

The  Newsletter for Tennis Coaches

High-Performance Coaching

Understanding Optimum Technique In Today's Game

by **Scott Riewald, Ph.D.** and **Paul Lubbers, Ph.D.**, adapted from *High Performance Coaching Study Guide*

Having solid fundamentals of tennis technique is one of the key components that enable a player to reach his or her potential. When a player masters the fundamentals of technique, he or she can consistently produce the most efficient, effective and successful strokes while minimizing the risk of injury. These fundamentals transcend different playing styles and are relevant and applicable to virtually all ages and levels of play.

The goals of technique training are threefold:

1. To understand what the fundamentals of technique are;
2. To be able to recognize and delineate among fundamentals, styles, and technical flaws; and
3. To be skilled at teaching technique in the context of the player's overall development.

Fundamentals of Technique

Fundamentals are those aspects of technique that remain consistent from player to player, regardless of playing style, age or level of play. These are the mechanical features that must be

obeyed by all players. One of these commonalities is how the ball is contacted. Even though many professional players demonstrate different techniques during their respective swings—due to differences in style, age, and physical size—the path and orientation of the racquet at the instant of ball contact are all very similar.

Fundamentals, Style and Technical Flaws

Coaches often have differing opinions on what the fundamentals of a stroke actually are, since it is very easy to confuse stylistic aspects of technique with the essentials. All players bring unique aspects of technique to the game of tennis that are specific to their body types and approach to the game. This is referred to as **style**. For example, one player may have a small loop in her backswing as she prepares to hit a forehand. Another may have a slightly larger loop. Is this a stylistic difference in technique or does it represent a breakdown in the fundamentals of the forehand? One way to approach this is to look at performance and potential injury aspects of the stroke. If the player's technique is likely to result in an injury or limit performance we would call this a **technical flaw** and it should be corrected. However, in this example, since we see players who are able to hit either type of shot with consistency, accuracy and power, and neither shot increases the injury risk to the player, we would not view this as a flaw, but rather a stylistic difference in technique. Either technique is acceptable and players should be encouraged to find what works best for them.

As a coach, you need to be able to distinguish



Andy Roddick's forehand is characterized by solid fundamentals and elements of style which are unique to him.

critical mechanical fundamentals from individual styles. Focus on instilling these fundamentals of technique and eliminating technical flaws that can lead to injury or limit performance, while at the same time allowing the player to evolve his or her own individual style.

Optimum Technique

The goal for all coaches should be to optimize the technique of each player with whom they work. With that said, no standard technique or swing path for a stroke is going to be optimal for all players; what is optimal technique for one player may not be optimal for another.

While the optimal stroke technique may vary from player to player, all tennis strokes

continued on page 4

In This Issue

USA Tennis High Performance Coaching Program Update	2
Forehand Returns	5
Optimum Technique and the Phases of a Stroke	10

USA Tennis High Performance Coaching Update

In this issue of *High-Performance Coaching*, you will find that we have dedicated a great deal of space to most coaches' favorite topic: *Technique*. In the coaching profession there is never a shortage of ideas, opinions and innovative ways to address technique. Perhaps the information in the following pages will clear the way for you to examine what you believe to be the "truths" of technique and help you as you teach the fundamentals to your players.

Speaking of the coaching profession, we recently came across an article that belittled the role of coaches in the United States and the manner in which they coach. Dr. E. Paul Roetert, Managing Director of USA Tennis High Performance, felt strongly enough about what was written in this editorial by a physical educator that he wrote a response entitled *Coaching as a Profession*. Dr. Roetert's article addresses what was written and, at the same time, challenges all of us to strive to learn and improve ourselves so that we ensure that Coaching stays a Profession.

As always, we hope that you will enjoy this issue of *High-Performance Coaching*. If you have any suggestions or comments, please feel free to contact us at Coaching@usta.com or 305-365-USTA.

Paul Lubbers, Ph.D.

Director, Coaching Education

USA Tennis High Performance

USA Tennis High Performance Coaching Program Update

The USA Tennis Coaching Education Department is accepting applications for the USA Tennis High Performance Coaching Program. Over 400 coaches throughout the United States have participated in this program, which is intended specifically for the coach who is working with players striving for excellence in competitive tennis (i.e., sectional and national ranked junior players to collegiate and young professionals. Applications for the 2005 program dates are available by contacting Bobby Bernstein at 305-365-8711 or e-mailing us at Coaching@USTA.com. We encourage all interested coaches to apply as soon as possible. See page 12 for dates, locations and application deadlines.

USA Tennis High Performance Coaching Program Attendance

The following list of coaches successfully completed the May 11-16, 2004, USA Tennis High Performance Coaching Program in Houston, Texas. Congratulations to all of the coaches for their hard work and dedication toward helping improve the level of play in the United States. Job well done!

Jim Blacketer
Lubbock, TX

Christopher DeVore
Flower Mound, TX

Gerry Perry
Springfield, MO

RJ Tessier
Houston, TX

Tim Blenkiron
Las Vegas, NV

Greg Haywood
Ojai, CA

Jason Peters
Wichita Falls, TX

Chris Wade
Dallas, TX

Carey Brading
Littleton, CO

Doug Kruger
Little Elm, TX

Scott Flippin Read
Houston, TX

Meredith Geiger Walton
Austin, TX

Thomas Brinkhoff
Ventura, CA

Todd Norton
Houston, TX

Blake Russ
Woodland Hills, CA

John Wilkerson
Houston, TX

Steve Bryan
Clear Lake Shores, TX

Kevin O'Shea
Austin, TX

Craig Sandvig
University City, MO

Shirish Deshpande
Omaha, NE

Oliver Stephens
Monterey, CA

Coaching as a Profession

by E. Paul Roetert, Ph.D., Managing Director of USA Tennis High Performance

I recently read an editorial in a professional journal that really disturbed me. The editorial was written by a physical education professor with a background in health education. That sounds like a pretty good background—in fact, I believe that we often don't promote the health benefits of physical education enough. But here's what concerned me:

This professor stated that he has approached physical education as a health educator, *in contrast to how a coach might*. He went on to say that he occasionally *lapsed* into the coach mentality. Finally, he points out that coaches often deliver physical education as a bitter pill, forcing athletes to do things not because it's fun but because it must be done even though it is painful or uncomfortable. All I can say is, "Boy, am I glad this guy is not a coach." In fact, I wonder about his skills as a teacher. All good coaches are, in my opinion, also good teachers. They possess the ability to teach skills and, at the same time, motivate the learner to work hard to reach his or her potential.

Coaches can have a tremendous impact on players' lives—both positive and negative. It is our job as coaches to make sure that our influence is as positive as possible. Coaching tennis is a step beyond just teaching the strokes. In fact, it requires a more comprehensive approach. **Coaching is directly related to competition, it occurs over an extended period of time and it encompasses the overall development (physical, mental, emotional, tennis skills and strategy) of an athlete.** That's why a coach's job is so important.

As a coach, you must continually strive to better yourself. Study successful coaches, not just in tennis, but also in other sports. You will start recognizing specific traits all good coaches share. Look for coaches that have strong ethics, a good coaching philosophy, specific knowledge in the technique and tactics of the sport and a desire to continually improve. Many occupations, such as doctors, lawyers and teachers have educational and/or practical requirements necessary to retain professional status. As a coach, you owe it to yourself and your students to keep up with the latest information in the field of coaching as well. Continuing education can be a key to staying at the top of your profession. Consider upgrading your knowledge in the following areas, just to name a few:

1. Developing and/or updating your philosophy of coaching.
2. Communicating with and motivating your players.
3. Conditioning players.
4. Planning for the season, both practices and matches.
5. Teaching specific skills in a proper progression.

All of these skills, and many more, are covered in the USA Tennis High Performance Coaching program, so if you haven't taken part in that program yet, look on page 2 for further information. Over 400 High Performance coaches have already participated. Oh, and for that physical educator mentioned previously, make sure he never works with your athletes.



Need Hi res. from Dave

Rick Stewart/Getty Images

Understanding Optimum Technique *continued*

should share the following four characteristics (Saviano, 1999; Schonborn, 1998):

1. **It is simple.** The optimal technique uses as many segments as necessary to produce an effective shot.
2. **It is efficient.** When using the optimal technique, a player produces the shot with minimum effort relative to the desired results. In addition, use of the optimal technique minimizes stress to the body and helps to prevent injury.
3. **It is effective.** Using the optimal technique, the player can successfully execute the desired shots.
4. **It is flexible and versatile.** The player can adapt the technique to the tactical requirements of the game situation.

As a coach, you can help players acquire optimum technique by teaching them the mechanical fundamentals of stroke production, while still allowing them to evolve their own individual stroke characteristics. A good example of this is the serve of both Roger Federer and Andy Roddick. Both players have mastered the fundamentals of technique, yet their technical styles of hitting the ball are different.

Technique as Part of a Whole Process

It is important to look at technique development as part of the larger process of developing a player's ability to play the game successfully. Good technique should not be a goal unto itself, so keep the isolation of technique work to a minimum. When working on technique, try, when it is appropriate and possible, to incorporate the broad spectrum of skills required to play the game. For example, tactical understanding is intricately tied to technique. Any discussion of the fundamentals of technique must include the development of tactical patterns that are based around a player's technical strengths.

Technique and Biomechanics

The terms "technique" and "biomechanics" are often used interchangeably when discussing tennis, but there are slight—yet important—differences in what these terms mean. Technique refers to how a movement is performed without necessarily giving consideration to the physical factors that influence the movement. Biomechanics goes a little deeper to study and understand the forces experienced by the body

and how they influence and drive these movements. When coaches combine their practical tennis teaching experience with knowledge of tennis biomechanics, they can accurately analyze strokes, prescribe training and exercises, and maximize skill development while minimizing the risk of injury to their players. To help you become better equipped to analyze and develop optimal technique, we want to describe several key concepts of biomechanics and illustrate how these principles are used by some of today's top players.

Forces and Torques

A force can be defined simply a push or pull. Forces are what drive all movement. Forces occur inside (e.g., muscle contractions, joint contact forces) and outside (e.g., ground reaction forces, friction, gravity) the body. How well the body creates and manages these forces determines, among other things, how well a player can move, develop power, and maintain stability.

Typically, when a force is applied to an object that object will rotate. This tendency for a force to cause rotation is called a **torque** or **moment of force**. Think of a see-saw. When a person sits on one side of the see-saw, the force of his weight creates a torque and causes the see-saw to rotate about its axis.

One way that torque impacts tennis play can be seen when looking at muscles and how they function. In all tennis strokes, muscular forces produce torques that rotate body segments around body joints. In the service motion, for example, the internal rotation of the upper arm, that is so important to the power of the serve, is the result of an internal rotation *torque* at the shoulder joint caused by muscular contractions. To rotate a segment with more power a player would generate greater muscle force.

The Kinetic Chain

All the different segments of the body are linked together. What happens in one part of the body impacts what happens everywhere else. Power generation in tennis starts from the ground up, and it is important for players to tap into the strength and the power of the legs and torso to develop racquet head speed. Recognize it is possible to achieve high racquet head speeds using only the shoulder and arm, but this places greater stress on the upper body and can lead to injury.

Loading and Unloading

Muscles are like rubber bands, to some extent, in that when they are stretched rapidly they store energy that can later be released. In preparation for a shot, the muscles of the lower body and trunk are stretched, allowing them to subsequently contract more forcefully as the player unloads and executes the shot. Once loaded, the muscles must be unloaded quickly to make the best use of the elastic energy that was stored during loading. Timing and coordination are therefore critical for tapping into this "free energy."

Momentum

Momentum is essentially the quantity of motion an object possesses and is equal to an object's mass multiplied by its velocity. There are two types of momentum used in tennis strokes and both are important in today's game.

- **Linear momentum**, as the name suggests, is momentum in a straight line. Linear momentum is created by the forward step in a square stance forehand.
- **Angular momentum** is rotational momentum and is created by the rotations of the various body segments. The open stance forehand uses significant angular momentum. The tremendous increase in the use of angular momentum in ground strokes and serves has had a significant impact on the game of tennis. One of the main reasons for the increase in power in the game today is the incorporation of angular momentum into ground stroke and serve techniques.

There are several additional points to note about momentum. First, momentum can be transferred from one object to another. Second, momentum can be changed from one form to another. This is probably most clearly seen when we consider the angular momentum developed by the coordinated action of the different body segments being transferred to the ball and changed to linear momentum as it leaves the racket after contact.

Center of Gravity and Balance

Understanding the concepts of the center of gravity and balance is enormously important if you are to coach tennis successfully. These concepts are interrelated and have a profound

continued on page 9

Forehand Returns

by E. Paul Roetert, Ph.D., Managing Director
of USA Tennis High Performance

In these sequence pictures, we will analyze the forehand returns of Tim Henman, Thomas Johansson and Serena Williams. More specifically, we are looking at the forehand return as these players are being pulled wide off the court by their opponent's serve. Although there are differences in these players' respective returns, there also are some clear commonalities.

Keep in mind that each of these players uses a different grip. Henman is closest to an Eastern Forehand grip, Williams employs a true semi-Western grip and Johansson is closer to a Western. These grips likely developed because of the way these players were taught, as well as the court surfaces on which they grew up playing. Henman played mostly on faster court surfaces growing up (including grass), Williams mostly on hard courts and Johansson mostly on clay. These grips affect not only game style, but also the players' swing path, as can be seen in these photos of the forehand return. Henman exhibits a shorter backswing and more of a blocking action whereas Johansson and Williams have a more extended backswing and follow-through.

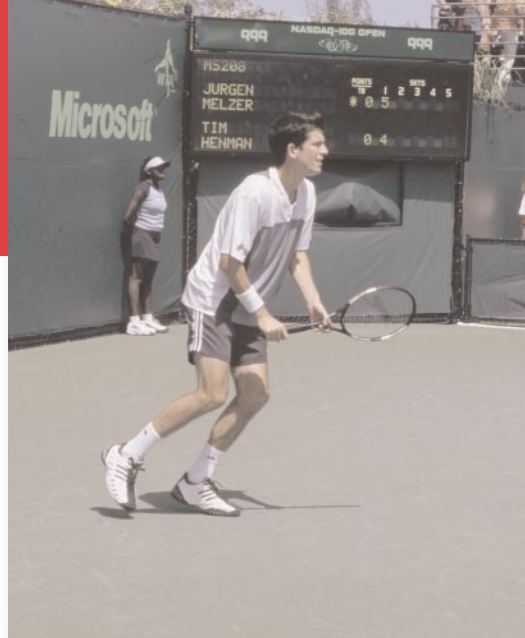
The first thing to focus on is how well-prepared all three players are. They all utilize the split step very well, enabling them to explode forward and sideways to the ball. It looks like Henman doesn't expect the wide serve as much as the other two players; therefore he's not able to transfer as much body weight into the shot.

Each of these players steps out with the right leg first. The photos clearly show that tremendous leg strength is needed to be able, not only to generate ground reaction forces, but also to be able to recover to the middle of the court after contact. Note that although these players are hitting a difficult return, they focus on staying as balanced as possible while keeping their head still throughout the shot. One of the things that helps all three players to achieve this balance is the use of the left arm.

Because of the speed of the serve in the men's game, we see that Henman and Johansson make contact with the ball earlier than does Williams. This gives Williams a bit more time to set up and take a good cut at the ball.

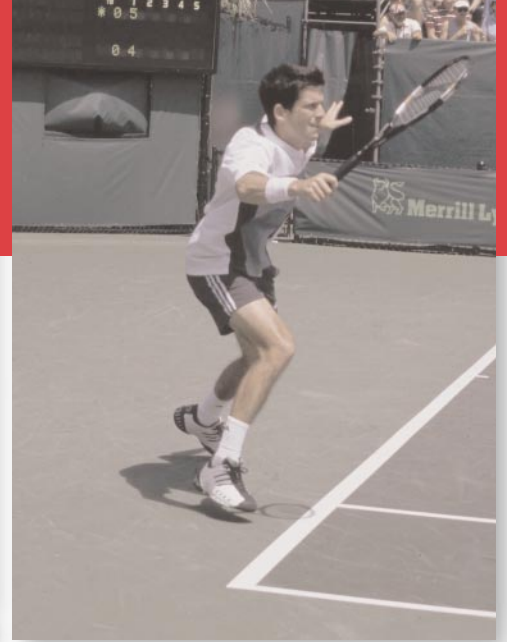
As the players make contact it is clear that each shot has a different purpose. Henman has a short backswing and focuses on getting the ball back to give himself time to recover. He's not able to provide much force from that position, but with his excellent athletic ability, he is looking to keep the ball low and get back into position for the next shot. Williams and Johansson are hitting a much more forceful shot, although Williams is set up for the quicker recovery.

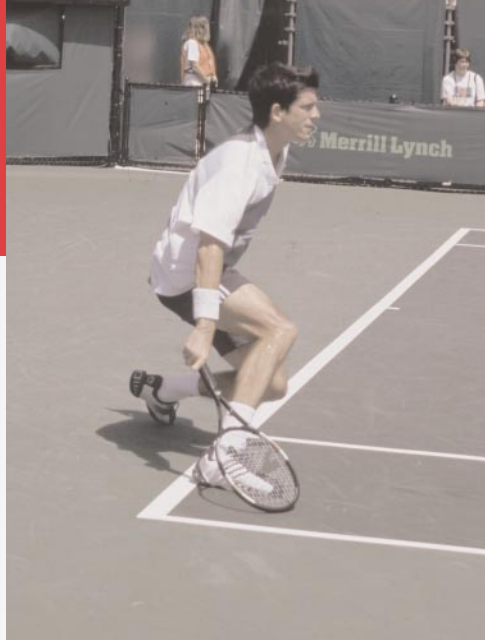
Williams gets an excellent shoulder turn, followed by a quick and strong push-off to recover. Johansson also has a very good shoulder turn, but he looks like he's going more for a winning shot, especially judging by how far beyond the doubles sideline he ends up. Besides the obvious technique differences (see comments about the grips above), the key differences among these shots are how wide the serves are and how well each player has anticipated the serves. All three of these players clearly have excellent focus on the ball, superb timing and great balance while they execute their forehand return.



Top to bottom:
Tim Henman,
Thomas Johansson,
Serena Williams.







Understanding Optimum Technique *continued*

effect on the success or failure of stroke production. Loss of balance or poor balance is one of the single biggest causes of errors in tennis.

Center of Gravity

The **center of gravity (COG)** is an imaginary point around which body weight is evenly distributed. The center of gravity typically lies at the level of the belly button when a player is standing. However, a player's COG does not stay in one place and can change considerably as body segments are moved. This concept is critical to understanding balance and stability and how gravity affects tennis technique.

Balance and Base of Support

Balance is the ability of a player to control his or her equilibrium or stability. As a coach, you need to know and understand two types of balance:

- **Static balance** is the ability to control the body while in a stationary position.

A player uses static balance when he or she prepares for a serve.

- **Dynamic balance** is the ability to control the body during motion. A player uses dynamic balance when he or she changes direction after hitting a shot.

For the body to stay balanced, the center of gravity must be located over the base of support. A good way to picture the base of support is to construct an imaginary rectangle between your feet. The feet themselves serve as two sides of the rectangle. The other two sides are formed by drawing a line between both sets of toes and another between the heels. As long as your COG sits over this base of support you will maintain balance.

Try this as an experiment: Place your feet shoulder-width apart and you should find that it is easy to get your balance. Now lift one foot off the ground. When you do this, you will either have to shift your weight so it is centered over your new

base of support—the one foot remaining on the ground—or you will fall over. Once the COG falls outside the base of support, it becomes difficult to maintain balance.

Balance and stability are essential in all aspects of tennis, from movement to hitting a shot. The following points relate to balance and should be followed by all tennis players

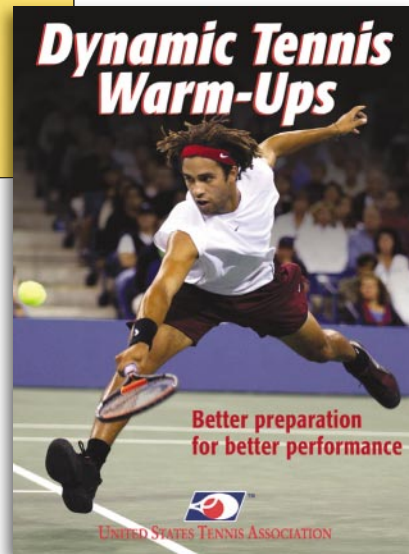
- Maintain good upper body posture, with the head up and the shoulders and back relatively straight.
- Keep the upper body as still as possible, with minimal movement. That is especially important with the head during all the phases of a stroke.
- Use a proper base of support by keeping the feet at approximately shoulder-width apart.
- To enhance stability during the backswing/preparation phase, lower your center of gravity by bending your knees.

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Optimum Technique and the Phases of a Stroke

by Scott Riewald, Ph.D. and Paul Lubbers, Ph.D.



Andre Agassi: Preparation Phase

Amazing! In this picture, we see some of the keys that characterize aspects of great preparation:

- Loading of the large muscle groups that include the legs, hips and trunk. Please note the shoulder/hip separation, which provides Andre with large amounts of stored energy that then can be used in the hitting phase.
- An established position where the weight is primarily shifted to the back leg with a low center of gravity and solid base of support.
- Excellent balance where his head is still and shoulders level.
- The use of the non-dominant arm which aids in shoulder rotation and also serves as a counterbalance to the racquet arm.

Maria Sharapova: Hitting Phase

Here we see Maria Sharapova hitting her signature square stance backhand. She is initiating the hitting phase of the stroke by beginning to uncoil her trunk and shoulders and by transferring her weight forward. This illustrates the combination of angular and linear momentum that is seen in almost every stroke used in today's game. A few other things to note:

- Her racquet head is well below the ball, which means her swing path will travel from low to high and will aid her in the development of topspin.
- Many players use the wrist (ulnar deviation) to further drop the racquet head below the ball.
- Sharapova displays excellent balance with a wide base of support, her head up, shoulders level and eyes focused on the ball.





Justine Henin-Hardenne: Contact Phase

Here we see Justine Henin-Hardenne hitting with classic form, a running backhand. At contact point, she is displaying tremendous balance and strength. Her head is down and her eyes are focused on the ball. At this point she has a low center of gravity with a solid base of support. This base provides her stability as the large muscles uncoil and transfer energy through the kinetic chain to the racquet. When examining the contact point look for the following characteristics.

- Full extension of racquet arm at contact. Note that the type of grip will impact the location of the contact point. In this case, Henin-Hardenne uses a full Eastern backhand grip which brings her contact point farther out into the court.
- Racquet angle at contact is square ($\pm 5^\circ$).
- Still head and level shoulders.
- Continuation of swing path through the contact point.

Roger Federer: Follow-Through

Reigning US Open champion Roger Federer is executing a beautiful follow-through that displays the tremendous angular momentum and racquet head speed that is part of the modern forehand. The follow-through serves as a means to decelerate the racquet after contact and contributes to making the racquet follow the planned path of the ball for as long as possible. Without a follow-through, a player would experience much greater loads on the shoulder, potentially leading to injury. Some other guiding principles that relate to the follow-through are:

- Depending on the type of shot executed, the ground reaction force can drive a player off the ground.
- The best players exhibit great dynamic balance and body control—even when off the ground.
- Head and eyes remain on contact point after the ball is off the strings.



photos by Lance Jeffrey



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USA Tennis High Performance Coaching Program Dates

Program Dates for 2004 and 2005

Date	Location	Application Deadline
November 16-21, 2004	Atlanta, Georgia	Program is Full
January 11-16, 2005	Key Biscayne, Florida	November 15, 2004
May 17-22, 2005	Carson, California	February 15, 2005

Applications for the above program dates are available
by contacting 305-365-USTA or e-mailing us at
Coaching@USTA.com. We encourage all interested
coaches to apply as soon as possible.