on a slightly flexed extremity with a valgus internal rotation force of the forearm [18].

- In traumatic elbow dislocation, structures are disrupted on the lateral side, progressing medially as more force is applied [18].
- When recurrence or persistence in instability results from traumatic dislocation, the posterolateral structures are most commonly affected [18].
- Medial structures can also be involved in traumatic dislocation and cause significant instability [18].
- A coronoid fracture in association with disruption of the posterior band of the ulnar collateral ligament can result in symptomatic posteromedial instability [18].
- Isolated medial side disruptions from valgus stress can result from football tackling, gymnastics, or throwing a javelin [18].
- Valgus instability from attritional disruption of the anterior bundle of the medial ulnar collateral ligament is the most common form of recurrent elbow instability [18].
- The anterior bundle of the medial ulnar collateral ligament is divided into two nonisometric bands: an anterior band taut at 0 to 60 degrees and a posterior band taut at 60 to 120 degrees [18].
- During the acceleration phase of throwing, up to 60 N of force is applied to the medial ulnar collateral ligament, which is near its tensile failure point [18].
- Pitcher fatigue, poor mechanics, or repetition overuse can result in bundle fiber failure, partial tearing, and eventual complete disruption of the medial ulnar collateral ligament [18].
- Failure of the primary stabilizer results in increased stress on secondary stabilizers [18].
- Increased stress on secondary stabilizers can result in capsular contractures, chondromalacia, osteophytes, and loose bodies from compression of the radiocapitellar joint and shear forces to the posteromedial tip of the olecranon [18].
- Ulnar nerve symptoms may develop from traction, scarring, or osteophyte impingement following primary stabilizer failure [18].

MUSCLES & SOFT TISSUE

- The brachialis is the strongest elbow flexor and attaches to the coronoid 11 mm distal to the tip [12, 13].
- The biceps brachii inserts at the ulnar margin of the radial tuberosity, with the long head proximal and short head distal [12, 13].
- The biceps brachii is a powerful supinator of the forearm [12, 13].
- The primary elbow extensor, the triceps, inserts on the olecranon process [12, 13].
- The mobile wad consists of the brachioradialis, extensor carpi radialis longus, and extensor carpi radialis brevis [12, 13].
- The flexor-pronator mass consists of the pronator teres, flexor carpi radialis, palmaris longus, flexor carpi ulnaris, and flexor digitorum superficialis [12, 13].
- The common origin of the extensor muscles is attached to the lateral condyle and need not be disturbed in a lateral approach to a fracture of the lateral condyle [14].
- The radial nerve enters the interval between the brachialis and brachioradialis muscles in the proximal angle of the lateral approach wound [14].

- The deep branch of the radial nerve enters the supinator muscle and must be protected during lateral approach dissection [14].
- The common extensor tendon is a secondary stabilizer of the lateral elbow [8].
- The articular capsule is a secondary stabilizer of the lateral elbow [8].

PATHOPHYSIOLOGY & INSTABILITY

- Elbow instability may be congenital, traumatic, or attritional [18].
- In a long-term follow-up study of simple elbow dislocations, 60% of patients had residual stiffness with loss of extension and residual pain [18].
- In a long-term follow-up study of simple elbow dislocations, only 8% of patients had functional instability [18].
- When fractures are associated with elbow dislocation, resulting in loss of bony stability provided by the greater sigmoid notch of the ulna or the radiocapitellar joint, greater instability and disability can be anticipated [18].
- The docking technique for lateral ulnar collateral ligament reconstruction has shown recurrent instability rates as high as 25% [8].
- Postoperative stiffness is a known complication of lateral ulnar collateral ligament reconstruction and occurs not uncommonly [8].

Classification

- The docking technique originally described by Jones et al. in 2012 is the most common method in use in contemporary practice for LUCL reconstruction [8].
- The docking technique has shown recurrent instability rates as high as 25% [8].
- A knotless, onlay technique performs LUCL reconstruction with a tendon graft without violation of the extensor origin and soft tissue envelop [8].
- The use of knotless anchors and an onlay technique shortens operative time, reduces the required surgical exposure, and removes the risk of tunnel osteolysis or fracture and resultant graft failure while maintaining a broad bone surface for graft incorporation [8].
- Minimally-invasive dissection prevents iatrogenic injury to the common extensor origin, an important secondary stabilizer of the lateral elbow, and the articular capsule [8].
- Remaining extracapsular with a minimally-invasive technique avoids plication of the capsular structures or risk of formation of intra-articular adhesions, theoretically reducing the risk of any postoperative loss of range of motion [8].

Clinical Presentation

- Posterolateral rotatory instability of the elbow involves a complex spectrum of lateral-sided injuries [3].

- High-grade atraumatic posterolateral rotatory instability is a clinical presentation managed by arthroscopic lateral collateral ligament reconstruction with tendon graft [6].
- Subacute and chronic posterolateral rotatory instability is a clinical presentation managed by suture-augmented lateral ulnar collateral ligament and radial collateral ligament reconstruction [3].
- Terrible triad injuries are a clinical presentation in which lateral ulnar collateral ligament repair using suture button fixation is indicated [5].

Investigations

PHYSICAL EXAMINATION

- Elbow stability is determined by primary stabilizers (ulnohumeral articulation, MUCL, LUCL complex) and secondary stabilizers (radiocapitellar articulation, common flexor tendon, common extensor tendon, joint capsule) [9].
- The normal elbow has a range of motion from 0° to 140° from extension to flexion and 75° and 85° in pronation and supination respectively [9].
- A functional arc in each plane is 100° for flexion and extension and forearm rotation [9].
- The physical exam is directed by history and the location of the patient's pain in the anterior, posterior, medial, or lateral aspect of the elbow [9].

IMAGING

- Plain radiographs remain the hallmark and the best screening test for elbow evaluation [9].
- AP, lateral, and oblique radiographs are standard for elbow evaluation [17].
- CT is helpful when assessing for malunion architecture and the location and pattern of osteophytes and/or loose bodies [17].
- Three-dimensional CT is used to check for heterotopic ossification [17].
- CT is not necessary when the stiffness is entirely soft-tissue related [17].
- MRI can be used to evaluate ligaments and tendons, but it is rarely indicated for elbow stiffness [17].
- Magnetic resonance evaluation of the elbow includes imaging of ligament complexes [16].
- MR evaluation of instability patterns including the soft-tissue lesions that result from dislocation is emphasized [16].
- MRI may be most helpful in evaluating associated injuries including partial or complete tears of the MCL in valgus extension overload syndrome [20].
- CT with two-dimensional reconstruction and three-dimensional surface rendering best visualizes the pathology of valgus extension overload syndrome [20].
- Radiographic evaluations are essential when diagnosing an OCD lesion of the elbow, however important aspects of the OCD lesions may be better seen with MRI [21].

Treatment

ARTHROSCOPIC TECHNIQUES

- An all-arthroscopic reconstruction of the lateral ulnar collateral ligament is a reproducible technique that avoids residual instability [1].
- Arthroscopic lateral ulnar collateral ligament plication or reconstruction with augmented lateral collateral ligament imbrication is a minimally invasive method that promotes quicker patient recovery and long-term functional restoration [4].
- Arthroscopic lateral ulnar collateral ligament reconstruction with a tendon graft restores stability through a dynamic "sling effect" rather than rigid constraint [6].
- Arthroscopic-assisted lateral ulnar collateral ligament reconstruction provides less insult and dissection to the soft tissue at the lateral side of the elbow [7].
- Arthroscopic-assisted lateral ulnar collateral ligament reconstruction serves as an excellent tool to diagnose concomitant intraarticular pathologies [7].

OPEN AND MINI-INVASIVE TECHNIQUES

- Open posterolateral ligament plication and lateral ulnar collateral ligament repair using an all-suture construct allows for complete posterolateral stabilization of the elbow with a single implant and bone preservation [2].
- Suture-augmented lateral ulnar collateral ligament and radial collateral ligament reconstruction provides a reproducible, anatomically based construct that restores posterolateral elbow stability [3].
- Suture-augmented lateral ulnar collateral ligament and radial collateral ligament reconstruction addresses the complex spectrum of lateral-sided injuries observed in posterolateral rotatory instability [3].
- A mini-invasive approach for lateral ulnar collateral ligament reconstruction uses a knotless, onlay technique that performs reconstruction without violation of the extensor origin and soft tissue envelop [8].
- The knotless, onlay technique for lateral ulnar collateral ligament reconstruction shortens operative time and reduces the required surgical exposure [8].
- The knotless, onlay technique for lateral ulnar collateral ligament reconstruction removes the risk of tunnel osteolysis or fracture and resultant graft failure while maintaining a broad bone surface for graft incorporation [8].
- Minimally-invasive dissection for lateral ulnar collateral ligament reconstruction prevents iatrogenic injury to the common extensor origin and the articular capsule [8].
- Minimally-invasive dissection for lateral ulnar collateral ligament reconstruction allows for earlier rehabilitation and return of range of motion, reduced postoperative pain, and reduced operative time [8].
- Fluoroscopic guidance during minimally-invasive lateral ulnar collateral ligament reconstruction can help to reduce injuries to unintended structures [8].
- Remaining extracapsular during lateral ulnar collateral ligament reconstruction avoids plication of the capsular structures and the risk of formation of intra-articular adhesions [8].

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- Remaining extracapsular during lateral ulnar collateral ligament reconstruction theoretically reduces the risk of postoperative loss of range of motion [8].

SPECIFIC INDICATIONS AND CONSTRUCTS

- Suture button fixation for repair of the lateral ulnar collateral ligament in terrible triad injuries has not been previously described [5].

Complications

- The docking technique for LUCL reconstruction has shown recurrent instability rates as high as 25% [8].
- Postoperative stiffness is a known complication of LUCL reconstruction and occurs not uncommonly [8].
- The use of a knotless, onlay technique removes the risk of tunnel osteolysis or fracture and resultant graft failure [8].
- Minimally-invasive dissection prevents iatrogenic injury to the common extensor origin, an important secondary stabilizer of the lateral elbow [8].
- Minimally-invasive dissection prevents iatrogenic injury to the articular capsule [8].
- Remaining extracapsular with a minimally-invasive technique avoids plication of the capsular structures [8].
- Remaining extracapsular with a minimally-invasive technique avoids the risk of formation of intra-articular adhesions [8].
- Fluoroscopic guidance can help to reduce injuries to unintended structures that could be foreseen due to a limited exposure [8].

Recovery

- The arthroscopic reconstruction of the lateral ulnar collateral ligament avoids residual instability [1].
- The open posterolateral ligament plication and lateral ulnar collateral ligament repair technique allows for complete posterolateral stabilization of the elbow [2].
- The open posterolateral ligament plication and lateral ulnar collateral ligament repair technique achieves bone preservation [2].
- The suture-augmented lateral ulnar collateral ligament and radial collateral ligament reconstruction restores posterolateral elbow stability [3].
- The arthroscopic lateral ulnar collateral ligament plication/reconstruction with augmented lateral collateral ligament imbrication promotes quicker patient recovery [4].
- The arthroscopic lateral ulnar collateral ligament plication/reconstruction with augmented lateral collateral ligament imbrication promotes long-term functional restoration [4].
- Reconstruction of the lateral ulnar collateral ligament with a tendon graft restores stability through a dynamic “sling effect” rather than rigid constraint [6].

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Key Evidence

- [L5] The presented arthroscopic technique is reproducible and achieves the reconstruction of the LUCL of the elbow as well as avoids residual instability. [1] (10.1016/j.eats.2024.103096)
- [L5] The technique allows for complete posterolateral stabilization of the elbow with a single implant and bone preservation. [2] (10.1016/j.eats.2024.103172)
- [L5] The described method provides a reproducible, anatomically based construct that restores posterolateral elbow stability and addresses the complex spectrum of lateral-sided injuries observed in PLRI. [3] (10.1016/j.eats.2025.103797)
- [L5] This minimally invasive method allows effective management of elbow instability while promoting quicker patient recovery and long-term functional restoration. [4] (10.1016/j.eats.2025.103529)
- [L4] The use of suture button fixation for repair of lateral ulnar collateral ligament has not been previously described. [5] (10.1016/j.eats.2023.10.004)
- [L5] Reconstruction of the lateral ulnar collateral ligament with a tendon graft offers an alternative, restoring stability through a dynamic “sling effect” rather than rigid constraint. [6] (10.1002/atn2.70037)
- [L5] It provides less insult and dissection to the soft tissue at the lateral side of the elbow while being an excellent tool to diagnose any concomitant intraarticular pathologies. [7] (10.1016/j.eats.2024.103101)
- [L5] [8] (10.1002/atn2.70135)

References

[1] Posterolateral Elbow Dislocation: An All-Arthroscopic Reconstruction of the Lateral Ulnar Collateral Ligament. *Arthroscopy Techniques*. 2024. DOI: 10.1016/j.eats.2024.103096

[2] Open Posterolateral Ligament Plication and Lateral Ulnar Collateral Ligament Repair in Posterolateral Rotatory Instability of the Elbow Using an All-Suture Construct. *Arthroscopy Techniques*. 2024. DOI: 10.1016/j.eats.2024.103172

[3] Suture-Augmented Lateral Ulnar Collateral Ligament and Radial Collateral Ligament Reconstruction for Subacute and Chronic Posterolateral Rotatory Instability. *Arthroscopy Techniques*. 2025. DOI: 10.1016/j.eats.2025.103797

[4] Arthroscopic Lateral Ulnar Collateral Ligament Plication/Reconstruction With Augmented Lateral Collateral Ligament Imbrication. *Arthroscopy Techniques*. 2025. DOI: 10.1016/j.eats.2025.103529

[5] Suture Button Repair for Lateral Ulnar Collateral Ligament in Terrible Triad Injuries: Surgical Technique. *Arthroscopy Techniques*. 2024. DOI: 10.1016/j.eats.2023.10.004

[6] Arthroscopic Lateral Collateral Ligament Reconstruction With Tendon Graft in High-Grade Atraumatic Posterolateral Rotatory Instability in Elbows. *Arthroscopy Techniques*. 2026. DOI: 10.1002/atn2.70037

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[7] Arthroscopic-Assisted Lateral Ulnar Collateral Ligament Reconstruction for Posterolateral Rotatory Instability of the Elbow: A Technical Note. *Arthroscopy Techniques*. 2024. DOI: 10.1016/j.eats.2024.103101

[8] Lateral Ulnar Collateral Ligament Reconstruction Through a Mini-Invasive Approach. *Arthroscopy Techniques*. 2026. DOI: 10.1002/atn2.70135

[9] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Anatomy, Biomechanics, Physical Examination, and Imaging of the Elbow > Summary and Conclusions.

[11] Orthopaedic Knowledge Update 13 Ebook Without Multimedia. Anatomy, Biomechanics, Physical Examination, and Imaging of the Elbow > Anatomy > Bony Anatomy.

[12] Miller S Review Of Orthopaedics. SECTION 16 PATELLAR TRACKING IN TOTAL KNEE ARTHROPLASTY > TABLE 2.3 Shoulder Spaces.

[13] Miller S Review Of Orthopaedics. Genetics of musculoskeletal conditions and abnormalities are summarized in Table 1.27 > TABLE 2.3 Shoulder Spaces.

[14] Campbell S Operative Orthopaedics 4 Volume Set. LATERAL APPROACHES.

[16] Orthopaedic Knowledge Update Sports Medicine 6. Magnetic Resonance Imaging of the Elbow > Annotated References.

[17] Aaos Comprehensive Orthopaedic Review 3. Elbow Stiffness* > IV. Evaluation.

[18] Campbell S Operative Orthopaedics 4 Volume Set. POSTERIOR SURGICAL APPROACH FOR QUADRILATERAL SPACE SYNDROME > MCLAUGHLIN PROCEDURE > ARTHROSCOPIC SURGERY.

[20] Aaos Comprehensive Orthopaedic Review 3. Elbow Injuries in the Athlete* > III. Valgus Extension Overload Syndrome and Posterior Impingement.

[21] Orthopaedic Knowledge Update. Osteochondritis Dissecans of the Knee and Elbow* > Summary.

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