Aquatic Exercises and the Shoulder
The Influence of Hand Positions
By Marty Biondi, PT

Shoulder motions require the combined action of four joints, affording an extraordinary amount of versatility for both functional and sports-related movements.1 While it is this biomechanical complexity that accounts for the amazing potential to combine incredible speed with accuracy and range of motion, it is equally responsible for debilitating conditions.2 Add to the mix the buoyant properties of water, and a unique set of capabilities exist that can enhance good shoulder mechanics as well as help to generate common shoulder pathologies. Thus, it becomes essential that exercise address the combined efforts of both the muscles required to effect movement at the shoulder and appropriate movement sequences throughout the related joints.

Anatomically, the most obvious shoulder joint is the ball-and-socket structure comprised of the glenoid fossa of the scapula and the head of the humerus and is located at the most lateral aspect of the upper axial skeleton.4.5 Known as the glenohumeral joint (GHJ), this structure has as its primary assignment, the task of placing the hand in appropriate position to perform its functions, and is where the majority of movement occurs.4 The shallowness of the glenoid fossa coupled with the disproportionate size of the head of the humerus are responsible for its inherent instability.5 Next, the acromioclavicular joint (ACJ) provides both the anterior/posterior bony connection of the axial skeleton and allows for the movement of the scapula, which helps to manage shoulder motion. The sternoclavicular joint (SCJ), comprised of the medial aspect of the clavicle and the lateral aspect of the sternum, acts to provide both stability and end range flexion mobility for the shoulder complex. Lastly, the scapulothoracic joint (STJ), considered a functional joint since there are no bony articulations, provides for scapular orientation, which drives the motions of the GHJ.4,5

Shoulder motion is dependent on synchronous coordination of all four joints; dysfunction at any one of these joints impacts the integrity, stability and range of the shoulder complex.3,4,5 Additionally, abnormal cervical or thoracic spine posture alters the position of the scapula, leading to decreased range of motion, dysfunction and/or weakness of the upper extremity.5 Lastly, restricted muscle extensibility drastically impacts shoulder mechanics, as can be noted with tight pectoralis complex, altering the orientation of the shoulder.

Whether the scapular position is altered due to poor posture, or muscle imbalances that create biomechanical deviations, specific muscles and/or their

tendons can become impacted between the humeral head and the coracoarcromial arch. Situated beneath this arch are the rotator cuff tendons, long head of the biceps and the GHJ capsule plus a bursa, positioned there to protect the tendon structures. As the arm is raised forward or abducted, the scapulothoracic articulation positions the glenoid fossa to provide a stable base from which the humeral head can then move.6 This coordinated effort by the four joints of the shoulder to produce a smooth movement pattern is known as scapulohumeral rhythm.6 This pattern serves to maintain the glenoid fossa in an optimal position to support the humeral head, and to allow muscles acting on the humerus to optimize their length-tension relationships.6 Thus, shoulder impingement, one of the most frequently occurring pathologies, is related to movements that involve raising the arm at or above shoulder height and trapping the structure(s) lying beneath the arch.2,3 When muscle imbalances occur, if posture is altered, if the coordinated effort of the joints is insufficient, impingement can occur.

Specific muscle activity and muscle extensibility are critical to normal, pain-free motion. While discussion of all muscles that impact shoulder motion is beyond the scope of this article, the rotator cuff muscles do provide active stabilization throughout the glenohumeral joint. Comprised of four muscles that have specific tasks for which the shoulder depends (internal and external rotation) and collectively provide dynamic stability to the glenohumeral joint, the rotator cuff is involved in a force vector to hold the humeral head in the socket. Since the socket of this joint is so shallow, dislocation would occur with shoulder flexion; without the rotator cuff plus ligamentous attachments and the labrum, the humeral head would slide inferiorly out of the socket. Contraction of both the rotator cuff and the deltoid muscles acting as a force couple, compress the shoulder joint surfaces minimizing joint dislocation.7 Additionally, the subscapularis counterbalanced by the teres minor/infraspinatus (all muscle of the rotator cuff) provide dynamic stability in the transverse plane. Thus, the co-contraction of these force couples provide dynamic stability of the glenohumeral joint in any arm position.7

Regarding muscle tightness, consider that the anterior muscles of the upper quadrant provide a counterbalance to the contraction of the posterior muscles**.** When the scapula is maintained in an elevated position due to constant upper trapezius contraction/shortening, there is a disruption of the synchronous motion throughout the shoulder complex. Not only is range of motion at the glenohumeral joint decreased, but the scapula is also placed in an anterior orientation, which decreases the space through the subacromial arch. Impingement of the supraspinatus tendon occurs with subsequent tendonous pathology. Relaxing the upper trapezius and providing for normal scapulohumeral rhythm to occur restores healthy shoulder mobility.

Additionally, when one can replace the humeral head in a position that minimizes impingement, such as neutral or a slightly externally rotated position, the damage to those structures beneath the arch is minimized. Water exercises that position the hand with thumbs up tend to assist in acquiring a more neutral humeral head position. However, because such a hand position usually is accompanied with increased resistance, when the hand is placed palm down, motions at the surface of the water can equally maintain proper humeral head positions.

Water exercises that require hand/upper extremity motion in front of the body must also be cued appropriately to maintain accurate scapular positions. Because scapular motion is intimately tied to the motions of the upper extremity, care must be taken to maintain the integrity of scapular positioning. When the scapula is elevated or abducted greater than is required with normal scapulohumeral rhythm, the risk for impingement is increased. Over time, with multiple exercises emphasizing this position, one can create supraspinatus tendonitis. Oftentimes, in an attempt to work harder, clients “grab” for additional water to move; this may be at the expense of increased scapular elevation/protraction. Thus, appropriate cueing and hand position can do much to maintain the integrity of movement, while at the same time minimize the risk of soft tissue injury and/or muscle imbalances.

In closing, the beauty of the water is that for every action, one can likewise work the reactive motion. Thus, anterior and posterior structures of the upper quadrant can function in their respective capacities, without the risk of over-emphasis of one to the demise of its opposing muscle group. This, however, occurs with accurate cueing as pulling from front to back is oftentimes easier than reversing that action going back to front. While hand position definitely impacts the intensity of the motion, appropriate scapular position, good muscle extensibility, movement through one’s full range of motion and postural awareness are the components of good shoulder “health”.

References

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