Dynamic Chiropractic

SOFT TISSUE / TRIGGER POINTS

Eccentric Overload

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Especially in the throwing athlete, but also in the weekend athlete, "eccentric tensile overload" is a significant cause of overuse in the shoulder and other areas of the muscular system.

Eccentric contraction represents a lengthening of the muscle, i.e., the biceps contracts while the elbow angle is decreasing. A concentric contraction is a shortening of the muscle, i.e., the biceps contracts while the elbow angle is increasing. There are significant differences between concentric and eccentric contractions.[1,2,3,4] Metabolic energy cost is lower for eccentric exercise at comparable work loads; at the same resistance, lower EMG activity demonstrates that fewer motor units are recruited during an eccentric contraction to produce the same amount of force as a concentric contraction, and postexercise pain and muscle soreness are associated with bouts of eccentric contraction. With eccentric training, pain and soreness decrease.

Some physiological examples of eccentric contraction are of the tibialis posterior during foot pronation, and of the gastrocnemius-soleus during the 20 to 50 percent of the stance phase of walking in order to stabilize the forward motion of the tibia. The words "stabilization" and deceleration" are very applicable when we speak of eccentric contraction. In throwing, "activation" and the creation of energy is usually related to concentric activity.[5]

The static stabilizers of the shoulder include the bony anatomy, the labrum, and the intact capsular ligaments which also permits negative interarticular pressure which acts as a suction.[6] The dynamic stability of the glenohumeral joint is provided by the rotator cuff, long head of the biceps, and scapular rotators.[7] If either the static or dynamic stabilizers are weakened, the other one suffers. "The thrower relies heavily on the dynamic effect of the rotator cuff for joint compression to avoid capsular stretching."[6] Weakening of the capsular structures due to failure of the cuff muscles to provide adequate humeral compression creates traction stress on the cuff musculature. With regard to the cuff muscles in the throwing mechanism, as the arm is elevated to the cocking position, concentric activity occurs as the supraspinatus elevates the arm, as the infraspinatus externally rotates the arm, and as the subscapularis helps in forward flexing of the arm. The subscapularis also concentrically works during acceleration and follow-through as the shoulder internally rotates. The subscapularis is eccentrically working in the late cocking phase of throwing when the shoulder is at maximal external rotation to decelerate the shoulder's external rotation and possibly protect the anterior shoulder joint, while the supraspinatus and infraspinatus are eccentrically working during the acceleration phase of throwing in order to stabilize the shoulder during the deceleration and follow-through. If static stabilizers are already stretched (occult instability) the rotator cuff muscles must overwork and eventually fatigue due to eccentric overload. Excessive movement of the humeral head may further stretch and aggravate the static labrum and capsule. During follow-through (internal rotation) the humeral head is driven posteriorly and the posterior labrum and capsule may be affected.[6] The biceps must eccentrically decelerate elbow extension and pronation during follow-through and may be overused (tendinitis) while also possibly causing superior labral tears.

Silliman and Hawkins[8] state that with eccentric tensile overload the rotator cuff musculature and its underlying capsuloligamentous complex would be subjected to "overuse injury" and failure. As injury accumulates and eccentric overload affects the shoulder, precise motion patterns involved in throwing may be affected, resulting in pain, tendinitis, and scapular dysfunction.

Interestingly, professional pitchers use their rotator cuff muscles in a more efficient way than amateur pitchers. During the acceleration phase the professionals fire the subscapularis selectively over the other cuff muscles, while amateur throwers tended to make more use of the cuff muscles and biceps brachii for power.[9]

Due to the "eccentric" overload problem in the causation of tendinitis and stress on the static stabilizers, it is essential that every exercise program includes eccentric strengthening. The use of rubber tubing and hand-held weights can be used in the painless ranges. Internal and external rotation should be especially emphasized with high-repetition and low resistance. With rubber tubing, both eccentric and concentric activity can be stimulated. Only weights up to five pounds should be initially used for building the rotator cuff endurance type muscles. Later on, the larger muscles such as the pectoralis major, latissimus dorsi, serratus anterior, trapezius, and rhomboids should be emphasized with heavier weights. Of course stretching should be emphasized (especially the posterior capsule) always without pain. Pushups or bench pressing with a closed grip strengthens the serratus and decreases the risk of anterior capsule stretching.[6]

Referencs:

1. Abbott BL, Bigland B, Ritchie JM: The physiological cost of negative work. J Physiol (Lond), 380-390, 1952.

2. Aura O, Komi PV: Mechanical efficiency of pure positive and pure negative work with special reference to work intensity. Int J Sports Med, 7:44-49, 1986.

3. Francis KT, Hoobler TR: Delayed muscle soreness and decreased strength (abstract). Phys Ther, 68:803, 1988.

4. Ryan LM, Magidow PS, Duncan PW: Velocity-specific and mode specific effects of eccentric isokinetic training of the hamstrings. JOSPT, 13:33-39, 1991.

5. Jobe FW, Tijbone JE, Moynes DR, et al: An EMG analysis of the shoulder in pitching and throwing: A preliminary report. AM J Sports Med, in press.

6. Abrams JS: Special shoulder problems in the throwing athlete: pathology, diagnosis, and nonoperative management. Clin in Sports Med, 10:839-861, 1991.

7. Saha AK: Dynamic stability of the glenohumeral joint. Acta Orthop Scand, 42:491, 1971.

8. Sillman JF, Hawkins RJ: Current concepts and recent advances in the athlete's shoulder. Clin

in Sports Med, 10:693-705.

9. Jobe FW, Perry J, Pink M: Electrographic shoulder activity in men and women professional golfers. Am. Sports Med, 17:782-787, 1989.

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Editor's Note:

Dr. Hammer will conduct his next soft tissue seminar on March 14-15, 1992 in Las Vegas, Nevada. You may call 1-800-327-2289 to register.

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