CLINICAL EXAMINATION

While it is beyond the scope of this monograph to completely cover all aspects of the clinical evaluation of the shoulder complex, the reader is referred to two texts that cover this topic thoroughly.[47,48] An overview of several key parts of the clinical evaluation of the shoulder is necessary and updated references to several systematic reviews profiling the diagnostic accuracy of many traditional and recently recommended manual orthopaedic tests will be included in this section.

Observation and Posture

Evaluation of posture for the patient with shoulder dysfunction begins with shoulder heights evaluated in the standing position, as well as use of the hands-on-hips position to evaluate the prominence of the scapula against the thoracic wall. Typically, the dominant shoulder is significantly lower than the nondominant shoulder in neutral, nonstressed standing postures, particularly in unilaterally dominant athletes like baseball and tennis players.[49] Although the exact reason for this phenomenon is unclear, theories include increased mass in the dominant arm, leading the dominant shoulder to be lower secondary to the increased weight of the arm, as well as elongation of the periscapular musculature on the dominant or preferred side secondary to eccentric loading.

In the standing position, the clinician can observe the patient for symmetry of muscle development and, more specifically, focal areas of muscle atrophy. One of the positions recommended, in addition to observing the patient with the arms at the sides in a comfortable standing posture, is the hands-on-hips position, which simply places the patient's shoulders in approximately 45° to 50° of abduction with slight IR. The hands are placed on the iliac crests of the hips such that the thumbs are pointed posteriorly. Placement of the hands on the hips allows the patient to relax the arms and often enables the clinician to observe focal pockets of atrophy along the scapular border, as well as more commonly over the infraspinous fossa of the scapula. Thorough visual inspection using this position can often identify excessive scalloping over the infraspinous fossa, which may be present in patients with rotator cuff dysfunction, as well as in patients with severe atrophy who may have suprascapular nerve involvement. Impingement of the suprascapular nerve can occur at the suprascapular notch and the spinoglenoid notch and form paralabral cyst formation commonly found in patients with superior labral lesions.[50] Further diagnostic testing of the patient with extreme wasting of the infraspinatus muscle is warranted to rule out suprascapular nerve involvement.

Scapular Evaluation

Objective examination of the patient with a shoulder injury must include scapular testing and observation.[51] Tests are indicated to diagnose scapular posterior displacement in multiple positions (waist level and 90° of flexion or greater) with an axial load via the arms. Testing for scapular dyskinesia can be performed using the Kibler scapular slide test in both neutral and 90° elevated positions.[52] A tape measure is used to measure the distance from a thoracic spinous process to the inferior angle of the scapula. A difference of more than 1 cm to 1.5 cm is considered abnormal, and may indicate scapular muscular weakness and poor overall stabilization of the scapulothoracic joint.[52]

Greater understanding of the importance the scapulothoracic joint plays in shoulder dysfunction has led to the development of a more advanced and detailed classification system of scapular dysfunction. It is important to note that several movements and translations occur in the scapulothoracic joint during arm elevation. These include scapular upward and downward rotation, IR and ER, and anterior and posterior sagittal plane tilting. In addition to those 3 rotational movements, 2 translations occur, superior and inferior translation, as well as protraction and retraction.[52] It is important to point out that with normal healthy arm elevation, scapular upward rotation, posterior tilting, and ER occur.[52] While scapular movement and biomechanics are very technical and complex, clinical evaluation of the scapulothoracic joint is an integral part of the complete evaluation of the patient with shoulder dysfunction. Kibler and associates[53] have outlined 3 primary scapular dysfunctions. This classification system proposed by Kibler can assist the clinician in evaluating the patient with more subtle forms of scapular malady. Zeier[54] described the massive disassociation of the scapula from the thoracic wall that occurs with injury to the long thoracic nerve. This massive disassociation of the scapula from the thoracic wall has been termed scapular winging.[54] However, few patients typically seen in orthopaedic physical therapy clinics with shoulder pathology clinically display true scapular winging.

To address and better define the types of scapular pathologic conditions seen clinically in patients with rotator cuff injury, Kibler[53] has developed a classification system for subtle scapular dysfunction. This classification system consists of 3 primary scapular conditions and is named for the portion of the scapula that is most pronounced or most prominently visible when viewed during the clinical examination. The scapular examination recommended by Kibler includes visual inspection of the patient from a posterior view in resting stance; again in the hands on hips position (hands placed upon the hips such that the thumbs are pointing backward on the iliac crests); and during active movement bilaterally in the sagittal, scapular, and frontal planes. These scapular dysfunctions are termed inferior angle, medial border, and superior.[53]

In the inferior angle scapular dysfunction, the patient's inferior border of the scapula is very prominent (Figure 5). This results from an anterior tipping of the scapula in the sagittal plane. It is most commonly seen in patients with rotator cuff impingement as the anterior tipping

Figure 5. Inferior Angle Scapular Dysfunction

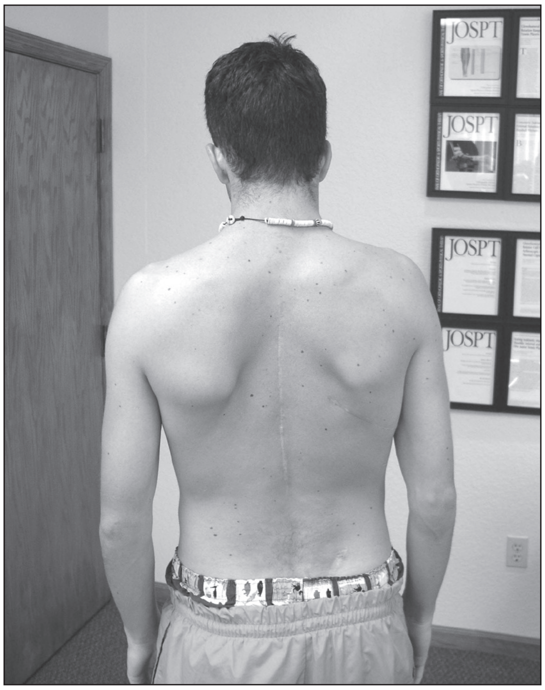


Figure 6. Medial Border Scapular Dysfunction

of the scapula causes the acromion to be positioned in a more offending position relative to an elevating humerus.[53] The medial border dysfunction results in the patient's entire medial border being posteriorly displaced from the thoracic wall (Figure 6). This occurs from IR of the scapula in the transverse plane, and is most often witnessed in patients with GH joint instability. The IR of the scapula results in an altered position of the glenoid—commonly referred to as "antetilting," which allows for an opening up of the anterior half of the GH articulation.[52] The antetilting of the scapula has been shown by Saha[8] to be a component of the subluxation/dislocation complex in patients with microtrauma-induced GH instability. Finally, superior scapular dysfunction as described by Kibler[52] involves early and excessive superior scapular elevation during arm elevation (Figure 7). This typically results from rotator cuff weakness and force couple imbalances.

Kibler tested his scapular classification system using videotaped evaluations of 26 individuals with and without scapular dysfunction.[53] Four evaluators, each blinded to the other evaluators' findings, observed individuals and categorized them as having one of the 3 Kibler scapular dysfunctions or normal scapulohumeral function. Intertester reliability measured using a kappa coefficient was slightly lower ($\kappa = 0.4$) than intrarater reliability ($\kappa = 0.5$). Kibler's results[53] support the use of this classification system to categorize subtle scapular

Figure 7. Superior Scapular Dysfunction

dysfunction via careful observation of the patient in static stance positions and during active goal-directed movement patterns.

Additional studies have been performed testing the effectiveness of visual observation of scapular movement. McClure et al[55] measured athletes during forward flexion and abduction using a 3 to 5 pound weight using visual observation of scapular mechanics. They graded the scapular pathology as either obvious, subtle, or normal. Multiple examiners viewed the subjects with coefficients of agreement ranging from 75% to 80% reported between examiners with this method (kappa coefficients 0.48-0.61). Their findings support the visual observation of scapular pathology. Further support for this method of clinically applicable scapular evaluation comes from recent research by Uhl et al.[56] They measured 56 subjects (35 with pathology) during arm elevation in the shoulders in the scapular and sagittal planes. They reported coefficients of agreement of 71% ($\kappa = 0.40$) when grading the scapula as yes pathology (Kibler types I, II, or III) versus no pathology (Kibler Type IV), and coefficient of agreement of 61% ($\kappa = 0.44$) when using the 4-part Kibler Classification.[56] Additionally, Uhl et al[56] calculated specificity and sensitivity values by comparing scapular mechanics measured directly with 3-dimensional tracking and visual observation. Specificities of 31% to 38% were calculated for the yes/no classification method with 62% to 85% values generated for the 4-part Kibler Classification method. Sensitivities for the yes/no method were 74% to 78% while sensitivities of 10% to 47% were measured when observers attempted to classify the scapula into one of the 4 Kibler classifications. This research supports the use of the visual observation method for determining scapular pathology and highlights the need for further applying basic science research on scapular biomechanics to clinical practice.

Additional clinical tests can be used during the scapular evaluation of the patient with shoulder dysfunction. These include the scapular assistance test, scapular retraction test, and the flip sign. Each of these tests help the clinician to establish the important role scapular stabilization and muscular control play in shoulder function and highlight the role or involvement of the scapula in shoulder pathology.

Kibler[57] has described the scapular assistance test (SAT). This test (Figure 8) involves the assistance of the scapular through the examiners hands applied to the inferior medial aspect of the scapula and second hand at the superior base of the scapula to provide an upward rotation assistance type motion while the patient actively elevated the arm in either the scapular plane or sagittal plane. A negation of symptoms or increased ease in arm elevation during the application of this pressure as compared to the response of the patient doing the movement independently without the assistance of the examiner determines dictates a positive or negative test. A positive SAT occurs when greater ROM or decreased pain (negation of impingement type symptoms) occurs during the examiners assistance of the scapula. Rabin et al[58] tested the interrater reliability of the SAT and found coefficient of agreements ranging between 77% and 91% (κ range 0.53-0.62) for flexion and scapular plane movements. They conclude that the SAT is a clinical test acceptable for clinical use with moderate test-retest reliability. Additional research on the scapular assistance test by Kibler et al[59] showed an increase in the posterior tilt of the scapula by 7° during application of the clinicians stabilization and movement with a decrease in pain ratings of 56% (8 mm Visual Analog Scale [VAS]). This study demonstrates the favorable changes in scapular kinematics that can produce symptom reduction in patients with shoulder pain.

Figure 8. Scapular Assistance Test

Another test developed by Kibler is the scapular retraction test (SRT).[60] This test involves retraction of the scapula manually by the examiner while a movement that previously was either unable to be performed secondary to weakness or loss of stability or a movement that was painful. Manual retraction of the scapula performed using a cross hand technique (Figure 9) and is pictured for the movement of IR and ER at 90° of abduction, a common motion provoking pain in overhead athletes with posterior impingement and rotator cuff pathology.[61] Recent research by Kibler et al profiling the kinematic and neuromuscular actions during the SRT show an increase of 5° of scapular retraction during application

Figure 9. Scapular Retraction Test

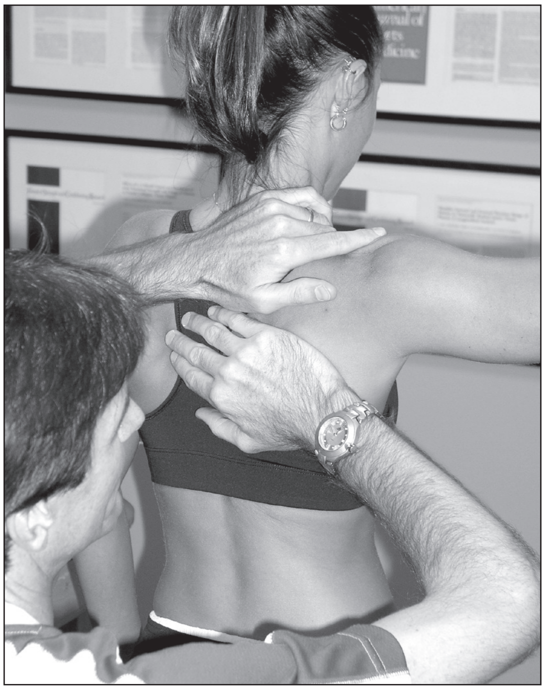
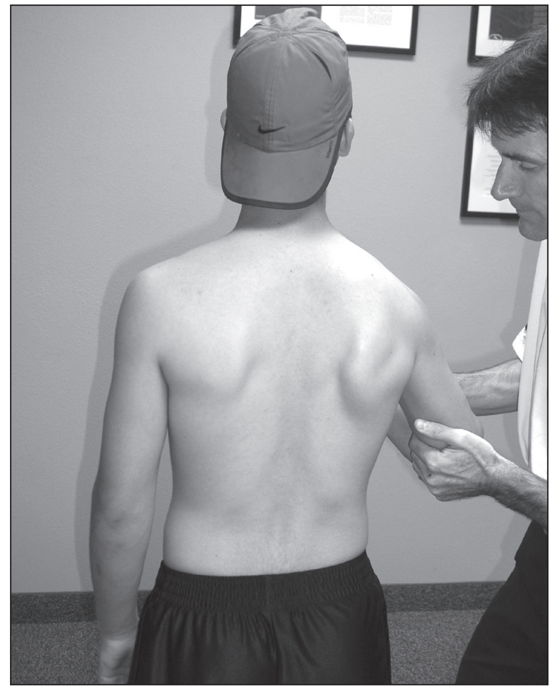


Figure 10. Flip Sign



of the clinician's pressure. Additionally, mean increases of 12° of posterior tilting, and a reduction of IR by 8° occurred during the performance of the SRT. Observed kinematic changes during the SRT place the GH joint in a biomechanically favorable position for function.

One final scapular test or sign that can be used during evaluation of the shoulder is the flip sign. Kelley et al[62] originally described this test that consists of resisted ER at the side by the examiner with close visual monitoring to the medial border of the scapula during the ER resistance applied by the examiner (Figure 10). A positive flip sign is present when the medial border of the scapula "flips" away from the thorax and becomes more prominent. This indicates a loss of scapular stability and would direct the clinician to further evaluate the scapula and integrate exercise progressions aimed at the serratus anterior and trapezius force couple to stabilize the scapula.[62]

Glenohumeral Joint Range of Motion Measurement

A detailed, isolated assessment of GH joint ROM is a key ingredient to a thorough evaluation. Measurement of several cardinal movements of the shoulder is important; however, GH joint IR and ER has significant clinical importance. Selective loss of IR ROM on the dominant extremity has been consistently reported in patient populations as well as in overhead athletes such as elite tennis players[63,64] and professional baseball pitchers.[65] A goniometric method using an anterior containment force by the examiner (Figure 11) to minimize the scapulothoracic contribution and or substitution is recommended by Ellenbecker and other authors to better isolate and represent GH rotational motion.[63,66] The loss of IR ROM is important to recognize and is clinically important for several reasons. The relationship between IR ROM loss (tightness in the posterior capsule of the shoulder) and increased anterior humeral head translation has been scientifically identified. The increase in anterior humeral shear reported by Harryman and colleagues[67] was manifested by a horizontal adduction cross-body maneuver similar to that incurred during the follow-through of the throwing motion or tennis serve. Tightness of the posterior capsule has also been linked to increased superior migration of the humeral head during shoulder elevation.[68]

Research by Koffler and associates[69] studied the effects of posterior capsular tightness in a functional position of 90° of abduction and 90° or more of ER in cadaveric specimens. They found that humeral head kinematics were changed or altered with imbrication of either the inferior aspect of the posterior capsule or imbrication of the entire posterior capsule. In the presence of posterior capsular tightness, the humeral head will shift in an anterior-superior direction as compared with a normal shoulder with normal capsular relationships. With more extensive amounts of posterior capsular tightness, the humeral head was found to shift posterosuperiorly.