Understanding Your Shoulder

By Mike Davis, DPT, ART

It is a widely known fact that the shoulder is one of the body's most mobile joints. Unfortunately this mobility comes at a cost. With its high degree of mobility, stability is often compromised. This is the reason why there is such a high prevalence of shoulder injuries among athletes that are lifters, throwers, strikers, etc. In order for us to adequately address this issue, we must first have a sound understanding of the structures that make up the shoulder as well as those that may influence its function.

When speaking of the shoulder, one is often referring to the glenohumeral joint (GHJ). However, the shoulder is actually made up of the following four joints/junctures: sternoclavicular (SCJ), acromioclavicular (ACJ), glenohumeral (GHJ), and scapulothoracic (STJ) joint. In addition, the axial skeleton, pelvis, lower extremity, and the associated soft tissue can influence shoulder function. To develop base of understanding, let us review the components of the shoulder region and its associative counterparts.

The sternoclavicular joint is synovial joint with three degrees of freedom. It is the incongruent articulation between the manubrium of the sternum, 1st costal cartilage, clavicle, and a space-occupying disk. The SCJ is supported by the anterior/posterior sternoclavicular ligaments and the interclavicular ligament. The motions of the SCJ are elevation/depression, protraction/retraction, and rotation. It is through this joint that the shoulder structurally interacts with the rest of the body.

The acromioclavicular joint is a synovial joint with three degrees of freedom, as it is the articulation between the lateral end of the clavical and the acromial edge of the scapulae. The ACJ is supported by the superior/inferior ligaments and indirectly by the coracoclavicular ligament. Scapular rotation, winging and tipping make up the motions of the ACJ.

The glenohumeral joint is a ball and socket synovial joint with three degrees of freedom. It is the articulation between the head of the humerus and the glenoid fossa/glenoid labrum of the scapulae. The GHJ is supported by the GH ligaments (superior/middle/inferior) and the coracohumeral ligament. There are several bursa around the GHJ, but the two primary bursa are the subacromial and subdeltoid bursa. The bursa allow for the smooth gliding of the tendons about the GHJ. The coracoacromial arch serves as a protector of the head of the humerus and its tendonous attachments. The motions of the GHJ are flexion/extension, abduction/adduction, internal/external rotation, and horizontal abduction/adduction.

The scapulothoracic joint is not a true joint as the scapulae interacts with the thorax but does not actually articulate with it. Therefore there are no ligaments associated with the STJ. The STJ functions somewhat as a base to the three previously mentioned joints. Elevation/depression, abduction/adduction, upward/downward rotation, winging, and tipping are the motions of the STJ.

These four joints/junctures are interrelated, thus motion occurring in one joint results in relative motion in the other three joints. With that in mind it is easy to see how a restriction in one joint can result in dysfunction in one or more of the other three.

The axial skeleton, also known as the spine or vertebral column, serves as a base to the scapulae via the rib cage, which forms the thoracic wall of the STJ. As a result, the axial skeleton influences STJ mobility by virtue of its positioning. For instance, lumbar flexion in upright positioning facilitates a kyphotic posture along with bilateral upper crossed syndrome (abducted scapulae with forward positioned internally rotated GHJ) by way of altering the thoracic wall and associated soft tissue in a manner that is not conducive to normal STJ kinesis.

The pelvis, in the upright position, is the base to the axial spine and can influence shoulder function via the axial spine. When the pelvis rotates forward and/or backward, the lumbar spine follows as anterior rotation of the pelvis results in lumbar extension/lordosis and posterior pelvic rotation causes lumbar flexion. The pelvis can be influenced by the position of lower extremities. For example, excessive hip flexion results in posterior rotation of the pelvis. So one can see how shoulder function/performance can be affected by intimate as well as remote regions of the body.

Once there is a good understanding of osteo/arthrokinematics of the above noted structures and their interdependence, it is time to take a look at the associated soft tissue. While soft tissue refers to muscular tissue, tendons, ligaments, fascia, and nerves, we will only discuss the impact of the muscular system. It is important to understand the interdependent relationship between soft tissue function, osteo alignment, and joint function. Soft tissue dysfunction can result in osteo mal-alignment and joint restrictions or be the result of these factors. A detailed understanding of traditional anatomy, functional anatomy, and biomechanics are imperative to address these issues. If a person has an injury and/or physical performance problems, it is recommended that the individual see a physical therapist for a comprehensive evaluation. For the purpose of this discussion we will focus on how two muscles (subscapularis and latissimus dorsi) can influence shoulder function. It is important that the reader understand that this underlying theory or method of thought is applicable to any region in the body as the body's systems are interdependent and do not function in isolation.

The subscapularis attaches to the anterior (costal) surface of the scapulae and the lesser tubercle of the humerus. Its function is to assist in the stabilization of humeral head during GHJ motion as well as to assist in internal rotation of the humerus. There are several reasons as to why an individual's subscapularis may be dysfunctional. One situation that we will address is upper crossed syndrome, which as mentioned earlier is characterized by kyphosis, scapular abduction, and forward positioning of the GHJ with internal rotation. This posture places the subscapularis in a shortened position and over time the subscapularis will tighten and become dysfunctional. The subscapularis' role in the stabilization of the humeral head is to maintain it in an inferior/posterior position as this maintains relative subacromial space allowing a clear spacious pathway for the supraspinatus. So one can see how a dysfunctional subscapularis can facilitate the anterior/superior migration of the humeral head, thereby decreasing the subacromial space resulting in GHJ/supraspinatus impingement and possible supraspinatus tearing. The key in preventing this is maintain/develop a balanced shoulder. That is relative posterior scapular and anterior chest wall flexibility and strength. As human beings in modern day society, we tend to spend a lot of time performing activities in a kyphotic posture with our arms in front of us (i.e. – driving, working at a desk, eating, etc.), which promotes an upper crossed syndrome posture. As a result, most of us need to spend more time training our posterior scapular musculature and external rotators (i.e.- rhomboids, middle/lower traps, posterior deltoid, infraspinatus, and teres minor) and stretching the anterior chest/thoracic wall (i.e.- pectoralis major/minor and anterior deltoid). This will help to provide a happy home for the rotator cuff via "normalized" posture thus enabling optimal GHJ function/performance.

The latissimus dorsi attaches to the thoracolumbar fascia, posterior portion of the iliac crest, the intertubercular sulcus on the humerus, and in some instances the inferior angle of the scapulae. Do to its orientation in the body, the latissimus dorsi can perform a variety of actions. It can function to stabilize and influence the mobility of the lower thoracic and lumbar regions of the axial skeleton, internally rotate the humerus, extend the humerus, depress the scapulae, and elevate the body when the upper extremities are fixed (i.e. – pull-ups or inverted rows). It is important to note that the functions noted above are not all inclusive as the they are concentric actions and the latissimus dorsi also acts to eccentrically control or decelerate actions opposed to those listed. As previously noted, shoulder function/performance can be influenced by the axial skeleton and STJ/GHJ mobility. The latissimus dorsi can have an impact on all of these regions. Through the thoracolumbar fascia, the latissimus dorsi (when it is tight and/or dysfunctional) can limit the stability of the lumbar and thoracic regions of the axial skeleton necessary to perform overhead lifts such as a snatch and/or overhead squat. This predisposes the shoulder region to injury as it will potentially go through various compensatory methods to maintain the load overhead subjecting the shoulder to excessive dysfunctional forces. The STJ moves in conjunction with the GHJ. This is known as the Scapulothoracic/glenohumeral (STGH) rhythm and is approximately 1:3 for the first fifty degrees, 1:1 from fifty to one hundred forty degrees, and 1:3 from one hundred forty to one hundred eighty degrees. The latissimus dorsi crosses over the inferior angle of the scapulae and sometimes attaches to it. This impacts scapular mobility thus resulting in a dysfunctional STGH rhythm via scapulothoracic dyskinesis. If scapular mobility is restricted, then the GHJ is subjected to increased stress as it will attempt to pick up the slack from the STJ thus increasing the chances of potential injury. The latissimus dorsi's distal attachment is at the lesser tubercle of the humerus and because its orientation across the GHJ, the latissimus dorsi can effect GHJ rotation, abduction/adduction, flexion/extension and horizontal abduction/adduction. It is important to understand that not only may latissimus dorsi dysfunction result in the problems noted above secondary to an issue such as a muscular strain but it may also become dysfunctional secondary to problems with osteo alignment and/or joint function of the above noted regions. To maintain a healthy/functional latissimus dorsi, one must assess and ensure that it is functioning properly over all of the structures with which it directly interacts.

In conclusion, it is imperative that we understand the detailed interdependent nature of the human body as functional movement does not occur in isolation.

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