Dynamic Chiropractic

SPORTS / EXERCISE / FITNESS

Sports Biomechanics, Neuromuscular Disadvantage and Myofascial Pain and Dysfunction in Athletes, Part I

Overuse injuries are common in sports[1,2]. In fact, according to Garrick and Webb[2] "overuse injuries outnumber acute, instantaneous injuries in almost every athletic activity." However, overuse injuries command very little attention since they are not immediately disabling. Overuse injuries gradually limit an athlete's dynamic function and may, in extreme cases, ultimately be responsible for his early retirement from competition.

The sheer volume or quantity of an activity has been blamed for the abundance of the overuse injuries[1,2]. Although this is true to a certain extent, there is evidence to suggest that the quality of motion may play a significant role in the production of overuse injuries[3,4,5]. This generally states that it is the manner in which an athlete chooses and applies his sports techniques that will determine his rate of overuse injuries. The quantity and intensity by which he executes his "poor quality" sports techniques only serves to magnify the problem of overuse injuries.

All poor quality sports techniques share a common feature: they place the athlete at a neuromuscular disadvantage while attempting to gain a mechanical advantage. In other words, sports techniques designed to give the athlete a mechanical advantage may put the athlete at a distinct neuromuscular disadvantage.

Most athletes and coaches are unfamiliar with the neuromuscular principles at work in sports techniques. This, combined with a limited knowledge of sports biomechanics, can spell poor performance for their athletes at best, and injury at worst. Sports techniques are all too often engineered with consideration toward maximizing mechanical advantages in a "neuromuscular vacuum." This must change since we are neuromuscular creatures who take advantage of biomechanical laws and not vice versa. When, and only when, a sports technique is designed according to sound neuromuscular principles, a neuromuscular is obtained and a solid biomechanical advantage will follow. The reverse is not always true.

Consider a popular major league baseball player who bats right-handed. During the execution of the swing phase of batting the batter's torso rotates toward the left. At this point the left shoulder tilts upward and backward while the left arm is extended to the point of impact with the oncoming pitch. Typically, at the moment of impact, the elbows are extended and the shoulders are forward flexed to 90 degrees with the left shoulder possessing more than 100 degrees of horizontal adduction[6].

The purpose of this positioning at impact is to increase the batter's mechanical advantage. With the arms outstretched, a long lever arm is created between the batter's shoulders and the end of the bat. This long lever arm is believed to increase the bat speed and the leverage with which the ball is struck.

The mechanical advantage is there, but the neuromuscular advantage is lost.

This positioning of the batter's left arm at impact places the latissimus dorsi muscle in a state of passive insufficiency[7]. The latissimus dorsi is "virtually" incapable of generating adequate tension to do work on the arm, bat, and ball during impact. Much of the tension generated by the left latissimus dorsi muscle at impact, in this situation, comes from the elastic energy stored in the series elastic components of the muscle fibers themselves, not from contractile forces.

The latissimus dorsi muscle's inability to generate tension results in the batter's left shoulder tilting upward and backward. It's interesting to note that this same phenomenon of passive insufficiency of the latissimus dorsi results in the batter's upper torso "lagging behind" the powerful forward stride of the legs during the swing phase.

Consider an ideal right-handed baseball batter. In the execution of the swing phase of batting, the torso must rotate to the left and the left arm must drive the bat to and through impact with the oncoming pitch. This motion, thus described, is best performed by an "actively sufficient" left latissimus dorsi muscle. This is achieved by the batter drawing the left arm toward the torso and "sliding it around" his left side. This positioning of the left arm results in minimal to no forward flexion of the arm at the shoulder and minimal to no horizontal adduction of the arm at the shoulder during impact.

With the left arm fixed to the left, anterolateral aspect of the torso, as is the case at the moment of impact between bat and ball, the left latissimus dorsi will rotate the torso to the left, depress the left shoulder and laterally bend the torso to the left[7,8,9]. This allows the powerful latissimus dorsi muscle to be at a neuromuscular advantage. In addition, certain biomechanical advantages are gained. The batter's shoulders are turned toward and moved in the direction of the oncoming pitch. This adds a component of speed and momentum to the bat at impact. Bat speed is an essential biomechanical component to optimum batting technique[4,6]. It is also interesting to note that a shorter lever arm between the shoulders and bat end reduces the moment of inertia, thus allowing the bat to be swung faster with less force[4,6].

Look for Part II in the April 9th issue.

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