The Scapula: Achieving Stability

by
Dr. Mark Erickson, PT, MA, DScPT, OCS
Certified Feldenkrais Practitioner
Affiliate Member ABME

The primary functional purpose of the shoulder complex is to position the hand in space for a multitude of purposeful intentions. The scapula, as an integral component of the shoulder girdle, accomplishes its mobility and stability responsibilities in a marvelously intricate and balanced manner. The purpose of this essay is to describe the balance between mobility and stability at the shoulder girdle with emphasis on scapular stability mechanisms.

Shoulder girdle bony architecture consists of the sternum/manubrium, clavicle, scapula and humerus that move at the sternoclavicular (SC), acromioclavicular (AC), and glenohumeral (GH) joints respectively (figure 1). In addition, the scapula slides on the thoracic ribs at what is typically referred to as the scapulothoracic (ST) interface and sometimes misclassified as a “joint”.

We will consider the shoulder girdle one functional unit to reflect how it behaves during upper extremity activities with the clavicle and scapula serving as the bony links that move at the SC and AC joints. The shoulder girdle moves in three planes at both the SC and AC joints, allowing it to attain an almost infinite number of positions.

The clavicle moves up (elevation), down (depression), forward (protraction) and backward (retraction) relative to the manubrium/sternum at the SC joint. During SC motions the scapula comes along for the ride due to its connection to the clavicle at the AC joint. The AC joint is SC’s “little helper” and serves to maintain congruity between the scapula and the rib cage during functional movements and postures. Such mobility is required to effectively position the elbow and hand where they need to be to accomplish the innumerable desired tasks performed by humans.

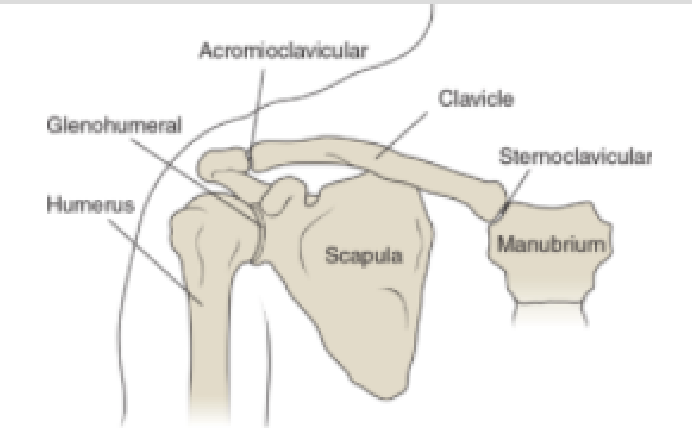

Figure 1

The connection between the scapula and clavicle at the AC joint is small without bony architectural stability and minimal ligament support making the scapula a relatively free-floating bone.

This is advantageous for mobility, but disadvantageous for stability. Thus, almost all scapular stability is achieved through muscular and fascial connections in a biotensegrity manner and integrated with the nervous system.

Biotensegrity, a term coined by Dr. Stephen Levin, is the application of tensegrity principles to biological structures. Tensegrity is an architectural structure whose form is provided by discontinuous compression and continuous tension (figure 2). In humans, the bones represent the discontinuous (separated) compression connective tissue element of the tensegrity model and are suspended in space supported by the continuous tension connective tissue elements that are the muscles, tendons, ligaments, joint capsules, skin and fascia (figure 3). This is the basis for how stability is achieved at the shoulder girdle and throughout the body in a manner that simultaneously permits functional mobility.

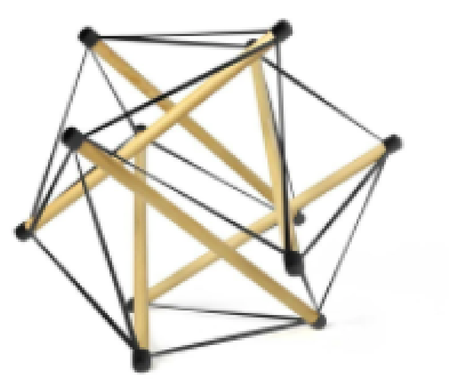

Figure 2

Figure 3

So, how is scapular stability realized at the shoulder girdle?

Scapular stability is accomplished at the shoulder girdle through both static and dynamic mechanisms. Static mechanisms are those that are non-contractile (non-muscular activity) in nature such as skin, bone, ligament, tendon, fascia and the non-contractile elements of muscle (epimysium, myofascia). They attach the scapula to the clavicle, humerus, spine, and pelvis and create compression and tension forces that simultaneously maintain scapular posture thereby stabilizing or “anchoring” it in its suspended position. Static stabilizers also create force during movement to allow sufficient motion and prevent excessive motion in all directions.

Dynamic stabilizers are contracting muscles. When the scapular muscles contract in a coordinated manner, they create forces in many directions that work harmoniously to stabilize the scapula in position. When there is zero movement during muscle contraction it is called an isometric contraction and the scapula is anchored or stabilized in place. During shoulder girdle movements some scapular muscles shorten when contracting (concentric) while others lengthen while contracting (eccentric). When contracting, the muscles are generating forces that, in addition to creating movements, also stabilize the scapula to prevent abnormal and/or excessive motion. This is referred to as “dynamic stability”.

An essential component of dynamic stability is the nervous system (figure 4); muscles do not function in isolation. The central nervous system generates and sends out signals through the spinal cord and efferent nerves to tell muscles when to contract and to what degree. Simultaneously, sensory information from muscles, skin, fascia, tendons, joint capsules, ligaments, eyes, and ears is travelling through the afferent nerves and spinal cord to the brain where it is integrated. This circular and continuous process of sensory-motor circuitry also plays a vital role in dynamic stabilization of the scapula and shoulder girdle that allows us to have a large range of motion at the shoulder while maintaining stability to meet our functional demands.

Figure 4

Finally, like muscles, the scapula and shoulder girdle do not function in isolaton. The position/posture of the scapula, its stability and its mobility are all influenced by the rest of the body especially the cervical spine, thoracic spine, lumbar spine, pelvis, lower extremities, elbow, wrist, hand/fingers as well as the balance system, cardiovascular and respiratory systems, clothing, emotional state, diet, intent, and the environment. This final thought is offered as a reminder to always consider the entire body as well as influencers to movement when analyzing specific links within the movement system. It is this holistic perspective that deepens our understanding of movement and facilitates genuine growth in our performances as well as our teaching.

In summary, achieving scapular stability is a complex, multi-system affair. It involves neuro-musculoskeletal static and dynamic components that rely on one another and are participating continuously to hold or move the scapula within its biotensegrity web. Effective coordination of all contributors is necessary for optimal movement and performance.