Medial Elbow Injuries in the Throwing Athlete

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KEYWORDS

• Ulnar collateral ligament • UCL reconstruction • Throwing elbow injuries
• Adolescent sports injuries • Tommy John surgery

KEY POINTS

- The anterior bundle of the ulnar collateral ligament (UCL) is the primary restraint to valgus stress in the elbow.
- The incidence of athletes undergoing UCL reconstruction has been increasing substantially.
- Advances in the surgical technique of UCL reconstruction have minimized postoperative complications.
- Most athletes are able to return to a high level of competition following both nonoperative and surgical treatment of medial elbow injuries.

INTRODUCTION

Since its first description in 1946, ulnar collateral ligament (UCL) and other medial elbow injuries have been observed with increasing frequency in the overhead athlete.[1] Presumably due to increased participation in throwing sports as well as an enhanced awareness of this injury constellation, there has also been a significant increase in the incidence diagnosis and treatments required for these injuries.[2,3] Fortunately, a concomitant awareness to the issue within the orthopedic community has lead to the development of a substantial body of research on the pathophysiology and treatment of medial elbow abnormality. Jobe and colleagues[4] pioneered UCL reconstruction (colloquially known as Tommy John surgery) in 1974, and since then, multiple technical multiple alterations in both technique and the scope of the procedure have been proposed.[5] In addition, research has led to advances in measures designed to limit injury risk and postoperative rehabilitation methods to facilitate safe return to play.[6,7]

Owing to a discrete pattern of supraphysiologic and pathologic forces acting on the elbow during the throwing motion, medial elbow injuries are most commonly observed in the overhead-throwing athlete. Although most classically and frequently described in baseball players (>95% in one study of 1266 patients[8]), UCL injury and other medial elbow abnormality have been reported in a variety of overhead athletes, including gymnasts, javelin throwers, cheerleaders, and tennis and football players.[7,8] Although the overall rate of elbow injuries is low, the total number of these injuries is significant because of an increasing participation nationally in overhead athletics.[2] Even though no national database of these injuries is available to determine the exact rate of medial elbow injury in the throwing athlete, the incidence of these injuries has reportedly been increasing.[2,9,10] For example, the number

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of UCL reconstruction procedures has increased 193% in New York State from 2002 to 2011.[11] Fleisig and Andrews[2] reported a 22-fold increase in the incidence of UCL reconstruction from 1994 to 2010 at their institution. The purpose of this article is to review current concepts related to medial elbow injury and reconstruction in the overhead athlete.

RELEVANT ANATOMY OF THE MEDIAL ELBOW

The osseous structures of the medial elbow consist of the ulnohumeral articulation between the trochlea of the humerus and the sigmoid notch of the olecranon (**Fig. 1**), which normally features a valgus carrying angle of 11° to 16°. This bony articulation contributes to valgus stability of the elbow from full extension to ~30° flexion. In greater degrees of flexion, stability is mainly determined by UCL function.[12]

The UCL comprises 3 different bundles of fibers: the anterior, posterior, and transverse bundles. The posterior bundle of the UCL is a fan-shaped thickening of the posteromedial joint capsule. It provides minimal stability to the medial elbow. Its average length and width are 16.5 and 9.9 mm, respectively.[13] The transverse, or oblique, bundle originates and inserts on the ulna and thus does not contribute to elbow joint stability.

The anterior bundle of the UCL is the primary restraint to valgus stress at the elbow during range of motion (ROM) between 20° and 120°.[14] As the strongest and stiffest ligament of all the elbow stabilizers, the anterior bundle is well defined and easily discernible from, although still intimately associated with, the medial joint capsule underneath. It originates from anterior-inferior edge of the medial epicondyle and inserts on the sublime tubercle of the proximal ulna. The ulnar insertion begins an average of 2.8 mm distal to the ulnar articular surface and extends distally an average of 29 mm along a bony prominence known as the medial ulnar collateral ridge (**Fig. 2**).[15] The anterior bundle has an average length reported between 21 and 59 mm and average width of 7.6 mm.[13,15] The anterior bundle itself separates into an anterior and posterior band at its insertion. The anterior band provides the major source of valgus stability, whereas the posterior band becomes a significant restraint at flexion past 90°.[16]

The ulnar nerve passes posterior to the medial epicondyle of the humerus through the cubital tunnel, in which the floor is made up of the posterior and transverse bundles of the UCL. The nerve leaves the elbow as it passes between the 2 heads of the flexor carpi ulnaris (FCU). Around the elbow, the nerve may be compressed by medial epicondyle osteophytes, Osborne ligament (roof of the cubital tunnel), or the arcuate ligament (aponeurosis of the 2 heads of the FCU).

Originating from the medial epicondyle, the flexor-pronator muscle group includes the pronator teres (PT), flexor carpi radialis (FCR), palmaris longus, flexor digitorum superficialis (FDS), and the FCU. From this group, the PT, FDS, and FCU contribute to dynamic valgus elbow stability. The FCU, in particular, overlies the UCL in nearly the entire ROM of the elbow.[17]

In the skeletally immature patient, the developing growth plates (physes) are relatively weak compared with the other surrounding structures, predisposing to unique injury patterns in this population. The medial epicondyle apophysis begins its ossification at ~5 years of age and completes ossification at ~15 years of age, a time at which

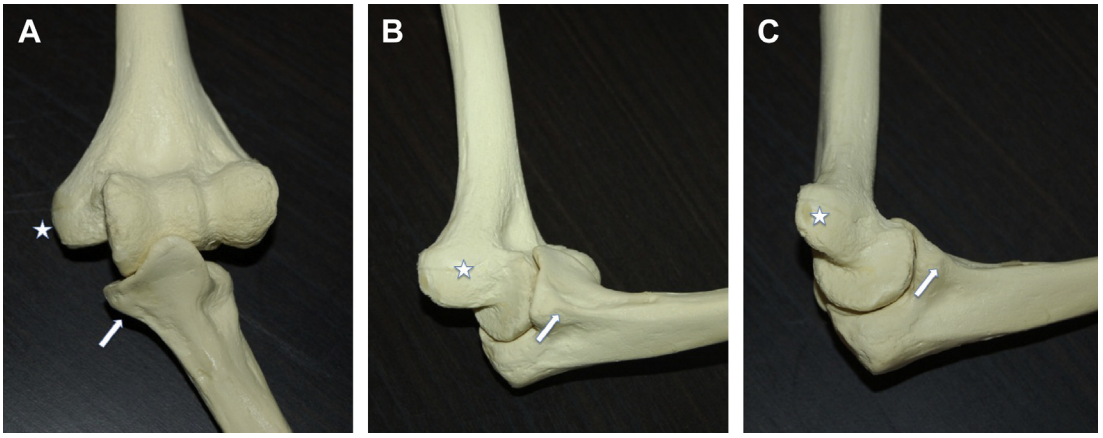

Fig. 1. AP (*A*), oblique (*B*), and lateral (*C*) views of a model detailing the osseous anatomy of the medial epicondyle (*star*) and sublime tubercle (*arrow*).