Basic Shoulder Anatomy

The shoulder complex is made up of three bones, which are connected by muscles, ligaments, and tendons. The large bone in the upper arm is called the humerus. The shoulder blade is called the scapula and the collarbone is called the clavicle. The top of the humerus is shaped like a ball. This ball sits in a socket on the end of the scapula. The ball is called the head of the humerus and the socket is called the glenoid fossa, hence the term "glenohumeral" joint. The glenoid fossa has a rim of tissue around it called the glenoid labrum. The glenoid labrum makes the glenoid fossa deeper. The glenohumeral joint is the most mobile joint in the body.

Articular cartilage is a smooth shiny material that covers the humeral head and the glenoid fossa of the glenohumeral joint. There is articular cartilage anywhere that the bony surfaces come into contact with each other. Articular cartilage allows these bones to slide easily over each other as the arm moves.

The glenohumeral joint is just one of the joints in the shoulder complex. The other two joints are the sternoclavicular joint and the acromioclavicular joint. The sternoclavicular joint allows a small amount of movement to occur between the inner (medial) part of the clavicle and the breastbone (sternum). The acromioclavicular joint allows a small amount of movement to occur between the outer (lateral) part of clavicle and a projection on the top of the scapula called the acromion process. The scapula sits on the back of the ribs and moves as the arm moves.

Ligaments are like strong ropes that help connect bones and provide stability to joints. In the shoulder complex, ligaments provide stability to the sternoclavicular joint, the acromioclavicular joint and the glenohumeral joint. The ligaments around the sternoclavicular joint and the acromioclavicular joint are strong and tight and do not allow for much movement in these joints.

The glenohumeral joint is surrounded by a large, loose "bag" called a capsule. The capsule has to be large and loose to allow for the many movements of this joint. Ligaments reinforce the capsule and connect the humeral head to the glenoid fossa of the scapula. These ligaments work with muscles to provide stability to the glenohumeral joint. The glenoid labrum also helps provide stability to the joint.

Tendons connect muscles to bone. There are four muscles (supraspinatus, infraspinatus, subscapularis and teres minor) that surround the glenohumeral joint. These four muscles are attached to the scapula. They turn into tendons, which in turn attach to the humerus. The tendons of these four muscles make up the "rotator cuff" that blends into and helps support the glenohumeral joint capsule. The muscles of the rotator cuff and their tendons provide stability to the glenohumeral joint when the arm is in motion. The biceps muscle is located in the front of the upper arm. It has two
tendons, one of which attaches above the glenoid fossa. This tendon runs down the front of the glenohumeral joint and provides added stability to the glenohumeral joint.

There are muscles that stabilize the scapula and others that help move the arm. The rhomboid muscles, trapezius muscle and serratus anterior muscle are a few of the scapular stabilizing muscles. The pectoralis major muscle, the deltoid muscle and the muscles of the rotator cuff are some of the muscles that move the arm at the glenohumeral joint. The upper part of the trapezius muscle also helps "shrug" the shoulder. All of the muscles that are part of the shoulder complex work together in order to move the arm through its many possible ranges of movement.

Finally, a bursa (pl. bursae) is a fluid filled sac that decreases the friction between two tissues. Bursae also protect tissues from bony structures. In the shoulder, the subacromial bursa (also called the subdeltoid bursa) covers the rotator cuff tendons and protects them from the overlying acromion process. Normally, this bursa has very little fluid in it but if it becomes irritated it can fill with fluid, become painful and also irritate the surrounding rotator cuff tendons.

Basic Shoulder Biomechanics

There are three joints in the shoulder complex. The main joint is the glenohumeral joint. It is a ball and socket (modified ovoid) joint and it is the most mobile joint in the body. The top of the humerus is shaped like a ball and it sits in a socket on the end of the scapula. The ball is called the head of the humerus and the socket is called the glenoid fossa, hence the term "glenohumeral" joint.

The other two joints in the shoulder complex are the sternoclavicular joint and the acromioclavicular joint. The sternoclavicular joint connects the inner (medial) part of the collarbone (clavicle) to the breastbone (sternum). The acromioclavicular joint connects the outer (lateral) part of the clavicle to a projection at the top of the shoulder blade (scapula) called the acromion process. The scapula sits on the ribs and moves as the arm moves.

The movements of the glenohumeral joint include forward lifting of the arm (flexion), backward lifting of the arm (extension), inward (internal) rotation, outward (external) rotation, movement of the arm away from the body (abduction) and movement of the arm towards the body (adduction).

Movement at the glenohumeral joint requires motion at the other joints of the shoulder complex. The coordinated movement of these joints during arm movement is referred to as the scapulohumeral rhythm. The scapulohumeral rhythm describes movement that occurs at the glenohumeral joint compared to movement that occurs at the other
shoulder complex joints, the sternoclavicular, the acromioclavicular and the scapulothoracic joints. The scapulothoracic joint is not a true joint but it describes movement of the scapula against the thoracic wall during arm movement.

The scapulohumeral rhythm allows the shoulder to move through its full range of movement and it allows the head of the humerus to be centered within the glenoid fossa. For every 15 degrees of shoulder abduction, 10 degrees occurs at the glenohumeral joint and 5 degrees occurs at the scapulothoracic joint. For 180 degrees of shoulder abduction, 120 degrees occurs at the glenohumeral joint and 60 degrees occurs at the scapulothoracic joint. If there are changes to the scapulohumeral rhythm, the head of the humerus does not remain centered and it can lead to problems with the rotator cuff tendons such as tendonitis or rotator cuff impingement.

The muscles of the shoulder complex provide stability and movement. During shoulder movements such as lifting, certain muscle groups help to move the shoulder, while other muscle groups help to stabilize the shoulder complex. Much of the stability in the shoulder complex is provided by this muscular coordination.

Poor posture, muscle weakness or ligament injury can lead to abnormal biomechanics of the shoulder, which can result in abnormal forces in the shoulder. Over time these abnormal forces can cause injury to the soft tissues or the articular cartilage of the glenohumeral joint.

Adapted with permission from Santa Monica Orthopaedic Group Tom Knapp, M.D.