HOSPITAL PHYSICIAN®

ORTHOPAEDIC SPORTS MEDICINE BOARD REVIEW MANUAL

STATEMENT OF EDITORIAL PURPOSE

The *Hospital Physician Orthopaedic Sports Medicine Board Review Manual* is a peer-reviewed study guide for orthopaedic sports medicine fellows and practicing orthopaedic surgeons. Each quarterly manual reviews a topic essential to the current practice of orthopaedic sports medicine.

NOTE FROM THE PUBLISHER:
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Elbow Injuries in Sports

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INTRODUCTION

Elbow injuries occur throughout a wide array of sporting activities;[1–8] the majority can be classified as either overuse or acute traumatic injuries. The nature of the sport or activity often helps to classify elbow pathology. Overuse injuries (ie, injuries resulting from repetitive stresses) are common in overhead and throwing sports (eg, baseball, tennis, volleyball), while acute traumatic injuries are more common in contact and tumbling sports (eg, football, gymnastics). Obvious overlap exists between these general groups; however, it is important to understand the nature of the demand on the elbow that led to injury.

Unfortunately, elbow injuries are on the rise in many sports. Most notably, injuries to the thrower's elbow have increased dramatically in the past 2 decades. Injuries once limited to throwers at the highest professional levels are now increasingly common at the high school and even junior high school levels. Azar et al[9] reported a more than 50% increase in the number of ulnar collateral ligament (UCL) reconstructions in high school athletes since 1995. Common denominators for many of these injured athletes include year-round throwing, high pitch counts, and curve ball throwing at early ages.[9–11]

This manual reviews common elbow injuries in sports. Some elbow injuries may not lead to significant morbidity, whereas others may endanger the athlete's ability to return to sport. However, most can be successfully treated, with minimal long-term ramifications. Knowledge of the forces and stresses that occur at the elbow is important for understanding common sports-related elbow injuries and the treatments offering the best chance for normal function and return to competition.

ELBOW ANATOMY AND BIOMECHANICS

ANATOMY

Both bony and soft tissue restraints contribute to the static and dynamic stability of the elbow. The olecranon/olecranon fossa and coronoid/coronoid fossa articulations provide primary bony stability at elbow flexion angles of less than 20° and greater than 120°, respectively. From 20° to 120° of flexion, soft tissue restraints provide the primary static and dynamic restraints.

The primary restraint to valgus stress at the elbow is the UCL complex,[12–15] which consists of 3 bundles: the anterior bundle, the posterior bundle, and a variable transverse oblique bundle (**Figure 1**). The anterior bundle provides the majority of the restraint to valgus stress from 30° to 120° of flexion. Secondary restraints to valgus stress include the radiocapitellar articulation and the medial flexor-pronator muscle group. The primary restraint to varus stress is the lateral ligament complex, which consists of the lateral collateral ligament (LCL) and the lateral ulnar collateral ligament (LUCL) (**Figure 2**). Secondary varus restraints include the extensor mass and the ulnohumeral articulation. The ulnohumeral articulation is the primary restraint to anterior translation; the coronoid process and joint capsule along with the ligament complexes all contribute to posterior stability, depending on the elbow flexion angle.

BIOMECHANICS

The forces commonly encountered at the elbow in sports are best documented in the overhead throwing athlete. The overhead throwing motion generates significant valgus and extension forces. Fleisig et al[16] estimated that the valgus stress can reach 64 Nm, with compression forces in the radiocapitellar articulation as high as 500 N and extension velocities in excess of 3000° per second. In addition to lateral compressive forces, large tensile forces occur in the medial structures (ie, UCL, medial muscle mass, medial epicondyle), and shear stresses occur in the posterior compartment (ie, olecranon tip, olecranon fossa). These combined forces have been termed *valgus extension overload* (VEO) and are believed to be responsible for most injury patterns seen in the throwing athlete. Repetitive tensile stresses, which approach or exceed the ultimate strength of the UCL, can ultimately cause attenuation or rupture of the ligament. Continued valgus stress, even to intact ligaments, can cause the formation of olecranon tip osteophytes, loose bodies, articular