

NSCA's

January 2002  
Volume 1, Number 1  
[www.nscs-lift.org/perform](http://www.nscs-lift.org/perform)

# Performance Training

*Journal*

## Racquet Sports

Training the Shoulder  
*Speed & Agility Drills*  
From **Torso** to **Movement**

Bringing **Quality**  
to Your Training

STRENGTH without SIZE?



# Volume 1, Number 1 Contents



## Feature: Racquet Sports

- 5 | **Agility Training for Improved Tennis Performance**  
By Tracy L. Morgan, CSCS  
Improve your agility on the court with this four-week program.
- 9 | **Training the Shoulder for Racquet Sports**  
By Michael Barnes, M.Ed., CSCS  
This comprehensive shoulder strengthening and flexibility routine can reduce your chance of injury and maximize your effectiveness on the court.
- 16 | **Training for Tennis: From Torso to Movement**  
By Barrett S. Bugg, CSCS  
Increase your ability to produce power with this torso training routine.

## Departments

- 3 | **Ask the Experts**  
**Can I stunt my growth by lifting weights?**
- 4 | **Mind Games**  
**Bringing Quality to Your Training**  
By Suzie Tuffey, Ph.D., NSCA-CPT  
Do you find your self just going through the motions? Sport Psychologist Suzie Tuffey explains how you can make every training session more productive by "training with quality."
- 13 | **Fitness Frontlines**  
By Edmund R. Burke, Ph.D., CSCS\*D
- 14 | **Your Body**  
**Increase Strength without an Increase in Size?**  
By Lee E. Brown, Ed.D., CSCS\*D  
Physiologist Lee E. Brown explores the mechanism whereby you can see strength increases without increasing muscle size.

# NSCA's Performance Training Journal

NSCA's *Performance Training Journal* is a publication of the National Strength and Conditioning Association (NSCA). Articles can be accessed online at <http://www.nscs-lift.org/perform>.

All material in this publication is copyrighted by NSCA. Permission is granted for free redistribution of each issue in its entirety. Permission to reprint or redistribute altered or excerpted material will be granted on a case by case basis; all requests must be made in writing to the editorial office.

## Editorial Office

1955 North Union Boulevard  
Colorado Springs, CO 80909  
719-632-6722

## Staff

### Editor

Rebecca Milot-Bradford, M.B.S.  
[rmilot-bradford@nscs-lift.org](mailto:rmilot-bradford@nscs-lift.org)

### Editorial Review

Michael Barnes, M.Ed., CSCS  
[mbarnes@nscs-lift.org](mailto:mbarnes@nscs-lift.org)  
Keith Cinea, M.A., CSCS  
[kcinea@nscs-lift.org](mailto:kcinea@nscs-lift.org)  
Brian Newman, M.S., CSCS  
[bnewman@nscs-lift.org](mailto:bnewman@nscs-lift.org)

### Advertising Sales

Robyn Curtis  
[rcurtis@nscs-lift.org](mailto:rcurtis@nscs-lift.org)

### Sponsorship Information

Susan Weeks  
[sweeks@nscs-lift.org](mailto:sweeks@nscs-lift.org)

## Mission

As the worldwide authority on strength and conditioning, we support and disseminate research-based knowledge and its practical application, to improve athletic performance and fitness.

# AskTheExperts

## Question

"I'm 14 years old. I started weightlifting at 13 years old and I started just doing basic pushups and crunches at 11. My height has not changed AT ALL for one year, I'm still 5'1 1/2". I was never hurt lifting, just pulled muscles here and there, nothing serious. Can genetics be the reason I'm so small or can I have stunted my growth? Tell me what you think please ... thanks!"

## Answer

Boys and girls of all ages and abilities can benefit from performing strength training exercises, provided that appropriate training guidelines are followed. In addition to increasing muscle strength, lifting weights can make your bones stronger too. Despite outdated concerns associated with this type of training, current research studies indicate that strength training will not stunt your growth. In fact, teenagers who are physically active (and eat a well-balanced diet) are more likely to reach their genetic potential in height than teens who are sedentary and eat a lot of "junk" food. You should continue participating in strength training activities as well as other sports and recreational activities you enjoy. However, you should seek the advice of a physical education teacher or certified strength and conditioning specialist who can review your strength training program and provide sound advice on safe training procedures.

**Avery D. Faigenbaum, Ed.D., CSCS\*D, University of Massachusetts-Boston**

*Dr. Faigenbaum is an Assistant Professor in the Department of Human Performance and Fitness at the University of Massachusetts in Boston, and a leading researcher and practitioner in the area of youth fitness.*

# TalkToUs

Share your questions and comments. We want to hear from you. We will choose one question each month for the "Ask the Experts" column. Write to *Performance Training* Editor, NSCA, 1955 North Union Blvd., Colorado Springs, CO 80909 or send email to [webmaster@nscs-lift.org](mailto:webmaster@nscs-lift.org).

## Bringing Quality to Your Training

**T**he alarm goes off at 5:30am. You drag yourself out of bed, change into your workout clothes and drive to the gym. Once at the gym, you stretch briefly before beginning your workout routine. Less than twenty minutes into the workout, your thoughts are consumed by details and stresses of the day ahead. You quickly finish your workout so you can get started with your day.

Sound familiar? You are committed to your physical fitness/sport but find that you are going through the motions. More often than not, you get the workout in physically but are not “mentally” in to what you are doing. This is a common situation given personal, professional and family responsibilities and the harried lifestyles we tend to lead. How can we change this to make training more enjoyable and productive?

In the field of sport psychology, there has been an attempt to characterize elite athletes or compare less versus more successful athletes from a psychological perspective. One characteristic that typifies elite performers relates to training with quality on a daily basis; elite athletes use a variety of mental skills and strategies to enhance the intensity of training. Put another way, they take purposeful steps to maximize their physical and mental effort in training, a characteristic that relates to more successful performance.

Whether you are a recreational athlete, competitive athlete, or fitness enthusiast, you can benefit physically, mentally, and emotionally by taking steps to bring quality and purpose to your training. Two strategies are suggested to help you mentally engage in your physical pursuits.

### Identify a Purpose

On a daily basis, you should have a reason to not just workout but to workout with physical and mental intensity. Having such a reason can be the “flame” behind the workout;

it can raise your intensity from a simmer to a boil. A simple strategy that can bring this purpose and intensity to training is to ask yourself one question before you get started—“what am I going to do today to make myself better?” In answering this question, identify just one goal or objective ... one thing to focus on that could be related to technique, duration, reps, effort, or attitude. After the session, hold yourself accountable by answering the question “what did I do today to make myself better?” (In a future column I’ll discuss details of effective goal setting.)

### Be an Athlete

You wear many “hats” during the course of the day such as parent, spouse, co-worker, boss, athlete, and student. When working out, however, you should have on only one “hat”—you need to allow yourself (remind yourself) to be an athlete and only an athlete. Mental baggage from the day needs to be left in the locker to be picked up later. This isn’t always easy to do. To help make this transition to “being an athlete,” you can use a strategy called behavioral symbolism. This simply means that you tap into a behavior that symbolizes for you that you are now an athlete and are ready to get on with the workout. For example, the act of putting on your lifting gloves or tying the laces on your running shoes could be used to symbolize that you are now an athlete and are focused on the task ahead. While training, all that matters and all you can control is what you are doing right now so invest your energy wisely.

Be an athlete with a purpose ... and have fun!

### About the Author

*Suzie Tuffey received her Master’s and Ph.D. in Sport Psychology/ Exercise Science from the University of North Carolina-Greensboro. She has worked for USA Swimming as the Sport Psychology and Sport Science Director, and now is Associate Director of Coaching with the USOC where she works with various sport national governing bodies (NGBs) to develop and enhance coaching education and training. Additionally, Suzie is an NSCA-certified personal trainer.*

# Agility Training for Improved Tennis Performance

Tracy L. Morgan, CSCS

**I**n addition to being a game that requires mastery of strokes and strategies, at competitive levels, tennis is a game of rapid acceleration and deceleration. You must be quick to the ball. You must then settle in and hit your shot in a balanced position in order to have power and placement. You must keep your eyes on the ball when hitting and be able to anticipate its trajectory when receiving. You must do this over and over again if you want to win. And all of these capabilities can be improved when you learn ways to improve your agility.

## Movement Mechanics

There are a variety of movements and positions used in tennis that allow you to move with agility around the court. These movement mechanics are described here and utilized in the agility drills that follow.

### Tennis-ready Position

The tennis-ready position is the most effective way of preparing the body for movement. It creates balance and allows for rapid and powerful movement in any direction.

The tennis-ready position is the same as the ready position for many other sports. The back is straight but leaned slightly forward and the hips and knees are flexed as if performing a half-squat. Body weight is on the balls of the feet, so the heels are raised off the court about an inch or slightly less.

### Split Step

The split step is actually the process of assuming the tennis-ready position after movement and before shots. It allows you to regain control and balance after movement and prepare to hit the next shot. The final position for the split step is the same as the tennis ready position.

### Shuffle Step

The shuffle is most effective when used as a way of adjusting

your position on the court. When preparing to hit a ball that is nearly within reach, one or two shuffle steps may help you obtain the best position to hit with power and place the ball strategically.

The shuffle is performed with your body in the same position as the tennis ready position. Movement is initiated by the foot that is farthest from the direction in which you are going. That is, when you are moving to your left, your right foot initiates movement. Drive down and away against the court with the ball of your foot to propel you body laterally.

### Run

When players need to change position on the court they run. Whether getting from the net to the baseline, or from sideline to sideline, the run is the most effective move to cover greater distances on the court quickly.

The run is employed most effectively when the ball of your foot is used to propel your body. Running with your heels on the ground increases the amount of time your foot is actually in contact with the court and will slow you down. A powerful run incorporates arm action as well. Keep your elbows bent at 90 degrees and drive them back alternately.

### Cross-over Step

The cross-over step is the key to a successful overhead shot when it drives you from the net to the baseline. Some players use it as a first step prior to a run or shuffle as well.

The cross-over step is performed by turning the hips to the sideline, while keeping the front shoulder and head turned toward the net. Right-handed players will use the left foot as their cross-over foot. Using the ball of the left foot, cross over the right foot and propel the body back toward the baseline.

## Benefits of Training

While each and every one of us is born with a particular athletic ability, training is the key to playing and competing as close to that ability as possible. The drills provided here are aimed at improving your agility—quick and powerful change of direction, faster reaction time and improved balance will all contribute to improved agility.

# The Plan

## Week 1

Focus on proper movement mechanics. Perform the exercises one day during the week.

Drill	Repetitions
Ball drops	5
The Chute	2
Situational Agility	2

## Week 2

Focus on proper movement mechanics. Perform the exercises two days during the week.

Drill	Repetitions
Ball drops	5
The Chute	2
Situational Agility	2

## Week 3

Focus on increasing speed and quickness. Perform the exercises two days during the week.

Drill	Repetitions
Ball drops	8
The Chute	4
Situational Agility	3

## Week 4

Focus on increasing speed and quickness. Perform the exercises two days during the week.

Drill	Repetitions
Ball drops	10
The Chute	6
Situational Agility	4



## Common Training Questions

### *How do I need to prepare for these drills?*

First, you should be injury and illness free before beginning any training program. If you have been involved in a strength and cardiovascular training program you will be better prepared for the strength and energy demands of agility training.

Be sure to warm up thoroughly before beginning any training program. Experts have long agreed that a proper warm up is essential to remain injury free while improving your performance. Keep in mind that with increased age, a longer warm up is required. Activities that involve the entire body should be performed until you begin to produce a sweat.

### *When should I do these agility drills?*

Agility drills demand a great deal of nervous system involvement, muscular effort and cardiovascular system contribution. They can cause you to tire quickly and therefore should be performed while you are fresh. You have the option of incorporating your agility training prior to your current strength training routine, just before a lesson or as a stand-alone training session.

### *How many times should I do each drill and how often?*

It is important to allow your agility performance to improve by progressively utilizing the agility drills provided here. First, focus on learning the correct mechanics for performing each. Go through each drill slowly at first, being sure that you are maintaining your balance and using the ball of your foot to generate movement force. Once you have mastered the movement mechanics, begin to progressively increase how much effort you put forth in each repetition as well as the number of repetitions.

### *Can I rest?*

Allow complete and active rest between each repetition. Walk and shake your limbs after each drill until your breathing returns to normal. With increased training, you will find that the amount of rest you need between each drill gets shorter.

### *What about strength training?*

Strength training is an essential tool for athletes of all sports, levels and abilities. Experts have found that strength training can improve sport performance through injury prevention and increased ability to generate force. If you are currently involved in a regular strength training program, keep up the good work. Continue to challenge yourself and be sure that your program is specific to the demands of tennis. If you have yet to participate in a strength training program, it may be helpful for you to find a qualified NSCA coach or trainer in your area to help you get started.

# The Drills

All drills described here are performed on the tennis court. It is essential that you are free of injury and illness before attempting any of the drills described here. Be sure to warm up properly and allow adequate rest between repetitions. Perform each drill slowly and under control at first, and gradually increase your speed and effort.

## Ball Drops

Aimed at improving reaction and first step quickness, this drill will help you in the following situations:

- ✓ Return of serve
- ✓ Defending the drop shot
- ✓ Defending a wide shot or slice

### Directions

Begin by standing at the baseline, facing the net. Your partner/coach stands facing you five (5) feet away. He or she holds a tennis ball in one hand with his or her arm extended in the air. Assume a tennis-ready position, and keep your eyes on the ball. Your partner/coach drops the ball by simply releasing his or her grip. As you see the ball fall, burst forward as quickly as possible and catch it on the first bounce. With each successful catch, your partner/coach increases the challenge by taking one large step back while you remain at the baseline.

### Variations

Because tennis is a game that demands movement in a variety of directions, it is essential to train in many directions as well. Your partner/coach should also stand at a 45-degree angle to you, and directly to your right or left, in order to improve your ability to move rapidly in a variety of tennis situations.

## Situational Agility Drill

A common game strategy is for opponents to force each other to run all over the court to defend shots. Repetitive acceleration and deceleration in a variety of directions can be tiring; however if you train for these situations, you will have the advantage over your opponent.

### Directions

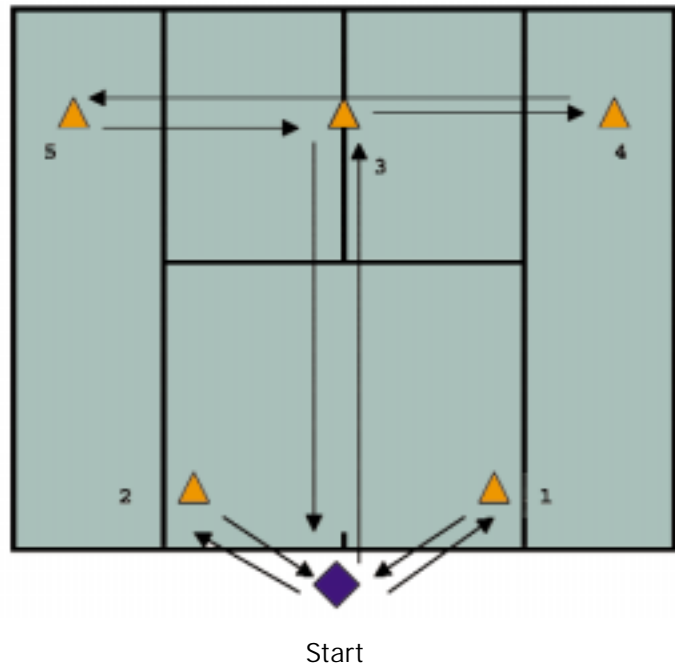
Place five (5) cones on the court as indicated below. (Figure 1) Each cone represents the destination of a shot that your imaginary opponent has hit. Beginning at cone 1, you will progress to each cone as quick as possible. You will settle in to “hit” each shot and then recover with a split step and progress to the next cone.

Exactly how you move will depend on where the cone is on the court. For example, you may take two or three steps shuffling from the start to cone 1 before settling in to hit your forehand. However, when moving from cone 4 to cone 5, covering a greater distance requires you to run if you want to get there quickly.

### Variations

Perhaps there are one or two game situations that seem to put you at risk for losing a point. Move the cones in position for you to practice that particular situation.

Figure 1: Situational Agility Drill



## The Chute

Tennis is full quick starts and stops in a lateral direction. Strong hips and legs and the ability to generate power quickly will improve your ability to meet these demands.

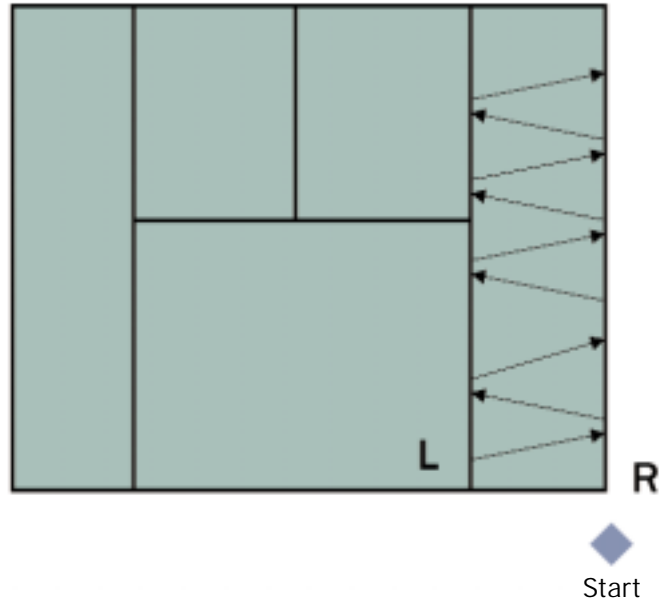
### Directions

This drill is performed in the alley of the court on the forehand side. (Figure 2) Assume a tennis ready stance at the baseline, with your right foot on the doubles sideline. Begin by pushing off the right foot and landing on the left foot on the singles sideline, forward of your original starting point. With minimal time on the ground, push off again with the left, landing on the right. Continue to propel your body forward using the ball of your foot as quickly as possible. As you get stronger and quicker, avoid heel contact with the court. Continue this lateral hopping movement until you have reached the net. Perform this drill by starting on the left foot on alternate repetitions.

### Variations

Holding your racquet in your hand will help to make this drill more sport specific. Be sure to use your normal grip and do not allow the racquet face to drop.

Figure 2: The Chute



## About the Author

Tracy Morgan, CSCS, is a NSCA Certified Strength and Conditioning Specialist. She earned her BS from SUNY Cortland in Physical Education and a BS in Psychology. Tracy is the former Executive Director of the Cybex Institute, the educational arm of Cybex International, and has been a consultant to companies such as Jim Kelly Enterprises, Cleveland Indians, and Nike. Tracy writes education material for magazines such as Fitness Magazine, Training and Conditioning Magazine and Student Sports Magazine.

# Training the Shoulder for Racquet Sports

Michael Barnes, M.Ed., CSCS



**M**any sport movements involve accelerating an implement, such as a ball, bat or racquet, or transferring force from the ground to the hands. The human body serves as a kinetic chain during these actions, linking and summing forces together in a synchronized effort. Segments of the body are coordinated to elicit a favorable outcome and the segments can be thought of as links to the chain.

The overhand serve is an explosive, violent and forceful movement initiated by the strong muscles of the hips, thighs and legs. On the other end of the kinetic chain, the rotator cuff is the muscle group that decelerates the arm and racquet during the overhand serve. The rotator cuff, consisting of four small muscles on the posterior side of the shoulder, serves to stabilize the shoulder joint. If these muscles become tired, overtrained, weak or fatigued, the shoulder is jeopardized and can become injured. A comprehensive shoulder strengthening and flexibility routine can reduce the chance of injury and maximize the effectiveness of the player.

## The Warm Up

A general warm-up prior to a strength training session is recommended. The general warm-up would consist of cycling, jogging or light calisthenics and last for five (5) to

ten (10) minutes. The purpose of the general warm up is to raise the temperature of the body and muscles, decrease viscosity of the joints, and increase the range of motion. There is also an increase in heart rate, blood flow and respiration.

A specific warm-up would follow the general warm-up. This would include performing exercises with light weights. Flexibility can be included at this time with the exercises. Some specific stretches for the shoulder will be introduced latter.

## The Strength Training

All of the following strength training exercises can be done three times per week. Here is a specific lifting routine to be done on Mondays, Wednesdays and Fridays.

Straight Arm Pull Through: 1-3 sets of 15-30 reps

Straight Arm Bench Press: 1-3 sets of 15-30 reps

Thumb Down Side Raise: 1-3 sets of 15-30 reps

Thumb Up Front Raise: 1-3 sets of 15-30 reps

Thumb Up Side Raise: 1-3 sets of 15-30 reps

External Rotations: 1-3 sets of 15-30 reps

These exercises are to be done with little or no rest between sets. Equal numbers of each exercise should be completed in the recommended order.

# Shoulder Exercises

## Straight Arm Pull Through

**Equipment:** A lat pull down machine will be used for completion of this movement. Stand directly in front of the pull down and grasp the bar at shoulder width.

**Start:** Begin with the arms at, or slightly below shoulder height. Reach forward as far as possible, “rounding” the upper back. Pull through squeezing the scapula (shoulder blades) together. (Figure 1)

**Finish:** Conclude this exercise by elevating the chest, squeezing the shoulder blades together and briefly pausing at the end of the movement. (Figure 2) Return the weights to the starting position with a slow, controlled movement.



**Figure 1: Straight Arm Pull Through - Start**



**Figure 2: Straight Arm Pull Through - Finish**

## Straight Arm Bench Press

**Equipment:** Use a flat supine bench press for this movement. Lie flat on the bench with feet on the floor and a shoulder width grip, wrapping the thumb around the bar.

**Start:** The elbows are held straight through the entire movement. Lower the bar toward the torso as far as possible without bending the elbows. (Figure 3)

**Finish:** Push the bar as far away from the torso as possible. There should be some rounding of the upper back. (Figure 4) Return the weights to the starting position with a slow, controlled movement.



**Figure 3: Straight Arm Bench Press - Start**



**Figure 4: Straight Arm Bench Press - Finish**

## Thumb Down Side Raises

**Equipment:** Use light dumbbells—less than five (5) pounds—for this rotator cuff movement. Stand with feet shoulder width apart.

**Start:** With good posture, hold the upper back muscles tight to prevent any movement from the scapula (shoulder blades). The thumbs are turned down as far as possible with the hands at the sides. During the movement move the arms about 30 degrees rotated in. This is called a “scapular plane.” (Figure 5)

**Finish:** The movement is completed when the arms are slightly lower than horizontal. (Figure 6) Return the weights to the starting position with a slow, controlled movement.



**Figure 5: Thumb Down Side Raise - Start**



**Figure 6: Thumb Down Side Raise - Finish**

### Thumb Up Side Raises:

Equipment: Use light dumbbells—less than five (5) pounds—for this rotator cuff movement. Stand with feet shoulder width apart.

Start: Externally rotate the arms pointing the thumbs up. Keep the upper back tight to prevent any movement from the scapula. (Figure 7) During the movement, move the arms about 30 degrees rotated in.

Finish: Complete the movement with the hands at, or slightly below shoulder level. (Figure 8) Return the weights to the starting position with a slow, controlled movement.



**Figure 7: Thumb Up Side Raise - Start**



**Figure 8: Thumb Up Side Raise - Finish**

### Thumb Up Front Raises

Equipment: Use light dumbbells—less than five (5) pounds—for this rotator cuff movement. Stand with feet shoulder width apart.

Start: In the standing position, begin with the hands at the sides and the palms facing in. Once again, keep the upper back muscle contracted to prevent any unnecessary movement. (Figure 8)

Finish: Raise the weights just to shoulder level or slightly below. Return the weights to the starting position with a slow, controlled movement. (Figure 9)



**Figure 8: Thumb Up Front Raise - Start**



**Figure 9: Thumb Up Front Raise - Start**

### External Rotations:

Start: Lying on one side, place a rolled-up towel under the upper arm. This will assist with proper mechanics of the shoulder joint. Keep the elbow at 90 degrees during the movement. Externally rotate or turn the arm, moving the dumbbell away from the body. (Figure 10)

Finish: The top position is reached when a full contraction and range of motion is completed. (Figure 11) Lower the weight back to the starting position with a slow, controlled movement.



**Figure 10: External Rotations - Start**



**Figure 11: External Rotations - Finish**

## The Flexibility

There are many different specific stretches for the shoulder joint, and several different techniques. Two static stretches that are safe and effective are described below.

### Posterior deltoid and rotator cuff

In a standing position, reach horizontally with the right arm across the body in the opposite direction. With the left hand assist the right arm by pulling the right arm further across grasping at the right elbow. (Figure 12) Hold the stretch for 15-30 seconds and repeat it on the left side.

### Anterior Deltoid stretch

In the standing position, keeping the upper arm at the side reach behind the back making a 90-degree angle at the elbow. Grab the wrist of the opposite hand and assist the stretch with gentle force from the opposite hand. (Figure 13) Hold the stretch for 15-30 seconds and repeat it on the opposite side.

These specific exercises are designed to assist the athlete in maintaining shoulder health and integrity. They should be part of any athlete's training routine regardless of level.



**Figure 12: Posterior deltoid and rotator cuff stretch**



**Figure 12: Anterior deltoid stretch**

### About the Author

*Michael Barnes, M.Ed., CSCS earned a B.S. in Physical Education from SUNY Cortland and a M.Ed. in Human Performance from Auburn University. Mike is presently the Education Director for the National Strength and Conditioning Association. Previous work experience includes assistant strength coach at UC Berkeley and seven years as the Strength Development Coordinator for the San Francisco Forty-Niners. Mike is a Certified Strength and Conditioning Specialist through the NSCA.*

# FitnessFrontlines

Edmund R. Burke, Ph.D., CSCS

The medical literature often contains research of interest to the exerciser. I have recently come across the following pieces of research information that should point to the continued benefits of exercise and the need to include it in our daily lifestyle.

## What good does stretching do?

This is a question sports physiologists are examining with greater interest, especially since an Australian study published last year in the *Journal of the American College of Sports Medicine* found that stretching before exercise does not appear to prevent injuries such as strains, sprains or tendinitis. The practice of stretching before and after physical activity is based on tradition, common sense and practical experience, but now exercise scientists are trying to prove the benefits. It's well documented that stretching plays a role in rehabilitation from injury. It is also widely accepted that stretching improves athletic performance by increasing range of motion, and if this is so, then it seems to follow that greater range of motion means you are less likely to become injured by over-extending your body while competing or working out. Another school of thought holds that since you warm up before you stretch, perhaps it's the warm-up that provides the benefit. As the research goes on, no one in authority is backing away from the idea that flexibility is one of the key measures of fitness (along with strength and cardiovascular endurance).

Pope, Rodney, et. al. A randomized trial of preexercise stretching for prevention of injury. *Medicine and Science in Sport and Exercise* 32:271-277. 2001

## Intensity key to burning calories

We often wonder if aerobic type exercise or resistance training is better for burning calories and fat. Cycling, swimming or an hour in the gym hitting the weights? Heide Byrne, Ph.D. and coworkers from the State of New York, Brockport, NY, studied 61 women, ages 18-46 who participated in a study on the effects of exercise on resting metabolic rate (RMR). The women were either aerobically or resistance trained and separated into either highly or moderately trained groups. Tests for body composition, aerobic capacity and BMR showed no significant difference between the aerobically trained or resistance trained groups. But when grouped by intensity, the high intensity trained women tended to have increased resting metabolic rates, regardless of how they exercised. So whether you are lifting weights, running, cycling or swimming, if you are trying to lose weight

and burn calories make sure to exercise at a higher intensity.

*International Journal of Sports Nutrition and Exercise Metabolism* 11:1-14. 2001.

## Research shows older men build and lose muscle protein as fast as young men

Losing muscle and strength late in life may not be an inevitable consequence of aging, as scientists traditionally have thought, according to a study undertaken by researchers at the University of Texas Medical Branch at Galveston, TX. Many believe that the decline of muscle as people grow older—called sarcopenia—and the accompanying loss of strength and function occur because muscle proteins begin to break down faster than they can be created and restored. The team studied 48 healthy men—the largest group to date examined on this topic—and tracked the rate at which their bodies created muscle proteins and the rate of muscle protein breakdown. They found that turnover rates were similar in younger and older men. That means that other factors must account for the muscle loss and weakening that come with age. Muscle loss in aging may be linked to many other potential reasons, including older people's eating habits, the body's ability to use protein from food, and hormonal changes. Between 1997 and 2000, the researchers recruited 22 healthy seniors with an average age of 70 to participate in the study. They compared them to 26 younger healthy men with an average age of 28. In both old and young participants, the balance between synthesis and breakdown was similar—although the researchers found that muscle protein both was created and broken down a little faster in older people than in the young group.

Volpi, E., et. al. Basal muscle amino acid kinetics and protein synthesis in healthy young and older men. *Journal of the American Medical Association* 286(10): 1206-1212. 2001

## About the Author

Edmund R. Burke, Ph.D., CSCS, is Professor and Director of the Exercise Science Program at the University of Colorado at Colorado Springs. He served as Coordinator of Sports Sciences for the U. S. Cycling Team leading up to the Olympic Games in 1996 and was a staff member for the 1980 and 1984 Olympic Cycling Teams. Dr. Burke is a Fellow of the American College of Sports Medicine and a Certified Strength and Conditioning Specialist (CSCS) with the NSCA. He has authored or co-authored fifteen books on training, fitness and nutrition.

## Increase in Strength without an Increase in Size?

**R**esistance training results in strength gains. This has been known since early Greek times when Milo lifted cows. Since then, hundreds of experimental studies have agreed that gains in strength are the primary result of an increase in muscular size, referred to as hypertrophy. When a muscle gains size it also gains strength. What is less well known is the phenomenon that results in increased strength after only a few resistance training sessions. This has been observed in people without a long history of resistance training. It has been speculated that these “short-term effects” are the result of changes in neural factors rather than hypertrophy (Komi, 1992). Experimental studies have shown that short-term resistance training can increase strength production in the absence of hypertrophy or muscle size. These early strength gains are largely attributed to an increase in the maximal muscle activation level. In other words, the untrained human system becomes more efficient at both sending and receiving the brain signals that cause muscles to contract prior to initiating growth of muscle.

De Lorme and Watkins (1951) were the first to suggest that

the initial changes in strength following resistance exercise in untrained individuals occurs at a rate too fast to be accounted for by hypertrophy. In later work by Moritani and deVries (1979), they measured untrained subject's elbow strength in conjunction with neural signals from the brain. After the subjects trained for eight weeks in a progressive resistance, dumbbell exercise program, all of them had significantly increased their maximal strength. More importantly, the neural measurements indicated that changes in electrical activity at the elbow were primarily responsible for early strength increases while hypertrophy responses gradually increased over time. That is, the first factor that influences strength gains in untrained subjects is not size but brain signal efficiency.

A recent study (Akima, 1999) also demonstrated short-term improvements in leg strength-speed can occur by increasing the amount of resistance training performed during the training time. This study increased the training volume and this increase in the amount of exercise performed contributed to the strength changes demonstrated by the subjects. However, when the muscle of the upper leg was measured via MRI at the conclusion of training, muscle fiber area revealed no changes. In contrast, the neural activity of the leg increased significantly. These results again point to a learned neural efficiency in untrained subjects as a function of resistance training.

### Conclusion

The increases in strength associated with resistance training occur within a time frame that entails two primary factors (Baechle, 2000). First, neural changes occur within the human system that involve greater efficiency of signal transmission from the brain as well as an increase in the muscle's ability to accept these signals and convert them into muscle contraction and therefore strength. Second, the actual size of

the muscle increases over time, which also results in strength gains. Therefore, it is possible to gain strength without gaining size in untrained participants. Of course, all of this occurs within the constraints of the human hormone system, which varies with age and gender. We will discuss those factors in the next column.

## References

1. Akima, H., Takahashi, H., Kuno, S. Masuda, K., Masuda, T., Shimojo, H., Anno, I., Itai, Y., & Katsuta, S. Early phase adaptations of muscle use and strength to isokinetic training. *Medicine and Science in Sports and Exercise* 31(4), 588-594. 1999.
2. Baechle, T.R. & Earle, R.W. (Eds). *Essentials of strength training and conditioning*. Champaign, IL: Human Kinetics. 2000.
3. De Lorme, T.L. & Watkins, A.L. *Progressive resistance exercise*. New York: Appleton Century, Inc. 1951.
4. Komi, P.V. (Ed.). *Strength and power in sport*. London: Blackwell Scientific Publications. 1992.
5. Moritani, T & deVries, H.A. Neural factors versus hypertrophy in the time course of muscle strength gain. *American Journal of Physical Medicine* 58(3), 115-30. 1979.

## About the Author

*Lee E. Brown, EdD, EPC, CSCS,\*D, is Assistant Professor and Director of the Human Performance Laboratory at Arkansas State University. He received his Doctorate at Florida Atlantic University, where he was Health Sciences Lab Coordinator. Dr. Brown is a Fellow of the American College of Sports Medicine, a USAW Certified Club Coach and a Certified Strength and Conditioning Specialist with Distinction (CSCS, \*D) with the NSCA. He will be exploring topics of human physiology each month in this column.*

# Training for Tennis: From Torso to Movement

Barrett S. Bugg, CSCS

**A**ndre Agassi or Andy Roddick hitting a running forehand for the win is a spectacular shot that all of us love to watch and may enjoy hitting ourselves! One of the keys to a powerful volley is a well-trained torso. While the torso's involvement is ever-present in all tennis movements, the most difficult demand may very well be the rotational aspect. Rotation occurs when hitting groundstrokes, serves, and volleys.

By rotating, the body is able to transfer its center of gravity into the shot, which is a major source of power. When hitting that running forehand, the torso must also have the ability to stave off injury. While proper hydration and flexibility are required for optimal power production and injury prevention, performing the necessary movement patterns is of great importance as well.

In sport, the torso has four responsibilities:

- (1) Flexion = straight line, vertical movement with the torso
- (2) Rotation = circular/crossover movement with the torso
- (3) Stabilization = holding, without movement, with the torso
- (4) Lateral Flexion = side to side movement with the torso

A balanced approach of all of these movements develops the torso's ability to provide power and prevent injury. Thus, a strong torso provides off balance coordination for shot making capabilities.

Though torso training may not be the most thrilling part of a training session, it is one of the most important manners in which to train for tennis. Incorporating torso training at the beginning of a training session allows players to overcome a difficult aspect of training while concurrently allowing the body to internally warm itself.

## Torso Exercises

### To improve flexion

Hold a stability ball between your feet while lying face up on the ground. With legs extended, raise the ball using your torso until the bottom of your feet face the ceiling, then slowly return to the starting position. Perform 2-3 sets of 10-30 repetitions.



**Figure 1: Rotation (boxing)**

### To improve rotation

You will need to work with a partner who is wearing focus gloves. Your partner will hold the focus gloves at shoulder height, arms width apart. Don boxing gloves, and lightly punch diagonally to your partner's focus gloves (your right hand to your partner's right hand). Rotate into each "punch"

while maintaining proper balance with a shoulder-wide stance. (Figure 1) Perform 2-3 sets of 5-50 rotations/punches.

### To improve stabilization

Start in a push up position, with your hands on a stability ball and your feet on a bench (Figure 2). You should have a spotter to ensure that you don't lose your balance, and the ball does not "escape." Perform a push up on the stability ball and remain in the fully extended position without allowing any flexing of your torso. Hold for 15-60 seconds. Perform 2-3 repetitions.



**Figure 2: Stabilization with stability ball**

### To improve lateral flexion

Start by lying on your side on a firm surface, and elevate your torso with one arm. Your support arm is flexed at the elbow with the forearm resting on the ground. Raise your hips four (4) to six (6) inches from the ground, then slowly lower back to a resting position. Perform 2-3 sets of 10-30 repetitions on each side.

## Movement Drills

Employing the correct drills takes plenty of practice and perseverance. Since every ball should have a purpose, whether practicing or playing, drills offer the opportunity to improve court awareness, conditioning, stroke consistency, spin, depth, pace and movement. Two of the most important factors to consider are spin development and movement.

### Short Court Topspin Drill

Purpose: spin development

After adequate stretching and a proper warm up, focusing on

spin development before hitting groundstrokes from the baseline helps to develop "feel" (e.g. control) for the ball.

Begin with you and a partner each standing on the "T" of the service boxes on either side of the net. Hit the ball back and forth to each other. Focus on spin generation and height over the net. You should start slowly and work together while adding increasing amounts of spin to each shot. Short backswings are typically best with this drill since high reaction times are needed and maximum control is desired.

Two progressions include:

- (a) crosscourt only forehands
- (b) crosscourt only backhands

Finally, add movement to this drill for increased effectiveness. Instead of hitting the ball directly to each other, hit the ball slightly away from each other, both crosscourt and down the line. The focus here should be on getting the racquet prepared, footwork set, and body weight balanced for the shot. This will enable you to properly execute the shot while preparing for the next shot.

After spending five to ten minutes with this drill progression, take a few steps toward the baseline while continuing the drill. This will allow you to add depth to the groundstrokes while continuing to generate spin.

In short, the drill progression begins just inside the service box, proceeds to 1/2 court, then proceeds to 2/3 court, and finally to the baseline.

### Crosscourt/Down the Line

Purpose: movement

This is a drill that takes place on the baseline. Once again, both players work together to develop movement skills with consistency of shot. One player hits the ball crosscourt while the other player hits the ball down the line. Net clearance should be high while employing the spin principles practiced in the aforementioned short court topspin drill. After two (2) to five (5) minutes, partners switch roles while maintaining consistency.

Your goal is to be set up and balanced in order to transfer body weight into the shot. Your greatest challenge is remaining consistent while maintaining movement capabilities. Conditioning is an inherent benefit of this drill.

Consider the following movement guidelines:

1. Split step just before your opponent hits the ball
2. Powerful first step toward the oncoming shot
3. Make small decelerating steps for balance as you approach an oncoming shot
4. Position self behind ball with rear foot
5. Racquet should be prepared to hit ball
6. Transfer your body weight into each shot from rear foot to front foot

The first step for the tennis player may be the most important component. Perhaps the most forgotten movement guideline is making small decelerating steps before hitting the ball. It is this component that allows the tennis player to line up the shot in a balanced manner while making consistent contact in the hitting zone. A high quality shot most often occurs when a player is relaxed, balanced, and still at ball contact.

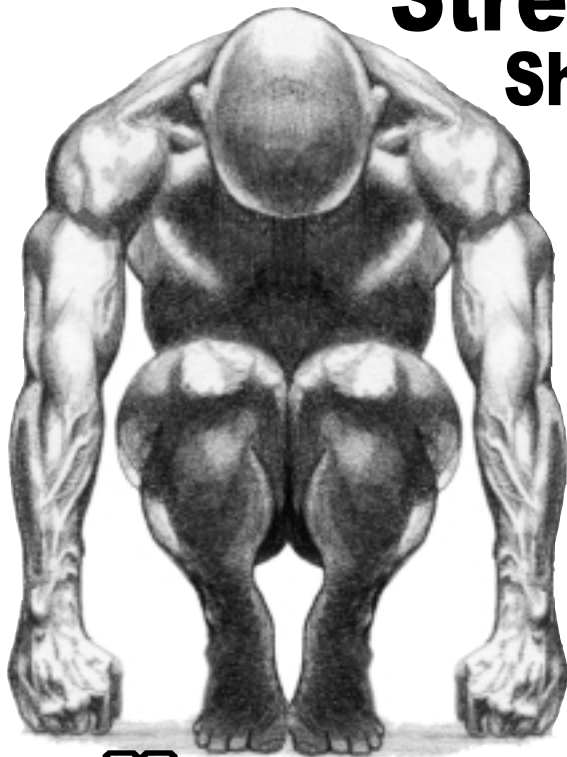
Attending to the needs of the torso while improving on-court movement may allow the tennis player to prevent injury as well as improve on-court performance. It is at this time during competitive play when most injuries occur due to the unpredictable nature of tennis.

### About the Author

*Barrett S. Bugg, CSCS, was the USA Tennis Strength and Conditioning Coach for the USA Tennis Player Development Program (USTA) for five years. His primary responsibility was the exercise testing, training, and tracking of the USA Tennis Touring Pro Teams who were on the WTA and ATP tours. He also implemented tennis-specific strength and conditioning programs for elite junior American tennis players. Barrett is a Certified Strength and Conditioning Specialist (CSCS) with the NSCA, and a PT Tennis Professional with the United States Professional Tennis Association. He frequently contributes strength and conditioning-related articles for a variety of publications.*

# Strengthen the NSCA... Share your knowledge with other professionals

## Help The NSCA GROW!



The National Strength and Conditioning Association, as the worldwide authority on strength and conditioning, brings together a diverse group of professionals from the sport science, athletic, and fitness industries.

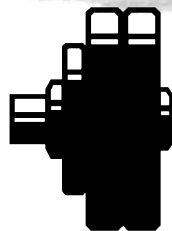
NSCA journals offer members research findings and practical information regarding resistance training, sports medicine and science, and issues facing strength and conditioning professionals. Members also benefit from NSCA clinics and conferences including the National Conference, Sport-Specific Training Conference, Coaches' College, and Personal Trainer Clinics.

Members are the driving force of the NSCA. If you are currently a member, share your publications and encourage others to join the Association.

Together, the NSCA and its members will continue to shape the future of the strength training and conditioning profession.

### MEMBER BENEFITS

- ◆ Professional Publications: *Strength and Conditioning Journal* - 80 pages, published bi-monthly  
*Journal of Strength and Conditioning Research* - 64 pages, published quarterly
- ◆ Association updates in the NSCA's newsletter, the *Bulletin*
- ◆ Discounted entry into the NSCA's cutting-edge conferences
- ◆ Discounts on testing for nationally accredited certifications: CSCS (Certified Strength and Conditioning Specialist) NSCA-CPT (NSCA Certified Personal Trainer)
- ◆ Access to current job listings through NSCA Career Services
- ◆ Educational resources and products at a member discount
- ◆ Professional Liability Insurance
- ◆ MasterCard Gold Card Program -- featuring no annual fee!
- ◆ Eligibility for NSCA scholarships and grants



*The Journey of Excellence*

**NSCA™**

Since 1978...  
**BRIDGING THE GAP**  
between science and  
practical application

## NSCA PROFESSIONAL / INTERNATIONAL MEMBERSHIP APPLICATION

**YES! ENROLL ME AS A MEMBER OF THE NSCA.** E-MAIL ADDRESS: \_\_\_\_\_

NAME \_\_\_\_\_ DAYTIME PHONE \_\_\_\_\_

ADDRESS \_\_\_\_\_ FAX \_\_\_\_\_

CITY \_\_\_\_\_ STATE/COUNTRY \_\_\_\_\_ ZIP/POSTAL CODE \_\_\_\_\_

### MEMBERSHIP OPTIONS (select one):

Check the appropriate category and the price option desired.

**Professional** (U.S. and Canada. Includes *Strength and Conditioning Journal*, *Journal of Strength and Conditioning Research*, and the *NSCA Bulletin*.

Canadian members add \$15/year for postage.)

\* 1-year (\$80) \* 2-year (\$135) \* 3-year (\$200)

**Student** (U.S. and Canada. Includes your choice of one journal *Strength and Conditioning Journal* or *Journal of Strength and Conditioning Research*, and the *NSCA Bulletin*. Canadian members add \$15/year for postage.) *Please circle which journal you would like to receive if selecting the \$45 option.*

\* One journal \$45 \* Both journal \$55

**International** (Includes *Strength and Conditioning Journal* and *Journal of Strength and Conditioning Research*.)

\* 1-year pricing only (\$105 surface mail)

\* 1-year pricing only (\$165 air mail)

### PAYMENT OPTIONS:

Check (Payable to NSCA)

VISA  MasterCard  American Express

Account# \_\_\_\_\_

Exp. date \_\_\_\_\_

Signature \_\_\_\_\_

Total Membership Fee \_\_\_\_\_

Canada add \$15 per year for postage \_\_\_\_\_

TOTAL ENCLOSED (U.S. funds only) \_\_\_\_\_

Mail application and payment to: National Strength and Conditioning Association

P.O. Box 9908 ♦ Colorado Springs, CO ♦ 80932 ♦ 800-815-6826 ♦ Phone: (719) 632-NSCA ♦ Fax: (719) 632-6367