Dynamic Chiropractic

SPORTS / EXERCISE / FITNESS

Shoulder Rehabilitation, Part III

Over the last two months we have examined general shoulder rehabilitation and prevention recommendations, and most recently, specifics for throwing and swimming. This month we will continue the discussion with a focus on tennis and golf. Although these two sports are worlds apart with regard to technique, aerobic demands, and muscular effort, they do have in common the use of an apparatus which increases the lever arm of the upper extremity for the purpose of increasing impact to a ball.

Tennis

Like throwing sports, tennis requires the shoulder to rely on force contributions from the lower body. When elite players were examined, it was demonstrated that the shoulder contributed little to total energy (13%) and contributed only 21% to total force.[1] The explanation for this disparity lies in the role the shoulder plays in the kinetic link that moves the racquet. Over 50% of total kinetic energy and total force are generated by the leg/hip/trunk contributions.[2] The shoulder simply has to pass on this force down the kinematic chain. Therefore, the muscular function at the shoulder is more for stability rather than producing movement. In other words, the lower body and trunk generate the forces that move the shoulder. When these reach the shoulder, it must be stable enough to pass on the forces distally.

In elite junior players, the overall incidence of shoulder injury ranged from 10-30%, 80% of which is overuse injury.[3] It is interesting to note that the shoulder and elbow are often both injured. Of those with tennis elbow, one study indicated a 63% higher incidence of shoulder injuries. The shoulder is injured alone more often with the serve than with other strokes.

Muscular Demands

There are in essence three main strokes in tennis: (1) the serve; (2) the backhand groundstroke; and (3) the forehand groundstroke. The serve is divided into four phases: (1) windup; (2) cocking; (3) acceleration; and (4) follow-through (similar divisions for throwing). Unlike pitching which involves throwing down, serving requires the ball to go up and arc over the net. During windup, the arm is positioned by the body with little shoulder muscle activity required. In the cocking phase, glenohumeral stability is provided by a sharp increase in rotator cuff and biceps activity supported by the scapular positioning function of the serratus anterior, which by far demonstrates the highest level of activity.[4]

The acceleration phase is characterized by a peak in internal rotator muscle activity from the subscapularis, pectoralis major, and latissimus dorsi, while the serratus anterior continues to maintain proper scapular positioning. The biceps functions eccentrically during acceleration (an important point for rehabilitation and training). During follow-through, the posterior rotator cuff, serratus anterior, latissimus dorsi, and biceps are all quite active (mainly eccentric contractions). The amount of activity appears to be increased in the recreational player as compared to the professional player pointing to an uncoordinated performance; less lower body force causes more shoulder participation, and therefore, predisposes to overuse.

The forehand and backhand are divided into three phases: (1) preparation; (2) acceleration; and (3) follow-through. Muscular activity is highest in the acceleration phase. With the forehand the highest activity is found with the subscapularis, biceps, pectoralis major, and the serratus anterior. With the backhand, the peak contributors were the middle deltoid, supraspinatus, and the infraspinatus. Some activity is also noted for the biceps, latissimus dorsi, and serratus anterior. The follow-through for the forehand is characterized by high activity of the serratus anterior, subscapularis, infraspinatus, and biceps. For the backhand, follow-through is characterized by moderate activity of the biceps, middle deltoid, supraspinatus, and infraspinatus. It appears that the follow-through for the backhand is more a body controlled event, relying less on the decelerator function of the anterior musculature.

Training and Rehabilitation

Most serious injury occurs with serving. The repetitive nature of the act coupled with the overhead position sets up a potentially harmful scenario. Couple with these inherent positional demands underlying capsular laxity (often increased by the act of serving itself) or underlying acromial pathology, and the stage is set for injury. Laxity is more often a younger player's fatal flaw, while underlying acromial or subacromial degenerative changes are the older player's. These should be focused on in the evaluation process for each group. Laxity is a clinical assessment, whereas acromial involvement is primarily radiographic.

Shoulder injury with groundstrokes is generally from overuse or misuse. Some of the general recommendations include specifics for the body, and racquet guidelines:[5]

- String the racquet at the upper end of the manufacturer's tension range (generally nylon should be strung between 62 and 67 lbs.; with oversized racquets [better for novices] the range is 72-80 lbs. with nylon).
- Grips should be leather, and long enough for a two-handed grip (open-throat design helps decrease twisting with off-center hits).
- Graphite offers the advantage of vibration dampening and being light weight.

The novice player should avoid:

- playing on wet surfaces;
- timing the body to the ball (instead of the stroke);
- use of one-handed backstroke and leading with the elbow;
- using the wrist prior to ball contact to make up for poorly timed or executed stroke.

The general rehabilitation program for the injured shoulder should follow the general recommendations made in Part I of this series. Emphasis for training should focus on the stabilizers (rotator cuff and biceps) and whether they function eccentrically or concentrically during the problem phase of a stroke. It is believed that many injuries are eccentric injuries and are due to lack of focus on development of eccentric strength. Special emphasis should be placed on two muscles: (1) the subscapularis and (2) the serratus anterior. With serving, higher arm elevation (135 degrees abduction) may be protective for the rotator cuff by increasing subacromial space (compared to 90 degrees of elevation) and decreasing medial elbow forces (due to a more extended position). Functional training may be accomplished by attaching elastic tubing to the club

and practicing against the resistance provided.

Golfing

Unlike most sports previously discussed in this series, golf does not require much humeral abduction or rotation; technically it is not an overhead sport. Shoulder injuries in golfers are not as common as in overhead sports. Compared to swimmers, professional pitchers, and volleyball players, where more than half of all injuries are to the shoulder, golfers have only 7-8% of all injuries at the shoulder.[6] The low back is most frequently injured, followed by the left elbow or wrist. Shoulder injury in golf is predominantly left shoulder injury. This is because the majority of players are right-handed and the injury is on the non-dominant arm (lead arm). Part of the reason for this occurrence is that many players try to use the left arm (in a right-handed player) to power through the swing, having been told that this is where the power comes from. This has not been supported by electromyographic evidence.[7] Another reason is the extreme compression that occurs at the AC joint with crossbody adduction at the top of the takeaway (backswing) portion of the swing.

It appears there may be an age-related phenomenon with shoulder injury in golf as noted above in tennis. Older players are more common in golf than in most any other sport. Accumulative degenerative changes may predispose these individuals to impingements of the rotator cuff, bursa, or AC joint, in particular at the extremes of motion. In younger players, it appears that instability may be a factor in overuse injury.

Muscular Demands

The golf swing is generally divided into the: (1) takeaway (backswing); (2) forward swing; (3) acceleration; and (4) follow-through.[5] Forward swing and acceleration are often combined into a stage called impact. As with throwing sports, golfing requires substantial lower body contribution to the development of a powerful swing. The lower body and pelvis rotate ahead of the upper body during acceleration. For the left arm (right-handed golfer), the main muscle for the takeaway is the subscapularis. For the forward swing, the main muscle activation is the latissimus dorsi, with assistance from the pectoralis major and rotator cuff. Acceleration demonstrates an increased activity of the subscapularis and infraspinatus. There is a dramatic increase in pectoralis major firing. During follow-through, the infraspinatus demonstrates a marked increase in activity. The pectoralis major, subscapularis, supraspinatus, and latissimus dorsi all participate. It is interesting to note that the supraspinatus is less important in golfing than with other sports, primarily due to the fact that golfing requires so little overhead movement.

Training and Rehabilitation

The biomechanics of the swing may give clues as to muscular or joint damage. The following is a discussion of left shoulder pain in a right-handed golfer. If pain is felt anteriorly at the left shoulder at the top of the backswing, either AC compression or anterior labrum impingement are likely. If the pain is felt posteriorly in the left shoulder, capsular tightness or capsulitis is likely. If pain is felt during the downstroke, an underlying cause may be scapular lag, where the scapula does not keep up with the movement. Primarily, the serratus anterior and the rhomboids should be strengthened. If pain is felt with follow-through at the left shoulder, consider posterior labral or posterior rotator cuff impingement.

A summary of observations recorded by Mann[8] on 52 professional golfers may assist with recommendations regarding do's and don'ts:

- Stiff-leggedness may lead to an excessive upright swing.

- Too much leg flexion may lead to a flat swing.
- If the ball is positioned to far to the rear the player may "hang back" to the right.
- Top golfers have similar swings. In general, shorter golfers have flatter swings that taller golfers.
- Weight shift with change of club is minor.
- (With right handed golfers) the left arm is not straight at the top of the backswing, but flexes more than 90 degrees.
- The head remains stationary with no more than two inches of movement during the swing.
- The backswing and downswing are not the same. The downswing is outside of the backswing.

References

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