Introduction

The elbow is a complex structure that provides an important function as the mechanical link in the upper extremity between the hand, the wrist, and the shoulder. Its primary functions are to position the hand in the space; loss of this ability can cause significant disability for the activities of daily living. The elbow and the wrist joints associated with the ulna and radius bones linked with the interosseous membrane constitute the anatomical and functional unit of the forearm. This unit provides the rotational movements of the forearm and allows the forces transmission from the hand to the elbow when the elbow joint is the stable fulcrum needed for powerful grasping and fine motions. The elbow joint consists of three separate articulations: the ulnohumeral, radio-capitellar, and proximal radio-ulnar joints, together inside a small capsule with a volume of 15-20 cc. The soft tissue are divided into passive stabilizers (the lateral collateral ligament, the medial collateral ligament, and the capsula) and into active stabilizers as the muscle that provides joint compressive forces and functions. This chapter begins with an overview of the anatomical features, including some anatomical tables of the nonarticular structures, and examines the passive structures of the elbow that are related to joint function and motion. The second section discusses the elbow biomechanics including kinematics, and force transmission through the elbow.

Anatomy of the Elbow

Bone Anatomy

The distal humerus comprises two condyles that form the articular surface of the capitellum laterally and the trochlea medially (Fig. 1). The more prominent medial epicondyle is the region (Fig. 2) where the ulnar collateral ligament and the flexor-pronator muscles are attached. The less prominent lateral epicondyle (Fig. 3) is the attached point for the lateral collateral ligament and the extensor supinator muscles. The articular surface is angled approximately 30° anterior to the axis of the humerus shaft. The medial ridge of the trochlea is larger than the lateral ridge; this gives to the articular surface a slight valgus position, approximately 6° from the epicondylar axis (Figs. 4, 5). During the flexion extension the olecranon moves on the articular surface of the trochlea like a screw tapping on it and it allows the normal valgus angle in extension and the varus in flexion (carrying angle) [1-7]. The coronoid fossa and the olecranon fossa proximally to the articular surface accommodates the olecranon process during the extension and the coronoid tip during the flexion movements, increasing the osseous stability of the joint in these positions [1, 4, 8]. Laterally a small radial fossa accepts the contour of the radial head with the elbow in full flexion.
Fig. 1 a, b. The anterior and posterior aspects of the distal humerus with the bone landmarks (TC 3D reconstruction)

Fig. 2. The medial aspect of the distal humerus (TC 3D reconstruction)

Fig. 3. The lateral aspect of the distal humerus (TC 3D reconstruction)

Fig. 4. The distal humerus articular surface: TC 3D reconstruction with bone landmarks

Fig. 5. The distal humerus articular surface anatomical picture with bone landmarks