Scapular Plane Swimming: Freestyle Summary

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Swim stoke recovery in the scapular plane with neutral humeral positioning vs. traditional swimming stroke

- Positive effects of this motion

  - Keeps shoulder joint in a balanced position allowing for more effective muscle activation through the upper quadrant extending down into the pelvic floor of the swimmer.
  - Avoids sub-acromial impingement, hence protecting the joint from cuff irritation or fraying.
  - Allows for easier replication of the stroke due to less degrees of freedom. Engram is easier to establish.
  - Higher turnover which might increase speed during shorter races (400 and down).
  - Longer level established during recovery phase increasing forward momentum.
  - Decreases upward and downward forces allowing for swimmer's kick to have increased forward movement for there is less torque being exerted through the hips and low back

Components of the swim stroke outside of the scapular plane and subsequent compromises that this produces

- Inward rotation of the humerus during recovery

  - What happens during this motion biomechanically
    - Compression of the rotator cuff and biceps tendon placing these structures at increased risk of injury
    - Places the sub-acromial space and acromioclavicular joint at increased risk of injury due to the increased compressive forces

- Compresses the thoracic outlet region increasing compressive forces on the brachial plexus
- Causes over distension of the posterior shoulder and body musculature generating an active insufficiency.
- Causes excess shortening of the anterior shoulder and body musculature generating passive insufficiency.
- Places the hand in a non advantageous position to initiate the pull phase for the palm of the hand is facing outward causing the swimmer to have increased lateral movements, hence wasted energy during forward progression

❖ Humerus behind the scapular plane during the overwater recovery phase ("high elbow")

➢ What happens during this motion biomechanically

- Over stretches the front of the shoulder
  - Stretches the glenohumoral ligaments which are vital passive restraints of the shoulder joint.
  - Can result in bicipital tendonitis, tendonosis, and then tendon fraying and give way episode.
  - Stresses the rotator cuff causing pain and swelling.
- Places undue compression and sheer forces between the humeral head and the sub-acromial surfaces.
- Doesn't allow for effective muscle recruitment around the shoulder joint. Traditional swimming positions musculotendinous units in both passive and active insufficient lengths, hence minimizing optimal force generation.

❖ Forces the shoulder joint into a very unstable position which forces the humeral head out of the center axis of the glenoid fossa.

❖ Linear Hyper-extension of arm into position behind scapular during at initiation of overwater part of stroke (traditionally called finish)

- What happens during this motion biomechanically
  - Tissues of the shoulder and upper arm are over distended due to the acceleration of the arm with the momentum of the water around the arm and then an abrupt change of direction places an inordinate amount of stress on these areas.
  - Drives the humeral head in a downward direction within the shoulder joint and possibly causing over stressing the posterior shoulder. This can result in trigger points forming in the posterior cuff causing radiating symptoms down into the arm and hand.
  - Latissimus dorsi tends to overwork and fatigue early decreasing the swimmer's capability to maintain speed.

❖ Linear Hyper-extension behind scapular plane transition from overwater part of the stroke to underwater part of the stroke (traditionally called entry). This is the coached trait of entering at the surface and "reaching out" for length.

- What happens during this motion biomechanically
  - Places shoulder in a very weak and unstable position due to the fact that the subscapularis muscle is rendered, for the most part, ineffective to produce any stabilization or pulling force. .
  - Causes the sub-acromial space to be over compressed causing a myriad of joint injuries from a SLAP lesion and/or torn or frayed rotator cuff. This style of swimming can also lead to degenerative changes with bone spur formation.
  - Forces the swimmer to flex the wrist and elbow to generate forward progression due to the significant torque forces rendered on the shoulder with straight arm flexion. This series of events drives the humeral head superiorly into the sub-acromial space.

❖ Hyper-extension of elbow at any time during the freestyle swim stroke

- What happens during this motion biomechanically
  - If this happens during the pull phase then this causes excessive rotational forces in the glenohumoral joint.
  - This makes the biceps passively insufficient, which destabilizes the elbow joint not allowing for maximal force application through the limb.
  - Compresses the elbow joint surfaces together which can lead to joint irritation, pain, swelling, and osteochondral lesions.

Crossing arm under mid-sagittal (midline) during the pull phase

- What happens during this motion biomechanically
  - Compression of the neurovascular structures at the thoracic outlet.
  - Compression of the rotator cuff and biceps tendon.
  - Active and passive insufficiencies of the upper arm rendering the force capability of the upper extremity sub-par.
  - Increased lateral forces slowing the swimmer and detracting subject from producing forces that are forward positive in nature.