FITNESS and nutrition

Are You Serving Up a Shoulder Problem?

By Chris Ostling, PT, DPT

Anyone who has played tennis for a little while comes to realization that the difference between a good player and a great player is often his or her serve. A strong first serve can make up for a lot of mistakes and can win you a lot of games. Of course, having a strong first serve isn't that easy.

The serve is generally considered the most intricate and complex of all the strokes in the game. Biomechanics have divided the serve into six parts:

1. Wind up
2. Early cocking
3. Late cocking
4. Acceleration
5. Early follow-through
6. Late follow-through[2]

There are several different demands that the shoulder is put through during some of these phases that are important to understand in order to identify where one may run into injury problems.

During late cocking, just before the acceleration phase of the serve, the shoulder has to rotate a tremendous amount. Normal values of external rotation of the shoulder are 90 degrees. Olympic tennis players have been calculated at over 170 degrees at the late cocking phase.[1] Moderate tennis players are probably somewhere in between, which is still considered a lot. If you have any range of motion restrictions, which is prevalent particularly in our older tennis players, this can be a major source of shoulder joint injury. In this case, shoulder pain would usually occur right before you hit the ball, as you bring that racket all the way back before pushing forward to make contact. The good news is that with proper stretching and joint mobilization, it is possible to restore the needed range of motion and allow that serve to be pain-free.

Besides range of motion demands, the shoulder must also generate an enormous amount of force during the serve. This occurs during the acceleration phase—when you are pushing the racket as fast as you can towards the ball. The rotational speeds

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an elite player can generate at the shoulder are over 2,000 degrees per second.[1] The muscles that make up the majority of that force production include parts of your rotator cuff and deltoid, as well as your pectoralis muscles and your serratus anterior—a muscle that helps move the shoulder blade.[3] Pain during this phase may indicate pain in those force-generating muscles. Strengthening exercises can improve the capability of these muscles and not only allow you to serve without pain, but may increase the speed of your serve as well.

The follow-through phase of the serve is also highly demanding on the shoulder. Remember, during the acceleration phase, all of the force is created to hit the ball. Now, during follow-through, all of that force must be stopped in a very short amount of time. In order for you to "slam on the brakes," the muscles in your shoulder, including the rotator cuff, part of your deltoid, and your trapezius muscle, all have to work to rapidly slow the speed of the advancing arm. This is accomplished through a controlled lengthening of those muscles, called an eccentric contraction.[3] Shoulder pain during the follow-through may be indicative of a muscular injury. This is because forceful eccentric contractions can be very damaging to a muscle and can lead to muscle strain. Rest and progressive strengthening under proper supervision can resolve a strained muscle and allow you to return to pain-free serving.

Whether you are a novice or an expert, pain during the serve should not occur in a healthy shoulder. Due to strength and range of motion demands on the shoulder, there are several different phases of the serve that have the potential to cause injury. If you experience consistent shoulder pain during your serve, a physical therapist can help resolve the situation. Proper identification and treatment can make a big difference in the severity and duration of shoulder injuries. Keep working on that serve, just make sure it doesn't hurt! ●

Chris Ostling, PT, DPT is with Next Step Physical Therapy in Hicksville, N.Y. Chris is an orthopedically-trained physical therapist with experience treating both novice and professional tennis players. For more information, contact Chris by phone at (516) 681-8070, e-mail nextstep@nextsteppt.com or visit www.nextsteppt.com.

Footnotes

1—Fleisig. et al. (2003). *Sports Biomechanics*, 2, 51-64.
2—Morris. et al. (1989). *American Journal of Sports Medicine*, 17, 241-247.
3—Seeley. Et al. (2004). *Medicine and Science in Sports and Exercise*, 36, S136.