United States Tennis Association

USTA Player Development

Competition Training Center

CTC MANUAL

AN OPERATIONS GUIDE FOR COMPETITION TRAINING CENTER STAFF

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8th Printing

ACKNOWLEDGMENTS

When we started the USTA Competition Training Centers in 1988, we all knew that the concept of bringing together our very best players to train together was a great plan. Since that time we have tried to provide all of the coaches involved in the program with the latest in sport science and technical coaching developments. Many of our best young professional players have gone through our CTC programs and thus we have to thank you the coaches involved in the program. This program reaches the largest number of High Performance junior players and since the inception of this program you have assisted in the development of thousands of junior tennis players.

Our continued goal is to develop the base of great junior tennis players from the United States. Each year the CTC program assists to reach approximately 2000 of our best young junior players. Therefore it is important that we continue to challenge ourselves to develop as coaches so that we can help our best young players become as good as they desire. As well, we need to continually challenge these good young players so that they too can become the best possible players that they can be.

This manual, which is now in its 8th printing, is the result of a joint and continued effort of dedicated USTA volunteers, outstanding coaches, and USTA Sectional and National Staff. This manual continues to be a living document that constantly evolves to meet the needs of the coaches. It has certainly changed and improved since that first printing. Many people have added to this manual over the years – so many that it would take pages to name them all.

Finally, a special thanks to the many coaches and administrators of Competition Training Centers who have offered suggestions for the manuals based on their experience at the Centers. They are responsible for the many improvements in this manual over the years.

Bobby Bernstein
Administrator of Junior and Collegiate Programs
USTA Player Development

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INTRODUCTION

Welcome to USTA Player Development, a division of the United States Tennis Association. As the national governing body for the sport of tennis in the United States, the USTA uses its annual budget to promote and develop the growth of tennis, from grass roots to Grand Slams. The USTA owns and stages the US Open and also selects teams to compete in the Davis Cup, Fed Cup as well as the Olympics, Pan American and the Paralympic Games.

The United States boasts more tennis players than any country in the world. This large base has always been a great starting point for producing top players and will remain so in the future. To this end, the USTA invests a considerable percentage of its human and financial resources to attracting people to the sport and developing community-based associations and programs.

USTA Competition Training Centers were established to help young players learn about competitive tennis without worrying about rankings. The Centers serve as a training site for some of the best 8-13 players within an established geographic region. These Centers supplement the training schedule of players and are not intended to replace any aspect of their regular training.

This manual is designed to help you operate the Competition Training Center as efficiently and effectively as possible. Since there are 100 USTA Competition Training Centers across the country, it is essential that all the Centers operate in a similar manner. While you have flexibility in the scheduling, player selection and daily plans of the program, there are specific guidelines to which all Competition Training Centers must adhere. Whether you serve as administrator or coach, it is important that you are fully aware of all aspects of the Competition Training Centers, and we encourage you to read this manual in its entirety.

The volunteers and staff of the United States Tennis Association truly appreciate your dedication and efforts toward the cause of American tennis. Thank you and good luck.

Paul Roetert Managing Director, Player Development Competition	Timon Corwin Senior Director, Junior and Collegiate	Lew Brewer Director, Junior Competition

GUIDELINES & SUPPORT

The following are basic guidelines that you should remember as we discuss the coordination of activities of your Competition Training Center (CTC) program. These are fundamental aspects, which should be followed as you design your CTC Program. This is not a complete list but rather a basic list of items to keep in mind as we discuss the operations of your CTC Program. Also, below is a list of the support that you will receive from the USTA as a CTC Program.

Operating Hours: The USTA Competition and Training Centers should operate for 50 hours (or a minimum of 45 hours) over the course of the season. The season should usually run during the school year from September to June. It is preferable that the centers operate 25 hours during the fall and another 25 hours during the spring. However, due to differences in sectional calendars it is important to get input from sectional staff members.

Players: 16 players (8 boys and 8 girls) shall be selected to participate with a maximum of 20 players, thus allowing for 4 of those players to be alternates.

Player Fees: Players will pay $250 per season. It is recommended that players pay either the $250 upfront or in two installments of $125 each. Alternates should be charged at a rate of $125 per season or $5.00 per hour.

Facilities: It is the responsibility of each CTC Program to obtain donated court time to run their program. A minimum of 4 courts should be available to the program. If a program is unable to get court time donated then fundraising will have to be done in order to conduct their program.

The USTA makes available a wide variety of support for Competition Training Centers. The following is a brief list of what is provided by the USTA:

Tennis Balls: Each Center will receive tennis balls to run the CTC Program. Please check with your sectional staff person for shipment dates.

Clothing: Each Center will receive 24 t-shirts per year for the players. Additional shirts are can be purchased at cost from the USTA. Competition Training Center staff will receive a collared staff shirt each year. Additional shirts can be purchased at cost from the USTA.

Banners: A USTA Competition Training Center banner will be sent to each site location. The banner features the USTA logo and the sectional identification.

Sectional Staff for Player Development: The USTA has made possible the hiring of staff people who will provide support for your efforts. They are responsible for overseeing the Competition Training Centers in their section. A complete listing of the Sectional Staff is located in the appendix of this document.

Printed Materials: The USTA provides all the materials for Competition Training Centers including this CTC manual and an annual stock of stationery.

Training: Training for coaches is provided by the USTA. In addition, training and support for administrators is provided by the Sectional Staff for Player Development.

Financial Aid: Contact your sectional staff person to see if your section offers financial aid to players that cannot afford the program. Most sections have financial aid available on a limited basis to players who cannot afford the $250 fee.

ADMINISTRATION

The USTA's Competition Training Center staff will usually be comprised of a head coach, administrator and 2-3 additional coaches. Each CTC site is independent in determining how to run and operate the best CTC Program for their area as long as they follow sectional and national guidelines. The following includes some general examples of how to run your CTC Program. However, there are many ways to conduct a successful CTC program. The most important aspect is that there should be one person ultimately in charge of each site's CTC program. This person should ensure that communication is transpiring with all of the players, parents, personal coaches and the coaches working within the program.

An important aspect to remember is that each of you is an integral part of the Competition Training Center program. You are the USTA's link in dealing with parents, players and personal coaches. Each of you are working through your sections for the USTA's Player Development Program and thus your actions are a reflection of the USTA and the CTC program. Therefore, we expect the highest ethical standards from all those involved with our program.

Below we have listed some general responsibilities of personnel involved with the CTC Program. The head coach is responsible for the entire operation of the CTC Program. He/She must ensure that the activities of the program are coordinated well and that he/she is in constant communication with the Administrator and the other coaches in program. His/Her responsibility is also to develop a rapport with the personal coaches of the players involved at the Center so that they do not feel threatened by the program. In addition, all staff members must be USPTA or PTR members and the head coach of the program should verify this.

The Administrator coordinates the activities of the Center, including managing the CTC's financial information, scheduling the meeting dates, and maintaining correspondence with players and parents. The administrator works closely with coaches at their Centers, the CTC facility contact (s), and the USTA Sectional and National offices.

Additional Coaches are responsible for the training program at the Competition Training Center. They organize the practice sessions for the Center and work with together with the head coach and administrator on the CTC schedule of events and the development of practice schedules.

The specific job descriptions and qualifications of Administrators and Coaches for the CTC program are listed in the Appendix on pages 103 and 104. These are provided to assist you in understanding the criteria used to select the various staff members at the Center and to be aware of what is expected from USTA Competition Training Center personnel.

Selection of Competition Training Center Sites and personnel is made by USTA Section office staff, and approved by the USTA Player Development National Staff. Anyone interested in becoming part of the Competition Training Center should be referred to the Sectional office. It is a good idea for the head coach to contact the sectional staff person so that they understand the sectional guidelines for the hiring and firing of CTC staff members. Should you have any questions on the following material, you should call the Sectional Staff Person for Player Development in your Section. You can find a complete list of the Sectional Staff People in Appendix on page 102.

SELECTION & RESPONSIBILITIES

Each year, one of the first steps that should be performed is to design your team plans for conducting a successful CTC Program. As you set out to develop the best CTC program that you can you should consider the mission of the USTA's Competition Training Center Program.

> *"The mission of USTA Competition Training Centers is to provide competitive training opportunities that motivate and encourage all junior players to develop to their highest competitive level".*

With this mission statement in mind there will be a number of aspects that need to be done in order to create the best tennis environment for your players. We have provided the framework to assist with the development of a quality program. Since this is a supplemental program for the players, one of the most important aspects is creating a schedule that works with the player's tournament and training calendars. Therefore, it is important that the Administrator and staff establish an operations calendar. Many sections will provide administrators with activity dates for the CTC season. These dates will assist in the development of the calendar.

The operating calendar should be established at an organizational meeting with the administrator, head coach and facility personnel. This meeting should be held well in advance of the anticipated starting date of the Competition Training Center. At this meeting the following items should be discussed and decided.

1. Criteria for Selection
2. Selection Methods
3. Schedule Dates for Practice and Match Sessions
4. Session Plan
5. Coaches Roles and Responsibilities

1. Criteria for Selection

The USTA has three requirements for the selection of players into the CTC Program. These requirements must be followed unless a National or Sectional Administrator has authorized an exception.

1. Current USTA Membership

2. Citizenship Requirements

United States Citizen	or	Resident Alien with valid Alien Registration Certificate in the process of obtaining United States Citizenship

3. Age Requirements

Players should be between the ages of 8-13. When selecting players for the Competition Training Center, staff should follow the age guidelines below:

CTC Calendar Year	Players Born Between
Sept 2007-May 2008	1994-2000
Sept-2008-May 2009	1995-2001
Sept 2009-May 2010	1996-2002
Sept 2010-May 2011	1997-2003

2. Selection Methods

There are several methods available for selecting players into the CTC Program. The following are suggested methods for selecting players. Please check with your sectional staff person to see if the section has any requirements for selection.

1. Invitation and Applications
2. Tryouts
3. Sectional Coaching Commissions
4. Combination of the above methods

1. Invitation and Applications

One method for player selection is to send out invitations to players based on sectional, district and national ranking. You could have each of the "potential" CTC players complete an application for involvement in the program. As the deadline for the application approaches, you may want to call some of the players who you had invited to see if they wanted to be apart of the program for the season. Once the deadline for the application has passed then you will need to start notifying players of acceptance or non-acceptance into the program.

2. Tryouts

Another method for player selection is to have a tryouts session. Using this method many players could be invited to attend the tryouts session. The actual number of players who are invited would be determined by the amount of time and tennis court space available. A tryout session provides the coaches of the program an opportunity to observe players in a controlled setting.

Some of the items that could be done at a tryout are the Level 1 USTA Fitness Testing Protocol. Other activities could include using modified match competition results. A variety of drills could be used as well.

The tryout method requires a good deal of organization and planning. While this is a great way to generate goodwill and visibility with parents, players and coaches, there are also problems associated with this method. Some of problems include the subjective selection of players and parental complaints over these selections. Second the cost of holding a tryout is not covered in the programs expenses and would include court time, coaches time, tennis ball, etc. However, many who use this method give their time and donate court time for the program.

3. Sectional Coaching Commissions

A third method is to use the sectional coaching commissions for input on selection of players. These commissions are designed to assist with talent development and perhaps they could offer suggestions on ways to involve some of the younger more talented players in your area. Contact your sectional staff person for the contact person in your area.

4. Combination of the above methods

Finally, you and your other coaches may find a more effective to use a combination of the above methods. For example, it may make better sense for your CTC to invite a certain number of players directly into the program based on ranking and then invite another group of players to apply and have a tryout for those players for the remaining spots. This could include those players recommended by the sectional coaching commission.

3. Schedule Dates for Practice and Match Sessions

Once the selection criterion has been determined you will need to develop the CTC schedule for the season. The following items should be considered when the CTC schedule is being planned:

1. **USTA Tournament Schedule**

   CTC activities should not take place on dates that coincide with important district, sectional, and national tournaments. Coaches and the Sectional Staff for Player Development can easily identify which tournaments are important for the players to be involved.

2. **Periodization**

   Periodization simply means combining rest, preparation, and competition in proper proportions for optimal performance. CTC coaches have received training on this critical topic. For example, CTC's should not be scheduled during a period, which has been identified as a rest time. Furthermore, activities such as Competition Training Centers should not be held during periods identified as peak competition periods. The times for each of the above will vary for each player and each section. In general, USTA Competition Training Centers operate in the spring and fall and not in the summer months.

3. **Workout Schedule**

The workout schedule should be organized using the concept of periodization as well. For example, since many USTA Sections have segmented their tournament calendars there will be times when players can use the CTC sessions as a tournament preparation session. There will be other times when players can devote their efforts to improving their competitive skills.

4. **Special Events**

Competition Training Centers are encouraged to participate in special activities, such as section wide rallies or matches against other centers. Special events help foster team spirit and give the players a greater sense of being part of a national program. The Sectional Staff for Player Development can be an excellent resource in this area, as many sections have coordinated successful rallies in the past. A rally can be part of the 50 hours or can be a special event in which players pay a nominal fee to participate.

An end of the year party is another way to recognize the participants in the CTC. In the past, CTCs have had pizza parties, tennis socials and other fun events to celebrate the successful year.

4. Session Plan

Once the meeting dates have been established, the coaching staff, in conjunction with the administrator, can work on the plan for each session. This plan should consider which dates are available for match competitions against other centers, possible speakers, fitness testing and other important aspects you would like to see encompassed during the CTC season. Below are lists of some of the activities you may want to consider when scheduling your CTC plan.

1. Rotate Practice and Matches to various clubs/facilities
   - Have practices at clubs of players involved in program
   - Have practices at locations where certain professionals may feel "threatened" by the program
2. Invite all personal coaches to attend at least one practice
3. Schedule matches with other CTC Programs
4. Schedule matches against older players in USA Team Tennis
5. Involve many different teaching professionals
6. Invite older "graduates" of CTC program back to talk or hit with players
7. Bring back highly nationally ranked players to discuss experiences
8. Bring in speakers regarding nutrition, heat illness, ranking, endorsement, injuries, etc.
9. Get parental involvement; have parents act as "team mom" or bring snacks, etc.
10. Have players chart their fitness development
11. Have an occasional pizza party
12. Have players attend as a group the satellite, futures, challengers and

professional events in the area

13. Have players attend as a group the local college matches in the area

5. Coaches and Administrators Roles and Responsibilities

Before the start of the season there should be a discussion on the roles and responsibilities of everyone involved in the program. This discussion should take place so that all aspects of the program are discussed and so that no hard feelings or misunderstandings take place between any of the staff members. The most important aspect in working well with others is communication. Below are some tips to assist with this area.

- Discuss each coach's availability for each of the scheduled dates. This will provide you with an advanced warning of which coaches will be unable to attend certain schedule practices or matches and thus may provide you an opportunity to involve other coaches for certain dates.
- Discuss whose responsibility it is to call players about schedule changes.
- Discuss goals of your individual CTC, and how your practices will meet those goals.
- Discuss who will make contact with personal coaches.
- Discuss the importance of spending equal time with all participants involved in program.
- Discuss how to handle parental issues. (Remember it is important to work together and present a united front)
- Discuss any other issue that may have developed during the past or current season(s).

OPERATIONS CALENDAR

The following operations calendar is provided as an example of the planning necessary for a successful Competition Training Center Program. The months of operation may be different from your program but the process is still the same.

August

- Contact Sectional Office for sectional requirements for CTC Program.
- Find out if the Sectional Coaching Commission will be involved with CTC Program in your area.
- Have an organizational meeting of CTC personnel to establish schedule for the year.
- Obtain Sectional Rankings from Sectional Office to assist with a prospect list.
- Decide selection criteria, such as tryouts or no tryouts, use of ranking lists, etc.
- Send Invitations to players (allow 2 or 3 weeks for reply).

September

- Coaches meet to organize schedule.
- Receive reply from players regarding interest in program
- Call some of the top players that had not responded to invite into program
- Hold Try-Outs (if doing so)
- Make player and alternate selections
- Contact personal coaches of players
- Have first meeting with players and parents and explain how the CTC Program will work
- Conduct Fitness Testing; develop a monthly plan of certain activities for developing physical conditioning.

October/November

- Center in full operation
- Players preparing
- Check monthly physical conditioning goals and player progress
- Teach dynamic stretching to players

December

- CTC Staff meets to evaluate players in CTC and tournament results.
- Check monthly physical conditioning goals and player progress

January/February

- Coaches meet to organize schedule.
- Check monthly physical conditioning goals and player progress

March/April

- CTC Staff meets to evaluate tournament results and plan final sessions.
- Check monthly physical conditioning goals and player progress

May/June

- Center shuts down for summer
- Have year end Rally, Team Cup, and Jamboree with other sectional teams.
- Have a year-end pizza party for players.
- CTC Staff meets to evaluate players in CTC.
- Conduct Final Fitness Testing-- Evaluate progress with players
- Send in Financial Accounting (due on July 1st) Information to Boca Raton office.

Throughout the season, if possible have guest's speakers attend your CTC workouts or matches. You can have speakers talk on mental toughness, parent issues, sectional and national ranking and endorsement, obtaining company sponsorship, etc. These are all important subjects that your players are interested in learning more about while attending your CTC.

COMMUNICATION

An area of critical concern for Competition Training Center personnel is the relationship with the parents and personal coaches who live within the geographic region served by the Center. It is essential to have good relations with these people, as they can be the basis of a tremendously effective support group for the Center.

One of the USTA's major efforts in the Player Development is to educate the players, parents, and personal coaches of the need to build a strong team. The Competition Training Centers offer a unique opportunity to educate these groups of their special role within the team. It is very important for the administrator and coaches to involve parents and personal coaches as much as possible.

We have included the following sample forms to send to parents, players, and/or personal coaches:

1. Player application and player contract- page 98
2. Medical Release form - page 99
3. Invitation to player invited to CTC - pages 100 and 101
4. Information form - page 102
5. Letter to player/parents not selected to participate in the CTC explaining the selection process - page 103
6. Letter to personal coach of player selected to CTC - Page 104

Parents

It is extremely important that the parents of young players be kept fully informed of the plans and activities of the Competition Training Center. Parents should receive mailings announcing the Center, any tryouts that may be held, meeting or match dates, or any other special activity. Parents need to fully understand the goals of the USTA Competition Training Center to ensure that everyone's expectations for the program are similar.

Parents can also serve as the core support group to a successful fundraising effort. Many Little League baseball groups owe their success to the support of the parents. The same type of parental support should be nurtured at a Competition Training Center.

Personal Coaches

The personal coaches of the players invited to the Competition Training Center are as important to the success of the Center as any other group. The USTA recognizes the close relationship which many coaches have developed with their players and does not want to change that relationship in any way. Consequently, personal coaches should

receive similar information on Center activities as the parents. They may be directly involved as visiting or guest coaches as well. Personal Coaches may also be important sources of information for CTC coaches.

Evaluations completed by personal coaches have demonstrated that those coaches invited to attend or participate in the centers rated the overall program higher than those not invited. The more involved the personal coaches are, the better sense they have for the goals of the program. It is important for them to understand that Competition Training Centers are not intended to replace or threaten their personal program.

Ultimately, the goal of the CTC personnel is to make sure that parents and coaches' stay informed, in order to insure their support.

FINANCIAL INFORMATION

Handling the finances of the Competition Training Center is one of the most important functions of the administrator. We have included a budget worksheet on page 109 and a financial accounting report on page 110. We ask that the administrator complete both forms by the following dates:

1. Budget Worksheet - Due September 1 or by the 1st week of program: -- keep for the center's records

2. Financial Accounting - Due July 1 or earlier: Please return to the USTA Player Development Office.

Collecting Fees

Most of the money used for the Competition Training Center comes from the $250 fee each player pays. This money can be collected in a variety of ways, depending on the cash flow needs of the Center. The fees can be collected in full before the Center begins operation; collected in two or three installments over the course of the year; or any other way. The USTA suggests that administrators avoid the pay-as-you-go method. Experience suggests that it will be difficult to collect the fees in a timely fashion and could have a serious effect on the cash flow of the Center.

The USTA recommends that whatever method is used, the money should be sent directly to the administrator before the session to which the fees apply. This will avoid confusion and delays during the session and should have a positive effect on the cash flow.

Record Keeping

The administrator is responsible for the record keeping of the Center, including paying the coaches and dispersing expense money to the scouts. A listing of these expenses and administrative expenses should be included in the annual financial accounting.

Current Internal Revenue Service regulations require that form 1099-MISC be filed for all individuals who are paid over $600 for professional services in a year. The administrator will most likely have to file this form with the IRS. This is not a difficult process and will require approximately 45 minutes of your time. To receive more information on this process, contact the local IRS. The USTA will update administrators on any important developments relating to IRS regulations.

Financial Aid

Financial aid from the USTA National Office for Competition Training Centers has been phased out. Financial Aid is now the responsibility of the Sections. USTA Sections are free to establish criteria for financial aid for Competition Training Centers.

Alternates
The staff of the Competition Training Center will identify 4 to 8 players who can be alternates for the 16 players selected. USTA Player Development suggests the alternates pay a pro-rated fee of $5.00 per hour for their participation or you could charge a player $125, which is half the price of a full time member. These funds should go into the general fund for Competition Training Centers and should be applied to the administrative and coaching expenses of the Center.

Fund Raising
One of the criteria for selection as a Competition Training Center is locally funded or donated court time. In many areas of the country, court rental fees must be paid for in order to ensure the longevity of the Competition Training Center. Paying for court time can also help avoid misunderstandings regarding court reservations.

Fund raising may be necessary to cover the costs of court time. In addition, the Center may wish to supplement the fees paid to the coaches. These funds must be generated locally and it is extremely important to gain the support of the community served by the Center. Community Tennis Associations or a local Patron group is often interested in assisting with programs such as the Competition Training Center. Though fund raising is not the primary responsibility of the administrator, it is important to gain the support of local groups who can assist in this area.

When seeking some type of sponsorship for the Competition Training Center it is critical for the administrator to ensure that the following guidelines are adhered to:

1. The title of the Competition Training Center cannot be sold or given away. The official name of each Center is the ***USTA COMPETITION TRAINING CENTER***. For example, a Center cannot be listed as the Jones Auto Dealership USTA Competition Training Center. A sponsor's name can be listed in the following manner: USTA Competition Training Center presented/sponsored by Jones Auto Dealership.
2. Before seeking sponsorship from national franchises, the administrator should consult with your Sectional Staff Person for Player Development. This is necessary to avoid a potential conflict with a national sponsor, should one be obtained.
3. The focus of fund raising efforts should be on local businesses whose principals enjoy or play tennis. The analogy commonly used is the local support that exists for Little League baseball.
4. The Center should seek sponsorship from companies whose products are compatible with junior tennis. Tobacco, Alcohol or other adult products should be avoided.
5. The administrator needs to be sensitive to any affiliations that the facility being used already has in place. It would be unfortunate for a sponsor of a

Competition Training Center to be in conflict with a sponsor/advertiser of a particular facility.

Fund raising for Competition Training Centers is important and we encourage the administrator to seek new approaches to it. By maintaining contact with the Sectional Staff for Player Development, the administrator can both hear about success stories at other centers and share new and creative methods for this critical task.

BUDGETS

The following information is provided as a guide to the financial arrangements of the program.

The Administrator will:

1. Collect a $250 fee from each participant. This fee need not be collected all at once, but may be spread out to reflect the cash flow needs of the center. Two payments of $125 is an acceptable alternative.
   (16 players x $250=$4,000) $4,000

2. Pay Coaches' fees weekly at the recommended rate of:
   $25 per hour = head coach
   $20 per hour = assistant coach 1
   $20 per hour = assistant coach 2
   (50 hours x $65 = $3250) $3250

3. Receives a $300 honorarium $300

4. Apply remaining $450 toward administrative costs $450
   (e.g.; phone, copying, postage, pizza parties, etc.)

Financial Aid

Financial Aid is the responsibility of the USTA Sections. Contact your Section Staff Person for Player Development to see if it is available in your section.

Additional Coaches

Each Center has funds budgeted to compensate one head coach and two assistant coaches. Additional coaches may be helpful but are not required. Each Center has the following options:

1. Have all coaches be paid the same amount and share administrator responsibilities.
2. Have no additional coaches.
3. Invite and/or recruit a player's personal coach to assist with the program on a volunteer basis.
4. Invite and/or recruit other interested coaches on a volunteer basis.
5. Pay coaches a stipend amount.
6. Invite and/or recruit a player's personal coach or other interested coaches and raise funds locally to compensate them.

Court Time

Players should receive between 45-50 hours of court time, but it is recommended to provide 50 hours. A minimum of 4 courts should be available for on-court sessions. The cost of this court time must be donated or the funds must be raised locally.

FACILITIES

Competition Training Center facilities are selected and approved by the USTA sectional and national offices. Once a facility has been secured, the administrator may begin communication with the facility contact.

During the summer, the administrator should arrange an organizational meeting with the facility contact in order to set the schedule for the year. The administrator should be flexible with the schedule, because the facility may not be available on selected weekends. Upon setting the schedule, the administrator should maintain the following contact with the facility:

1. Send a confirmation letter to the facility, including the schedule, number of courts each session and any meeting rooms needed

2. Confirm the usage of the facility before each CTC session

3. Send a thank you note to the facility at the end of the year

On the following pages are a sample confirmation letter and a thank you letter to the facility. These letters can serve as models for administrators when they begin their contact with the facilities.

COACHING PHILOSOPHY

The general coaching philosophy at the Competition Training Centers (CTC) is to stress the overall development of the tennis athlete. Players training at Competition Training Centers will work toward diminishing weaknesses and increasing strengths. Players should be encouraged to develop a mature game with the requisite skills for competing at the highest levels of play. Consequently, the development of long-range, intermediate, and short-term goals should be emphasized.

There are three important aspects for the Competition Training Centers in developing young athletes at these training centers. 1) Providing competition and match play 2) Working as apart of a team with individual player's personal coach (es) and 3) Providing the latest sports science information to players.

As we provide a training ground for our very best players within a geographical area to compete we should stress to these player's the importance of competition and match play. In order for our player's to become the very best we need to foster camaraderie and competition between these players at an early age. The Competition Training Centers are designed as a supplemental program rather than replace existing coaching. In addition, tennis athletes should have a basic knowledge of sport science and how it can help their game. Topics on sport psychology, sport nutrition, sport physiology, sport medicine, and optimal competition and practice schedules (periodization) should be discussed.

Fitness is an important concern for top players and is to be emphasized at the training centers. Objective standards (percent body fat, maximal oxygen uptake, range of motion) can be used to help athletes assess and improve their fitness. Fit tennis athletes decide long matches on skill and technique as opposed to conditioning. Periodization (the proper mix between rest, practice, and competition) should be a priority for tennis athletes, enabling them to be thoroughly prepared for major competitions.

Players are encouraged to develop a personal style suited to their physical and personality characteristics. The modern game requires that players be capable of playing from all areas of the court. Furthermore, since the game is played on a variety of surfaces, the complete player must be effective from the baseline, mid-court, and the net. Good players will be able to play from the baseline or serve and volley when the court surface and strategy dictates a particular style.

Players are encouraged to develop independence from coaches and parents, especially while on court. Independent players assume responsibility for their equipment, practice schedules, and other preparations. While top players may look to parents and coaches for moral support, and plan a match strategy prior to the game, players must adapt the plan according to the flow of the match. Consequently, players need to understand the concepts behind strategy and tactics. For example, a match strategy might be to tire one's opponent, while the tactics used might be to mix up short and deep shots. Good players should easily understand percentage tennis and patterns of play.

Doubles competency should also be stressed at Competition Training Centers. Coaches will help players understand the different skills required, the different emotional requirements, and the different strategic concepts involved in doubles. Furthermore, doubles play promotes the spirit of cooperation and teamwork that we are committed to encourage in our players.

Ultimately, the goal of the program is to help with the development of a well-rounded individual. Our goal is to encourage traits in tennis athletes, which can and will be carried over into other activities in their lives. Self-discipline, determination, and concentration are qualities, which would be desirable in anyone, not only a tennis player.

Philosophical Position Statement

The USTA Player Development Program will:

I. *Personal Excellence and Well-Being*
Help talented young players reach their maximum potential through a commitment to personal excellence in tennis. Every American player will be treated equitably and with respect for his or her inherent individual worth. The long-term welfare and happiness of players will be valued more than the fleeting pleasures or rewards of the moment.

II. *Self-Esteem and Sportsmanship*
Promote the development of the human potential and self-esteem of each player that is not based exclusively on success in competition. Sportsmanship is a high priority and we expect players, parents, and coaches to aspire to the highest standards of fair play, positive attitudes and responsible behavior.

III. *Support System*
An emphasis should be placed on developing a strong support system that includes a player's family, a personal coach, and other team members. The bonds of these relationships will be strengthened so that an effective team relationship forms between players, parents and coaches.

IV. *Personal Coaches*
Supplement rather than substitute for local coaches and programs by offering expanded competitive opportunities, innovative training assistance and reliable sport science based information and assessment. The secret to producing champion athletes has proven to be effective one-on-one coaching and endless hours of volunteer work by dedicated personal coaches. Recommendations for adjustments in stroke technique, match strategy or training regimen must be made in consultation with the personal coach.

V. *National Coaches*
Work cooperatively with the team of players, parents and personal coaches. National coaches will work to improve the standards of coaching at every level by becoming role models in the practice of high ethical standards, committing to continuing education, particularly in the sport sciences, and making responsible coaching decisions.

VI. *Individual Approach*
Assist in outlining a personal development plan with each young player that is tailored to his or her personal style, skills and abilities, within the context of the Player Development Program. Players will be active participants in establishing both long and short-range goals in tennis. Coaches will encourage players to be self-reliant and responsible, independent thinkers.

VII. *Tennis Specific Goals*
Include a renewed emphasis on playing skills and strategies that foster success on all court surfaces. Equally important is a dedication to the highest levels of physical and emotional fitness, along with a continuing emphasis from the early years on successful doubles play.

USTA Training Plan

The USTA Training Plan is the guide which Competition Training Center coaches adhere to when planning training sessions.

There are three main assumptions, which form the framework for the plan. The first is that the USTA Competition Training Centers operate for 50 hours per year. These 50 hours can be divided in a variety of ways, but the basic unit should be three six-week sessions with players meeting once a week for about three hours. Second, players are selected to train at a Competition Training Center for a one-year period. This allows for continuity and enables players to focus on development rather than keeping their spot at the Competition Training Center. Third, the training schedule may vary depending on the location of the Competition Training Center. Due to the diversity of the country, we have constructed the plan to be as flexible as possible. This allows each Center to tailor its schedule to best fit the needs of the players and the facility.

Workouts

Each workout session at a Competition Training Center will consist of four basic elements:

1. **Match play--competition**
2. **Practice or skill work**
3. **Fitness training**
4. **Sport science education**

The USTA Player Development National Coaches have determined that instruction and workouts at the national training camps will be based on the different zones of the court. The on-court workouts at the Competition Training Centers should follow this lead and also be organized around the zones of the court.

Baseline play, mid-court, and net play should all be stressed during practice sessions. The drills and practice routines selected for the different zones of the court should emphasize mastery of the various zones. For example, the goal of practice at the net should be more than just volleying - the goal should be to actually ***play*** the net. Competency in executing winning volleys and overheads should be the ultimate goal.

While during practice the emphasis should be on the zones of the court, important areas such as serve and return, offense/defense-type drills, and competitive drills are also integral components of the practice session.

Each workout should include a competitive segment. This segment may include modified singles and/or doubles play as well as regular singles and/or doubles matches. The goal is to provide a forum to practice tactics in a ***real*** match. Furthermore, this segment offers players the opportunity to practice under the simulated pressure of match play.

Fitness work should be included in each session and done near the end of the workout. The goal of this session is to train the athletes how to do fitness work. Athletes should review their fitness schedule regularly with coaches and/or parents to ensure they are working toward optimal fitness. Fitness evaluation is also an important part of the program of Competition Training Centers, but it should not be a part of each workout session.

One of the most important aspects of the program at Competition Training Centers is sport science education. Our goal is to provide our athletes with the most up-to-date and complete sport science information available. Advice on nutrition, sports medicine, sport psychology, strength training, and other sport science topics will de discussed during each workout at Competition Training Centers.

The sport science segment should not be a lecture. The goal is to have athletes obtain a sport science experience. A dialogue on the various sport science topics, which are important to tennis athletes, can best accomplish this. This dialogue may be stimulated by videotape on a particular sport science topic.

The sport science segment should also be activity oriented. For example, players could experience elements of sport psychology by doing relaxation exercises. This would provide the athletes with an opportunity to practice the sport psychology elements, which can help them on-court.

Sample Six-Week Plan

Players training at a Competition Training Center typically meet at the Center once a week for six weeks. Each workout session should be between three and four hours in duration. **The following guide is intended to be helpful in planning the workout schedule, yet it is flexible enough to allow for the different needs of each USTA Competition Training Center.** Each individual component may be switched depending on available court time, and the logical flow of the workout.

1. Week One
    a. Fitness testing - Part I
    b. Practice/informal workout (analysis of game)
    c. Fitness activity
    d. Sport science element - flexibility training

2. Week Two
    a. Fitness Testing - Part II
    b. Instructional element
        i. Baseline play
        ii. Serve & return
    c. Practice/modified play
    d. Fitness activity

e. Sport science element - periodization

3. Week Three
   a. Instructional element
      i. Review
      ii. Mid-court play
   b. Practice/modified play
   c. Fitness activity
   d. Sport science element - strength training

4. Week Four
   a. Instructional element
      i. Review
      ii. Net play
   b. Practice/modified play
   c. Fitness activity
   d. Sport science element - sport psychology

5. Week Five
   a. Instructional element
      i. Review
      ii. Singles strategy/tactics
   b. Practice/modified play
   c. Fitness activity
   d. Sport science element - nutrition

6. Week Six
   a. Instructional element
      i. Review
      ii. Doubles strategy/tactics
   b. Practice/modified play
   c. Fitness activity
   d. Sport science element - sportsmanship

18-Hour Unit Plan

Our goal is to make the training program at a Competition Training Center flexible enough to satisfy the needs of the players and facility. With this in mind, the following eighteen-hour unit plan will help in organizing the sessions properly.

The program of a Competition Training Center will most typically be comprised of three, eighteen-hour segments. Approximately 15 percent (2-3 hours) will be devoted to fitness testing. An additional 15 percent (2-3 hours) needs to be used for sport science topics. The remaining 70 percent (12 hours) will be spent in on-court training.

Fitness Testing

Ideally, the Fitness Testing Protocol should be conducted at the beginning of each unit, but it may be held at any time during the unit. The period between testing should be no less than 10 weeks. The fitness protocol can be administered in two to three hours if organized properly, but it can be broken up over several sessions to avoid muscle soreness. We recommend dividing the players into small groups and testing in various stations. This way the players can rotate from station to station until they have completed the testing protocol.

Sport Science

Sport science information should be discussed in half-hour blocks with each block devoted to a different aspect of sport science. Outlines for sport science topics are provided in the Sport Science Chapter.

On-Court Training

The on-court training should also be done in twenty to thirty minute blocks. Following each block, sufficient time should be allowed for rest and water. Each twenty-minute block should be done with high intensity. Short periods of high intensity are more beneficial than long periods of low intensity. Practice and drills related to skill work should be done first while the athletes are fresh. This helps prevent bad habits from forming due to fatigue. Ordinarily competition should occupy two or three consecutive on-court blocks. The following is a guide to assist with planning the on-court program.

1. Instruction (organized around the zones of the court)
    a. Baseline play (includes serve and return)
    b. Mid-court play
    c. Net play
    d. Specialty shots

2. Practice
    a. Offense/defense drills
    b. *Pressure* drills
    c. Modified match play

3. Competition (matches or modified matches with other players at the training center)

Daily Plan

The following daily plans provide a typical structure of a one-day and a two-day workout. Use these general guidelines as a tool to develop a plan which best satisfies the needs of your Competition Training Center.

1. One-Day Workout
    a. Announcements, administrative tasks, etc. (5 minutes)

    b. Warm-up (15-20 minutes)
        i. Light running
        ii. Stretching
        iii. Easy hitting

    c. Instructional element (60 minutes)
        i. Review of previous skill practice
        ii. Demonstration of instructional activity
        iii. Practice & drill

    d. Match play (60 minutes)

    e. Fitness activity (20-40 minutes)
        i. Fitness training
        ii. Cool down

    f. Sport science element (30 minutes)
        i. Activity/videotape
        ii. Discussion

    g. Wrap-up (5-10 minutes)
        i. Review of session
        ii. Finish any administrative tasks

2. Two-Day workout (6 hours)
    a. Day one (Saturday)
        i. Arrive in early afternoon (12:30 p.m.)

        ii. Announcements, administrative tasks, etc. (5 minutes)

        iii. Warm-up
            (1) Light running
            (2) Stretching
            (3) Easy hitting

        iv. Instructional element one (60 minutes)

(1) Demonstration of instructional activity
(2) Practice and drill
(3) Rest and water

v. Instructional element two (60 minutes)
(1) Demonstration of instructional activity
(2) Practice and drill
(3) Rest and water

vi. Sport science element one (30 minutes)
(1) Activity/videotape
(2) Discussion

vii. Dinner and evening activity

b. Day two (Sunday)
i. Arrive at facility early (8:30 am)

ii. Warm-up (15-20 minutes)
(1) Light running
(2) Stretching
(3) Easy hitting

iii. Match play (60-120 minutes)
(1) Singles
(2) Doubles

iv. Fitness activity (20-40 minutes)
(1) Fitness training
(2) Cool down

v. Sport science element two (30 minutes)
(1) Activity/videotape
(2) Discussion

vi. Final administrative tasks (5 minutes)

vii. Departure (approximately 12:30 p.m.)

Instructional Objectives

The instructional elements will be organized around the zones of the court as outlined in the Competition Training Center Coach's Manual. The instruction should be devoted to achieving the objectives listed below for each zone of the court.

1. Baseline Play

    a. Ability to hit a variety of spins and understanding their effects (e.g., topspin produces a higher bounce and allows for a greater margin of error over the net; underpin produces a longer, lower bounce)
    b. Understanding the angles of the court from the baseline (e.g., hitting to the middle of one's opponent's court minimizes the available angle the opponent can hit)
    c. Understanding the various patterns of play from the baseline
    d. Ability to vary depth (through spin, trajectory, and pace)
    e. Ability to hit effective serves and returns and understanding of the tactical elements of serves and returns (e.g., effective serves can neutralize the offense of the receiver and generate offensive advantage)

2. Mid-court Play

    a. Ability to make smooth transition between the baseline and net
    b. Ability to effectively place approach shots
    c. Understanding of the tactical opportunities in the mid-court area (e.g., opening the court for attack)
    d. Understanding of going for a winner to the open court under the proper circumstances
    e. Understanding of angles from the mid-court area (e.g., wrong footing an opponent to gain advantage)
    f. Understanding of the tactical implications of mid-court volleys (e.g., using these volleys as a transition shot or type of approach shot)

3. Net Play

    a. Ability to finish the point at the net (e.g., understanding angles and depth)
    b. Understanding of tactical positioning (e.g., covering the net to make recovery easier, and reading opponent's trends)
    c. Understanding of the general concept of *playing the net* not just hitting volleys (e.g., setting yourself up for the next shot, being at the net means finishing the point)
    d. Ability to hit effective overheads (e.g., understanding which balls to play in the air and which to play on the bounce)

Modified Match Play

Objective: To simulate situations which arise during match play.

Activities

1. One Serve - Server gets one serve and then plays out the point

2. 3 Ball & Play - Players must hit 3 shots between them (e.g. serve, return, and ground stroke) then they may play out the point

3. Deep Game - Players hit from the baseline keeping the ball deep (e.g. between the service line and the baseline

4. Serve 10 points - Server continues to serve until 10 points are played and then the players switch

5. Tiebreak Tournaments - Players compete in a tournament where all matches consist of one or more tiebreaks

6. Two points for winner at net (volley or overhead) - Players who are able to finish the point with a volley or overhead are awarded two points

7. Short Ball - If the ball lands between the service line and the net the player must come in or lose point

8. Handicap Scoring - keeps sets close

9. Return and approach- server hits an easy serve to either the forehand or backhand of the receiver who must hit an approach shot on the return and come to net.

10. Short game (touch and angles) - Points are played within the service court where touch and angles are more important than power

Sport Science for the Competition Training Centers

In developing the Competition Training Center Manual, we have relied heavily on the sport sciences. In particular, the following sport sciences have been singled out for their importance to tennis athletes:

1. ***Sport Psychology:*** The study of human behavior within the setting of sport.

2. ***Sport Physiology:*** The study of how systems of the body function and adapt during sport.

3. ***Sport Nutrition:*** Sport nutrition focuses on how the body uses food and water to fuel performance.

4. ***Sports Medicine:*** Sports medicine is the area of sport science that deals with the prevention of injuries and the treatment and rehabilitation of an injured player.

5. ***Sport Biomechanics:*** Sport biomechanics is the study of the natural laws of physics and how they impact the body and how it moves on the court. Biomechanics also deals with technology that is used in tennis equipment.

6. ***Strength and Conditioning:*** The study of how to train the body to achieve optimal performance and prevent injury.

On the following pages is sport science information that can be provided to your players. In addition there are sport science activities in the appendix that are appropriate for the Competition Training Centers.

Sport Psychology in Tennis

Introduction

As most coaches and athletes will attest to, tennis is not strictly a physical sport. Players need to be as strong mentally as they are physically. How many times has a player seemed to 'crumble' under the pressure of match point and go on to not only lose the game, but also the match? Or how often does a player make a mistake and then allow that mistake to impact the next point, and the next, and the next? Conversely, players with strong mental skills seemingly charge through adversity and do not let negative thoughts get in the way of their performance. It is easy to see how mental skills come into play in competition, but does mental skills training receive this same level of importance in practice? Many times mental skills training is seen as a rainy day activity or as something to fit in around on-court practice and physical training. Is that enough time to devote to such an important aspect of the game? Consider this. Just like the body will not be ready to perform come competition time if it is not trained properly, you can not expect mental skills to 'just be there' if they are not trained as well. It is clear that the mental aspect of tennis is extremely important at all levels of play and the groundwork for mental skills training should be laid when the players are young. This chapter on sport psychology is designed to present several skills that young players can use to strengthen the mental aspects of their game.

In addition to the written information presented in this chapter, several other pieces of information have been included. This material includes:

- Mental Skill Development: Goal Setting
- Mental Skill Development: Developing a Routine
- Mental Skill Development: Factors You Can and Cannot Control
- Mental Skill Development: Controlling Negative Thought

What is Sport Psychology?

Sport psychology is the study of people and their behavior in sport situations. Most people think of sport psychology as training an athlete to develop mental skills that will enhance performance. That is in fact true, but athletics also have the potential to shape and influence a player's mental health and development. It is important for a tennis coach to realize both of these "sides" of sport psychology. Yes you want to train mental skills to optimize on-court performance, but it is also important to consider how training and competition affects the development of the athletes you are working with.

Learning from the Best

As a coach, one of your goals likely is to get the most out of the players you work with. You want them to grow and advance as far as their bodies and minds will allow them. But what do they need to get to the next level? Is it just a matter of more time on the court? Do they need more mental skills training? One of the best ways to understand

the skills young tennis players need to master is to learn from the best – to uncover what makes the great athletes great.

Research on Olympians from 1996 and 2000 has identified factors that positively and/ or negatively affected athletic performance of US Olympic athletes. Some of the areas that athletes felt affected their performance were:

- *Distraction preparation* – Successful athletes had well-developed plans for dealing with distractions and put the plans into action. While they enjoyed the experience, they didn't allow themselves to get distracted by "the show". Do your athletes deal well with internal and external distractions? Remember that these distractions can occur at practice and competition

- *Having a plan and adhering to that plan* – Successful athletes not only had physical and mental preparation plans, they stuck to them. Unsuccessful athletes either didn't have a plan or didn't adhere to their physical and mental preparation plan. Effective mental plans for your players will make use of a multitude of mental skills and strategies that are implemented to help manage physical performance

- *Mental preparation* – While the majority of athletes reported experiencing stress leading up to the Games, successful athletes knew how to effectively manage these stressors and unexpected events through effective mental preparation. Do your players manage stress that "weighs" on them during practice and competition performance? Or, does stress tend to get the better of them?

- *Optimal physical training* – Athletes that did not perform well reported being over-trained – in part because there is a tendency to over-do things and be "more ready than ever" at major competitions. Optimizing physical readiness relates to balancing training and physical and mental recovery. What steps do you take to ensure the training of your players is optimized? Does the player take an active role to ensure optimal training?

Look at how many of these factors contain a mental component. Before you say, "These are elite-level athletes, they are different from the players I am working with," realize that they were not always elite level athletes. These are the skills that they have developed and have taken them to the elite level. You have an opportunity to start the mental training process with your players now to help them to optimize their on-court performance.

Another way to learn about how mental skills influence performance is to look at the athletes themselves. Top athletes tend to exhibit several common "elements of excellence" that characterize the top athletes and are linked to successful performances.

As an exercise, have your players make a list of the factors they think the top athletes possess. You should write down your thoughts as well.

Psychological Elements of Excellence

1._____	2._____
3._____	4._____
5._____	6._____
7._____	8._____
9._____	10._____

Now, let's look at the skills that have been identified from studying elite athletes. Compare these factors to the list you and your players developed – for ones you didn't think of, ask yourself how critical the skill is in tennis.

Elements of Excellence:

- Determination and commitment to athletic pursuits
- Consistent quality training characterized by the daily use of mental skills such as goal setting, simulation training and imagery training
- Focus/ concentration skills
- Recognition, expectation, and preparation to cope with pressure situations
- Well-developed plans for competition that include the use of mental imagery, positive thoughts, and attentional control strategies
- Distraction control strategies
- High self-confidence

The list of psychological attributes and skills that characterize elite athletes offers valuable information for you as a coach. It is a great place to start when trying to determine what skills your athlete may need to further develop to help them achieve their goals and get to the next level.

Using Mental Skills

In this guide you will find four mental skills and drills that were taken from 'The USTA Mental Toughness Skills and Drills: Top Twenty Drills' manual. These drills were put together by Dan Gould, Ph.D. a top sport psychologist and a member of the USTA Sport Science Committee, along with Kristen Dieffenbach, Yongchul Chung, Russell Medbery and Larry Lauer. The drills highlighted in this chapter target skills that are important in tennis. Each drill is presented as a "lesson" you can lead and take your players through. The exercises provide clear steps that can be taken, even with young players, to make mental skills training a part of tennis training. The specific drills that are highlighted are:

1. *Goal Setting:* The purpose of this exercise is to teach players the importance of setting both short and long term goals.

2. *Developing a Routine:* The purpose of this exercise is to guide players through the development of a routine to use in match play.

3. *Factors Players Can and Cannot Control:* The purpose of this exercise is to teach players what factors they can and cannot control on the tennis court.

4. *Countering Negative Thoughts:* The purpose of this exercise is to help players develop the ability to change negative thoughts into positive ones.

The exercises presented in this guide are just a few of the many drills you can start to teach your players to help improve concentration, confidence, and performance in the players you coach. To obtain the complete edition of 'Mental Skills and Drills' contact the USTA Sport Science Department at sportscience@usta.com.

Exercise Physiology in Tennis

What is Exercise Physiology?

Before getting into a discussion of why exercise physiology is important for tennis player it is important to understand what exercise physiology is. Webster defines physiology as the branch of biology that deals with the functions of the body. Therefore, exercise physiology is the study of how the body's systems respond to exercises and physical exertion. Of particular importance in athletics is how the body produces and uses the energy needed for muscle contraction and performance.

Introduction

The physiological demands of tennis and how a player's body responds to meet these demands are not as clearly understood as they are for some other sports and activities. Tennis is characterized by intermittent bouts of activity of variable intensities and durations. In addition, the length of a match can range from less than an hour in length to more than four hours. Tennis can also be played on a variety of surfaces with a wide range of accompanying environmental conditions. All of these factors play a significant role in defining the energy demands on the body and how a player's body must respond.

Many of the physiological processes related to play involve converting chemical energy stored in the muscles and other parts of the body into the mechanical energy needed to run, hit the ball, and recover. In addition, after each one of these bouts of muscular activity, the chemical energy in the muscles must be rapidly restored before the next point. These processes go on throughout a match and a player's ability to continue playing depend in large part on one's ability to efficiently and rapidly convert, utilize, and replenish energy as it is needed. This can become a great challenge as a match goes on and the intensity of play increases.

Energy Systems in the Body

The body has three systems that continually function together to provide the energy needed for muscle activity and replenish energy stores (Figure 1). These are the:

1. Immediate energy system that provides energy for short bursts of high-intensity activity lasting for 10 seconds or less.
2. Short-term energy system, which is the main source of energy for activities lasting between 10 seconds and 2 minutes.
3. Long-term, aerobic energy system, which provides energy for endurance events lasting for 2 minutes or longer.

All three are important during tennis play.

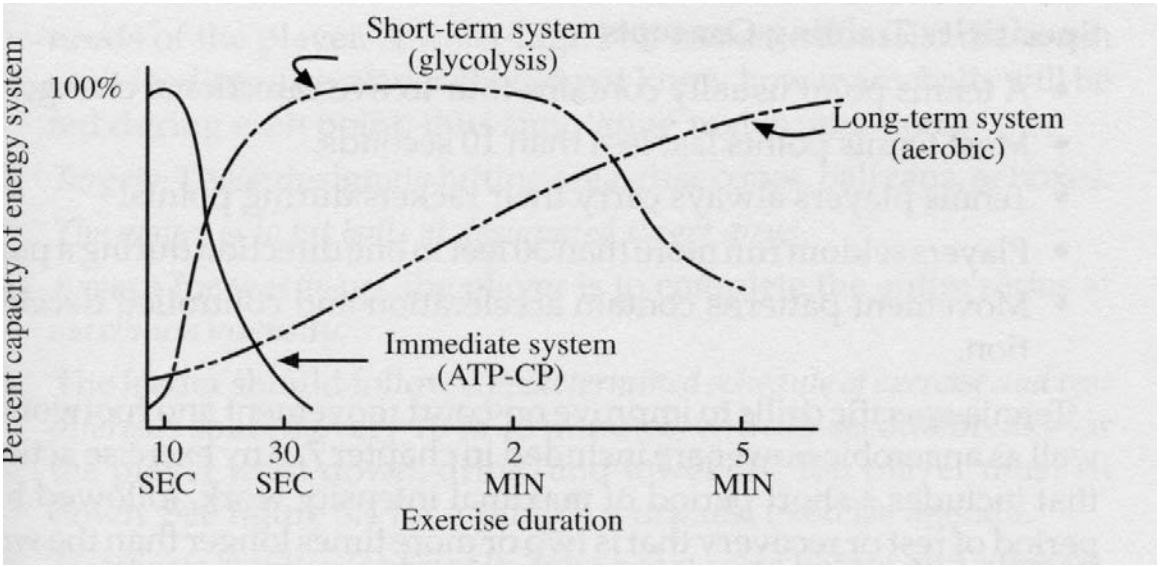
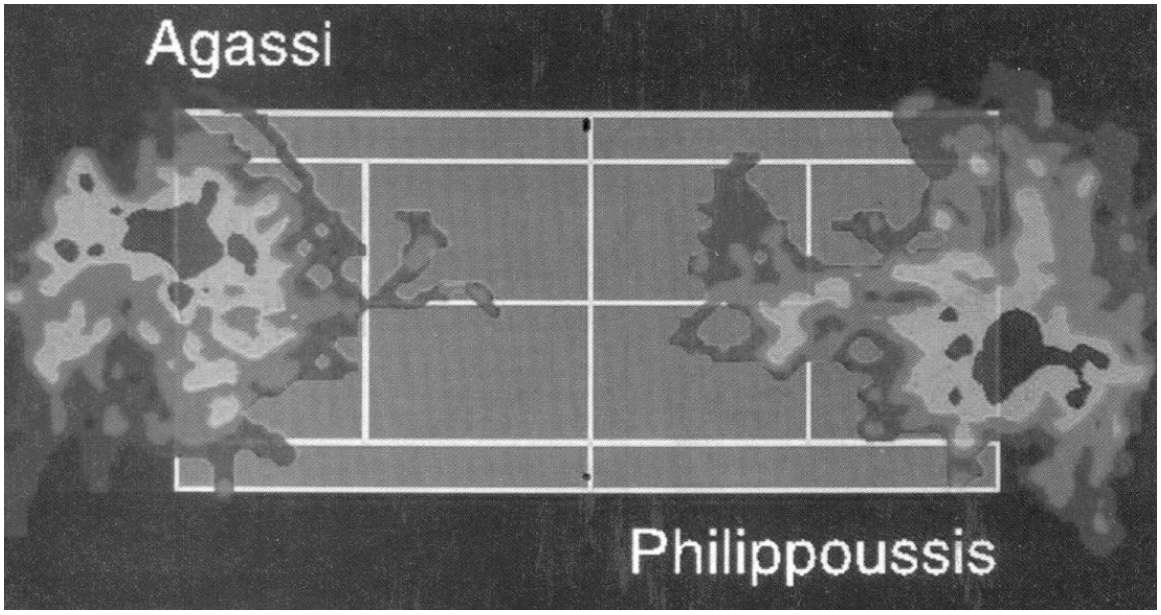


Figure 1: The three energy systems in the body. The immediate, short-term and long-term energy systems provide energy to working muscles for activities of different durations and intensities.

Demands of Tennis

Think about the demands of tennis play for a minute. The graph below shows some information from a match played by Andre Agassi and Mark Philippousis. The different colors/shades show where the players spent the most time on the court. The darkest areas show where the players spent the greatest amount of time. For both players this was along the baseline in the deuce court. You can then see the shading change as you move away from this point, signifying the



players spent less and less time in these locations on the court. There are even large areas of the court where the players never stepped foot. Analysis of this match and others showed several interesting facts:

- An average point lasts less than 10 seconds.
- Maximally, there are 25 seconds of rest between points.
- On average, a player has 4 directional changes per point and travels <10 feet in any one direction.
- A player produces 300 – 500 bursts of energy
- Matches can last from 30 minutes to longer than 4 hours.

From this you can see that tennis requires a player to generate both short powerful bursts on power, but also be able to do it for long periods of time. The energy demands of tennis are unlike any other sport and require the use of all three energy systems.

ATP – The Energy Building Block

The immediate source of energy for all muscle contractions is a chemical called ATP (also known as adenosine triphosphate). ATP is a high-energy molecule that stores a considerable amount of chemical energy within the bonds that hold the molecule together. The energy that fuels muscle contractions is produced when ATP is broken down into ADP (adenosine diphosphate) and a molecule of phosphate. Typically, for ADP to be "recharged" and have the capacity to produce more energy, the phosphate molecule must be chemically reattached to re-form ATP. The three energy systems all function to perform this function and replenish the ATP stores in a muscle.

Aerobic and Anaerobic Energy Systems

Aerobic means "with oxygen" and anaerobic means "without oxygen." These terms can be used to characterize the three energy systems that have been discussed.

The immediate and short-term energy systems are anaerobic – meaning they do not require the presence of oxygen to be able to produce energy for the working muscles. The fuel in the muscles is used up quickly and typically is not replenished very rapidly. This is the reason why high intensity exercise cannot be performed for a very long time.

The long-term energy system is an aerobic energy system – meaning it requires the presence of oxygen to produce energy and ATP. The oxygen is carried to the working muscles by the blood, and this energy system will continue to produce ATP as long as sufficient oxygen is present. Aerobic activities are also typically thought of as endurance activities. They can be performed for long periods of time, but never at maximal intensity.

Immediate Energy System

As ATP is used by a working muscle, another chemical called creatine phosphate (CP) is broken down to provide phosphate molecules that can replenish a muscles' ATP supply almost immediately. This energy pathway is also sometimes referred to as the ATP-CP energy system. As mentioned previously, oxygen is not required for energy to be produced via this pathway. The immediate energy system is used to fuel short, intense activities that last for several seconds. Muscles usually contain large reserves of CP, so a player typically has plenty of CP to effectively restore energy (ATP) after most points and movements on the court.

The immediate energy system is very effective for meeting the short-term energy needs of tennis. However, to keep going, the assistance of two other energy-providing systems is needed. Moreover, these other energy systems are relied on as well to

restore muscle energy during and between points when the demand for energy in a given muscle or muscle group is less.

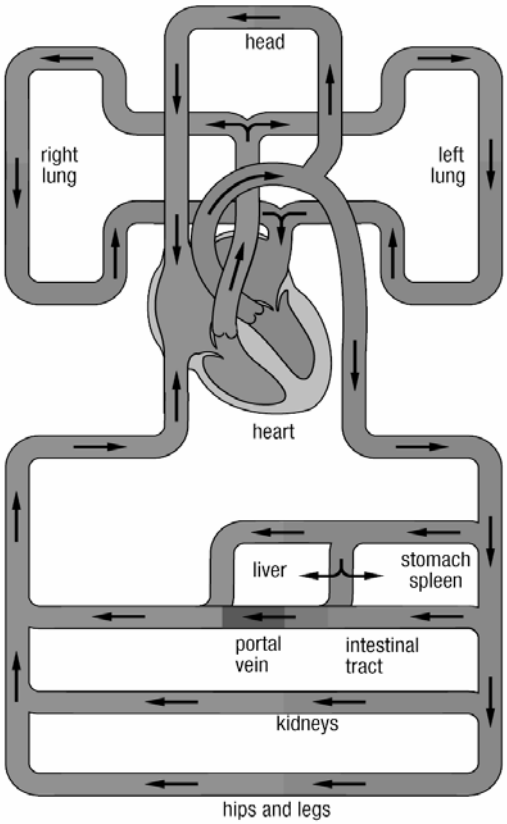
Short-term Energy System

In the nutrition chapter we learned that carbohydrates are broken down into sugars, specifically glucose, which is then stored in muscles and the liver as glycogen. This glycogen can be then be broken down to provide energy in the form of ATP via a process called fast-glycolysis (which literally means splitting of glycogen). This energy system is also an anaerobic system and does not require the presence of oxygen to create ATP. Using the fast-glycolysis system, one molecule of glucose is used to produce 2 molecules of ATP.

This short-term energy system is also sometimes referred to as the lactic acid system, since lactic acid is a byproduct of this form of metabolism. (Sometimes you will hear scientists and physiologists refer to lactate – this is what becomes of lactic acid when it enters the blood; lactate levels can be measured with a simple blood test.) This energy system might be used when a player runs hard from sideline to sideline to hit a series of groundstrokes. If the duration and intensity of points remains high, or little rest is allowed between points, the reliance on this short-term energy system increases. Fortunately, such a high demand is not usually sustained for more than a couple of points at a time and lactic acid levels rarely get very high. If it did last for longer, or adequate rest was not provided between bouts of activity, then a high level of lactic acid would accumulate in the muscles and fatigue would set in quickly. Even though the long-term energy system also functions to provide energy to working muscles during intense activities, the rate of ATP production via the long-term energy pathway is not fast enough to keep up with this temporary high demand.

Long-Term Energy System

The long-term system provides energy for "endurance" events lasting longer than two minutes. Like the short-term energy system, the long-term system also uses glycogen in the muscles to provide energy. When this process occurs in the presence of oxygen, the number of ATPs that are produced per molecule of glucose jumps from 2 to 38. As effective as the immediate and the short-term and immediate systems are for providing rapid energy during tennis, the long-term



energy system can supply substantially more energy and plays a critical role throughout play.

Carbohydrate, fat, and even protein can be used to fuel aerobic metabolism. Again, even when the intensity of play is high and the immediate and short-term energy systems are called upon to meet the energy demand, the long-term energy system continues at the same time. When the intensity of a point is lessened (and certainly between those hard points), aerobic metabolism is already working to rapidly help the muscle cells to recover. A player with good aerobic conditioning will recover faster – during and between points. Overall, the long-term, or aerobic, system is the primary source of ATP and energy restoration during a tennis match – even though the other anaerobic systems are continually functioning as well.

Anaerobic Training Guidelines

Anaerobic exercise is characterized by brief, high-intensity periods of activity, where energy metabolism during the activity periods is predominantly provided by the systems that do not involve oxygen. As such, anaerobic training should include a series of brief, high-intensity drills or activities followed by a specified period of rest to allow for replenishment of the anaerobic energy stores within the working muscles. In general, it is recommended that you provide a 1:3 work to rest ratio; this means for every second the player works, he or she gets 3 second of rest before the next interval. In other words, the longer the activity, the longer the recovery interval should be.

With this type of training it is possible to impact the body's ability to deal with lactic acid. With a properly designed anaerobic training program a player's body will adapt to be able to perform at higher intensities without an appreciable gain in the lactic acid that is produced. The intensity level where the body switches from aerobic to anaerobic energy systems is commonly called the lactate threshold. In Figure 2, the lactate threshold is identified as the intensity where the lactate levels in the blood start to increase suddenly. With training, it is possible to shift the lactate threshold to higher and higher intensities.

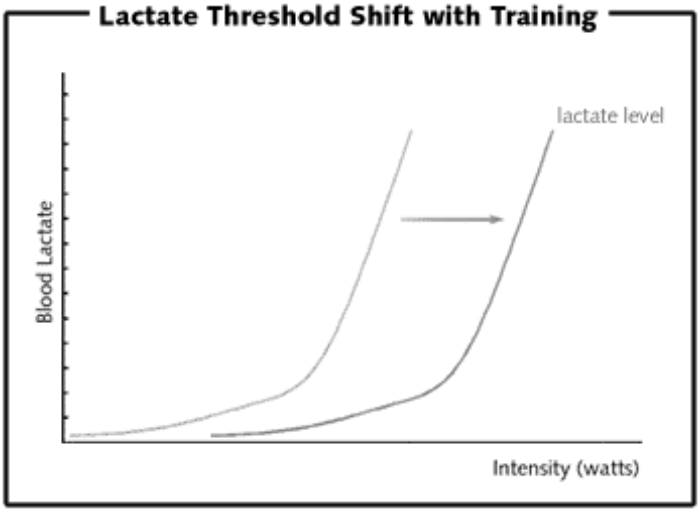


Figure 2.. The body can adapt to anaerobic training so that it produces less lactic acid at a given intensity level, effectively shifting the lactate threshold.

Please note, as important and beneficial as anaerobic interval training can be for

helping to optimally develop a tennis player, such training is also very demanding. Without sufficient preparation, progression (within the session and over longer periods of time), warm-up, and recovery, too much of this type of training can readily lead to injury.

Aerobic Training Guidelines

One of the key components to maintaining optimal energy conversion and restoration throughout a match (i.e., endurance) is a player's ability to take in and utilize oxygen. A player with well-developed cardiovascular (heart and blood vessels) and pulmonary (lungs and airways) systems is able to deliver oxygen effectively and efficiently to the working muscles. With aerobic training, muscles also undergo an adaptation to make them better equipped to pull oxygen from the blood more efficiently and use it to create energy. Thereby, a player can continue to play longer without fatiguing as rapidly or having to reduce the intensity of play as much. This, combined with the body's ability to provide energy to the muscles at a very high rate to maintain power, speed, and strength (via adaptations of other physiological systems), will give a player a tremendous advantage over one who is less physiologically well trained and conditioned.

Tennis is a sport that requires a high level of aerobic conditioning. Therefore, it is often recommended that players receive additional aerobic training, above and beyond what they get on the court, to be able to perform at optimal levels. In the chapter on strength and conditioning, we talked about adaptation and how the body responds to increased demands it is required to face. That holds for physiological training as well as for strength training. In general, this means that players who are looking to improve their conditioning and on-court endurance should perform regular aerobic training to induce changes in the body's ability to get oxygen to the working muscles. In other words, most tennis players should engage in some form of regular endurance training that will help bolster their aerobic conditioning.

The American College of Sports Medicine has established several guidelines for improving cardiovascular health and endurance. They are to perform an aerobic activity:

- At least 3 times per week.
- For 20-30 minutes at a time.
- That involves large muscle groups.
- With a heart rate between 60-85% of a player's maximum heart rate.

Aerobic/ endurance training also provides many other beneficial physiological adaptations that can enhance performance and reduce certain health risks. Some of these positive benefits are listed below:

- Improved efficiency of the heart as it pumps blood to the muscles.
- Increased ability of the blood to carry oxygen to the muscles.
- Improved ability of muscles to extract oxygen from the blood.
- Improved body composition/ reduced body fat.
- Lower blood pressure and resting heart rate.
- Decreased stress on the body.

There is a wide array of on- and off-court exercises that will enhance a player's aerobic capacity. Endurance training can include moderate- to high-volume, interval or continuous, on- or off-court tennis-specific drills, as well as the more traditional forms of endurance training like jogging, swimming, cycling, or roller blading. The key to enhancing the aerobic system is keeping the heart rate elevated for a fairly long period time. Generally, the player should keep the intensity high, but below the level where lactic acid is produced. Monitoring the heart rate is usually the most effective way of telling is a player is training in their 'aerobic training zone."

The recommended range for heart rate during an activity to promote aerobic fitness is between 60 and 85% of the player's maximum heart rate. Despite the variability in maximal heart rate within specific age ranges, the following formula can be used to estimate a player's heart rate range for enhancing aerobic fitness:

(220 – age of player) x .60 = lowest heart rate (60%)
(220 – age of player) x .85 = highest heart rate (85%)

For example, a 20-year-old player would want to train at an intensity where his or her heart rate would be between 120 and 170 beats per minute.

Several sample heart rate profiles recorded from players during several sets of singles tennis are shown in Figure 3. The main curves shows the heart rates and the black dotted lines show the upper and lower limits of this players' aerobic training zone. You can see that the players' heart rate remained in the aerobic training zone for most of the match.

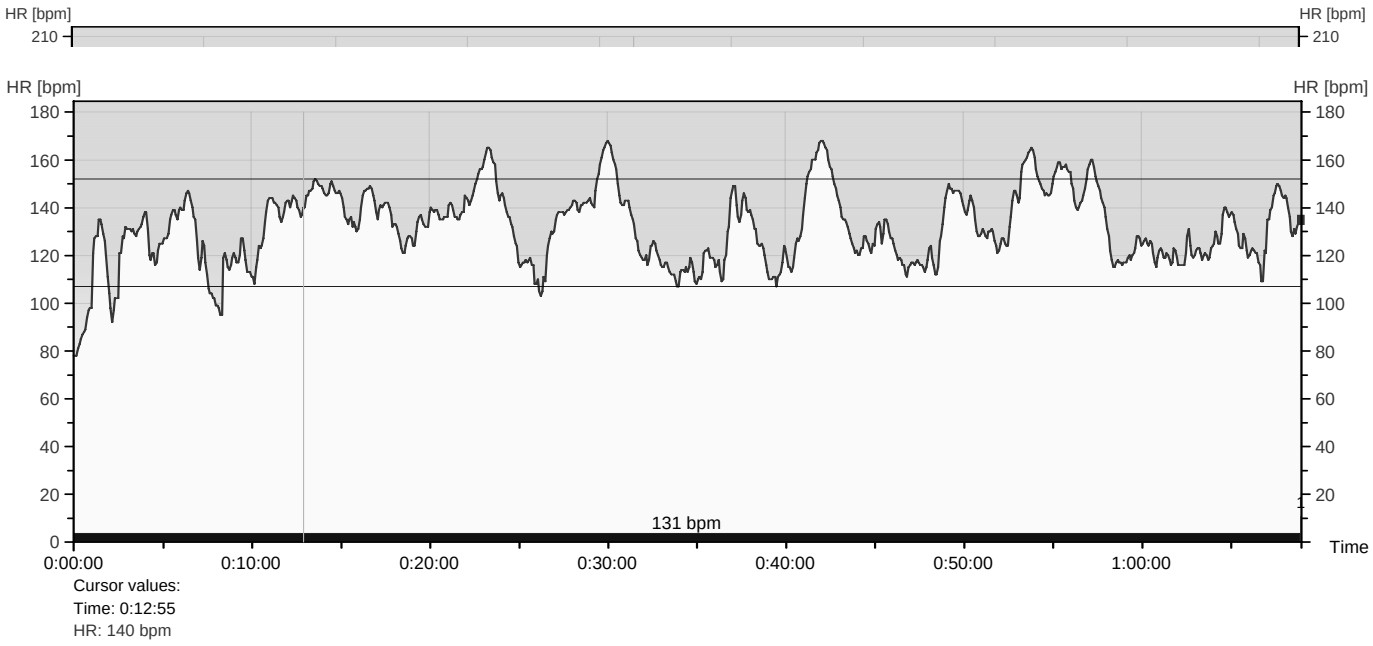


Figure 3: A heart rate profile measured during a singles tennis match. It shows that the heart rate typically stays within the aerobic training zone.

Sport Nutrition in Tennis

Introduction

Whether preparing for the club championship or the US Open, a "healthy" diet and body can clearly contribute to a player's quest to reach peak performance. With all of the other aspects of training a player has to focus on it is very easy to neglect nutrition as one strives for optimal performance. However, proper nutritional habits, which include hydrating and fueling the body, are essential for maintaining health and achieving peak performance.

There are several important things to realize about a tennis player's diet. Tennis players are not "average people" and more likely than not, will have dietary needs that differ from other children their same age. Similarly, fad diets and other nutritional schemes that may help sedentary adults lose weight may not be appropriate for tennis players. Coaches, players, and parents need to recognize this and understand how to prepare the body for tennis matches, or practices, that can last for several hours, often times in intense heat. This chapter is designed to present the fundamentals of nutrition and why it is important for tennis players.

In addition to the information presented in this chapter, several other pieces of information have been included related to nutrition. This material includes:

- A copy of the food guide pyramid.
- USTAs *Fluid Play* hydration guidelines poster.
- Table of vitamins and their functions.
- Table of minerals and their functions.
- Nutritional survey.
- A sample nutritional log.
- USTA *High Performance Coaching Newsletter* article on 'Sports Foods.'
- USTA *High Performance Coaching Newsletter* article on 'The Nutrition Advantage.'

Why is Nutrition Important?

Optimal performance results only when the nutritional needs of the body have been met. Next to practice, nutrition is probably the one area that can make the greatest impact on a player's performance. Food is fuel for the body, much like gas is fuel for your car. If you put the wrong fuel in, the body will not "run" properly. Therefore, making the right food choices at optimal times before, during, and after exercise allows the body to operate efficiently. This increased efficiency improves the probability of players attaining peak performances.

A Balanced Diet

A varied and balanced diet will provide all the necessary nutrients (carbohydrates, fats, protein, minerals, vitamins, water, etc.) to support growth and development as well as provide the energy needed for training and competition. There are a wide variety of foods that a player can choose from to build a balanced diet, but there are also a lot of foods with a lower nutritional value that players should limit. To ensure that people eat enough of the right foods, the US Department of Agriculture has developed a Food Guide Pyramid (see below) that can help coaches, players, and parents choose the appropriate mix of foods to maintain a healthy and effective diet. Tennis players will likely need more calories than a less active person of the same age. The increased caloric needs can be addressed by eating more food, but in the same proportions, as outlined in the food guide pyramid.

The Food Guide Pyramid graphic is used with permission from the U.S. Department of Agriculture and the U.S. Department of Health and Human Services.

Energy Balance and Fuel for the Body

In short, the energy in the food consumed should equal all of the energy losses a player experiences during the day. Energy is lost on the court during practice and during conditioning sessions, but energy is also burned during the rest of the day – even when you are sleeping the body is burning some energy. If the body is not refueled appropriately, at some point it will run out of gas and a player becomes more likely to get injured or perform at a less than optimal level.

As you can imagine, players can readily expend a lot of calories on the court, especially during intense competition. However, do you know which nutrients provide the most support for such an expenditure of energy? Carbohydrates and fats are the primary sources of energy for tennis. Fats are typically used for fuel during low to moderate intensity exercise, but as the intensity of play increases during a match, and energy expenditure goes up, the body's emphasis shifts to utilizing more carbohydrates.

Maintaining a proper energy balance is important over the course of a day, but it is also important during tennis play as well. Food and fluids should be consumed before, during and after play to ensure a player can maintain his or her intensity on the court. Pre-match, during-match, and post-match nutritional guidelines are provided later in this section. You are also encouraged to refer to the included "Fluid Play" hydration poster that outlines proper hydration strategies fro tennis players.

Maintaining a proper energy balance also influences weight gain or weight loss.

- If a player eats the same number of calories that are burned, the player should maintain a consistent weight.

- If a player eats fewer calories than are used, the player will lose weight.

- If a player east more calories than are used, the player will gain weight.

To better understand the types and amounts of food a player is eating we have attached a food log that players can use to track there eating habits. By logging all of the foods and fluids a player consumes one can better see if the player is meeting his or her nutritional needs as well as consuming a balanced diet.

Carbohydrates

Carbohydrates are the main fuel for tennis play. All carbohydrates are broken down into sugars, a simple form of energy that the body can use easily. And sugar is what provides the brain and muscles with their favorite source of energy. Foods that contain carbohydrates are broken down into simple sugars by the digestive system. These single sugar units can be easily absorbed by cells in order to fuel the body.

Think of all the foods that contain sugar. Some are pretty straightforward, like candy or fruit. However, there are other sources of carbohydrates that might not come to mind as quickly. Pastas, vegetables, breads, rice and sports drinks all contain carbohydrates that can provide your body with fuel for performance.

Some interesting facts about carbohydrates are listed below.

- Sugar is stored in the muscles for immediate use and gets used when muscles exercise.
- Glucose is the most common type of sugar that the body uses and provides most of the fuel the working cells.
- Fructose is name of the sugars found in fruit. It takes the body longer to digest fructose compared to glucose.

Recommendations:

- 55% to 70% of an athlete's daily dietary calories should come from carbohydrates.
- Carbohydrates should make up most of a tennis player's diet.
- In most cases, carbohydrates (sport drinks, sports bars, etc.) should be consumed at regular intervals before, during and after practices or games.
- Carbohydrates should also be consumed immediately after practice or a match to restore muscle energy stores

Fats

Fat is not bad for tennis player. Tennis players need fat for a number of important biological functions and energy. In fact, it is recommended that between 20% and 30%

of an athlete's daily dietary calories should come from fat. With that said, dietary problems can occur when too much fat included in a player's diet.

There are good fats and there are 'less healthy' fats, and tennis players should choose carefully where they are getting their fat. Saturated fats are the 'less healthy' fats and typically are solid at room temperature; examples of saturated fats are butter, lard and meat fats. Un saturated fats are better for the body and are typically in a liquid form at room temperature.

Some interesting facts about fats are listed below.

- Some fat in the diet is actually good for the body.
- Some primary sources of fat are meat, dairy, oils, and condiments like salad dressing, mayonnaise, margarine and butter.

Recommendations:

- 20 - 30% of an athlete's daily dietary calories should come form fats.
- Fats should not be consumed right before play or during play since they take more time to digest than carbohydrates
- Saturated fats should not make up more than 10% of the calories a player consumes per day.

Proteins

Proteins are needed to help with muscle building and repair. It is recommended that between 10% and 15% of an athlete's daily dietary calories should come from protein. However, certain activities (e.g. regular weight lifting) may further increase the daily protein needed for that individual. Some primary sources of protein are meat, fish, and dairy products, as well as meat alternatives like soy products.

Some interesting facts about proteins are listed below.

- Meats, fish, beans, eggs and even tofu are good sources of protein.
- Most players consume enough protein in their diet and do not need to consume protein supplements or drinks.

Recommendations:

- 10 – 15% of an athlete's daily dietary calories should come form proteins.
- Proteins should not be consumed right before play or during play since they take longer to digest than carbohydrates.
- Some protein taken immediately after a practice or competition may help enhance muscle recovery and improve performance in the next practice.

Vitamins and Minerals

Vitamins are organic substances and minerals are inorganic substances that the body needs to convert food into energy. In short, vitamins and minerals are essential for the human body to function properly.

Some interesting facts about fats are listed below.

- The body produces some vitamins, but in most cases both vitamins and minerals need to be obtained through the food we eat.
- Primary sources of vitamins and minerals are whole forms of food including all the major food groups.

Additional information on vitamins and minerals is included in the attached tables.

Water and Electrolytes

Tennis players sweat a lot and just like it is important to keep energy levels high, it is equally important to keep the body properly hydrated. Some players can lose as much as 3.5 liters of fluid per hour during intense play in the heat. That equates to as much as 7 pound of water loss in an hour of play.

Sweating is a necessary process and we do not want to stop it. Sweating is the most effective and most utilized on-court method for dissipating heat. If the fluid lost via sweat is not properly balanced by fluid intake on the court, a tennis player may become dehydrated and overheated, and likely will experience 'premature' fatigue. In addition to dehydration, heat exhaustion, heat cramps, or even worse, heat stroke could occur.

Sweat also contains electrolytes such as sodium (salt) that are necessary for the body to function normally. When a player loses too much salt, deficits can occur that lead to muscle cramps. Many times, fluid and electrolytes can be replaced by consuming a sport beverage during play. Doing this has the added advantage of providing energy to the body since these drinks often contain carbohydrates as well.

The challenge to the player is to replace the fluid lost during a practice or match rapidly and regularly. Follow the guidelines presented in the USTA "Fluid Play" hydration poster to learn how to properly hydrate the body before, during and after practice or competition.

Some interesting facts about water and fluid intake are listed below.

- Water makes up a large percentage of your blood (83%), and helps to carry

nutrients and oxygen to cells for utilization and generation of energy.
- Athlete's lose water and electrolytes through sweat.
- Electrolytes help to maintain fluid balance in the body and are necessary for proper muscle contraction and nerve impulse transmission.
- Inadequate amounts of water and electrolytes (especially sodium) may lead to cramps.
- The weight lost during a single practice or match is all water weight, not fat loss. Players should be sure to drink enough to re-gain this weight after practice.

Recommendations:

- Follow the recommendations for staying hydrated that are laid out in the "Fluid Play" hydration poster.

Heat Illnesses: Dehydration, Heat Cramps, Heat Exhaustion, and Heat Strokes

Playing tennis in the heat carries the risk of developing a heat-related illness or injury. The following section describes these heat illnesses and identifies steps to take to help prevent them, but also gives suggested courses of action to take should a player experience a heat illness or injury.

Dehydration is loss of water from the body. Since the body is made up primarily of water and water is needed to function properly, becoming dehydrated can have a negative impact on performance. A fluid loss of even 1-2 pounds can have a negative impact on performance in some people. Symptoms of dehydration include thirst, dry lips and mouth, a fast-beating heart, and even a feeling of fatigue, dizziness or chills.

Unfortunately, dehydration is not something that just happens on the court. Many players begin matches or practices dehydrated and do not re-hydrate adequately after training or competition. They compromise their performance before they even step on the court.

Do not let thirst be the indicator of when you need to start drinking fluids. When you start to feel thirsty you are already dehydrated.

Recommendations if dehydration occurs:
- Drink cool beverage (e.g. water, juice, sports drink)
- Drink fluid slowly to reduce the possibility of regurgitation
- Sit in cool area.

Heat Cramps are muscle pains or spasms – usually in the belly, arms, or legs – caused by participating in strenuous activities while being exposed to high temperatures. Players who sweat a lot during strenuous activities are more prone to heat cramps because of the enormous depletion of water and electrolytes they experience during

these activities. Additionally, heat cramps may also be a symptom of heat exhaustion.

Recommendations if Heat Cramps occur:
- Stop all activity and sit quietly in a cool place.
- Drink water, juice, or a sports beverage.
- Do not return to strenuous activity for a few hours after the cramps subside because further exertion may lead to heat exhaustion or heat stroke.
- Seek medical attention for heat cramps if they do not subside in 1 hour.

Heat Exhaustion is a form of heat-related illness (i.e. dizziness, fatigue, etc.) that is caused by consistent exposure to high temperatures and inadequate fluid intake. The warning signs of heat exhaustion are heavy sweating, paleness, muscle cramps, tiredness, weakness, dizziness, headache, nausea or vomiting, fainting.

Recommendations if Heat Exhaustion occurs:
- Drink cool beverages.
- Drink fluid slowly to reduce the chance of getting an upset stomach.
- Take a cool shower, or sponge bath.
- Seek an air-conditioned environment.
- Wear lightweight clothing.

Heat Stroke is the most serious of the heat-related illnesses. It occurs when the body becomes unable to regulate its temperature causing a rapid rise in core body temperature. Typically the body's sweating mechanism shuts down as well. This results in the inability to cool the body and may lead to death or permanent disability if emergency treatment is not provided. The warning signs of heat stroke are an extremely high body temperature (above 103°F), red, hot, rapid/strong pulse, throbbing headache, dizziness, nausea, confusion, and unconsciousness.

Recommendations if Heat Stroke occurs:
- ***If you even suspect heat stoke contact emergency medical personnel immediately.***
- Get the victim to a shady area.
- Cool the victim rapidly, using whatever methods you can. For example, immerse the victim in a tub of cool water; place the person in a cool shower; spray the victim with cool water from a garden hose; sponge the person with cool water; or if the humidity is low, wrap the victim in a cool, wet sheet and fan him or her vigorously.
- If emergency medical personnel are delayed, call the hospital emergency room for further instructions.

Pre-match Nutrition

Before a tennis match begins, a player should focus on "topping off" muscle energy stores. To ensure this, the emphasis of a pre-match diet should be on consuming

carbohydrates. A player can also “carbo-load” by emphasizing an increased carbohydrate intake over the several days just before the start of a tournament while at the same time progressively decreasing the overall training volume. This will allow a tennis player’s internal carbohydrate stores and fluid/electrolyte balance to be topped off before beginning a first-round match. There should be little protein or fat in a pre-match meal.

Before the match, a player should also be sure to drink fluids on a regular basis (beginning at least the night before). This can include water, but a variety of other drinks should be consumed as well – juice, milk, and sport drinks are good options.

Ideally, players should try to eat a moderate-sized meal several hours before play begins, and a smaller snack 1 to 1.5 hours before the match. 16-20 oz. of a sport drink along with a high-carbohydrate sport bar or other solid carbohydrate food works well as a pre-match snack. Sometimes players are too nervous to eat solid food prior to a competition; in these situations, a liquid carbohydrate meal with a small amount of solid food often is better tolerated.

Nutrition During Play

Carbohydrate, water and in some cases electrolytes are the only principal nutrients that need to be consumed while playing tennis. Therefore, it makes perfect sense to drink a carbohydrate/electrolyte sport drink during play. These beverages have several distinct advantages over water alone: They

a) Provide energy in the form of carbohydrate,
b) Have been shown to delay the onset of fatigue and perception of effort,
c) Promote voluntary fluid intake because of their taste
d) Provide electrolytes that help to maintain mineral and fluid balance.

All of these factors are important in maintaining performance, especially when playing in a hot environment. Sport drinks, designed for consumption during play, generally should have a carbohydrate concentration of 6-8%. Drinking 4-8 swallows of a sport drink on every changeover should provide enough fluid and carbohydrate for the average player.

It is also perfectly acceptable for players to drink water and eat small snacks during play. The snacks should be relatively high in carbohydrates and low in protein and fat. There is no need to drink a sport beverage if the player is drinking enough water and replenishing energy supplies with food. Again, a player should drink 4-8 swallows of water on every changeover to stay hydrated.

Post-match Nutrition

After a match, a tennis player’s primary nutritional interest should be on starting the

recovery process. This means getting carbohydrates, fluids, electrolytes and a small amount of protein into the body. Whether the next match is scheduled to begin within 1-2 hours, or the next day, re-hydration and carbohydrate intake should begin immediately. High-carbohydrate sport drinks, along with sport bars, gels, and other carbohydrate-rich foods are good choices to get the process started. After a match it is also important to address any remaining fluid deficit should be replaced by consuming about 24 ounces of fluid for every pound of body weight that was lost during play.

Energy stores are most effectively replenished if the player can consume a high-carbohydrate meal within the first 2 hours after a match. The longer the player waits to eat, the longer it will take to replenish the body's energy stores. Ideally a player will get some carbohydrate and a small amount of protein into the body within 10 minutes after play has ended to start the recovery process off on the right foot.

If a player has multiple matches in a day second, he or she should generally follow the pre-match nutrition guidelines as much as possible. The more time a player has to eat between matches, the more variety he or she can have in choosing foods.

Nutritional Questionnaire

Finally, we have included a nutrition questionnaire (page 155) that was designed by member of the United States Tennis Association Sport Science Committee, for your usage. This questionnaire can be filled out by your players and mailed or faxed to:

USTA Training Center, Boca Raton
10399 Flores Drive
Boca Raton, FL 33428
Phone: (561) 962-6400
Fax: (561) 962-6401

Sports Medicine

Introduction

Injuries are a fact of life in almost every physical activity, and tennis is no exception. With the amount of tennis that today's high performance players play it is very unlikely that anyone will make it through their career without sustaining an injury of some sort. With that said, it is important to realize that not all injuries are created equal. Some injuries, like a sprained ankle, are accidents and "just seem to happen;" there is not much a player can do to "better prepare" for that type of scenario. However, there are other injuries that are directly related to preparation and technique. These are injuries that likely can be avoided if a player takes the time to learn, and use, proper technique while also conditioning the body to handle the demands of tennis.

In addition to the information presented in this chapter, several other pieces of information have been included in the Sports Medicine chapter. This material includes:

- USTA's Emergency Care Guidelines
- USTA High Performance Profile
- *High Performance Coaching Newsletter* article on the "High Performance Profile"
- *High Performance Coaching Newsletter* article on "Injuries and Technique"
- *High Performance Coaching Newsletter* article on "Wrist Injury Prevention"
- *High Performance Coaching Newsletter* article on "Strengthening the Core"

Acute and Overuse Injuries

There are two basic classifications of injuries that one may incur:

- **Acute Injuries** are injuries that occur as a result of a single traumatic event, e.g. breaking a bone or spraining an ankle.

- **Overuse Injuries** are injuries that occur when repeated stress is applied to body tissues resulting in overload and breakdown, e.g. tendinitis that leads to elbow or shoulder pain. As the name suggests, overuse injuries occur over time. The damage does not occur all at once, but instead a muscle, bone or tendon is damaged a small bit at a time until it eventually causes pain. Overuse injuries can typically be prevented by either allowing proper rest between practices or events or by maintaining proper stroke mechanics.

Most players will likely experience acute and overuse injuries in the course of their playing careers. Let's take a look at some of the more common injuries seen in tennis and how they can be recognized.

Common Injuries in Tennis

While it would be impossible to list out every possible injury that a tennis player might encounter, it is beneficial to highlight some of the more common injuries. The following table presents a list of common injuries, potential causes and ways they can be prevented.

Injury	Symptoms	Cause	Prevention
Muscle Strain	• Muscle soreness • Swelling	• Too much weight lifted • Tight muscles	• Proper warm-up • Train smart and don't lift too much weight
Ankle Sprain	• Ankle pain • Swelling	• Twisted ankle	• Wear shoes that better support the ankle. • Proprioceptive/ balance training
Plantar Fasciitis	• Pain in the bottom of the foot/heel, especially in the morning	• Over pronation • Tight calf muscle • Flat feet	• Orthotics • Calf stretching • Foot massage
Patellar Tendinitis	• Pain in the front of the knee, especially when jumping • Swelling	• Repeated jumping • Hard Landing • Running on a hard surface • Strength imbalance	• Quadriceps stretch • Leg strengthening • Run on softer ground
Achilles Tendinitis	• Pain in the Achilles tendon • Swelling	• Flat feet • Over pronation • Hill running • Poor running mechanics	• Wear orthotics • Stop hill running • Better Shoes
IT Band Syndrome	• Pain on the lateral side of knee when the knee bends • Swelling	• Too much running too fast • Over pronation • Old shoes • Poor running mechanics	• Reduce running mileage • New shoes • Wear orthotics
Tennis Elbow	• Pain on the lateral part of elbow	• Repetitive use of the muscles in the forearm (like tennis or painting)	• Strengthen the muscles of the forearm • Lift objects with palms facing medially • Stretch the forearm muscles after play
Stress Fracture	• Pain in foot, ankle, tibia or hip	• Repetitive trauma that comes from running	• Slow, progressive increase in running intensity

			• Do not wear worn-out shoes • Eat a healthy diet
Shin Splints	• Pain in the front of the shin, especially when running • Sometimes pain in the back of the shin	• Too much running without enough rest • Poor running mechanics • Calf muscle tightness	• Slow, progressive increase in running intensity • Calf Stretching • Do not wear worn out shoes
Rotator Cuff Tendinitis	• Shoulder pain on overhead activity • Pain when you bend the arm and rotate it outwards • Pain on the outside of the shoulder possibly radiating down into the arm • Pain in the shoulder which is worse at night • Stiffness in the shoulder joint	• Overuse • Poor mechanics • Drastic increase in training load	• Strengthening the rotator cuff muscles, particularly in external rotation • Proper warm-up • Post-play stretching
Wrist Pain	• Wrist painful to the touch • Swelling • Pain when moving against resistance	• Improper technique. • Overuse.	• Strengthening of the wrist muscles • Proper warm-up • Post-play stretching
Low Back Pain	• Pain in the back • Pain radiating down the arm or leg • Muscle soreness • Muscle spasms • Tightness/ loss of movement	• Poor lifting mechanics • Poor posture	• Proper warm-up. • Proper lifting mechanics • Core strengthening. • Maintain good posture • Use a cervical pillow when sleeping • Post-play stretching
Black Toe/ Tennis Toe	• Mostly affects the second toe (index toe) as blood accumulates under the nail	• Mostly caused by improper fitting shoes	• Ice lightly compressed on area in mild cases • Minor surgery to drain blood in more serious cases (Please consult a Podiatrist for this procedure)

Injury Prevention

Preventing an injury before it occurs, obviously is what you want to do if you can. Here are some simple steps that can be followed to help reduce the risk of injury.

1. *Warm-up properly before practice and competition.* Perform a dynamic warm-up before play to get the body ready for the demands of high-intensity tennis. Also be sure to hit lightly after the warm-up – do not go right into all out play.

2. *Stretch at the end of practice to maintain flexibility.* Flexibility is important for tennis players and some stretching exercises are presented in the section on strength and conditioning. Stretching should not be performed before you play however, and should be done after practice. Research has shown that stretching before play decreases the power and force your muscles can generate.

3. *Start strength training.* Do some basic "pre-habilitation" exercises to strengthen the areas of the body that typically get injured in tennis, including the shoulder, back and core of the body. Sample exercises are provided in the strength and conditioning chapter.

4. *Perform conditioning exercises.* Conditioning essentially means improving your fitness. Increase your fitness and you will be less likely to fatigue and will also decrease your risk on injury.

5. *Use proper equipment.* Wear good fitting shoes that are suited for the surface you are playing on. Also, do not use rackets that are too big or heavy for you.

6. *Adjust to the weather.* Prepare for extreme weather conditions. If you are playing in the heat, wear clothes that wick moisture away from your body and drink plenty of fluids.

7. *Use proper technique.* Technique plays a large role in injury prevention. So much so that it gets its own paragraph. Read on to see why technique is so important to playing injury-free tennis.

Importance of Technique in Injury Prevention

Technique should be one of the cornerstones of effective, injury-free tennis. The body is an amazing structure and it is incredible what players can make it do on the tennis court. However, there are also limits to how the body can perform. When the muscles, tendons and bones are pushed past their limits, injuries can occur.

Probably the type of injury most coaches and players are familiar with is tendinitis – especially in the shoulder, elbow or knee. Most types of tendinitis occur as the result of overusing or placing excessive stress on a muscle or tendon. In many instances the

added stresses the body experiences are due to improper technique. When practicing the serve, for example, fatigue in the shoulder and scapular muscles can lead to a breakdown in technique, which in turn places undue stress on the muscles and tendons of the rotator cuff. While it is not likely that the amount of damage done during one "poor serve" alone cause shoulder pain, every time technique is compromised, a little more damage is done. Overtime these repetitive "micro-traumas" add up to produce an injury--in this case tendinitis in the shoulder.

The USTA High Performance Profile

The USTA has also developed a series of tests, called the High Performance Profile (page 178) that can be used to assess areas of weakness and identify sites where injuries may occur. A copy of the High Performance Profile in included as an attachment to this chapter, but looks mainly at the shoulder, legs and the core of the body to assess strength and flexibility imbalances that could lead to injury. Please make copies of the High Performance Profile and have a therapist or physician put your players through the tests to get an idea of where they need to work on building additional strength or flexibility.

Treatment of Injuries

Most of the injuries tennis players suffer are not life threatening nor are they so severe that they require immediate medical attention from a doctor. There are many things that you, as a coach or a player, can do to treat injuries like tendonitis or muscle strains.

The best thing you can do when treating an injury is to think of the word **PRICE**. PRICE is an acronym to describe the first basic steps you should take for treating a muscle or tendon injury.

P - **Protection**: Immobilize the area that is affected to encourage healing and to minimize any additional damage to the area.

R - **Rest**: Avoid performing any activity that causes pain in the injured area. If your patellar tendonitis acts up when running, do not run. However, resting does not mean complete inactivity. Look for other activities that do not involve the injured body part to maintain conditioning. Cross-training activities like cycling or swimming may be effective.

I - **Ice**: Ice should be applied to the injured tendon for 15-20 minutes every 2-3 hours you are awake during the first 72 hours after the injury has occurred. This will help to minimize inflammation.

Note: To minimize the risk of cold injury, do not apply the ice directly to the skin. Use a washcloth or piece of fabric between the ice and your skin.

C - **Compression**: Compression will also help to minimize inflammation. Use an ACE bandage to wrap the injured body part firmly, but do not wrap the bandage so tightly that it interferes with proper circulation. Start wrapping at the point farthest from the heart and loosen the bandage if you feel numbness or increased pain.

E - **Elevation**: To reduce swelling, elevate the injured area above the level of your heart. This is especially important at night.

Anti-Inflammatory Medication

Anti-inflammatory medication such as Advil or Motrin is often used to treat the pain and swelling associated with an injury. Generally, non-steroidal anti-inflammatory medications are recommended (NSAIDS). However, keep in mind that these medications are only recommended for short-term use, and should not be used to treat long-lasting injuries without a doctor's permission.

<u>Caution</u>: Use any medication only as instructed on the product label or as prescribed by a physician. Seek medical attention if the injury is severe. Individuals with liver problems should consult their physician prior to taking any drug containing acetaminophen.

Overtraining and Over-reaching

Many times we hear stories of players being overtrained. But what does that mean? One of the best ways to describe what overtraining is and how it can be recognized is to go through the following series of questions and answers.

What is over-reaching?
Over-reaching is pushing the player past what he or she is currently unable to do. All training is based around applying a stimulus, whether it is lifting more weight or running at a faster pace, which causes the body to adapt and become 'stronger.' When these training stimuli are applied, and proper rest is given, the tennis player should become stronger, faster and be able to play at a higher level. Over-reaching is a normal and desired training response.

What is overtraining?
Overtraining is the physical and/or mental exhaustion that athletes may reach when the physical, mental and emotional demands of competition and training, become too much. At this point he/she has reached such a high level of exhaustion that distinct signs and symptoms are exhibited with or without the athlete's awareness.

Keep in mind that there is other events in player's life that contribute to the stress he or she feels and can contribute to overtraining. Things like school, relationships, and personal problems all combine with the physical stress tennis places on the body. It is important for a coach to be aware and considerate of what is going on off the court when developing a practice. Do not assume that the physical work a player does in practice is the only stress he or she is dealing with.

How do you spot overtraining?
To spot the signs and symptoms of overtraining one needs to pay attention to the player's behavior and physical state. Be particularly aware if a player exhibits:

- chronic fatigue
- Irritability,
- mood shifts,
- a decreased interest in sport,
- weight loss,
- slower reflexes,
- reduced speed, strength, or endurance, and/or
- poor performances in sport, school, or work.

Another way to monitor overtraining is to have the player measure her resting heart rate at the start of each day – before she has even gotten up from bed. If the player finds that her resting heart rate is going up over a period of time, this can indicate that the player's body is having difficulty responding to the work it is being asked to perform and is not recovering properly.

What is the negative impact of overtraining?
Overtraining adversely affects tennis performance as well as the sociable abilities of your players, but more so, it affects his/her desire to participate in tennis. Overtraining also may expose a player to an increased risk of injury or illness. This can consequently disrupt the player's ability to perform at his/her peak.

If overtraining is suspected, how should one address the situation?
The key to addressing this situation is to have an open door policy that is complemented by the development of a sincere relationship between the coach and his player. What this does is allow the coach to be able to confront a player that seems to be experiencing the signs and symptoms of overtraining, while allowing the player to feel secure enough to express the way that he/she is truly feeling. Additionally, it is a great idea to encourage your players to express when they may be feeling run-down or stale, so that you may be able to lighten their training loads or allocate additional rest days.

Seeking a Doctor

Not every injury warrants a trip to the doctor. However, if pain is severe, or persists for more than a few days it is advisable to seek out medical attention to determine the best course of action for treating the injury. Here are some steps to consider in developing a "Sports Medicine Team."

Developing a "Sports Medicine Team"

Many times it is good to have thought through what doctors you will want to use before and injury or illness actually occurs. There are a large number of doctors out there to choose from and it pays to do some homework when choosing health care workers you or your players will work with. It is important that you also look for health care providers who are familiar with the demands of a serious tennis player. For example, many doctors may advocate long periods of rest to treat an injury. A doctor familiar with tennis, on the other hand, may suggest a shorter period of rest followed by some alternative training guidelines that will allow a player to maintain his fitness and/ or tennis specific skills. Assembling a care team is something that can be done now before an injury has occurred.

To help you with knowing who should be on this "care team", we have provided a list of specialists and what they do. Knowing what resources you need is half the battle in setting up your team. Don't be afraid to call around and ask other tennis players to find the specialists who really know tennis.

General Medical Doctor – Someone trained in conventional medicine and can diagnose and treat "typical" illnesses and diseases.

Orthopedist – A medical doctor who specializes in the prevention or correction of injuries to the skeletal system and associated muscles, joints, and ligaments. An orthopedist will be able to help with the diagnosis and treatment of muscle or skeletal injuries that are common in tennis.

Physical Therapist – A physical therapist often assists in the treatment and rehabilitation process following an injury. They are trained to use of various techniques to promote healing and often work closely with orthopedists.

Athletic Trainer – An athletic training is an individual trained specifically in athletic health care. The athletic trainer is typically an on-site medical professional who often provides the first line of treatment for an injury. Players suffering severe injuries will likely be referred to an orthopedist.

Podiatrist – A podiatrist specializes in the diagnosis and treatment of diseases and disorders of the human foot. This is a specialized branch of orthopedics.

Pediatrician – A pediatrician is a general doctor who specializes in treating infants and children.

Emergency Action

Every coach should have an emergency action plan in place for each facility where he/ she coaches. The emergency action plan is a pre-determined protocol for dealing with any emergency that may arise during the course of training or competition. This action plan should also be clearly posted for all to see. Coaches, players, and parents should all be aware of this action plan for two specific reasons:

1. It allows for rapid treatment to be provided for a player suffering an injury and
2. It helps to minimize panic in the event an injury/emergency should occur.

It is also necessary to practice what you would do in the event of an emergency. While "book knowledge" is great, a "working knowledge" is even better when it comes to dealing with an emergency. Regularly run through scenarios with your coaches, parents and players so that everyone is familiar with the procedures should an emergency occur.

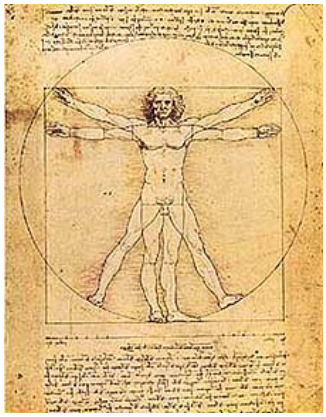
Additional information on being prepared for an emergency is included in the attached USTA Emergency Care Guidelines for Tournament Directors.

Emergency Response and CPR

While it is not a requirement for coaches to be qualified in either First Aid or CPR, we believe that it is a coach's professional responsibility to provide a safe practice environment. As such, we constantly advise coaches to seek certification in First Aid and CPR, emphasizing that this would allow them to be the first line of defense in the event of an untimely mishap. For more information on how one becomes certified in either of these care providing fields please go to the American Red Cross- Health and Safety Services website at www.redcross.org/services/hss/courses.

Biomechanics in Tennis

What is Biomechanics?



Biomechanics is commonly associated with tennis technique since this is the branch of science that deals with the natural laws of physics and examines how forces impact the body and influence its movement. Biomechanics also includes design of new technology and how the body interacts with racket, for example, or court surfaces. When tennis 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.

Introduction

Biomechanics and technique are two of the most commonly studies areas in tennis. Everyone wants to hit a serve like Andy Roddick or move like Justine Henin-Hardenne. It is not uncommon for coaches and players to spend hours and hours viewing videotapes to figure out why the best players in the world can do what they do. What modifications have they made to their technique to allow them to elevate their game? The answers to these questions could fill several books. The goal of this chapter is to discuss some of the fundamental principles of biomechanics and how they relate to technique. With this knowledge and understanding coaches can analyze technique differently and/or describe things to players in ways they could not before.

To better understand biomechanics and technique it is important to first go through several biomechanical terms and principles. These can be seen as the fundamental concepts in biomechanics and are described in the following pages.

Forces and Torques

A force is simply a push or pull and it changes the motion of a body segment or the racket. Motion is created and modified by the actions of forces (mostly muscle forces, but also by external forces from the environment). The types of forces the body is likely to experience are:

- Muscular forces that generate movement
- Ground reaction forces that result when the foot hits the ground.
- Weight – the force of the body acting under gravity.
- Environmental forces, like the wind.

- Frictional forces where the shoe interacts with the court, but also when the ball impacts the racket strings.

A torque is the tendency of a force to cause an object or body segment to rotate. Think of a see-saw. When a person sits on the see-saw it rotates about the fulcrum (the rotation point at the middle of the see-saw) so that the seat moves closer to the ground. In this case, the person's weight (a force) generates a torque that causes the see-saw to rotate. If a heavier person sits on the other side of the see-saw, he or she will generate a larger torque (because of the greater weight) in the opposite direction causing the first person will be lifted off the ground again.

In the body muscles cause the body segments to move by generating a force that then produces a torque about a joint. The forces muscles generate can be seen much like the people sitting on the see-saw. When a muscle contracts it pulls on the bones it is attached to, causing a rotation at the fulcrum, or in this case the joint.

Example: The biceps muscle inserts into the radius bone in the forearm. When the biceps muscle contracts it pulls on the radius, producing a torque that causes the elbow joint to rotate – in this case the elbow joint flexes. The triceps muscle, on the other hand, produces a torque in the opposite direction (like the person sitting on the other side of the see-saw). When it contracts it generates an extension torque causing the elbow to straighten. Whichever torque is greater (flexion or extension) will determine which way the elbow joint rotates.

Forces and Newton's Laws of Motion

Sir Isaac Newton developed three laws that govern how forces impact movement. It is likely that these laws are familiar to but it is worthwhile to describe them again since all three impact tennis players and their movement and interaction with the racket and environment. The three laws are usually referred to as the laws of inertia, acceleration, and reaction.

- ***Law of Inertia***. Newton's first law of inertia states that objects tend to resist changes in their state of motion. An object in motion will tend to stay in motion and an object at rest will tend to stay at rest unless acted upon by a force.

  Example—The body of a player quickly moving across the court will tend to want to retain that motion unless muscular forces can overcome this inertia.

- ***Law of Acceleration.*** The acceleration (tendency of an object to change speed or direction) an object experiences is proportional to the size of the force and inversely proportional to the object's mass. This law is sometimes better known as F=ma.

  Example—If a player improves leg strength through training while maintaining the same body mass, she or he will have an increased ability to accelerate the body

using the legs, resulting in better agility and court speed.

- ***Law of Reaction.*** The third law states that for every action (force) there is an equal and opposite reaction force. This means that forces do not act alone, but occur in equal and opposite pairs between interacting bodies.

  Example—The force created by the legs "pushing" against the ground results in ground reaction forces in which the ground "pushes back" and allows the player to move across the court. This action-reaction also occurs at impact with the ball as the force applied to the ball is matched with an equal and opposite force applied to the racket/body.

Power

It is not uncommon to hear that tennis is becoming more of a power sport every year. But what does that mean. Power is the term used to describe an action that is performed rapidly and forcefully. This makes sense when talking about tennis, since we have seen an evolution of the game to the point where players can move and hit balls forcefully and with great speed.

Mathematically power is equal to force multiplied by velocity. From this equation it should be clear that a player could produce more power in their strokes by doing one of three things.

1. Generate greater force, while keeping the same movement speed,
2. Produce a faster movement while maintaining the force output, or
3. Increase speed and force production simultaneously.

Tennis players also train their bodies to be able to produce more power. When performing exercises designed to improve power (like plyometric exercises) players need to be fresh and unfatigued, and perform the movements as quickly and as forcefully as possible.

Center of Gravity

A player's center of gravity is an imaginary point around which body weight is evenly distributed. It is the balance point in the body. Typically the center of gravity is located in the middle of the body around the level of the belly button. The center of gravity of the human body can change considerably as the segments of the body move in relation to the trunk.

A tennis racket also has a center of gravity and this can be identified as the point where the racket balances on your finger or another narrow object.

Balance

Balance is the ability of a player to control her or his equilibrium or stability. There are two types of balance a player will need:

- Static balance is balance without movement. A player with good static balance is able to control the body in a stationary posture. Standing on one foot, or preparing to hit a serve are examples of static balance

- Dynamic balance is balance during movement. A player with good dynamic balance can control the body while moving around the court. Good dynamic balance allows a player to hit shots with greater accuracy as well as change direction and recover more effectively after hitting a shot.

Both types of balance are necessary in tennis and movement training, and learning how to move while staying balanced and in control should be a part of every player's conditioning plan.

Momentum

Momentum is related to an object's mass and speed. Mathematically, momentum is equal to mass multiplied by velocity. Momentum is essentially the quantity of motion an object possesses. A heavy object traveling at a high rate of speed will have a great deal of momentum, while a light object traveling slowly will have very little momentum. There are two types of momentum a tennis player and coach should be aware of.

- Linear momentum**,** as the name suggests, is momentum in a straight line. For example, linear momentum is created by the forward step in a square stance forehand as the body (and its mass) moves in a straight line towards the net.

- Angular momentum is rotational momentum and is created as the body and body segments rotate. As an example, the open stance forehand uses angular momentum as the body rotates when performing the stroke.

The tremendous increase in the use of angular momentum in groundstrokes and serves has had a significant impact on the game of tennis. One of the main reasons for the increase in power of the game today is the incorporation of angular momentum into these strokes.

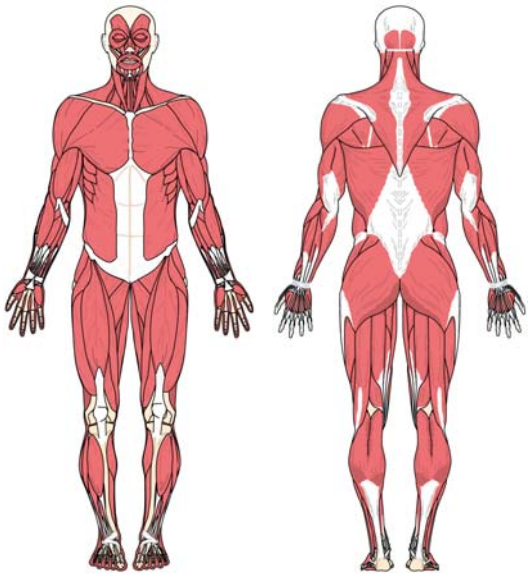
Several interesting facts about momentum are that

- Angular momentum can be transferred from one object to another. The body generates a great deal of momentum when performing a shot and some of this is transferred to the ball at contact.
- One form (linear or angular) of momentum can be converted into the other. The body when preparing to hit a shot may develop angular momentum. However, at

ball contact, this momentum is converted to linear momentum and transferred to the ball – evidenced by the fact that the ball travels in a line.

Muscle

A chapter on biomechanics would not be complete without discussing muscle. Muscles are the tissues in the body that fuel all movement. They are also very unique and demonstrate a number of properties that contribute to their importance in tennis. Let's look at muscles in greater depth.



- Muscle is the only tissue in the body that can actually generate force. Other structures like tendons and ligaments transmit force, but only muscle can produce force.

- Muscle exhibits a force-length property, meaning the amount of force a muscle can generate is dependent on its length. A muscle has an optimal length where it can generate the maximum amount of force. When a muscle is too short (inflexibility), too long (over stretched), or close to the end of its range of motion, the force it can produce is decreased.

- Muscle exhibits a force-velocity property, meaning the amount of force a muscle can generate is dependent on the speed of the contraction. Muscles can generate maximal force when contracting slowly. As the speed of a movement increases, the amount of force decreases. Think about lifting a weight. You can lift a lightweight very fast, but when you are approaching the maximum weight you can lift, you are only able to move it very slowly.

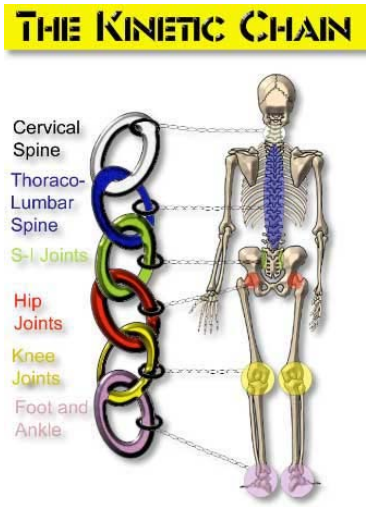
- Muscle acts as a spring to store energy and return it to the body. When a muscle is stretched while it is active it actually stores energy. Then when the muscle subsequently contacts, this energy is released allowing the muscle to produce a more forceful contraction. This unique aspect of muscle can be used to a tennis player's advantage in many instances. Muscles can be "put on stretch" or preloaded, then this stored energy can be released as a player moves or hits a shot. One example of this is the split step.

The Split Step, The Key to Balance and Control

One of the most important footwork fundamentals is getting into a ready position and preparing for the ball. The timing of a hop, or split step, as the opponent strokes the ball is vitally important to facilitate quick movement to the ball. Lowering the body's center of mass (bending the hips, knees, and ankles) as the opponent strokes the ball puts the muscles of the legs "on stretch", which then maximizes muscle force that can be generated and permits the use of elastic energy to initiate a quick movement to the ball. The slight tension that is placed on the calf, quadriceps and hip muscles allows them to respond quickly and with more force than if the player were to move from a "flat-footed" position, without having performed the split-step.

The Kinetic Chain

All of the different parts of the body are linked together, forming what has been called the "kinetic chain." In essence what this says is that what happens in one part of the body impacts what happens everywhere else in the body. The flip side is that is one part of the body is not functioning properly, the player will not perform optimally.



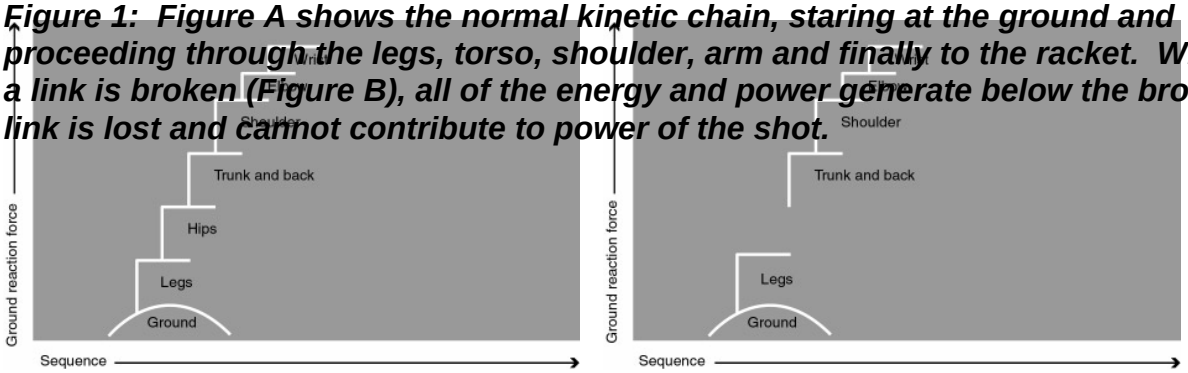
The parts of the body act as a system of links in a chain, whereby the energy or force generated in one link (or part of the body) can be transferred successively to the next link.

The link system in the service action, which starts from the ground, can be explained in the following way:

1. *Leg drive*
2. *Trunk rotation*
3. *Upper arm elevation*
4. *Forearm extension, upper arm internal rotation and forearm pronation*
5. *Hand flexion*

The most effective tennis strokes begin with leg drive generating ground reaction forces that can be transferred up the segments of the kinetic chain to the racket. The optimum coordination (timing) of these body segments and their movements will allow for the efficient transfer of energy and power up through the body, moving from one body segment to the next. Each movement in the sequence builds upon the previous motion and they all contribute to the generations of racket speed.

Figure 1: Figure A shows the normal kinetic chain, staring at the ground and proceeding through the legs, torso, shoulder, arm and finally to the racket. When a link is broken (Figure B), all of the energy and power generate below the broken link is lost and cannot contribute to power of the shot.



This transfer of energy up the chain in a sequential manner is also enhanced by the energy storing properties of muscle. The stretch-shortening cycle involves the active stretching (the muscle is activated but is elongated by another force) of a muscle in a countermovement immediately followed by a more forceful shortening of the muscle in the desired direction. In the forehand, for example, the chest and shoulder muscles are actively stretched (coaches often use the cue “loading” here) as the trunk rotates into the shot and the inertia of the arm and racket cause them to lag behind.

The active stretch of the muscle stores energy, which is reused as the muscle, begins to shorten. This sequence of muscular coordination tends to be chosen naturally by the brain, but sometimes this must be coached in players who develop pauses, that in turn lead to missed segment rotations or problems in sequencing segments.

When the kinetic links are used appropriately (Figure 1A) and much of the stroke power is generated from the legs and trunk, the upper arm does not have to generate a great deal of power itself. Therefore the risk of injury is relatively low. However, if a player has a broken link (Figure 1B) or they are mistimed, undue stress can be placed on the shoulder and upper limb, possibly leading to injury. The reason for this is that if the large muscles of the legs and torso do not generate the power, the smaller muscles of the shoulder and upper body will have to “pick up the slack” and try to do more that they are capable of. This overuse can eventually lead to tendonitis or another injury.

Choosing a Racket

As we mentioned, biomechanics also encompasses the technology side of tennis and nowhere have technological advances been made as they have in the area of rackets. The rackets players select will strongly affect their tennis play. Unfortunately, the aggressive marketing of tennis equipment manufacturers focuses players’ attention on “innovative” and “high-technology” design features that may not improve play or lower the risk of injury. You can help reduce some of this misinformation, but much is still not known about how racket design elements interact with the player in affecting performance or risk of injury.

Many features of tennis rackets dramatically affect performance. Some key design features that have been researched and have stood the test of time are the variations in head size, frame width, and racket mass and distribution of mass. Grip size and other design factors also should be considered. Probably the most influential racket variable is the size of the head.

- Head size. Larger head sizes (oversized versus midsized) create higher speeds of ball rebound and have a larger sweet spot. (The term sweet spot here is used to mean the area on the racket face where the ball rebound is the fastest and most accurate. Other points on the racket face minimize the shock or vibration that is transmitted to the hand.) A large racket head also dramatically increases

the racket's resistance to twisting in off-center impacts.

- Frame width. Another key design variation is the width of the racket frame. Increases in the width of the frame increase its stiffness and eventually the speed of ball rebound (since not as much energy is spent bending the racket). The cost of such increases is the transmission of a greater impact shock to the arm.

- Frame mass. Modern tennis rackets have been getting lighter and lighter. However, greater racket mass is directly proportional to greater speed on a ball, if all other variables remain equal. The other advantage of a racket with more mass is that this mass helps protect the player's arm by being more resistant to the acceleration of impact.

- Distribution of racket mass. The resistance to rotation of the tennis racket (swing weight) depends on where you grip the racket and the distribution of racket mass, more than just the mass itself. A racket can be relatively light, yet be head heavy and feel harder to swing.

- Grip size. Help players select the correct grip size. A grip that is too small will be maneuverable, but will cause the muscles of the forearm and hand to work very hard to grip the racket. Larger grips are easier on the gripping muscles, but the hand/wrist will be less mobile.

Finally it should be stated that the key mechanical variable in ball speed is the speed of the racket not its structure. It is therefore critical that good technique be the primary aim of all coaches.

Spins

The spin of the ball is another area of biomechanics that impacts play. A player can put topspin, backspin or sidespin on the ball, and each of these will affect the ball's flight and movement once it contacts the ground.

- Topspin. Topspin is created by upward motion of the racket through impact. For heavy topspin forehands, the path of the racket through impact is from low to high, usually between 40 and 50 degrees upward. Skilled players may use even steeper racket paths and some small closing of the racket face. Groundstrokes hit with topspin tend to bounce higher than slices because topspin balls curve steeply down toward the court.

- Backspin or slice. Slice forehands and backhands are created by downward racket motion through impact. Research has shown that most slice strokes follow a 15- to 30-degree downward (high to low) path, again with only small amounts of opening of the racket face. A steeper downward path and clear open racket face are used for drop shots. Slice shots bounce lower than shots with topspin because of the very flat trajectory of these shots.

- Sidespin. Sideward motion of the racket through impact creates sidespin on the ball. Slice serves and inside-out forehands are good examples of sidespin. Research has shown that in slice serves the racket usually moves forward and to the sideline at 15 to 40 degrees from the center service line.

Facts and Fallacies of Biomechanics

Below some common questions related to biomechanics are presented along with the answer. These questions can be used to ask the players or to improve your knowledge as a coach.

1. The fewer body segments involved in a movement, the less chance for error.

True - Although putting the entire body into a shot increases power, it is also necessary to have control over each shot. Use the example of the ball toss. A more accurate toss generally entails tossing the ball with the upper limb and keeping the elbow and wrist firm. Bending the elbow and wrist when throwing the toss will result in a less consistently accurate toss.

2. Keep the ball on the strings as long as possible.

False - It is impossible to hold the ball on the strings. A player can lengthen a follow through to increase control over the ball. Or a player can disguise a shot by waiting a little longer to hit the ball. But a player cannot control how long the ball is on the strings.

3. Roll the racquet head to produce topspin.

False - Topspin is produced when a player swings from low to high and brushes the backside of the ball. The more vertical the swing, the more topspin is produced. The rollover does not begin until the ball is about 3 feet off the racquet.

4. The racquet face must nearly perpendicular to the ground to achieve optimal impact.

True - This is true in most cases, the exception being when underspin is applied. Otherwise the racquet should be perpendicular to the ground within 5 degrees in either direction.

5. Larger headed racquets have a larger hitting zone and also absorb vibration better

than conventional racquets.

True - The larger head and small weights along the perimeter of the racquet head increase the resistance and the hitting zone of the larger headed racquets.

6. Run with the racquet back.

False - Expert players should not run with the racquet back. To obtain the maximum mobility, players should run in the normal pumping action associated with sprinting.

7. Hit down on your serve.

False -Although players have the sense that they are hitting down on the ball when serving, very few people actually can or do. The height and speed needed to hit down on the ball is nearly impossible to achieve. It is much better to hit the ball straight out when serving or to hit up on the ball.

8. Feel the ball on the strings.

False -As was the case in number 2, the racquet is on the strings for a very small period of time. The ball travels so quickly that by the time the player feels it on the strings, the ball has traveled 3 feet away from the racquet.

Strength Training for Tennis

Introduction

The game of tennis is becoming faster and faster and players are able to hit powerful shots from virtually anywhere on the court. As a result, players need to train their bodies to meet these increased demands. Strength and conditioning is becoming an ever-increasing component of today's training program. Think about all of the physical characteristics a player needs in today's game:

- ***Strength***
- ***Power***
- ***Endurance***
- ***Speed***
- ***Agility***

And this is only a partial list. As a coach, you will be better able to assist players develop their game with a basic understanding of the concepts and principles of strength training.

In addition to the written information presented in this chapter, several other pieces of information have been included. This material includes:

- Sample circuit training plan.
- Movement drills for tennis.
- USTA Physical and Physiological Testing Protocol.

What exactly is strength training?

"Strength training" is synonymous with 'resistance training,' and the two terms can be used interchangeably. Strength training uses the principle of progressive overload to force the body (muscles, bones, tendons, etc.) to adapt in order to be able to produce and resist greater forces. Strength training is not power lifting, nor is it bodybuilding. Also, one does not need to lift weights to strength train. Many exercises can be performed simply using a player's body weight as resistance.

Understanding the Terminology of Strength Training

When discussing strength training it is beneficial to understand the terms that are used in this field. The following list of definitions outlines some of the common strength training terminology.

Repetition - A repetition is one cycle of an exercise movement, from start to finish.

Example: a repetition of the bench press begins when the weight is lowered to the chest and is not compete until the weight is pushed back to the starting position.

Set – A set is a series of repetitions completed in succession.

Example: 10 repetitions completed on a bench press, each performed one after another, are defined as one set of 10 repetitions.

Volume - The volume of work that a tennis player performs in the weight room is equal to the number of sets multiplied by the number of repetitions performed multiplied by the amount of weight lifted. This measure is used to gauge how strenuous a workout is.

Example: A tennis player performing the squat exercise, performs 2 sets and lifts 200 pounds a total of ten times in each set. The player has lifted a volume of 4000 pounds (200 pounds x 10 repetitions x 2 sets).

1-RM - 1RM stands for 1-repetition maximum, and is the term used to define the maximum amount of weight that can be lifted 1 time by the tennis player. Many times, the amount of weight a player is asked to lift is expressed as a percentage of his/ her 1-repetition maximum.

Example: The most weight a tennis player can lift in the leg press is 400 pounds. Therefore, his 1RM for the leg press is 400 pounds. He is performing a set in which he is instructed to perform 10 repetitions using a weight that represents 75% of his 1RM. The player should lift 300 pounds, or 75% of 400 pounds.

Intensity – Intensity can also be thought of as effort. An exercise or drill preformed with at 100% effort is likely performed with 100% intensity. Often times intensity is defined as the percentage of the 1RM weight that is lifted. A 1RM lift equals an intensity level of 100%. Most lifts are performed at a percentage of a player's maximal intensity.

Example: A tennis player who has a 1RM of 100 pounds in the shoulder press, is performing a set in which he lifts 70 pounds for 15 repetitions. The player performs this exercise at an intensity level of 70% (70 pounds is 70% of his 1RM).

Frequency - Frequency is the term used to describe how often an athlete engages in strength training.

Example: A tennis player engages in strength training on Monday, Wednesday and Friday. This represents a frequency of three (3) times per week.

Rest - Rest is the term used to describe the time taken between sets, or between workouts, to allow the muscles to recover.

Adaptations to Strength Training

The body is remarkable in that it adapts to the demands placed on it. Strength training is no exception. Strength training stimulates the growth of muscle and strengthens bones. Additionally, strength training improves the neural "connections" between the brain and the muscles, allowing them to communicate more efficiently.

Strength is also improved and occurs via two different mechanisms.

1. Neurological adaptations
2. Physical adaptations

The neurological adaptation occurs as the body's nervous system become more organized and better at communicating with the working muscles during a particular exercise or movement pattern. This response can occur quite rapidly and is usually the reason that players may say that they feel stronger in as little as two weeks after starting a strength-training program. This adaptation is very important, as the body is dependent on proper muscle recruitment and communication between the nerves and the working muscles during all activities. This is also the primary means through which young players experience strength gains since their bodies do not yet produce the steroid hormones, like testosterone, that promote muscle growth.

The physical adaptation in muscle involves an actual change within the muscles being exercised or trained. This adaptation is thought to involve both the enlargement of the existing muscle fibers that comprise a muscle and the splitting and development of new or more muscle fibers within a muscle. This change takes at least six to eight weeks, however, and so people must adhere to a strength-training program for an extended period to see this result.

Goals of Strength Training

Strength training for tennis can should have two goals:

1. To prevent injury, and
2. Enhance on-court performance.

It is important for all tennis players, even young players, to strengthen the muscles of the rotator cuff to maintain a proper strength balance in the shoulder. With young players, the goal of strength training should also be to increase muscular endurance. The goals of strength training should not shift to increasing maximal strength until after a player goes through puberty.

Muscle Contractions

As mentioned, muscle undergoes adaptation in response to strength training. However, muscles can contract in different ways and it is important to train muscles in each of these ways to optimally prepare them for the demands of competition. The three types of contractions a muscle can undergo are isometric, concentric, and eccentric contractions.

- ***Isometric contractions*** - Isometric means "equal length" and isometric contractions are those in which the muscle does not change length. Such contractions are used by the body to stabilize joints.

- ***Concentric contractions*** – Concentric muscular contractions are shortening contractions and are what most people think of when they picture a muscle contraction. In this type of contraction the ends of the muscle are drawn closer together. Concentric muscular contractions are typically used during the acceleration of body segments. For example, when the arm is accelerating forward during a serve, muscles in the front of the body, such as the pectorals, are contracting concentrically.

- ***Eccentric Contractions*** - Eccentric muscular contractions occur when muscle fibers lengthen. This allows the body to decelerate a movement. For example, during the arm curl exercise, the bicep muscle works eccentrically as the weight is lowered from the shoulder. If we were unable to perform eccentric contractions, the body would be unable to slowly control the lowering of a weight or object and uncontrolled shaky movements would occur.

  Example: In tennis, eccentric contractions are used by the muscles in the back of the shoulder such as the rhomboids and rotator cuff during the follow-through phase of the serve (following ball impact) to slow the arm and maintain joint integrity and control.

Eccentric contractions are harder on the body than concentric contractions in terms of the stress imparted to the muscles. This is important to keep this in mind, as excessive eccentric muscle work can lead to muscle soreness. This soreness typically presents itself 36 to 72 hours after exercise and has been termed delayed onset muscle soreness (DOMS). For this reason, eccentric training is usually used in a more limited fashion and combined with concentric muscle training to minimize the effects from delayed onset muscle soreness.

Types of Strength Training

The type of training that is performed in the weight room should be reflective of the needs and demands of the player. Depending on these needs, specific training

programs can target the desired results. In general, strength-training programs can be created to enhance a muscle's:

- ***Power*** - Muscle power is defined as the ability to move a weight or overcome a resistance quickly.

- ***Strength*** – Maximum muscle strength is defined as the greatest amount of force that a muscle can produce.

- ***Endurance*** - Muscle endurance is the ability of a muscle to contract for a long period of time against a light to moderate resistance.

  Example: Marathon runners, who run for hours at a time, require muscle endurance and are not as concerned with maximum strength or muscle size. They would need a strength-training program designed to increase muscle endurance.

- ***Size*** - For some individuals (e.g. bodybuilders), maximizing muscle size is the goal of their strength-training program. While muscle size may be desirable and visually pleasing, it does not necessarily help to enhance the performance. For this reason, power, strength, or endurance training are preferred over training designed to strictly build muscle size.

For the most part, the differences between the training programs designed to emphasize one of these variables involves manipulating the number of sets, repetitions and rest intervals. Let's look at the different types of training in a bit more detail.

Training for Endurance

Note: endurance should be the main emphasis of a tennis player's training program before puberty, shifting to power and maximal strength after puberty has occurred.

A program designed to train muscle endurance should use a lightweight that is lifted many times and with very little rest between sets. The player's muscles must get used to contracting often against a light resistance and recovering quickly.

Endurance Training Guidelines

Training for Endurance	
Load Lifted	< 70% of 1RM
Sets	2 – 4 sets
Repetitions per Set	15 – 25 repetitions per set
Rest Between Sets	Less than 30 seconds between sets

Strength training for endurance is an important component of a complete conditioning program for a tennis player, and it can greatly enhance performance when applied correctly. Here are a few general recommendations for training to build endurance:

- Use both concentric and eccentric contractions.
- Have players perform three sets of 12 to 15 repetitions.
- Set rest periods between sets of exercise that is specific to the sport of tennis, generally between 20 and 30 seconds.
- Do not strength train immediately before skill-oriented practice or tennis play.
- Do not have athletes perform maximal lifts.

Circuit Training

Circuit training, in which players rotate among several 'stations', can be used as part of an endurance-training plan. Players should follow the guidelines listed above, performing 15-25 repetitions of an exercise before rotating on to the next station. Players should go through the circuit 2-3 times to receive the maximal benefit.

A sample circuit-training plan accompanies this chapter and can be used as a starting point for developing your own training plan.

Training for Power

Note that training for power should not occur until after a player has gone through puberty.

Power building exercises should be performed as rapidly as possible using a relatively heavy weight. The weight should not be as heavy as the tennis player would use to build maximum strength (see below) because the emphasis is on lift the weight as fast as possible. Additionally, power lifts involve maximal efforts on each repetition. The number of repetitions included in each set should be low and the rest between sets high to allow for complete recovery between sets.

Power Training Guidelines

Training for Power	
Load Lifted	80 – 90% of 1RM
Sets	3 – 5 sets
Repetitions per Set	3 – 5 repetitions per set
Rest Between Sets	2 – 5 minutes between sets

Training for Strength

Note that training for maximum strength should not occur until after a player has gone through puberty.

Maximum strength is built by lifting very heavy weights for only a few repetitions per set. The loads lifted should be greater than 85% of the player's 1RM. The tennis player should perform 3-6 sets of each exercise and each set should contain between 2-6 repetitions. Since the effort exerted is so intense, the rest between sets should be between 2-5 minutes to allow for recovery.

Maximal Strength Training Guidelines

Training for Strength	
Load Lifted	> 85% of 1RM
Sets	3 – 5 sets
Repetitions per Set	2 – 6 repetitions per set
Rest Between Sets	2 – 5 minutes between sets

Quality vs. Quantity of Training

The quality of an exercise is how well the exercise is performed and is influenced by the technique and focus that are used when performing the exercise.

Example: A tennis player is trying to develop power in his lower body by performing the squat exercise. To ensure that he maintains a high level of quality, the player focuses on using proper technique and giving a maximal effort on every repetition. If the player is not able to maintain technique or give a maximal effort, he will stop the set.

Exercise quality should never be compromised in an effort to perform more repetitions.

Quantity refers to the volume of training, or the total number of repetitions performed.

Many athletes often sacrifice the quality of their training in an effort to increase quantity. This should be avoided since it leaves the tennis player open to injury and does not train the muscles properly.

Example: A tennis player wants to perform ten repetitions of the bench press exercise. She completes the first five repetitions easily, but starts to really struggle at repetition number seven. Even though she knows she may injure herself and that she is not performing the exercise correctly, the player lifts his lower back off the bench so she can complete the set. This is an example of a tennis player sacrificing the quality of an exercise in an effort to achieve a greater quantity.

Choosing quality over quantity will allow a tennis player to properly recover before the next training session and reduce the risk for injury.

Keys Principles of Training

There are several principles that should govern strength training. These include:

1. Ensuring proper rest and recovery.
2. Modulating exercise intensity and volume.
3. Choosing and appropriate frequency of strength training.
4. The principle of progressive overload.
5. Choosing appropriate exercises.
6. Choosing an appropriate exercise order.

These principles are investigated in greater detail below.

Rest

There are two times that rest is important for the tennis player who strength trains and each are important for different reasons.

1) Resting between sets (during a training session)
2) Resting between training sessions

Rest between sets is necessary to restore the energy levels within the muscles and recover from fatigue. During a training session, muscles become fatigued and are depleted of the energy sources they need to continue to strength train. Additionally, muscles generate waste products when they contract. Time is required for the body to "flush" these substances out of the working muscle before the tennis player should starts the next set. A general rule is that the more intense the exercise, the more time the player needs to take between sets to allow for the muscles to recover. For heavy lifts, the player should take between 2-5 minutes to recover before starting the next set.

Strength training causes damage to muscle and stresses the systems of the body. Rest should also be given between training sessions to allow the body to repair damage to the muscles and recover from the stresses that were placed on the body.

There are several general rules that pertain to the amount of rest that should be taken between training sessions.

- A tennis player should not train the same muscle group(s) on consecutive days. The player should take at least 48 hours between training sessions that involve the same muscle groups.

- Larger muscle groups, like the legs, require additional time to recover between workouts. It is advisable to allow 72 hours between training session that involve large muscles.

- The greater the intensity of the exercise, the longer the player should take before training that muscle group again, preferably 72 hours.

Modulating Volume and Intensity

While it would be ideal to be able to perform a high volume of strength training at a high intensity, that is not how the human body works. The body typically can only perform several repetitions at a high intensity before it becomes fatigued. This limits the volume of work that the player can actually accomplish in a training session.

In addition to the physical limitations of the body, there are other factors that will influence the intensity and volume a player should incorporate into his strength-training program. Most importantly, the player's training status influences the intensity and volume he should use.

Some factors that effect training status are:

- Age
- Previous training experience
- Health status
- Gender
- Environmental conditions
- Medications
- Involvement in other stressful activities.

All tennis players should begin strength training at basic level and progress systematically to more advanced and intense training plans over time. If a tennis player has no experience strength training he/she should begin with four or five basic exercises, three times per week. Each exercise should be performed for 2-3 sets of 8-12 repetitions. This is an example of low intensity and low volume.

As the player progresses he/she can add additional training days, greater volume or intensity and start to train for power, strength or endurance.

Progressive Overload

The concept of overload is that an exercise or activity must provide a 'stimulus' to the musculoskeletal system in order to improve the system's function. The body will adapt to the stresses and demands applied to it. The key, however, is overloading the body *progressively*. This means gradually increasing the stimulus, in this case the weight lifted, to improve strength. Applying too great a stimulus (too much weight, doing power exercises before building a strength base, etc) can lead to injury or overtraining as the muscles, tendons and bones are likely not able to handle these loads.

Frequency of Training

The frequency of strength training should be based on several factors including:

1. Exercise selection
2. Program structure,
3. Training status, and
4. Other stressful activities.

It is important for the coach and player to assess the level of preparedness, and honestly determine if the player is at a beginner, intermediate or advanced level in regards to strength training. This simple assessment will determine the player's tolerance for training stress and need for recovery between workouts.

Generally, three sessions of strength training per week are recommended for a player who is beginning a strength-training program. As the player adapts to training and his fitness levels improve, it is appropriate to increase the frequency of training to four or more sessions per week.

Training frequency should be adjusted to allow more rest between sessions for those who regularly use maximal or near-maximal loads. The player should be encouraged to alternate between "heavy" and "light" workouts.

Exercise Selection

Strength training exercises should be selected and prioritized with respect to

- The player's physical needs and strength training goals
- Training experience
- Available equipment
- Available training time.

It is beneficial to incorporate exercises into a program that will maintain muscle balance around a joint. For every "push exercise", there should be a corresponding "pull exercise."

Example: A tennis player performs four sets of a bench press exercise in a training session. To provide balance about the shoulder joint, she should also complement by four sets of pull ups (pull exercise).

Multi-joint exercises are movements that incorporate flexing or extending multiple joints at the same time. Multi-joint exercises are preferred for tennis players over single-joint exercises since they require the coordination of the entire body; similar to the demands faced by the player on-court.

Example: While using the leg press the knee and hip both flex and extend to perform the movement. This is a multi-joint movement.

Another benefit of multi-joint exercises is that they are better for developing power. The body is built as a number of "parts" that are meant to function together. By using them together the player will see a greater training effect.

Exercise Order

To maximize the gains that the player can achieve in a workout it is important to organize the training session appropriately. It may seem that it should not make any difference if the biceps curl exercise is performed before doing pull-ups, or if squats are done before the leg curl.

Several general guidelines that should be considered when planning a training session include:

- Performing a warm-up before the strength training session begins.
- Training large muscles before training smaller muscles.
- Full body, or multi-joint exercises before single-joint exercises.

Generally, the order of exercises during a training session should progress from large muscle group exercises to smaller. Larger muscles place the greatest demands on the body and it is beneficial to train them when the player is not fatigued.

Example: If a player intends to perform shoulder exercises, squats and abdominal exercises in a training session he should order them so that the squats are performed first (the largest muscles), followed by dumbbell shoulder side raises, followed by abdominal training.

A tennis player is only as strong as his weakest link. As an example, think about the pull-up and arm curl exercises. The pull-up is a multi-joint exercise involving shoulder and elbow. The ability to perform a pull-up is influenced by how much the muscles are fatigued at each of these joints. The arm curl, on the other hand, is a single joint exercise and only involves flexion of the elbow. If the player performs the arm curl as the first exercise in a training session, the muscles that flex the elbow will be fatigued and limit his ability to perform pull-ups, and train the muscles that adduct the shoulder, later in the workout.

Additionally, many multi-joint exercises are performed to train power and it is important to perform these exercises when the player's strength and power capabilities are maximal and fatigue is minimal.

Strength Training for Young Players

As mentioned, strength training and conditioning are becoming necessities in today's

tennis game as play continues to get faster and players hit the ball with more power from everywhere on the court. As coaches, players and parents become more aware of this, they want to get their players involved in a strength and conditioning program--often at younger and younger ages. There are a lot of questions surrounding strength training, especially when we start talking about younger players. Through a series of questions and answers, this section will look at some of the questions and dispel some of the myths surrounding youth strength training.

Is strength training safe for young players?
The risk of injury should be the primary concern of any coach or parent who has a child entering a strength-training program. Any exercise or activity carries with it some level of injury risk – even a child running in the backyard can suffer an injury - so it is unrealistic to assume that injuries will never occur in conjunction with strength training. Both the National Strength and Conditioning Association and the American Academy of Pediatrics state that youth strength training can be safe and effective if:

- A competent coach who is skilled in program design supervises *every* training session.

- Proper technique is taught and required in *every* repetition of *every* exercise.

Isn't there a risk that growth plates will be damaged?
Many parents and coaches are hesitant to begin strength training with young athletes for fear of damaging the bones and possibly stunting growth. The fact is that no growth plate fractures have been documented in athletes who engage in a resistance-training program that follows the two guidelines listed above. The risk of injury to the growth plates can be further minimized if players do not lift heavy weight over their heads or attempt extremely heavy lifts. Growth plate injuries should be taken seriously because they *can* happen. However, with proper care the risk can be almost eliminated.

Does strength training work for young players?
Yes, it does. Most people believe that testosterone (a steroid produced naturally in the body) is necessary to build strength. However, resistance training helps to improve motor control and strength by "teaching" muscles how to work together in a coordinated manner, which leads to improvements in strength without an associated gain in muscle mass. Some other benefits of youth strength training are:

- Improved strength and coordination
- Increased bone density
- Improved self-image and self-confidence
- Potential to prevent injuries

What exercises are appropriate for young players?
Probably the best way to introduce athletes to strength training is to start with 'body-weight' exercises. As you might guess, these exercises use the athlete's own body weight as the resistance. These exercises can include push-ups, pull-ups, sit-ups (crunches, bicycles, etc), 'supermans', body weight lunges and squats, and step-ups.

Players also can use stretch tubing to perform shoulder internal and external rotation exercises to train the muscles that make up the rotator cuff and rowing exercises to train the scapular muscles that also control shoulder movement.

The benefits of these exercises are multi-fold. First, this type of exercise is inexpensive and easy to implement, and second, these exercises strengthen the core muscles of the body (the core is defined as the muscles surrounding the body's center of mass – namely the abs, lower back, and hip musculature). The core muscles stabilize the body and it is important to develop a solid strength base in these muscles before progressing on to more advanced exercises.

What type of training should young players perform?
Before puberty, the emphasis of training should be on building muscular endurance. This means players should be using weights that allow them to perform several sets of 15 repetitions. It is not until after puberty that players should expect to see the significant increases in muscle mass that are commonly associated with strength training.

Questions to ask before starting a strength-training program
Is the athlete physically and emotionally mature enough to engage in a strength-training program?
Players need to show the maturity, both physical and mental, to advance to these more complex exercises. Keep in mind that athletes of the same 'chronological age' can differ by as much as ±2 years physically or mentally. Also keep in mind that females mature as much as 2 years earlier than males.

If you are using machines or equipment, is it sized appropriately for a young athlete?

Most equipment in strength and conditioning facilities will be sized to meet the needs of an adult, and not a young athlete. Make sure you can adjust any equipment to the size of the child. If you cannot, then do not perform the exercise until the child grows into the equipment.

Is the program going to be properly run and supervised?

Proper supervision and teaching is essential to running a safe and injury-free strength-training program. Strength training is more than just throwing a bunch of exercises together; a program should be carefully tailored to the needs of the athlete and the sport.

Flexibility Training

Flexibility is another area that is very important to tennis as many players exhibit tightness in certain joints in the body. Flexibility is simply defined as the ability of the body's muscles and soft tissue to elongate or lengthen to allow movement around a

joint. The two primary forms of stretching are static and dynamic, both of which can be used effectively and safely by tennis players. Other types of stretching include proprioceptive neuromuscular facilitation and ballistic stretching.

Static Stretching

Static stretching is stretching without movement and is probably the safest and most effective way of increasing flexibility. Static stretching has been used by athletes for many years and has been proven to effectively increase muscle length and motion of the joints.

While static stretching is effective at improving flexibility, there are some common misconceptions about this type of stretching and when it should be performed. Several points to consider when integrating static stretching as part of a strength and conditioning program are:

- Static stretching should only be performed at the end of practice or play and not as part of a warm-up. Recent research has shown that muscle strength and power is impaired for as long as two hours after static stretching. Therefore, if a player wants to have the best chance of moving and hitting with speed and power, the static stretching should be left for the end of practice.

- Static stretching does not prevent injury. It is important for tennis players to have a certain range of motion to be able to play effectively, but research has not shown that static stretching can help to prevent injury unless a player really has a limited range of motion.

- Static stretching may improve performance, but it may not. Data suggests that there is an optimal level of flexibility that will enhance performance. These optimal levels are likely to be sport specific, however, and performance may be lowered if an athlete's flexibility falls outside of this ideal range.

- Stretches should be held for 15-30 seconds, and repeated 2-3 times. Performing them for a shorter time will not elicit the same effects and holding them for longer than 30 seconds has not been shown to provide any added benefits to athletes.

Dynamic Stretching/ Dynamic Flexibility Training

Dynamic stretching is stretching with movement and is recommended for an athlete before practice of competition. Dynamic stretching and flexibility training is an essential element of any pre-practice or pre-competition routine and helps prepare the body for the demands of today's tennis game. A dynamic warm-up (described in greater detail below), which involves stretching with movement, is a recommended part of any pre-practice or pre-competition warm up routine. The USTA has a DVD, title Dynamic Tennis Warm-Ups, which presents sample exercises that can be used as part of a dynamic stretching program.

Proprioceptive Neuromuscular Facilitation

An advanced concept in stretching that is now used by many coaches and trainers is proprioceptive neuromuscular facilitation (PNF). This type of stretching uses a partner and involves contracting and relaxing a muscle or muscle group to elicit a greater stretch. During this type of stretching the athlete is actually contracting the muscle isometrically near the end of the available range of motion, then subsequently relaxing it as the partner moves the limb farther into the stretch. Here are the steps you would take as a partner in this type of stretching:

- Take the limb to right near the end of the available range of motion.
- Ask the player to isometrically contract the stretched muscle for up to 6 seconds as you or another player resist any movement during the contraction.
- Have the player relax the muscle, then slowly move the limb farther in the direction you are trying to stretch for 15 to 30 seconds.
- Repeat the sequence.

The theory behind this type of stretching is that a period of deeper muscle relaxation occurs immediately following a contraction of that muscle. It can be particularly effective for players who are having difficulty with a particular muscle group or who find it very difficult to relax their muscles while stretching.

Ballistic Stretching

One type of stretch that is not recommended for tennis, or any sport, is the ballistic stretch. Ballistic stretches involve fast, sudden movements at the end of a joint's range of movement that are intended to improve flexibility. While some sources report improvement using ballistic stretches, doing this type of stretch increases the chances of injury. Safer forms of static and dynamic stretches that use smoother, less jerky movements without bouncing are preferable.

Warm-up

A warm-up should be performed before every practice or competition to prepare the body for the increased physical and physiological demands that will be placed on it once play begins. An effective warm-up does five very important things for tennis players.

1. Increases body temperature, allowing muscles to work more efficiently.
2. Gets the heart and lungs ready for vigorous activity.
3. Stretches muscles actively, preparing them for the forces experiences during tennis.
4. Engrains proper movement patterns and the coordination needed in tennis.
5. Wakes up the nervous system and gets the brain talking with the muscles.

A proper warm-up can be broken down into three phases:

1. A general warm-up that involves several minutes of a general, full body activity like light jogging, jumping rope or riding a stationary bike.

2. A dynamic warm-up lasting from 5-10 minutes. This should focus on performing sport specific movements that target all the major muscle groups that will be used in tennis.

3. A specific warm-up that involves light hitting. This should be done before a player begins strenuous play.

All three phases of the warm-up should be used before play to best prepare the body. While it may seem like a waste of time to take 10 minutes at the start of each practice, the body will perform better following a proper warm-up. Keep in mind that the physiological systems of the body lag behind when a player starts exercising and it takes several minutes for them to get up to speed and be able to do what you want it to on-court; the warm-up allows the body to get primed for an increased level of play. Performing a warm-up will also reduce the risk of injury.

Cool-Down

There are a number of benefits that come with performing cool-down exercises following practice or a match.

- Cool-down exercises are performed to slow the body's systems down, in a controlled manner, from the high performance levels demanded during a tennis match/practice to normal levels found at rest.
- They help "flush out" metabolic waste products that accumulate in the body during exercise. These waste products can impair muscle function and performance if they are not removed from the body. Performing a light activity following a strenuous practice or match, as opposed to sitting around after a match, has been shown to help the body remove these waste products more effectively.
- They are also used to maintain the flexibility or range of motion of various components of the musculoskeletal system.

Performing a light exercise, preferably non-weight bearing, will help the body to cool down and rid itself of metabolic waste products like lactic acis. The amount of time a player should spend cooling down is dependent on the individual and the intensity of the exercise. However, research indicates that a good average is to exercise at a light intensity for approximately 15-20 minutes after intense play.

Active and passive stretching, combined with deep breathing exercises can also be included as part of the cool-down. In general, passive stretching techniques are slow and sustained (30-60 seconds in duration), are performed in a pain-free range and repeated 2-3 times. Active stretching techniques are performed by moving through the entire range of motion of the joint/joints, using a fluid and slow pace combined with deep breathing activity, again repeating 2-3 times. Rapid bouncing or ballistic movements are not recommended. There should be no pain associated with stretching. If pain is felt, the player should stop the stretch and seek help from a qualified medical/health care practitioner. To help in this process, the coach should learn about proper stretching

technique, frequency, duration and regularly solicit feedback from the player.

Periodization

One of the fundamental principles of training is periodization. Periodization is the cycling between work and rest, providing variety to training and allowing for adequate recovery between workouts. Tennis has often been viewed as a year-round sport, which leads quite naturally to overuse injuries. Without periodization it is very easy for players to become over-trained and develop injuries that can lead to lost playing time.

When designing a periodized training plan, the year is typically broken down into four phases:

1. Preparation phase.
2. Pre-competition phase.
3. Competition phase.
4. Active rest phase.

Preparation Phase

The main emphasis of the preparation phase is to build general fitness and endurance. This means developing a base of aerobic training and muscle endurance. The volume of work a player put in during this phase is typically quite high. This is where the foundation is laid that will carry the player through the competition phase of the year.

Pre-competition Phase

As the player gets ready for the competitive part of the year, the emphasis of strength training should shift from developing muscle endurance to developing strength and power. Similarly, conditioning work should focus on tennis-specific drills and training, shifting from an aerobic to an anaerobic emphasis. Keep in mind that as the intensity and quality of the work increases during this phase, the volume should decrease and players should be allowed adequate rest between efforts.

Competition Phase

This is also called a maintenance phase since the focus is on maintaining the strength and conditioning gains made in the earlier phases and bringing everything together to peak for the most important performances. Most of the training time during this phase should be spent on power development and performing tennis specific drills and exercises; the intensity should remain high.

Active Rest Phase

At the end of a competitive season it important to allow players a time to get away from the game. This does not mean players should not train, but instead they should engage in cross training activities to maintain fitness and provide a mental break from tennis. Players can still hit lightly, but the focus of the training in this phase should be on physical and mental recovery.

Tennis may seem at first that it does not fit into this periodized training model since there really is not off-season. That is a correct assessment and it is difficult to "fit" tennis into this simple plan. However, to maximize the long-term development of a player it is important break the season into these phases and develops a specific training focus in each phase. Even though there is no off-season, it is beneficial to dedicate part of the year to preparation where the player will work on developing a base of strength and endurance. This will be the training foundation that the player builds off of in the competition phase. You can look at this phase as a banking phase – strength and conditioning is being put in a player's bank to be withdrawn during competition. If a player is unable to make steady deposits into the bank, or even worse, does not make any deposits at all, he or she will not have anything to withdraw when the time comes. Additionally, building strength "along the way" as a player develops is a much better approach than trying to catch up once a player reaches a certain age or ability level.

Physical and Physiological Testing

Since tennis has become a sport with year-round involvement, superior fitness and preparation is required. Doesn't every player want to have that extra step of foot speed, hit more powerful shots with less effort, increase the speed of your serve and handle the power of a stronger opponent? In addition, isn't it great to last through a long match and still come back fresh the next day? Research indicates that players achieve the best results when their training activities replicate the actual demands of the sport. Testing the physiological and physical variables of flexibility, strength, power, aerobic endurance and speed and agility will provide a baseline for designing appropriate training programs. One of the most effective ways of monitoring the progression of these and other musculoskeletal adaptations is with the use of the testing protocol developed by the USTA Sport Science Committee. This protocol is included with this chapter is a testing guideline that will allow you to look at variables related to:

- Strength
- Speed
- Endurance
- Flexibility
- Power

Engaging in a regular testing program will help you to be able to track athlete performance, identify areas of strength and weakness, and use the information to head-off an injury before it occurs.

Additional information on testing can be found in the accompanying handout that details the USTA Physical and Physiological Testing Protocol or in the book *Complete Conditioning for Tennis*.

Summary

Strength training and conditioning can be an effective, and safe way to augment on-court training, and there is no reason why young players cannot engage in some form of

resistance training. The positive benefits of strength training include decreased potential for injury and improved strength and motor control. Additionally, the risk of training-related injury is reduced as long as sessions are built on sound technique and are properly supervised. Even performing simple body weight exercises will help players move better on court and adapt to the demands of today's game. It is worthwhile to make strength and conditioning work a part of every player's training plan.

National & Sectional Junior Competition

The CTC is a great place to disseminate information regarding national and sectional rules to our best young junior players. Below we have provided a list of resources, which you can use to become more knowledgeable about National Junior Competition issues. **(Please note that rules change each year and thus it is important to verify that you have the most up-to-date national schedule, which includes this information.)**

1. ***USTA Website***: Check out the USTA's website at **www.USTA.com** for information on selection into Nationals. On this site you can find out all the latest regulations/player information from selection into nationals to hydration to ranking info.

2. ***USTA Rule Book "Friend at Court":*** Provides all the rules that tournament directors and staff utilize for any tournament related matter.

USTA National Championship Structure

There are three types of National tournaments: USTA National Championships, National Opens, and Regional Tournaments. There are four USTA National Championships and sixteen National Opens and numerous Regional Tournaments throughout the year.

USTA National Championships take place four times a year. These are the highest levels of tournaments in the United States. The following are ways in which players can qualify for these events.

1) Players listed on the National Championship Selection List 1-16 for a 128 draw and 1-24 for a draw of 192*
2) Top 3 finishers at a National Open;
3) Sectional Endorsement (Quotas below);
4) Wild Card (4 for 128 draw and 8 for a 192 Draw)
5) Endorsed players on National Standing List**

*The National Championship Selection List (NCSL) is generated three times a year. This list is used for selecting players into the four National Championships. The NCSL includes any player ranked in the top 1000 of the ATP singles ranking, or the top 600 WTA singles rankings or in the top 50 of the ITF rankings. All players, except the above mentioned players must play one national event in the list's division during the 4 months before the effective date of NCSL and at least two other events used for National Ranking.

**All remaining vacancies of the tournament will go to the highest ranked players on the national standing lists that appear on the sections endorsement list. A player must have accumulated 100 points to have a spot on the National Standing List.

EXAMPLEFOR 128 DRAW (Spring & Winter)

16*	Players from the NCSL
12	Players from the National Opens
4	Players from Wild Cards
60	Players from Sectional Quotas
36	Players from Endorsed on National Standing List

EXAMPLE FOR 192 DRAW (Clay & Hard)

24*	Players from the NCSL
12	Players from the National Opens
8	Players from Wild Cards
100	Players from Sectional Quotas
48	Players from Endorsed on National Standing List

*Includes ATP, WTA, & ITF Players

Sectional Quotas: Junior membership in the USTA determines a section's quota for USTA National Championships. Therefore junior players, parents and coaches should encourage all young players to become members of the USTA. These spots are allocated to players meeting endorsement requirements.

2008 USTA Junior National Championships Section Quotas		
Section	**128 Draw**	**192 Draw**
USTA/Caribbean	2	2
USTA/Eastern	4	7
USTA/Florida	4	7
USTA/Hawaii Pacific	2	2
USTA/Intermountain	2	4
USTA/Mid-Atlantic	2	4
USTA/Middle States	2	4
USTA/Midwest	8	15
USTA/Missouri Valley	2	3
USTA/New England	2	3
USTA/Northern	2	2
USTA/Northern California	2	5
USTA/Pacific Northwest	2	2
USTA/Southern	13	22
USTA/Southern California	4	7
USTA/Southwest	2	2
USTA/Texas	5	9
Total	60	100

National Opens: These events take place four times per year prior to an USTA National Championship. At each of these times, four simultaneous 64-draw events are conducted throughout the country at different locations. Players are accepted into regional tournaments based on national standing. The top 3 singles finishers at the National Open get into the National Championship immediately following that National Open. The doubles finalists at the National Opens get into the proceeding National Championships for doubles and can be alternates for singles. Players are selected and given preference in their choice of site in the following order:

- up to 32 players from the top 200 players on the most recently published National Standings List of the next-younger division in the order in which their names appear on this list;
- up to 224 players from the most recently published National Standings List for the division in the order in which their names appear on this list;
- players not yet in the draw whose names appear on the most recently published National Standings List of the division in the order in which their names appear on this list;

- players not yet in the draw whose names appear on the most recently National Standings List of the next-younger division in the order in which their names appear on this list; and
- The remaining entrants in the order of the strength of their records.
- Players not selected for their first choice shall remain in the pool of applicants for entry into other concurrent USTA National Opens. Those players who have not been selected after all four USTA National Open draws have been filled shall be placed in alternate pools at all concurrent USTA National Opens for which the players indicated a preference. Tournament Committees may order the alternates based on the player records.

Regional Tournaments: These events are listed on the USTA National Junior Schedule. These events count for national ranking, but are events that the players enter on their own.

Month of Birth Age Eligibility: Instead of junior players aging up together on January 1st, junior players will be able to play in an age division until their "month of birth". Now, every player has the opportunity to be the oldest player in a division. This means that junior players who are 12, 14, 16, or 18 years old may continue to play in their age division until the month of they turn 13, 15, 17 or 19 respectively.

USTA NATIONAL JUNIOR RANKINGS

The United States Tennis Association has approved a change in the ranking system for juniors that took effect on January 1, 2008. The USTA will no longer publish individual singles and doubles standings and rankings. Instead, the USTA will publish a combined ranking, which includes results from singles and doubles. The USTA is making this change to encourage players to play more doubles and to reward players for their success in doubles. Moreover, the USTA feels that doubles will help players with their overall tennis development.

How it works

The new ranking system will include results from singles matches and doubles matches in all tournaments that are now included in the calculations for the National Standing List and the year-end National Raking. The points earned in singles competition will be combined with the points earned in doubles competition to form one final point total that will be used for the National Standing List and the National Ranking. Players will receive credit for 100% of their singles points from their best eight (8) events along with 15% of their doubles points from their best eight (8) doubles events. The chart below describes how the system will work:

Player X (a player with better singles results) Best eight (8) singles tournaments = 1500 points Best eight (8) doubles tournaments = 1200 points 15% of 1200 = 180 points 1500 + 180 = 1680 total combined ranking points

Player Y (a player with better doubles results) Best eight (8) singles tournaments = 1200 points Best eight (8) doubles tournaments = 1500 points 15% of 1500 = 225 points 1200 + 225 = 1425 total combined ranking points

SPECIFICS OF THE POINTS PER ROUND NJRS INCLUDE:

- A player must win a round to receive any points for the tournament. The points tables that appear below are based on draws as large as 256 players. In draws smaller than 256 players, players do not receive any points until they have won a round. Byes do not qualify as wins.
- Withdrawals and walkovers qualify as wins for the advancing player and earn Points Per Round, but do not earn Bonus Points.
- Retirements qualify as wins for the advancing player and earn Points Per Round and, if eligible, Bonus Points.
- A player who advances because of a default that takes place before the commencement of the first point in the match or because the opponent is disqualified shall receive Points Per Round for advancing, but shall not receive any Bonus Points.
- A player who advances because of a default that takes place after the commencement of the first point in the match shall receive Points Per Round for advancing and, if eligible, Bonus Points.
- A player who is defaulted from a tournament for code violations under the Point Penalty System or misconduct forfeits any points accumulated during the tournament, including both Points Per Round and Bonus Points. Players defaulted in singles only lose points accumulated for play in the singles main and feed-in championship draws.
- No Points Per Round will be earned in the qualifying rounds of tournaments when the qualifying draw and main draw are covered in a single sanction. However, Level 1 through 5 tournaments, Bonus Points will accumulate for the tournament and will be attached to the tournament at which they are earned. Additionally, American juniors winning matches against other American juniors at the Australian Open, French Open, Wimbledon, and Canadian Open will receive Bonus Points that will be added to the player's total points earned at the player's best eight tournaments. See "Bonus Points – Rewards for Significant Wins" below.
- The final rankings for a junior age division shall include all players who have been age eligible for play in the division at any time during the year and who have accumulated at least 200 points in the division. Only points earned in the division will count towards ranking in that division. Players may be ranked in more than one age division if they have been age eligible in more than one division during the year and have met the minimum point requirement for each age division.

NATIONAL RANKING TOURNAMENTS AND TOURNAMENT LEVELS: Below are the National Ranking Tournaments that will count for ranking in 2008. The table also includes the tournament "Level" that corresponds with the National Ranking Point Tables that follow.

Level	National Ranking Tournament
Level 1	USTA National Championships USTA Boys' 18 National Team Championships USTA Girls' 18 National Team Championships USTA BG 16 Intersectional Team Championships USTA International Spring Championships - ITF Grade 1 Event (BG18,16) Easter Bowl ITF Tennis Championships - ITF Grade B1 Event (BG18) US Open - ITF Grade A Event (BG18) Eddie Herr International Junior Tennis Championships BG 18 Events - ITF Grade 1 Event Orange Bowl International Tennis Championships- BG 18 and 16 Events - ITF Grade A Event (BG 18)
Level 1A	Kentucky International Junior Tennis Derby - BG 18 Events - ITF Grade 1 Event Pan American Closed ITF Junior Tennis Championships (Tulsa, OK) - ITF Grade B1 Event Junior Orange Bowl International Tennis Championships - BG 14 and 12 Events Eddie Herr International Junior Tennis Championships BG 16, 14, and 12 Events
Level 2	USTA National Opens USTA BG 16, 14, and 12 Zone Team Championships
Level 3	USTA BG 18 Interscholastic Championships (East/West) US Junior International Grass Court Championships - ITF Grade 3 Event US Junior International Hard Court Championships - ITF Grade 3 Event Kentucky International Junior Tennis Derby - BG 16, 14, 12 Events USTA Texas ITF Junior Tennis Classic - ITF Grade 4 Event USTA South Carolina ITF Junior Tennis Classic - ITF Grade 3 Event USTA Evert ITF Junior Tennis Classic - ITF Grade 4 Event Prince Cup - ITF Grade 4 Event Regional Tournaments on the National Junior Tournament Schedule Sectional Ranking Tournaments: 1 designated by each Sectional Association
Level 4	USTA Tennis Express ITF Junior Classic- ITF Grade 5 Event USTA Spring, Texas ITF Junior Classic- ITF Grade 5 Event USTA Waco, Texas ITF Junior Classic- ITF Grade 4 Event El Paso Youth Tennis Center Open - ITF Grade 5 Event Sectional Ranking Tournaments: 3 designated by each Sectional Association
Level 5	Sectional Ranking Tournaments: 8 designated by each Sectional Association
ITF BG 18 Bonus Point Only Events	Australian Open - ITF Grade A Event French Open - ITF Grade A Event Wimbledon - ITF Grade A Event Canadian Junior International Championships - ITF Grade 1 Event

NATIONAL RANKING POINT TABLE: Below are the National Ranking Point Tables for the National Ranking Tournaments. See the National Ranking Tournament table on page 93 to determine the Level assigned to a tournament. There are three separate tables for tournaments as follows:

- Main Draw with a Feed-in Championship through Quarterfinals
- Main Draw with a Feed-in Championship through Semifinals
- Main Draw with a Modified Consolation

Points are earned based on the player result in the tournament – a champion receives the points in the champion row, a quarterfinalist receives the points in the quarterfinalist row, etc. Withdrawals, walkovers, retirements, defaults, and disqualifications count as wins; byes do not count as wins. See Footnotes below for an explanation of how consolation points are awarded. A player must win a round to receive points in a tournament.

Main Draw with a Feed-in Championship through Quarterfinals Points Per Round
(This table is used, for example, at the BG 18, 16 and 14 USTA National Championships at all USTA National Opens)

Player Results[1]	**Level 1**	**Level 1A**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Champion	660	There are no Level 1A Tournaments with this type of draw format	300	220	165	88
2nd Place	540		250	180	135	72
3rd Place	480		220	160	120	64
4th Place/SF[2]	420		190	140	105	56
FIC Champion	390		175	130	98	52
FIC Finalist	360		160	120	90	48
FIC SF	330		140	110	83	44
FIC QF	300		125	100	75	40
FIC QF Qualifying	270		115	90	68	36
FIC R16	240		95	80	60	32
FIC R16 Qualifying	210		80	70	53	28
FIC R32	180		65	60	45	24
FIC R32 Qualifying	150		0	50	38	20
FIC R64	120		n/a	40	30	16
FIC R64 Qualifying	90		n/a	30	23	12
FIC 128	60		n/a	20	15	8
FIC 128 Qualifying	n/a		n/a	0	0	0

1 Players who lose their first Main Draw match are fed into the following round of a Feed-In Championship:

16 Draw Size: FIC QF Qualifying
32 Draw Size: FIC R16 Qualifying
64 Draw Size: FIC R32 Qualifying
128 Draw Size: FIC R64 Qualifying
256 Draw Size: FIC R128 Qualifying

Main Draw with a Feed-in Championship through Semifinals
Points Per Round

Player Results[1]	Level 1	Level 1A	Level 2	Level 3	Level 4	Level 5
Champion	There are no Level 1 Tournaments with this type of draw format	There are no Level 1A Tournaments with this type of draw format	There are no Level 2 Tournaments with this type of draw format	220	165	88
2nd Place				180	135	72
FIC Champion				160	120	64
FIC Finalist				140	105	56
FIC SF				120	90	48
FIC SF Qualifying				110	83	44
FIC QF				100	75	40
FIC QF Qualifying				90	68	36
FIC R16				80	60	32
FIC R16 Qualifying				70	53	28
FIC R32				60	45	24
FIC R32 Qualifying				50	38	20
FIC R64				40	30	16
FIC R64 Qualifying				30	23	12
FIC 128				20	15	8
FIC 128 Qualifying				0	0	0

1 Players who lose their first Main Draw match are fed into the following round of a Feed-In Championship:

16 Draw Size: FIC QF Qualifying
32 Draw Size: FIC R16 Qualifying
64 Draw Size: FIC R32 Qualifying
128 Draw Size: FIC R64 Qualifying
256 Draw Size: FIC R128 Qualifying

Main Draw with Modified Consolation Tournament Points Per Round, Including First Match Losers Consolation, First Round Losers Consolation, Modified FIC and Compass Draw 1
(This table is used, for example, at the BG 12 USTA National Championships)

Player Results[1]	**Level 1**	**Level 1A**	**Level 2**	**Level 3**	**Level 4**	**Level 5**
Champion	660	330	There are no Level 2 Tournaments with this type of draw format	220	165	88
2nd Place	540	270		180	135	72
3rd Place	480	240		160	120	64
4th Place/SF[2]	420	210		140	105	56
Quarterfinalist	300	150		100	75	40
Reached R16	240	120		80	60	32
Reached R32	180	90		60	45	24
Reached R64	120	60		40	30	16
Reached R128	60	30		20	15	8
Reached R256	0	0		0	0	0
Points Earned for Each Consolation Round Won[1]	30	15		10	8	4

1 In Compass Draw events, the East Draw earns main draw Points Per Round; all other directions and Gold Draw earn consolation Points Per Round.
2 If there is no playoff for 3rd and 4th place, the semifinalists will receive points in this row.

TEAM TOURNAMENTS: This table is used, for example, for the following Level 1 and 2 tournaments: Zonals, Intersectionals, USTA Boys and Girls 18 Team Championships (formerly Jr. Davis and Fed Cup). It is also used for any Sectional team tournament designated Level 4 or 5. There is no Level 3 tournament that will use this point table.

Player Position on Team	**Level 1**	**Level 2**	**Level 4**	**Level 5**
Position #1 Points earned per win	60	50	20	5
Position #2 Points earned per win	55	45	16	4
Position #3 Points earned per win	50	40	12	3
Position #4 Points earned per win	45	35	8	2
Position #5 Points earned per win	40	30	4	1
Position #6 Formerly USTA Fed Cup & Davis Cup Only Points earned per win	35	n/a	n/a	n/a
Maximum number of points that can be earned at event (*points earned by winning up to 5 rounds plus Bonus Points*)	300+ Bonus Points	250+ Bonus Points	100+ Bonus Points	25+ Bonus Points

Players in each of the positions receive the number of points per win that appear in this table. For example, if Position #1 player on the team has four wins at a Level 2 tournament, the player will earn 200 points (50 points x 4 wins). Any Bonus Points earned will be added to this total. See "Bonus Points – Rewards for Significant Wins" below.

BONUS POINTS – REWARDS FOR SIGNIFICANT WINS: Bonus Points are earned at National Ranking Tournaments for significant wins over top 100 players according to the table below. Bonus Points are earned for wins in both main draw and qualifying draw matches. At Level 1 through 5 tournaments, Bonus Points are "attached" to the tournament at which they are earned. If a tournament total is not among a player's best eight tournaments, neither the Points Per Round nor the Bonus Points will count toward the player's ranking point total.

Additionally, American juniors winning matches against other American juniors in the main draw and qualifying rounds at the Australian Open, French Open, Wimbledon, and Canadian Open will receive Bonus Points in the 18s division according to the Bonus Points table below. These Bonus Points will be awarded independent of the best eight tournaments and will be added to the player's total points earned in the player's best eight tournaments.

Standing of Player Defeated[1]	**Bonus Points Earned for Win**
Top 10	75
#11 through #20	50
#21 through #50	25
#51 through #75	10
#76 through #100	5

Player standings are determined by the Bonus Points Lists which will be published on the last day of each month and these lists apply to tournaments having a start date during the month following the publication.

The following table shows the publishing dates for the Bonus Points Lists, the match results included in each Bonus Point List and the dates of the tournament play for earning points based on these lists. To view the lists online, go to www.USTA.com, click on Juniors/Ranking, and click on the link to reach the Ranking Lists, and search for the Top 100 Bonus Point List

Date Published On:	**Match Results Included between:**	**List used for Earning Points for Events Starting between:**
Dec. 31, 2007	Jan. 1, 2007 & Dec. 31, 2007	Jan. 1 & Jan. 31, 2008
Jan. 31, 2008	Feb. 1, 2007 & Jan. 31, 2008	Feb. 1 & Feb. 28, 2008
Feb. 28, 2008	Mar. 1, 2007 & Feb. 28, 2008	Mar. 1 & Mar. 31, 2008
Mar. 31, 2008	Apr. 1, 2007 & Mar. 31, 2008	Apr. 1 & Apr. 30, 2008
Apr. 30, 2008	May 1, 2007 & Apr. 30, 2008	May 1 & May 31, 2008
May 31, 2008	Jun. 1, 2007 & May 31, 2008	Jun. 1 & Jun. 30, 2008
Jun. 30, 2008	Jul. 1, 2007 & Jun. 30, 2008	Jul. 1 & Jul. 31, 2008
Jul. 31, 2008	Aug. 1, 2007 & Jul. 31, 2008	Aug. 1 & Aug. 31, 2008
Aug. 31, 2008	Sep. 1, 2007 & Aug. 31, 2008	Sep. 1 & Sep. 30, 2008
Sep. 30, 2008	Oct. 1, 2007 & Sep. 30, 2008	Oct. 1 & Oct. 31, 2008
Oct. 31, 2008	Nov. 1, 2007 & Oct. 31, 2008	Nov. 1 & Nov. 30, 2008
Nov. 30, 2008	Dec. 1, 2007 & Nov. 30, 2008	Dec. 1 & Dec. 31, 2008
Dec. 31, 2008	Jan. 1, 2008 & Dec. 31, 2008	Jan. 1 & Jan. 31, 2009

APPENDICES

USTA PLAYER DEVELOPMENT STAFF

USTA Training Center, Boca Raton, FL
10399 Flores Drive
Boca Raton, FL 33428
Phone: (561) 962-6411
Fax: (561) 962-6401

USTA Training Center, Carson, CA
18400 Avalon Blvd
Carson, CA 90746
Phone: 310-630-4500
Fax: 310-630-4501

Player Development

Managing Director	**E. Paul Roetert, Ph.D.**
Administrator, Player Development	**Elizabeth Diaz**
Assistant	**Lisette Melchor**
Assistant/Receptionist	**Kristiana Bennett**

High Performance

Director, Tennis Operations	**TBA**
Director, Men's Tennis	**Rodney Harmon**
Director, Women's Tennis	**Jean Nachand**
Administrator, High Performance	**John Lansville**
Coordinator, Player Services	**Herlinda Lombardi**
Assistant, High Performance	**Karina Klein**
Assistant, Player Services	**Natalie Brannon**

Men's National Coaches	***Women's National Coaches***
Ricardo Acuna	**Richard Ashby**
Jay Berger	**Jean Desdunes**
David Dilucia	**Jai DiLouie**
Kent Kinnear	**Debbie Graham Shaffer**
Mark Merklein	**Wade McGuire**
David Nainkin	**Lori McNeil**
David Roditi	**Ola Malmqvist**
Mike Sell	**Kim Po Messeril**
Roger Smith	**Ray Ruffels**
Martin Van Daalen	**Robin White**

Junior Competition

Senior Director, Junior and Collegiate Competition	**Timon Corwin**
Director, Junior and collegiate Competition	**Lew Brewer**
Administrator, Junior and Collegiate programs	**Bobby Bernstein**
Administrator, Jr. & Collegiate Competition	**Elke Juul**
Assistant, Jr. & Collegiate Competition	**Angela Garcia**
Assistant, Jr. & Collegiate Competition	**Marcus Tyler**

Coaching Education

Director, Coaching Education	**Paul Lubbers, Ph.D.**
Administrator, Coaching Education	**Anne Pankhurst**
Manager, Sport Science	**Mark Kovacs, Ph.D.**
Strength and Conditioning Specialist	**Mary Jo Campbell Med, ATC, CSCS**
Strength and Conditioning Specialist	**Cori Thompson**
Assistant, Coaching Education and Sport Science	**Jessica Battaglia, MS, ATC**

USTA Sectional Associations and Player Development Contacts

Caribbean
Rosa Caamano
P.O. Box 40439
San Juan, PR 00940-0439
787-726-8782
caamano@cta.usta.com
www.caribbean.usta.com

Eastern
Julie Bliss
550 Mamaroneck Avenue,
Suite 209
Harrison, NY 10528
(914) 698-0414
bliss@eastern.usta.com
www.eastern.usta.com

Florida
Andy Gladstone
1 Deuce Court, Suite 100
Daytona Beach, FL 32124
(386) 671-8949
gladstone@florida.usta.com
www.usatennisflorida.usta.com

Hawaii-Pacific
Mimi Kennell
1500 South Beretania Street, Ste. 300
Honolulu, HI 96826
808-955-6696
kennell@hawaii.usta.com
www.hawaii.usta.com

Intermountain
Bethany Schott
1201 South Parker Road, #200
Denver, CO 80231
(303) 695-4117
bschott@ita.usta.com
www.intermountain.usta.com

Mid-Atlantic
Erin Williams
7926 Jones Branch Drive, Suite 120
McLean, VA 22102
(703) 556-6120
williams@mas.usta.com
www.midatlantic.usta.com

Middle States
Michael Kennedy
1288 Valley Forge Road, Ste. 74
Valley Forge, PA 19482-0987
(610) 935-5000
kennedy@ms.usta.com
www.middlestates.usta.com

Midwest
Andrea Calvert-Sanders
8720 Castle Creek Parkway, Ste 329
Indianapolis, IN 46250
(317) 577-5130
andrea@midwest.usta.com
www.midwest.usta.com

Missouri Valley
Evan Clark
8676 West 96th Street, Suite 100
Overland Park, KS 66212
(913) 322-4800
Eclark@movalley.usta.com
www.missourivalley.usta.com

New England
David Zeutas-Broer
110 Turnpike Road
Westborough, MA 01581
(508) 366-3450
zeutas-broer@newengland.usta.com
www.newengland.usta.com

Northern California
Jim Coyne
1350 S. Loop Road, Suite 100
Alameda, CA 94502-7081
(510) 748-9210
coyne@norcal.usta.com
www.norcal.com

Northern
Pat Colbert
1001 W. 98th Street, Ste. 101
Bloomington, MN 55431
(952) 887-5001
colbert@northern.usta.com
www.northern.usta.com

Pacific Northwest
Jim Markin
4840 SW Western Ave, Ste. 305
Beaverton, OR 97005-3430
(503) 520-1877
jmarkin@pnw.usta.com
www.pacificnorthwest.usta.com

Southern
Bill Ozaki
5685 Spalding Drive
Norcross, GA 30092-2504
(770) 368-8200
ozaki@sta.usta.com
www.southern.usta.com

Southern California
Darren Potkey
P.O. Box 240015
Los Angeles, CA 90024-9115
(310) 208-3838
darrenp@scta.usta.com
www.scta.usta.com

Southwest
Eric Mitchell
2720 E. Thomas Rd, Ste. B170
Phoenix, AZ 85016
(602) 956-6855
mitchell@southwest.usta.com
www.southwest.usta.com

Texas
Steve Cobb
2111 Dickson, Suite 33
Austin, TX 78704
(512) 443-1334
Scobb@texas.usta.com
www.texas.usta.com

USTA COMPETITION TRAINING CENTER
PERSONNEL APPLICATION FORM

CTC Site Location:_____ CTC #:_____

[ ] Head Coach [ ] Coach [ ] Administrator (Check One)

I. Personal Information:

Name:_____

Street Address:_____

City:_____ State:_____ Zip:_____

Home Phone:_____ Work Phone:_____

Birthdate:_____ Social Security #:_____

USTA #_____ USPTA Level:_____ PTR Level:_____

Present Position:_____

Employer:_____

Employer's Address:_____

City:_____ State:_____ Zip:_____

II. Tennis Playing Background: (list most significant achievements, including rankings if any)

Professional Experience:

College Experience:

USTA/ITF Experience:

III. Teaching/Coaching Experience: (list most recent first)

Date	Position	Facility	Supervisor	Telephone

IV. Background:

Have you ever been convicted of a felony?

Have you ever been convicted of a sex crime?

V. Tennis References:

Name:__________________________________ **Phone:**__________________________________

Address:____

City:____________________________ **State:**______________________ **Zip:**_______________

Name:__________________________________ **Phone:**__________________________________

Address:____

City:____________________________ **State:**______________________ **Zip:**_______________

Name:__________________________________ **Phone:**__________________________________

Address:____

City:____________________________ **State:**______________________ **Zip:**_______________

Name:__________________________________ **Phone:**__________________________________

Address:____

City:____________________________ **State:**______________________ **Zip:**_______________

VI. USTA Involvement: (List involvement in any activities, e.g. USTA programs, committee member, etc.)

Please attach any additional information.
Return completed form to your sectional office

USTA COMPETITION TRAINING CENTER

Name:_____ Birthdate:_____ USTA #_____

Address:_____

City:_____ State:_____ Zip:_____

Telephone:_____ Cell Phone:_____

Personal Coach (es):_____ Parents Names:_____

Coaches Telephone:_____ (H) _____(W)

Coaches address:_____

Tennis Experience: Total # of Years Playing Tennis_____

Current Sectional standing in_____(S)_____(D)

Other Experience: (List all tennis teams or programs you have been involved with)

_____

_____

_____

Player Contract

The USTA & _____ and the CTC staff are committed to providing a quality and comprehensive training program for the area's top junior players. Given our commitment, we expect all selected players will demonstrate their commitment to the program, to other players and coaches.

I promise to attend all scheduled CTC sessions (exceptions family emergencies and illness). If I cannot attend a session, I will contact the CTC Administrator at least three (3) days prior to the practice or match. I promise not to enter any tournaments that conflict with CTC match dates. I understand I could be dropped of the CTC Team for any such action. I will exhibit good sportsmanship and hustle at all times. Further, I will work hard and cooperate with the coaches at all times.

_____ _____

Player's Signature Parent/Guardian's Signature

USTA MEDICAL RELEASE FORM

My participation in the Competition Training Center program is without assumption or responsibility of any kind by the USTA, its sectional associates, committee or the management of any event in which I may participate. In consideration of my participation, I do hereby for and on behalf of myself, and my heirs and my legal representatives release and forever discharge the USTA, its officers, committees, and representatives and their successors and assigns, of and from any and all claims and damages, losses or injuries which may be suffered or sustained by me in connection with my activities during the period for which such permission is granted and any period traveling to and from the events described, and all claims are hereby waived and released, and I covenant not to sue therefore.

MEDICAL RELEASE: I hereby consent to the rendering of emergency first aid and other medical procedures, which at the time of injury or illness seems reasonably advisable. I further understand that I will be responsible for payment of any such medical procedures. I hereby agree to abide by all applicable rules and regulations and codes of the USTA and/or the same as may be adopted by the USTA for this program, and hereby consent to be tested for drugs pursuant to the provisions thereof.

Date:_____ USTA Number:_____

Player's Name:_____Signature:_____

Parent's Signature:_____

* * * * *

If the player is a minor, signature of parent or guardian is required.

Parent/Guardian Name (please print):_____

Address:_____
_____

Telephone numbers:

Home:_____ Work:_____

SAMPLE PLAYER INVITATION LETTER #1

Dear Junior Tennis Player:

Congratulations! You are among a very select group of young players who are being invited to participate in the USTA Competition Training Center program. Competition Training Centers are designed to help players achieve success in competitive tennis. This program is not intended to replace any aspect of your regular training, but rather, add new dimensions to your regular training.

Your invitation was based on your performance in competition along with the potential you have for development. You will now become part of a nationwide group of youngsters whose development will be tracked by the USTA using the most up-to-date computer technology. Please notify your personal coach of this invitation, as we would like to keep your coach fully informed.

You must reply by the date indicated on the attached information form to accept this invitation. Please fill out the form and return to the address listed on the form.

We are looking forward to having you as a part of this national program. Please feel free to call the USTA Competition Training Center administrator if you have any questions.

Sincerely,

E. Paul Roetert
USTA Player Development
Managing Director, Player Development

SAMPLE PLAYER INVITATION LETTER #2

Dear Junior Tennis Player:

Congratulations! You are among a very select group of young players who are being invited to be considered for participation in the USTA Competition Training Center (CTC) program. The goal of each CTC is to bring the 16 best players within an established geographic region together to train. This supplemental program is not intended to replace any aspect of your regular training. During the season, each player will have the unique opportunity to receive quality skill work practice, competition, fitness training, and sports science information.

If accepted into this program, you will become part of a nationwide group of youngsters whose development will be tracked by the USTA at the sectional and national level. The _____ Tennis Association highly recommends CTC's for players interested in competing at the USTA National Championships and USTA National Zone Team Championships. Parents and personal coaches are encouraged to participate.

Please read the enclosed information sheet carefully. Eight boys and eight girls will be selected to take part in this program. **To be considered for this year's Competition Training Center season, complete the enclosed Application Form by _____ and return to:**

_____
_____
_____

The first meeting will take place on _____. The administrator of the program will notify all players accepted by _____. We are looking forward to having you as part of this national program. Please feel free to call me at ( ) or your area administrator ( ) if you have any questions.

Sincerely,

USTA Player Development
_____ Section

CTC Coach
_____ CTC

USTA COMPETITION TRAINING CENTER INFORMATION SHEET

(Name of City) Competition Training Center

(This Competition Training Center Fact Sheet can accompany the letter on the previous page to all players invited to the center)

WHAT: Competition Training Centers serve as training sites for the 16 most promising players within an established geographic region. These Centers are designed to help players achieve success in competitive tennis and are not intended to replace any aspect of their regular training.

WHERE: List the Names of the Facilities

WHEN: The Center meets for 50 hours.
See the attached schedule for the specific meeting times

GOALS: To give players the opportunity to train with other top players in a non-threatening environment.
To help players develop their competitive skills.
To have fun

COST: The cost for 50 hours of training is $250.00.

COACHES: _____ Head Coach
_____ Coach
_____ Coach

CONTACT: (Name of Administrator)
PERSON: Administrator's telephone number _____
Administrator's
address: _____
_____
_____

DEADLINE: Please complete the application and return to the administrator with your acceptance by _____ .

(Below is a sample letter that could be sent to players or parents of players not selected to the Competition Training Center)

Dear Player/Parent:

We regret to inform you that you were not selected to participate in the (Name of City) Competition Training Center. Once again the process was highly competitive this year, as we could only invite 8 boys and 8 girls into the program. The criterion for the selection of players was based on rankings and recent tournament results.

We appreciate your interest in participating in the USTA Competition Training Center. We hope that you will continue to work hard on your game and will apply to the Competition Training Center again next year. If you have any questions, please feel free to call me at: _____. Good luck with your future endeavors.

Sincerely,

Administrator
(Name of City) Competition Training Center

Dear Coach:

Congratulations! We have selected the following players that you coach to participate in the USTA (Name of City) Competition Training Center: (list player/s). The Competition Training Center serves as a training site for the 16 most promising players in an established geographic region. It is a supplemental program not intended to replace any aspect of a player's regular training. The Competition Training Center meets 50 hours each season.

We are excited that your player/s will take part in the Center and hope that you will get involved as well. Attached is a schedule of the meeting times. If you would like to provide input that would be especially valuable. Please feel free to come to any of the session or contact any of our coaches with questions. If you are interested in volunteering to coach at the center, please let me know at least two weeks ahead of time, so that we can include you in the schedule.

Please feel free to call me at _____ if you have any questions about the Competition Training Center program. I look forward to seeing you at the Center.

Sincerely,

_____
Administrator
(Name of City) Competition Training Center

Dear Facility Contact:

The staff and players of the USTA_____ Competition Training Center are excited about the opportunity to use your facility for the (Year) Competition Training Center season. Enclosed is our schedule for the year. I have indicated on the schedule the number of courts we need each session and what times we will be using the meeting rooms.

The teaching professionals at your club are welcome to participate as volunteer coaches or observers. Since we operate on a limited budget we do not have funds available for additional coaches. Please let me know if any of your coaches have any questions regarding the program.

We will provide all of our own equipment (such as tennis balls and hoppers) for the Competition Training Center. At the end of the season, we will donate our used tennis balls to your club.

We really appreciate the opportunity to use your facility. Thank you for your generosity and support. If you have any questions, please feel free to call me at: _____.

Sincerely,

Administrator
USTA_____ Competition Training Center

Dear Facility Contact:

Once again the USTA_____ Competition Training Center had a successful season. Each session ran smoothly, and we have you to thank for generously donating your court time to the Center. The staff and players all thoroughly enjoyed using your club and its excellent facilities.

We left our used tennis balls with the teaching professionals at your club. Hopefully you will be able to use them in your junior programs.

We are already looking forward to next year and hope that we can use your facility again. Many thanks for all of your support. I look forward to talking to you soon. Have a great summer.

Sincerely,

Administrator
USTA_____ Competition Training Center

SCHEDULES

On the following pages are three sample schedules for the Competition Training Centers. All three schedules are acceptable, but A or B is preferable. Data from the Competition Training Center Evaluations suggest that players generally enjoy and benefit more from shorter sessions that meet more frequently. If scheduling problems only allow for longer sessions, be sure to include several breaks and a meal at each session. Please make sure once you have made your schedule that you send it off to the Player Development staff person in your section.

The Administrator, Coaches and Section Staff for Player Development should work together on the schedule to establish the optimal times for training.

Competition Training Center
Sample SCHEDULE A

FALL SEASON

Sat. Sept. 19 (Rain Date Sept. 20)	*YMCA	10:00 AM - 2:00 PM	3 hours
Sat. Oct. 3 (Rain Date Oct. 4)	YMCA Fitness Testing - Bring Your Running Shoes	10:00 AM - 2:00 PM	4 hours
Sat. Oct. 20 (Rain Date Oct. 21)	YMCA	10:00 AM - 2:00 PM	4 hours
Sat. Nov. 3	*Centre Court	4:00 PM - 8:00 PM	4 hours
Sun. Nov. 4	Centre Court	10:00 AM - 1:00 PM	3 hours
Sat. Nov. 18	Centre Court	10:00 AM - 2:00 PM	4 hours
Sat. Dec. 9	Centre Court	10:00 AM - 1:00 PM	3 hours

SPRING SEASON

Sat. Jan. 23	Centre Court	10:00 AM - 1:00 PM	3 hours
Sat. Feb. 6	Centre Court	10:00 AM - 2:00 PM	4 hours
Sat. Feb. 20	Centre Court Fitness Testing - Bring Your Running Shoes	4:00 PM - 8:00 PM	4 hours
Sun. Feb. 21	Centre Court	10:00 AM - 1:00 PM	3 hours
Sat. Mar. 13	Centre Court	10:00 AM - 2:00 PM	4 hours
Sat. Mar. 27 (Rain Date Mar. 21)	YMCA	10:00 AM - 1:00 PM	3 hours
Sat. Apr. 16 (Rain Date Apr. 17)	YMCA	10:00 AM - 2:00 PM	4 hours

*Directions to the facilities are enclosed

REMINDERS

- Pack a snack or meal for every session except for the last one, when dinner is provided
- For the outdoor sessions (Sept., Oct. and May) dress appropriately, i.e. layered clothing, warm-up suits, etc.

Competition Training Center
Sample SCHEDULE B

FALL SEASON

Fri, Sept 18	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Sept. 19 (Rain Date Sept. 20)	Fitness Testing Bring Your Running Shoes	10:00 AM - 2:00 PM	4 hours
Fri, Oct 2	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Oct. 3 (Rain Date Oct. 4)	LCTA	10:00 AM - 2:00 PM	4 hours
Fri. Oct 19	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Oct. 20 (Rain Date Oct. 21)	YMCA	10:00 AM - 2:00 PM	2 hours
Fri. Nov 2	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Nov. 3	*LCTC Pizza Night	5:00 PM - 8:00 PM	4 hours
Sat. Nov. 15	LCTC	10:00 AM - 1:00 PM	3 hours

SPRING SEASON

Fri, Jan 22	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Jan. 23	LCTC	10:00 AM - 1:00 PM	3 hours
Fri, Feb 5	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Feb. 6	LCTC	10:00 AM - 2:00 PM	3 hours
Fri, Feb 19	LCTC	5:00 PM - 7:00 PM	2 hours
Sat. Feb. 20	LCTC Fitness Testing - Bring Your Running Shoes	4:00 PM - 8:00 PM	4 hours
Fri, Mar 12	LCTC	5:00 PM - 7:00 pm	2 hours
Sat. Mar. 13	LCTC	10:00 AM - 2:00 PM	3 hours
Sat. Apr. 16 (Rain Date Apr. 17)	LCTC	10:00 AM - 2:00 PM	4 hours

*Directions to the facilities are enclosed

REMINDERS

- Pack a snack or meal for every session except for the last one, when dinner is provided

Competition Training Center
Sample Schedule C

FALL SEASON

Sat. Sept. 19 (Rain Date Sep. 20)	*Centre Court	2:00 PM - 8:00 PM	6 hours
Sat. Oct. 10 (Rain Date Oct. 11)	Centre Court	1:00 PM - 8:00 PM	7 hours
	Fitness Testing - Bring Your Running Shoes		
Sat. Nov. 14	Centre Court	1:00 PM - 7:00 PM	6 hours
Sat. Dec. 12	*YMCA	1:00 PM - 7:00 PM	6 hours

SPRING SEASON

Sat. Jan. 16	YMCA	2:00 PM - 8:00 PM	6 hours
Sat. Feb. 27	Centre Court	2:00 PM - 9:00 PM	7 hours
Sat. Mar. 26	YMCA	1:00 PM - 7:00 PM	6 hours
Sat. Apr. 23 (Rain Date Apr. 24)	Centre Court	1:00 PM - 7:00 PM	6 hours

*Directions to the facilities are enclosed

REMINDERS

- Pack a snack or meal for every session except for the last one, when dinner is provided
- For the outdoor sessions (Sept., Oct. and May) dress appropriately, i.e. layered clothing, warm-up suits, etc.

USTA COMPETITION TRAINING CENTER

PROJECTED BUDGET

PLEASE COMPLETE BEFORE FIRST MEETING AND KEEP FOR THE CENTER'S RECORDS ESTIMATE WHERE EXACT FIGURES ARE UNKNOWN

NAME OF COMPETITION TRAINING CENTER: _____

COMPETITION TRAINING CENTER ID#: _____

INCOME

FEE FOR PLAYERS _____

FUNDRAISING AND SPONSORSHIP _____

MISCELLANEOUS _____

SUBTOTAL _____

EXPENSES

COACHES WAGES
- HEAD COACH _____
- COACH 1 _____
- COACH 2 _____

ADMINISTRATIVE EXPENSES _____

ADMINISTRATIVE HONORARIUM _____
COURT FEES _____

MISCELLANEOUS _____

SUBTOTAL _____

	DEFICIT	SURPLUS
GRAND TOTAL	_____	_____

INCOME & EXPENSE REPORT

NAME OF COMPETITION TRAINING CENTER: _____ CTC ID#: _____

AMOUNT RECEIVED FROM PLAYERS:
_____ Players @ $_____ _____
_____ Alternates @ $_____ _____

SECTIONAL FINANCIAL AID:
_____ Players @ $_____ _____

SPONSORSHIP:
Name of Sponsor(s): _____ _____

FUNDRAISING:
Type of Fundraising: _____ _____
Carryover from previous CTC Program: _____

MISCELLANEOUS:_____ _____

TOTAL INCOME: _____

COACHING FEES: (Please list individually)
Head Coach: _____ Hours at $_____ per hour _____
Coach: _____ Hours at $_____ per hour _____
Coach: _____ Hours at $_____ per hour _____
Additional Coaches: _____ Hours at $_____ per hour _____

COURT FEES:
Facility #1: _____ Hours at $_____ per hour _____
Facility #2: _____ Hours at $_____ per hour _____

ADMINISTRATIVE HONORARIUM _____

CTC GATHERINGS (i.e. pizza party) _____

ADMINISTRATIVE EXPENSES
Postage: _____
Printing: _____
Telephone Calls: _____
Other: _____

DEFICIT FROM PREVIOUS CTC SEASONS: _____

FITNESS TESTING: _____

TRAVEL FOR COACHES: _____

OTHER EXPENSES (Please list type of expense):
_____ _____
_____ _____
TOTAL EXPENSES: _____

TOTAL PROFIT OR (LOSS) _____
If you had a negative balance, please explain why? (Please use back if necessary)

USTA Player Development
Competition Training Center
Administrator

Administrators at Competition Training Centers will work with the CTC Coaches to coordinate the overall activities of the Competition Training Center. He/She will be responsible for upholding USTA policies and communications with USTA Section personnel.

Qualifications - Candidates must show evidence of:

1. Experience in administration of tennis programs of similar size and scope to the USTA Competition Training Center.
2. Demonstrated ability with record keeping.
3. Good organizational skills.

Duties:

Administration: Responsible for all administrative aspects of the Competition Training Center such as:

A. Arrange the schedule of operating dates for the Competition Training Center. This should be done in consultation with the Competition Training Center coaches.
B. Inform all interested parties (e.g., players, parents, coaches, Sectional Staff, Facility Staff, etc.) of the schedule and any changes in scheduling.
C. Make arrangements for other facilities and equipment as needed. (e.g., indoor courts, meeting room, tennis balls, video camera, etc.)
E. Keep financial records.

Financial: Responsible for all financial details of the Competition Training Center such as:

A. Collect fees from players.
B. Pay coaches according to USTA guidelines.
C. Reimburse staff for allowable expenses incurred.
D. Contact Sectional office on behalf of players who may need financial assistance.

Other: Establish a system of regular communication with Sectional Player Development Staff.

USTA Player Development
Competition Training Center
Coach

Coaches at Competition Training Centers will work with the best players from a designated geographic area. He/She will be responsible for upholding USTA policies and coordinating efforts with USTA Section/District personnel.

Qualifications - Candidates must show evidence of:

1. Demonstrated commitment to junior tennis by coaching junior players, many of who have achieved a ranking from some recognized authority.

2. Be certified by the USPTA or PTR and hold the highest certification level offered by these groups (excluding Master Pro).

3. Have completed the USTA Level I Sport Science Competency Test and working towards completing level 2a, 2b, and 2c tests.

4. Have a playing background of high standard as demonstrated by ranking or other comparable achievement.

5. Be in good standing with USTA Section/District.

6. Complete the educational and training requirements established by the USTA.

7. Demonstrate ethical standards in all aspects of working with the CTC Program.

Duties

1. Organize and conduct the program at Competition Training Centers following the USTA provided guidelines.

2. Communicate with personal coaches of players regarding the Competition Training Center program.

3. Work with the Competition Training Center Administrator regarding the selection of players.

4. Communicate regularly with USTA Section/District Personnel on the operations of the USTA Competition Training Centers.

Administrator's Checklist

I. Arrange Organizational Meeting With CTC Staff	
Set-up yearly calendar - Times/Dates	
Assign dates for Competition Training Centers	
Inform Sectional Staff for Player Development of where supplies need to be sent	
II. Confirm Selection Process With Staff	
Confirm selection method and report to Sectional Staff Person for Player Development	
Confirm that selected players, their parents, and personal coaches are notified of selection	
Confirm that substitutes and non-selected players , parents, and personal coaches are notified of selection as substitutes	
III. Make arrangements for each CTC Workout Session	
Reserve courts and make rain/snow plans if necessary	
Coordinate with coaches any special equipment needed for workout sessions	
Coordinate with coaches the invitation to guest speakers, personal coaches, and special guests, USPTA and USPTR	
Confirm with coaches the date, time, and location of each workout session	
Confirm with players the date, time, and location of each workout session	
IV. Maintain Financial Records of CTC	
Collect fees from players	
Pay coaches - This must be coordinated with Sectional office	
Pay court fees (if applicable)	
Pay guest speakers (if applicable)	
Coordinate fundraising and sponsorship with 501(c)3	

Send coaches IRS form 1099-Misc where necessary (form to be filled out by midnight, January 31.)	
Keep records of all income and expenses of CTC	
Submit expense records to Sectional Staff Person for Player Development and to the national office at the end of the season.	
V. Forms to be Sent to National Office	
Player Information Forms	
Fitness Testing Result Forms	
Financial Accounting Report	
Personnel Updates	
Tentative Schedule	
VI. Checklist of Supplies to be Received and Date - If not Received Please Inform Sectional Staff Person	
Balls: Shipment #1 by Shipment #2 by	
Stationery	
Competition Training Center manual or updates	
Banners	
VII. Miscellaneous	
Contact Sectional Staff Person with any questions	
Thank you letters to guest speakers, volunteers, coaches, and any special volunteer/sponsor	
Evaluation with staff after last session with suggestions for improving future sessions	
Communicate with non-selected players/suggestions	
Have fun!	

Goal-Setting

Pre-Season: developing goals for the upcoming season.
Daily: setting goals for practices and matches

Total Time of Activity

Pre-season 13-15 minutes;
Daily 5 minutes

Purpose:

Pre-season (3-5 minutes)

- The purpose of this exercise is to teach players the importance of long-term goal-setting.
- Use the EXAMINING YOUR GOALS Worksheet.
- Team goals should always relate back to the Team Mission or Vision Statement.

Daily

- The purpose of this exercise is to teach players the importance of short-term goal-setting.
- Use the MOUNTAIN GOAL FORM
- For daily goal setting to be most effective players should set goals for every practice and match. They should keep a log of their goals and if they achieved them. This will increase their focus on improvement, and it is easier to track their progress.
- Daily goals should relate back to PRE-SEASON GOALS.
- Have players bring their mission statement, goals for the season, and their daily goal setting log (if applicable) to the goal-setting session.
- It is suggested that the coach make daily goal-setting a component of each day's practice. Have players' keep their goal-setting log in their tennis bag and complete the goal for today's practice or match before the practice or match.

Team Mission Statement

The team mission statement should be a highly recognized goal whose purpose is to increase team cohesion by clarifying the level of discipline, commitment, and effort required by each player to make the team successful. This statement should have inputs from every member of the team, which are complied into a written contract, signed by the team members, and vocalized to help in guiding the direction of the team.

Procedure:

Pre-seasonal (10 minutes); Daily (5 minutes)

- **Step 1:** Hand out a pencil and one EXAMINING YOUR GOALS Worksheet (Pre-season) or one MOUNTAIN GOAL FORM (Daily) to each player.

- **Step 2:** Start the exercise by telling the players that the purpose of this exercise is to increase their commitment to improvement, strengthen their focus on development, and track their progress during the season in according to their long and short term goals. Emphasize that they should come up with goals that will most likely lead to the most improvement. Note: For teams goal-setting have an open discussion on what the team goals for the season should be.

- **Step 3:** Read the instructions to your athletes. Spend 2-3 minutes on explaining the EXAMINING YOUR GOALS Worksheet for pre-season goals.

- **Step 4:** Pay attention to these goal setting reminders: [1] Goals should be specific, challenging, and realistic; [2] Focus on performance goals before outcome goals; [3] Set game goals and practice goals; [4] Write down your goals so you can see them daily; [5] Evaluate your goals as you make progress.

- **Step 5:** Ask your players what their short and long-term goals are. Challenge them to explain to you how they intend to accomplish their short and long-term goals, and what in their short-term goals would aid in those accomplishments.

Discussion Questions/Thoughts

- What to do we want to achieve this season?
- How do we achieve our goals?

Sample Examining Your Goals Worksheet

Instructions: Complete the questions below based on either your tennis experience or professional-career goals (e.g., to become a nationally ranked tennis player).

1. Dream goal (long-term): What is your long-term dream goal? What is possible in the long-term if you stretch all your limits?

To become a nationally ranked tennis player

2. Dream goal (this year): What is your dream goal for this year? What is possible if you stretch all your limits this year?

To win my conference championship.

3. Realistic performance goal (this year): What is a realistic performance goal that you can achieve this year (based on your present skill level, your potential for improvement, and your current motivation)?

Raise my first serve percentage from 55 to 65%.

4. Monthly goal: Set a personal goal that you feel you can achieve within the next month. Name one goal you would like to focus on with special intensity.

Develop a consistent toss (toss to same spot every serve).

5. Next lesson or practice goal: Set a personal goal that you feel you can achieve by the end of your next class or practice. Name one goal you would like to focus on with special intensity.

Find the toss I am comfortable with.

Adapted from Orlick, T. (1986a). Coaches training manual to psyching for sport. Champaign, IL: Human Kinetics

UUUUUExamining Your Goals Worksheet

Instructions: Complete the questions below based on either your tennis experience or professional-career goals (e.g., to become a nationally ranked tennis player).

1. Dream goal (long-term): What is your long-term dream goal? What is possible in the long-term if you stretch all your limits?

_____

_____

2. Dream goal (this year): What is your dream goal for this year? What is possible if you stretch all your limits this year?

_____

_____

3. Realistic performance goal (this year): What is a realistic performance goal that you can achieve this year (based on your present skill level, your potential for improvement, and your current motivation)?

_____

_____

4. Monthly goal: Set a personal goal that you feel you can achieve within the next month. Name one goal you would like to focus on with special intensity.

_____

_____

5. Next lesson or practice goal: Set a personal goal that you feel you can achieve by the end of your next class or practice. Name one goal you would like to focus on with special intensity.

_____

_____

_____

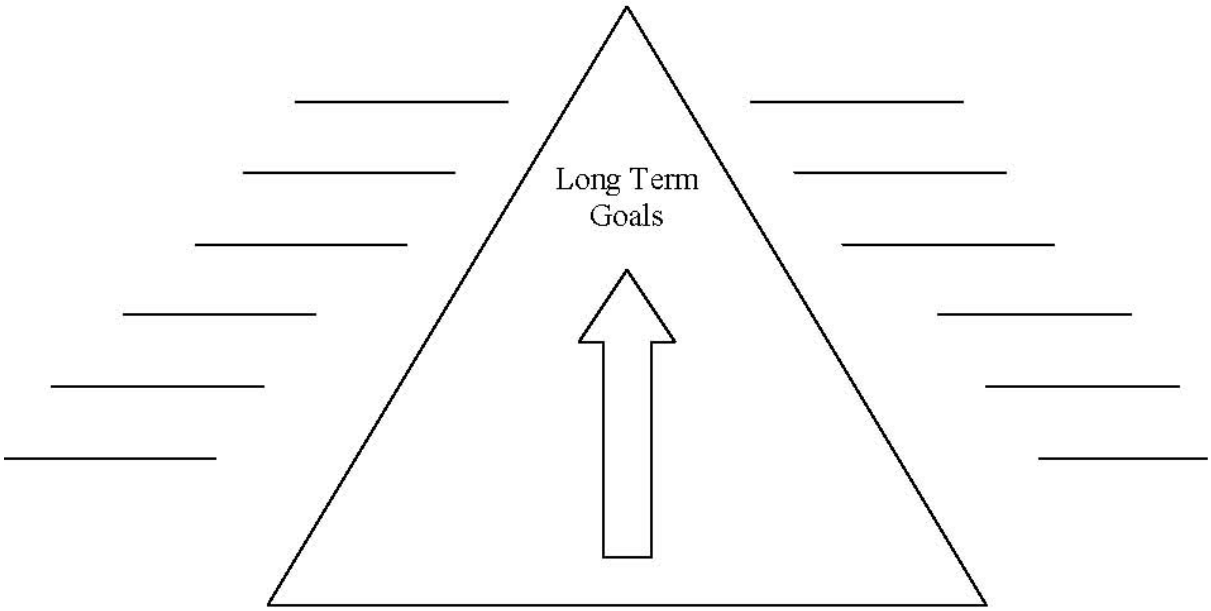
Mountain Goal Form

Instructions: The Mountain Goal Form is designed to help you determine what you need to do to meet your dream, by thinking about your strengths and weaknesses, and setting short-term goals to strengthen the areas you need to improve to meet long-term goals. Note: It is recommended that you set deadlines on your goals (e.g., I will hit 75% of my forehands in by 09/30/04), and keep track of your progress.

Mountain to Peak Tennis Performance: Setting short term goals to meet long term goals

Dream Goal (e.g., Make the Professional Tour)

Your Dream Goal: _____



Short Term Goals

Short Term Goals to Meet Long Term Goals (e.g., improve first serve percentage; serve 60% of first serves in by 09-30-04)

Developing a Routine

Develop a personal match routine.

Total Time of Activity

15 minutes

DRILL
2

Mental Skills Addressed	Equipment	Area Needed	Personnel
Routines	Pencils/Folders	Off-court	Leader 1-20 Players
	Worksheet A: Between Points Routine Worksheet B: My Between Points Routine Worksheet C: Adapting My Routine		

Purpose:

- ***The purpose of this exercise is to guide athletes through the development of a routine to use in match play***
- ***You will need copies of all three worksheets (A, B, C) for each player***

Procedure

(15 minutes)

- **Step 1:** Handout a pencil, one folder, one Worksheet A: BETWEEN POINTS ROUTINE and one Worksheet B: MY BETWEEN POINTS ROUTINE to each player.
- **Step 2:** Read your players the following, *"If you watch professional players all of them use routines between points. They will breath deep and let it out, look at their strings, bounce on their toes, and get ready for the next point by focusing on the ball. To effectively deal with pressure situations like break points you need to follow a routine that will help you play great in pressure situations."*
- **Step 3:** Read Worksheet A: Between Points Routine to your players.
- **Step 4:** Next, allow your players 5 minutes to create their own routine using Worksheet B: My Between Points Routine.
- **Step 5:** After the players have completed their routines, handout one Worksheet C: ADAPTING MY ROUTINE to each player.

- **Step 6:** Read your players the following, *"When your not playing well, you need to do something extra besides your routine to recover and prepare for the next point. When things are going great it's like a green light, your on a roll. However, when your play is starting to drop, you begin to miss some shots or lose your focus, you are at a yellow light. This means caution, you need to pick up your play. When things are going really bad, and you can't do anything right, this is like a red light. Your game is stopped and it's hard to get it going again. When you are at a yellow or red light you need to use one of the skills you have learned (e.g., positive talk, imagery) to start playing well again."*
- **Step 7:** Read the worksheet instructions to your players.
- **Step 8:** Inform your players to put their routines in their folder, and place it in their tennis bag so they can refer to it everyday.

Discussion Questions/Thoughts

- Discuss the importance of using a routine consistently for it to be effective.

Worksheet A: BETWEEN POINTS ROUTINE

Stage 1: Physical Response Immediately After Point Ends

*** End Point With Positive Physical Response**
*** Carry Racket By Throat Between Thumb And Forefinger** (Racket Is Not Carried With Head Hanging Down)
*** Confident Image** (Shoulders Back, Head Up)
* **High Energy Walk** (Walks On Toes, Not On Heels, And Projects Intensity)

Stage 2: Relaxation Response

*** Eyes Controlled** (Eyes On Strings, Ground, Ball)
*** Looks Relaxed And Loose** (Arms Hang Freely; Bends; Stretches; And Takes Deep Breaths [Centers])
*** Takes Normal Amount Of Time Between Shots**

Stage 3: Preparation Response

*** Thinks Clearly Before Point Begins** (Walks Across Baseline And Pauses Before Serving Or Returning)

Stage 4: Readying Response

*** Performs Well-Defined Preshot Routine** (Before Serve--Bounces Ball One Or More Times And Pauses After Bouncing For A Minimum Of One Second; Before Receipt Of Serve--Stimulates Feet, Sways Back And Forth).

Adapted from Loehr (1990).

Worksheet B: My BETWEEN POINTS ROUTINE

Instructions: Using your own previous tennis playing experience (think of how you act between shots when playing well versus poorly) and the information on the previous page identify key components that should be included in your between shot routine.

Stage 1: Physical Response Immediately After Point Ends

_____

_____

_____

_____

Stage 2: Relaxation Response

_____

_____

_____

_____

Stage 3: Preparation Response

_____

_____

_____

_____

Stage 4: Readying Response

_____

_____

_____

_____

Sample Worksheet C: Adapting My Routine

Instructions: The purpose of this worksheet is to have a routine ready for times when you are not playing well. On the left are green (go! playing great), yellow (caution! starting to lose it), red (stop! playing bad). To the right of each light is a space for you to write in when you get green, yellow, or red lights and what you will do in these situations (during green light times follow your normal routine and avoid changing what is working). Remember to use the mental skills (e.g., positive talk, body language, imagery, relaxation) you have learned to cope with yellow and red light situations.

RED LIGHTS
(Stop! I am playing bad,
I am not focused)

When do you get Red Lights (e.g., when I'm tired)?
When I get behind early and lose some confidence.

What will you do (e.g., say focus and look at strings)

I will use my positive talk cue "one point at a time" and focus on following my game plan on each point.

YELLOW LIGHTS
(Caution! I am starting to miss my shots, lose my focus)

When do you get Yellow Lights (e.g., set points)?
When my opponent breaks my serve early in a match.

What will you do (e.g., walk away from baseline/centered breathing)
I will refocus by taking a deep breath, bounce on my toes and visualize and great service return.

GREEN LIGHTS
(Go! I am playing great)

When do you get Green Lights (e.g., when mentally ready)?
When I am just playing and not worrying about my opponent, the score, or making mistakes.

What will you do?

Follow my between point routine.

Adapted from Ravizza, K. & Hanson, T. Heads up baseball.

Worksheet C: Adapting My Routine

Name:_____

Date: _____

Instructions: The purpose of this worksheet is to have a routine ready for times when you are not playing well. On the left are green (go! playing great), yellow (caution! starting to lose it), red (stop! playing bad). To the right of each light is a space for you to write in when you get green, yellow, or red lights and what you will do in these situations (during green light times follow your normal routine and avoid changing what is working). Remember to use the mental skills (e.g., positive talk, body language, imagery, relaxation) you have learned to cope with yellow and red light situations.

RED LIGHTS
(Stop! I am playing bad,
I am not focused)

When do you get Red Lights (e.g., when I'm tired)?

_____

_____

What will you do (e.g., say focus and look at strings)

_____

_____

YELLOW LIGHTS
(Caution! I am starting to miss
my shots,lose my focus)

When do you get Yellow Lights (e.g., set points)?

_____

_____

What will you do (e.g., walk away from baseline/centered breathing)

_____

_____

GREEN LIGHTS
(Go! I am playing great)

When do you get Green Lights (e.g., when mentally ready)?

_____

_____

What will you do?

_____

Adapted from Ravizza, K. & Hanson, T. Heads up baseball.

Factors Players Can and Cannot Control

Teaching players what they can and cannot control in tennis.

Total Time of Activity
10 minutes

DRILL
3

Mental Skills Addressed	Equipment	Area Needed	Personnel
Concentration	Paper Pencils	Off-court	Leader 1-20 Players

Worksheet D: Factors You Can Control

Set-Up

- The purpose of this exercise is to teach players what they can and cannot control on the tennis court. Trying to control things you cannot can lead to frustration, while not taking control over things you can limits growth.

Procedure

(10 minutes)

- **Step 1:** Handout a pencil and paper to each player.
- **Step 2:** Read your athletes the following,

"It is important to learn what is under your control, like your intensity during practice, and not under your control, like the weather."

- **Step 3:** Have your players draw two circles on the sheet of paper, and read the following,

"If you draw two circles, one is what's under your control and the other is not under your control. If you try to control things outside of your control it can lead to frustration, anger, and bad play. However, if you don't take control over things that you can it will hurt your performance. Therefore, you must learn what you can and cannot control."

- **Step 4:** Give an example of something you can and cannot control and put in the respective circles.
- **Step 5:** Now give your athletes 5 minutes to write in the circles factors they can/cannot control.
- **Step 6:** Discuss player responses. Use Worksheet D "Factors Player Can and Cannot Control" to give examples or to provide direction for those not grasping the concept. Note: Explain to athletes that some things are under their control but not completely (e.g., hitting the ball depends on the athlete, but also their opponent, wind, etc.).
- **Step 7:** Finish the exercise by conveying the key points to your athletes listed on Form X.

Discussion Questions/Thoughts

- What stresses you in sport?
- Why is this factor (parent's thoughts) an area of concern but not under your influence?
- If it's an area of concern, how can you make it under your control?
- Can others make you feel or think certain ways?
- How do you deal with things under your control that negatively affects you?

Roetert, P. & Weiss, G. at USTA Player Development Center

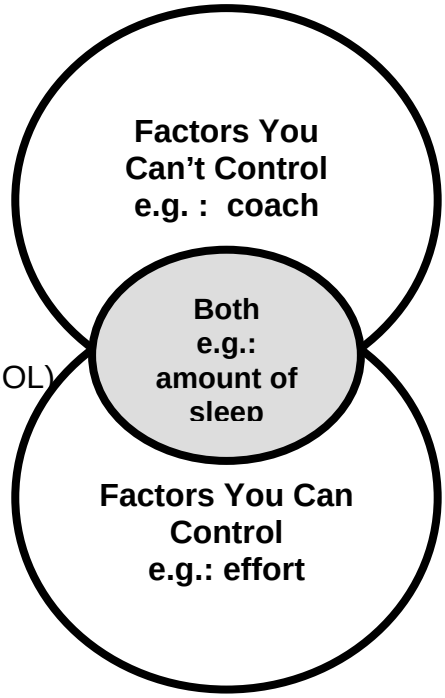
Worksheet D: Factors Players Can and Cannot Control

Instructions: Use this form as a list of potential factors to help athletes think about what they can and cannot control. The key points of this exercise are also listed as a reminder of what athletes should learn.

- Key points to get across to athletes are:

1. Let go of the things you cannot control. Attempting to control these things leads to frustration and pressure.
2. **You can't control what other people think, feel, or do. You can only control your reaction and responses (e.g., if an opponent is cheating on line calls, you will not be able to change their behavior, so use it to your advantage, "Cheating won't help them against me.").**
3. Although the primary purpose of this exercise is for players to learn what they can and cannot control, as they become more mature, experienced, and skillful they will take more responsibility for their actions. So, the circle of what they can control becomes larger.

Possible Factors List:



- Your intensity during practice (CONTROL)
- The weather (CANNOT CONTROL)
- Your mental state (CONTROL)
- Coach's feelings (CANNOT CONTROL)
- Parent's actions (CANNOT CONTROL)
- The court surface (CANNOT CONTROL)
- How you act (CONTROL)
- Parent's feelings (CANNOT CONTROL)
- The start time of the match (CANNOT CONTROL)
- Coach's thoughts (CANNOT CONTROL)
- Your response to situations (CONTROL)
- Your opponent (CANNOT CONTROL)
- A string breaking(CANNOT CONTROL)
- How you feel (CONTROL)
- Coach's actions (CANNOT CONTROL)
- What you eat (CONTROL)
- Parent's thoughts (CANNOT CONTROL)
- Line calling on your opponent's side of the net (CANNOT CONTROL)
- Your confidence (CONTROL)
- Your draw for the tournament (CANNOT CONTROL)
- Hitting the ball (BOTH)
- Who your coach is (BOTH)
- How much you sleep (BOTH)
- Your ranking (BOTH)

Roetert, P. & Weiss, G. at USTA Player Development Center

Countering Negative Thoughts

Develop the ability to change negative thoughts to positive thoughts.

Total Time of Activity

15-30 minutes

DRILL
4

Mental Skills Addressed	Equipment Personnel		Activity Setting
Positive Thoughts	1 Note card/player Pencils	Off-court	1 judge At least 4 players

Purpose:

- The purpose of this exercise is to help players develop the ability to change negative thoughts into positive ones.
- Key points players should learn are: (a) separate the person and the action, (b) they are in control of their thoughts, (c) self-talk should be productive, and (d) replace the bad, repeat the good.

Procedure

(10-20 minutes)

- **Step 1:** Sit the players in a circle and distribute one card and pencil to each.

- **Step 2:** Explain to the players that negative thoughts decrease confidence, and consequently performance. So, it is important to think positively and productively. The purpose of this exercise is to learn how to counter negative thoughts with positive ones. For example “I can’t hit my forehand in,” can be changed into “I will hit my forehand in”.

- **Step 3:** Have them think about the negative thoughts they have during matches or practice.

- **Step 4:** Each player should write on the note card the negative thought that they believe is most common or detrimental to their performance.

- **Step 5:** The leader collects the cards.

- **Step 6:** Break the players into several groups.

- **Step 7:** Select a card. Have each group deliberate for 30 seconds and develop a positive counter statement.

- **Step 8:** Each group announces its counter statement.

- **Step 9:** The judge decides which is the best of the statements (Criteria: Does the statement refer back to original statement, is it positive, short, and under player's control?) and gives that group a tally.

- **Step 10:** Continue to the next note card.

- **Step 11:** When finished with the note cards, the team with the greatest number of best counter statements is given a reward (e.g., do not have to pick-up balls for the upcoming practice).

Variations

- Negative thoughts could be placed on the cards by the coaches to save time (see Worksheet E: Negative Self-Talk Phrases for a list).
- For a supplemental exercise use Worksheet F Personal Positive Belief Statements to help players develop a personal list of positive statements.

Discussion Questions/Thoughts

- **How can we counter negative thoughts in competition?**

Roetert, P. & Weiss, G. at the USTA Player Development Center

Worksheet E: Negative Self-Talk Phrases

Instructions: This is a list of negative self-talk phrases that can be placed on the note cards by the leader to save time. The original negative statement is listed first, followed by a positive replacement, and finally a key point to relay to your athletes.

Negative Talk: If I lose to this rotten player I'm the worst player on the planet.
Positive Reframe: *"Play your game; one point at a time"*
Key Points: e.g., Focus on things you can control, not the outcome

Negative Talk: Why can't I hit that stroke in matches like I do in practice?
Positive Reframe: *"I own that shot! If I keep hitting it, it will be there."*
Key Points: e.g., Trust the strokes that you have worked on in practice.

Why do I always have to play him/her? I've lost to him/her the last 3 times.
"I've played this person before. I know his/her weaknesses, and my game is better than it was before. I will compete better this time."
e.g., Focus on your game and how it is improving. Believe you can win the match until the last point is over. Don't lose the match before it's played.

Oh no, there are all the national coaches watching me play. What if I choke?
"I love it when people watch me. I love to show everyone my talent."
e.g., Control what you think and how you play. You can't control what others think. It is better to have coaches watching you than ignoring you.

I've been broken the last three times, I just can't hold serve.
"Serve to a location, and construct the point"
e.g., Focus on what you need to do in order to win the next point. Use previous experience to develop better strategy.

This heat is awful. I don't know if I'll make it through this match.
"I've trained hard in this type of weather. I can stay out here longer than my opponent"
e.g., Trust your training, and realize that your attitude often controls your physical response.

If I can only stop choking on big points, I can win this match.
"Being nervous is good. It means I'm ready to go!"
e.g., Physical signs of nervousness do NOT have to be negative. The mind decides how to interpret "butterflies".

All right now, just don't screw up this return.
"Quick feet. Short back swing. Play the ball."
e.g., Focus on what you need to do, NOT on what you don't want to do.

Come on you loser, hit the ball!
"Move your feet. Come on! You can do it!"
e.g., Don't associate how you play with who you are. Focus on what you need to do to get the ball in your hitting zone.

I can't believe how lucky this guy is, he'll never miss.
"This guy is playing well, but it won't last forever, he'll come back to earth"
e.g., Focus on the things you can control. Play your game.

Don't be nervous-just don't be nervous, great players never get nervous.
"Yeah, I'm really pumped to play. All great players feel this way."
e.g., All players get nervous. It helps to view it as excitement rather than fear.

That bad warm-up will cause me to play bad in this match.
"I'm saving all my great shots for the match"
e.g., Create your own reality for one that builds confidence, rather than eroding it.

Oh no, I'm starting to lose my lead.
"Stay in the present; one point at a time"
e.g., Focus on things you can control, not the outcome

This wind is the pits. I can't hit my shots at all.
"I can use the wind to my advantage. Aim well inside the lines."
e.g., Focus on things you can control. Reframe the situation to the positive.

I always play worse when it counts most.
"I love big matches!"
e.g., Learn to love the experience of playing every match regardless of the results.

I just want to get this awful match over with and get out of here.
"Keep fighting until the last point. I may not be hitting the ball my best, but I can win other ways"
e.g., Don't let your attitude decide the match. Don't reinforce bad playing habits, such as giving up/"tanking".

Oh no, how could my best stroke break down just when I need it most.
"I own that shot! If I keep hitting it, it will be there. "
e.g., Trust the strokes that you have worked on in practice.

If I lose to this guy/girl I'll be letting my parents down.
"Play your game; one point at a time"

e.g., Focus on things you can control, not the outcome.

How can anyone play on these awful courts.
"I've trained hard on all types of courts. I can play on any type of surface."
e.g., Trust your training, and realize that your attitude often controls your performance.

From Roetert, P. & Weiss, G. at the USTA Player Development Center

Worksheet F: Personal Positive Belief Statements

Instructions: A personal belief statement is a phrase you believe in, motivates you, and makes you feel good. Below is a list of positive belief statements. In the space provided, personalize these statements by putting them in your own words (use statements that are listed if it is already in the words you would use). Make certain your belief statements are positive (e.g., I will do something, avoid "don'ts"). Repeat your statements several times a day, especially before practices and matches. You will find that repeating your personalized belief statements out loud daily will enhance your self-confidence. Remember, just don't say it, mean it!

Example:

Positive Belief Statements	**Personalized Belief Statements**
I am a great tennis player.	*I'm awesome. I'm the baddest player around.*

Adapted from Taylor, J. (1996). The mental edge for tennis. (4th ed.). Aurora, CO: Minuteman.

Positive Belief Statements	**Personalized Belief Statements**
I am a great tennis player.	
I enjoy competing.	
I love being challenged by my opponent, and I enjoy pressure situations.	.
I will play great today.	
I practice and play matches at full effort and intensity every day.	
I think and talk positively.	
I am confident, relaxed, and focused.	
I play my hardest every match.	

ID PLAY

PS FOR TENNIS PLAYERS

ks during play. Sport drinks are especially helpful
n hot weather and for recovery after play.
routine before, during and after practice.

RING PLAY

to 8 ounces (4 to 8 normal
vs) after the warm-up and

AFTER PLAY

Weigh yourself before and after play
and drink about 20-24 ounces of fluid

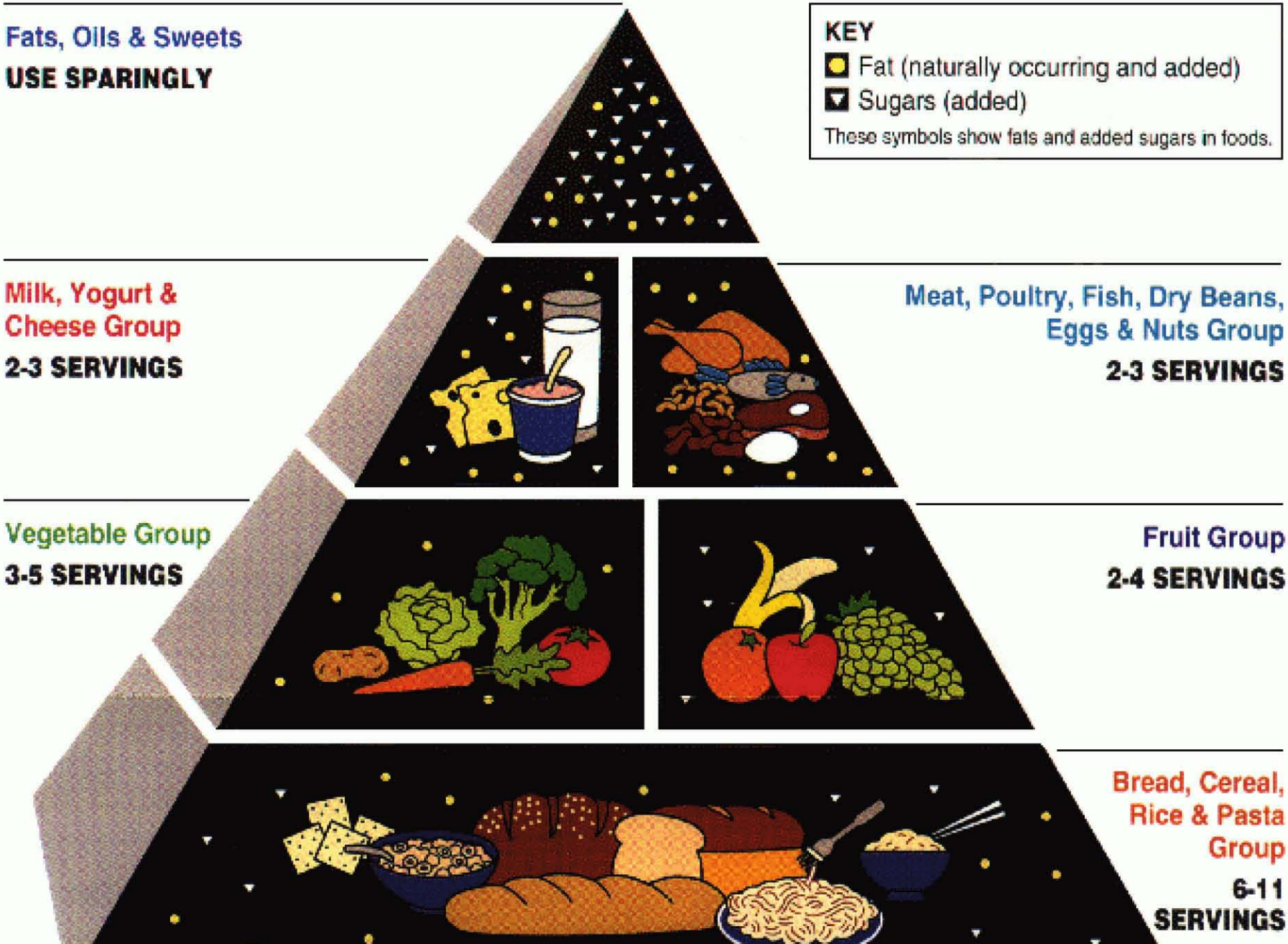

Fats, Oils & Sweets
USE SPARINGLY
KEY
Fat (naturally occurring and added)
Sugars (added)
These symbols show fats and added sugars in foods.
Milk, Yogurt & Cheese Group
2-3 SERVINGS
Meat, Poultry, Fish, Dry Beans, Eggs & Nuts Group
2-3 SERVINGS
Vegetable Group
3-5 SERVINGS
Fruit Group
2-4 SERVINGS
Bread, Cereal, Rice & Pasta Group
6-11 SERVINGS

Table 1: Vitamins and Their Functions

Vitamin	Function	Dietary Sources
Vitamin A	Promotes growth and repair of body tissues, bone formation and healthy skin and hair. Essential for night vision.	Liver (all sources), giblets, some cheese, egg yolk, whole milk, butter
Beta-carotene	Serves as an antioxidant.	Sweet peppers, carrots, grape leaves, pumpkin, sweet potatoes, yams, broccoli, dandelion greens, chili peppers, mustard greens, spinach, kale, turnip greens, apricots, papaya, watermelon, peaches, asparagus, winter squash, cantaloupe, muskmelon, chard
Vitamin D	Helps to build bone mass and prevent bone loss. Helps maintain blood levels of calcium and phosphorous.	Fish (herring, salmon, oysters, catfish, sardines, tuna, shrimp, mackerel), milk, margarine, fortified breakfast cereals, egg yolk, eggs, butter
Vitamin E	Serves as an antioxidant. Needed for normal growth and development.	Oils (wheat germ, vegetable), mayonnaise, fortified breakfast cereals, nuts (almonds, hazelnuts, peanuts, hickory, pistachio), margarine, wheat germ, peanut butter
Vitamin K (phylloquinone)	Needed for normal blood clotting and bone health.	Kale, Brussels sprouts, spinach, Swiss chard, cauliflower, broccoli, turnip and mustard greens, carrots, asparagus, avocado, bell peppers, strawberries, tomatoes, apples, peaches
Vitamin C	Promotes healthy cell development, wound healing, and resistance to infections. Serves as an antioxidant. Necessary for conversion of the inactive form of folic acid to the active form. Makes iron available for hemoglobin synthesis in blood.	Sweet peppers, broccoli, Brussels sprouts, cauliflower, strawberries, oranges, orange juice, limes, lemon juice, grapefruit, grapefruit juice, papayas, cantaloupe, tomatoes, tomato juice, asparagus, raw cabbage, spinach, pineapple, raspberries, potatoes, and onions
Thiamin (B_1)	Needed for carbohydrate metabolism. Needed for normal functioning of the nervous system and muscles, including the heart muscle.	Fortified breakfast cereals, sunflower seeds, peas, pork, orange juice, lima beans, pecans, enriched rice
Riboflavin (B_2)	Needed for red blood cell formation, nervous system functioning, and carbohydrate, protein and fat metabolism. Needed for vision and may help protect against cataracts.	Liver, wheat germ, brewer's yeast, almonds, cheese, fortified breakfast cereal, whey protein, milk, eggs, lamb, pork, veal, beef, broccoli, yogurt

Niacin	Needed for carbohydrate, protein and fat metabolism and proper nervous system functioning. High intakes can lower elevated cholesterol.	Soy protein, soy flour, textured vegetable protein, whey protein, beef, peanuts, peanut butter, sunflower seeds, fortified breakfast cereals
Pyridoxine (B_6)	Needed for protein metabolism, nervous system, and immune function. Involved in synthesis of hormones and red blood cells.	Liver, bananas, fortified breakfast cereals, soybeans, chicken, tuna, raw carrots, beef, broccoli, spinach, potatoes, alfalfa sprouts, navy beans, peanut butter, garbanzo beans, walnuts, sunflower seeds, avocado, eggs, lima beans, cabbage, salmon
Folic Acid	Needed for normal growth and development and red blood cell formation. Reduces risk of neural tube birth defects. May reduce risk of heart disease.	Brewer's yeast, fortified breakfast cereals, liver, blackeyed peas, beans (pinto, black, lima, white, garbanzo, soy), peanuts, peanut butter, spinach, turnip greens, asparagus, mustard greens, seaweed, eggs, enriched bread, orange juice
Cobalamin (B_{12})	Vital for blood formation and healthy nervous system.	Liver, oysters, lamb, eggs, beef, shellfish, fish, poultry, pork, chicken, fortified breakfast cereals
Biotin	Assists in the metabolism of fatty acids and utilization of B-vitamins.	Nuts (peanuts, hazelnuts, soy, almonds, cashews, macadamia), peanut butter, black eyed peas, liver, milk, egg yolks, yeast, cheese, cauliflower, carrots, avocado, sweet potatoes
Pantothenic Acid	Aids in normal growth and development.	Liver, sunflower seeds, fortified breakfast cereals, egg yolk, whey protein, soy protein, peanuts, pecans, veal, peanut butter, enriched rice, broccoli, lima beans

Table 2: Minerals and Their Functions

Mineral	Function	Dietary Sources
Calcium	Essential for healthy bones and teeth. Assists in blood clotting, muscle function and nerve transmission. Reduces risk of osteoporosis.	Fruit juices and fruit drinks fortified with calcium, cheese, sardines, milk, cottage cheese, yogurt, ice cream, calcium set tofu, turnip greens, Chinese cabbage, mustard greens, kale, rutabaga
Phosphorus	Works with calcium to develop and maintain strong bones and teeth. Enhances use of other nutrients. Essential for energy production, DNA structure, and cell membranes.	Cheese, fish, beef, pork, whole-wheat products, cocoa powder, pumpkin seeds, sunflower seeds, almonds
Magnesium	Activates nearly 100 enzymes and helps nerves and muscles function. Needed for healthy bones and teeth.	Bran (wheat and rice), cocoa powder, fortified breakfast cereals, seeds (pumpkin, sunflower), soybeans, nuts (almonds, pine, hazelnuts, cashews, walnuts, peanuts), spinach
Molybdenum	Needed for metabolism of DNA and RNA, and production of uric acid.	Milk, milk products, peas, beans, liver, whole grain products
Manganese	Necessary for the normal development of the skeletal and connective tissues. Involved in metabolism of carbohydrates.	Wheat germ, wheat bran, rice bran, fortified breakfast cereals, rice cakes, nuts (peanuts, pecans, pine, walnuts, almonds, hazelnuts), soybeans, mussels, whole wheat (pastas, breads, and crackers)
Copper	Involved in iron metabolism, nervous system functioning, bone health, and synthesis of proteins. Plays a role in the pigmentation of skin, hair, and eyes.	Liver, shellfish (especially oysters), lobster, nuts (cashews, Brazil nuts, hazelnuts, walnuts, peanuts, almonds, pecans, pistachio), seeds (sunflower, pumpkin), fortified breakfast cereals, great northern beans
Chromium (III)	Aids in glucose metabolism and may help regulate blood sugar and insulin levels in people with diabetes.	Mushrooms (white), raw oysters, wine, apple, Brewer's yeast, beer, pork, chicken
Iodine	Part of the thyroid hormone. Helps regulate growth, development and energy metabolism.	Iodized salt, saltwater fish and seafood
Iron	Necessary for red blood cell formation and function. Constituent of myoglobin and component of enzyme systems.	Liver, beef, lamb, pork, veal, poultry, clams, oysters, fortified breakfast cereals, enriched bread products, brewers yeast, nuts (pine, cashews, almonds), beans (kidney, green, garbanzo)

Selenium	Essential component of a key antioxidant enzyme. Necessary for normal growth and development and for use of iodine in thyroid function.	Tenderloin of beef, pollock, trout, tuna, oysters, mackerel, flounder, liver, sunflower seeds, wheat bran, wheat germ, some pork, fortified breakfast cereals, perch, crab, clams, cod, haddock, whole-wheat breads
Zinc	Essential part of more than 100 enzymes involved in digestion, metabolism, reproduction, and wound healing.	Oysters, beef, veal, lamb, pork, chicken, lima beans, black-eyed peas, white beans

Tennis: Tips for the Nutrition Advantage

This article was originally published in the High Performance Coaching Newsletter 4(4), 2002

By PAGE LOVE, M.S., R.D., L.D.
Sports nutritionist, Nutrifit and Nutrisport Consulting and USTA Sport Science Committee (Atlanta, GA)

Tennis has evolved into a "power sport." Players need to sustain the quick anaerobic movements required by the sport for matches that can last several hours. The competitive tennis season also is held during the warmer months where a high heat index and hot court surfaces are common environments. These conditions make tennis players targets for dehydration and heat illness. The tennis training diet should be focused on high-energy foods and adequate hydration, timed appropriately before and after multiple competitions. The following guidelines help develop successful nutrition and hydration practices for players.

Pre-Match Eating and Hydration Guidelines

Tennis players need to pay special attention to their pre-match meals and beverage choices, as these foods and fluids may need to last for hours during tournament and multiple match play.

Teach players to select pre-match meals and snacks that are:

- ✓ Familiar to them and known to settle hunger
- ✓ High in carbohydrates to supply energy for muscle reserves, moderate in protein and low in fat
- ✓ Quickly digested (not too high in fiber or fat)

Examples of pre-match meals and snacks rich in carbohydrates are pasta, bread, fresh fruit, granola bars, energy bars and sports drinks.

Meal Guidelines

LUNCH (3-4 hours prior to competition)
Turkey or grilled chicken sandwich with mustard
Saltine crackers
Apple
1 cup of skim milk
8 oz. serving of Gatorade

PRE-GAME SNACK (1-2 hours prior to competition)
Fruit yogurt or banana
1 cup of water
1 Gatorade energy bar
20 oz Gatorade thirst quencher

Hydration tips before players hit the court:

- ✓ Limit/avoid caffeinated beverages (iced teas, coffee, colas) especially right before and after match play. These may cause additional fluid loss as urine.
- ✓ The night before, fill and chill squeeze bottles or sports jugs and bring to each practice or match. Each player should have a minimum of 2 liters available courtside.
- ✓ Consume enough fluids throughout the day so urine is a light or pale yellow color before starting a match.

- ✓ Drink 17 to 20 oz. of fluid within 2 hours pre-match.

Fluid Needs During Play

Thirst is not a good indicator of hydration level. Adequate fluid consumption is a player's best bet for beating dehydration and heat illness. To keep tennis players performing at their best, encourage fluid consumption every 15 minutes and especially at changeovers. Players should consume 5-10 oz. of fluid (sports drinks containing 14g/8oz carbohydrates and electrolytes are ideal) every 15-20 minutes for optimal hydration and performance.

Favor sports drinks to enhance rehydration. Sports drinks contain carbohydrates and electrolytes, like sodium. Consuming carbohydrates during play has been shown to help players maintain more power and accuracy with serving and groundstrokes in long-match play. Gatorade contains 14 g carbohydrates per 8 oz, which is quickly absorbed and used by working muscles. Sodium replacement also is important since a significant amount of sodium can be lost through sweat during long tennis matches.

Post-Match Nutrition

Players should eat foods and drink fluids that replenish muscle energy stores and electrolytes lost in competition.

Share these guidelines with your athletes:

- ✓ Eat carbohydrates as soon as possible, preferably within 30 minutes of a match. Begin by drinking a sports drink as you walk off the court.
- ✓ Replace 150 percent of body fluids lost or at least 20 oz. per pound of weight loss within 2 hours of a match.
- ✓ Eat a high-carbohydrate meal that also contains a lean protein source within 2 hours after play to maximize muscle glycogen recovery (rebuild energy stores) and to support protein synthesis in muscle.
- ✓ During tournament play, be sure to include carbohydrates, protein, fluid and sodium in the evening meal to quicken recovery from play. Consider lightly salting foods and consuming foods and beverages that are natural sodium sources.
- ✓ Avoid high-protein and high-fat foods as these will contribute to dehydration.

Example of Post Match meal

2-3 cups of pasta with marinara sauce (light in meat and fat content
2-3 slices of garlic bread (light on margarine)
Salad with vinaigrette or low fat dressing
2-3 cups of Gatorade or low fat milk or energy drink

OR

2-3 cups of Chinese-steamed rice with vegetables and
chicken stir-fry
2-3 cups of Gatorade or low fat milk or energy drink

As tennis players play under intense heat and prolonged match situations, it is important to keep them well conditioned, fed and hydrated. When these guidelines are followed, players will serve up a powerful match to any opponent.

DO YOUR PLAYERS USE SPORTS FOODS?

This article was originally published in the High Performance Coaching Newsletter 3(2), 2001

Page Love, MS, RD, LD
Owner, NutriSport Consulting
USTA Sport Science Committee
Nutrilove@aol.com

Over the last year, I have been surveying tennis teaching professionals at various national-coaching meetings to find out if the players that they coach use sports foods. From the results of this survey it is evident that many players do indeed use sports foods to supplement their training diet.

What are sports foods?

Sports foods include sport beverages and conveniently packaged food products such as energy bars, gels, and sport shakes. Most coaches surveyed reported that their players used sport beverages (Gatorade was the most frequent response) on the court and sports energy bars (PowerBar was most often mentioned) to help meet energy needs and between-match nutrition needs. Many coaches also reported using sports beverages before and after play to meet pre- and post-match hydration needs. Very few coaches reported use of high carbohydrate sport drinks or energy gels or shakes. Other products commonly used were Powerade, Fruitopia, Clif Bars, Nutragrain bars, and SlimFast Bars. A very small segment of the coaches surveyed did not recommend use of sport beverages or packaged foods at all.

How are sports foods helpful to the tennis player?

These food sources can help the tennis player meet the demanding training diet needs for energy. Specifically, they fulfill carbohydrate and protein needs, as well as supplement the diet during tournament play. They service on-court nutrition needs, and are useful for both quick pre-and post-match energy and hydration sources.

It is currently recommended that athletes consume 30- 60 grams of carbohydrate per hour of exercise to meet energy demands of match play. Sports beverages especially help to meet these needs by providing diluted forms of carbohydrates in liquid form. Food sources are preferred components of the general daily training diet, but often tennis players,

because of training schedules, travel, and multiple match play demands, are not able to find appropriate and quickly-absorbable food and hydration sources to meet their training diet needs. Some sports foods make great snacks and pre-match meal choices, when eating whole foods may not be as available, or are limited when traveling to tournaments. Sports foods are also a way to avoid food safety concerns when traveling in foreign countries. These products are shelf stable training foods that can be packed for travel.

Should players beware of certain ingredients in sports foods?

Yes. Some ingredients added to sports foods can be dangerous to the tennis player by overstimulating heart rate, causing water loss, increase risk for dehydration, and potentially causing positive drug test results. Following are some ingredients to be cautious about:

Bee Pollen – can cause allergic reactions in players allergic to bees.

Caffeine – found in many commercial drinks, it could cause dehydration and increase risk for heat illness and muscle cramps.

Creatine. -Theorized to improve strength and power potential for short bouts of anaerobic movements. Some high carbohydrate beverages should not be consumed on the court due to the inclusion of creatine. Current research has not deemed creatine to directly enhance tennis performance. Tennis players should avoid beverages containing creatine due to the lack of evidence of its safety, long-term efficacy, and research available on younger athletes.

DHEA and Androstene – hormone-like compounds that can negatively affect the liver and other organs and potentially cause positive drug tests.

Ma Huang or Ephedrine – amphetamine-like herbal supplements that can overstimulate the heart, have caused death, and will increase risk for heat illness and muscle cramps.

Overall Tips to Consider in Using Sports Foods:

- Foods first! Use sports foods mainly to supplement a well-balanced training diet.

- Players should try sports foods away from tournament time. This way they will know how to use them to enhance their training diet needs at match time.
- Check your labels for added potential harmful ingredients (described above).
- Beware of using high protein energy bars right before or during tennis play – these require lots of water for digestion and have slow gastric emptying times, so the may cause stomach upset and nausea. These can be helpful as recovery food choices for tennis players.
- If players choose energy gels, make sure these are taken with recommended fluid amounts equal to that on the chart below for sport beverage use. Keep in mind that gels are much lower in electrolytes that sport beverages.
- High carbohydrate beverages should not be used during tennis play. These are too concentrated in carbohydrate to be absorbed rapidly and can cause stomach upset. These are appropriate as recovery beverages.
- Consult a sports nutritionist or registered dietitian in helping your players interpret the best use of these sports foods for individual training diet needs. One resource is the American Dietetic Association's Website: eatright.org in finding a dietitian in your area.

Below you will find a chart for use with tennis players in determining the appropriate use for sports foods before, during, and after match play.

Food and Activity Journal

Your goal is to provide accurate information on everything you eat and drink from the time you wake up until the time you go to bed FOR 3 DAYS indicating times and volumes you are consuming.

You will also need to indicate the type of activities and sports training you are involved in over the entire day, indicating activity levels described below:

resting…..: sleeping, reclining, lying down watching TV, etc.

very light..: seated/standing activities, driving, school work, typing or computer work, cooking, playing cards or games, playing a musical instrument, video games, etc.

light…….: walking on level ground at normal pace, garage work, restaurant work, house cleaning, child care, golf, sailing, table tennis, etc.

moderate…: walking on level ground at fast pace, carrying a load, riding a bike or cycling, skiing, doubles tennis, baseball, dancing, aerobics, etc.

heavy……: walking with a load uphill, heavy manual digging, basketball, climbing, football, soccer, singles tennis, weight lifting, running, plyometric training, swimming, etc.

Start Time	End Time	Description of Activity and Estimated Intensity (See Above)	Description of Food & Drink Consumed During Time Period. Indicate 'none' if no food consumed.	Amount of Food & Drink Consumed
7:00a	*8:00a*	*Wake up, shower, breakfast (Very Light)*	*Waffles*	*1 Large Round*
			Maple Syrup	*1 Tablespoon*
			Butter	*2 Pats*
			Coffee (black no sugar)	*1 Mug (10 oz)*
			Orange Juice	*1 Cup*
8:00a	*8:30a*	*Drive to match(Very Light)*	*Water*	*2 Cup*
8:30a	*10:00*	*Match (Heavy)*	Gatorade	*3 Cups*
10:00	*10:30*	*Sitting after match*	*Energy Bar - Power Bar*	*1*
10:30	*11:00*	*Driving back home(Very Light)*	*Water*	*2 cups*

Start Time	End Time	Description of Food & Drink Consumed During Time Period. Indicate 'none' if no food consumed.	Description of Activity and Estimated Intensity (previous pg)	Amount of Food & Drink Consumed

Start Time	End Time	Description of Food & Drink Consumed During Time Period. Indicate 'none' if no food consumed.	Description of Activity and Estimated Intensity (previous pg)	Amount of Food & Drink Consumed

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Start Time	End Time	Description of Food & Drink Consumed During Time Period. Indicate 'none' if no food consumed.	Description of Activity and Estimated Intensity (previous pg)	Amount of Food & Drink Consumed

Name: **Sex:** **Age:** **Ht:** **inches** **Wt:** **lbs.**

Lifestyle and Eating Habits

1. **Are you currently on a special diet? Yes ____ No ____ If, yes, select below:**
   ____low fat ____low carbohydrate ____high protein _____weight loss ____weight gain
   ____vegetarian ____other: explain type_____

2. **Are you currently avoiding or limiting any foods? Yes_____ No_____ If yes, select below:**
   ____red meat ____eggs ____butter ____fried foods ____breads ____sugar ____white flour
   ____milk ____cheese ____oil ____other_____

3. **How many eight ounce or one cup servings of the following dairy products do you consume daily?**
   ____milk ____cheese (2 oz) ____yogurt _____cottage cheese _____ice-cream ____frozen yogurt

4. **How many palm sized portions (three to four ounces) of the following proteins do you consume daily?**
   ____chicken ____turkey ____fish _____shellfish ____beef ____pork ____lamb ____tofu/soy

5. **How many times do you eat daily (including meals and snacks)? ____1 ____2 ____3 ____4 ____5**
   ____6 ____7 ____8 other:_____

6. **How many days per week do you dine out? ____1 ____2 ____3 ____4 ____5 ____6 ____7**
   Describe most common types of restaurants (e.g. ethnic, fast-food, family style):

7. **Indicate the type of condiment or product that you use below:**
   salad dressing: ____regular ____light ____fat-free
   margarine/butter: ____regular ____light ____fat-free
   cheese: ____regular ____light ____fat-free
   mayonnaise: ____regular ____light ____fat-free
   milk: ____whole ____2% ____1% ____1/2% ____fat-free
   ice-cream/frozen yogurt: ____regular ____light ____fat-free

8. **Do you use any other low-fat foods or diet products? Yes_____ No_____ If so, list:**

9. **Do you take vitamin/mineral supplements? Yes____ No____ If yes, select below:**
   ____multivitamin/mineral supplement ____calcium ____B-Vitamins ____Vit C
   ____Vit E ____iron other: _____

10. **Do you take any other dietary supplements? Yes____ No____ If yes, select below:**
    ____herbs (circle options: aloe, chamomile, ephedra, echinacea, ginger, gingko, ginseng,
    kava kava, valerian, other:_____
    ____creatine ____amino acids ____androstene ____growth hormone ____DHEA
    ____non ephedrine products weight loss products/body fat loss aids
    ____other:_____

11. **How often do you weigh yourself? _____none____2x/day or more ____1x/day ____1x/week ____1x/month**

12. **Do you feel you are overweight or need to lose weight? Yes____ No____**

13. **Have you suffered from any nutrition related health problems? Check all that apply.**

_____stress fractures	_____high cholesterol	_____indigestion	_____low blood sugar
_____low energy levels	_____diarrhea	_____constipation	_____binging
_____anorexia	_____bulimia	_____anemia	_____cold sensitivity
_____head colds often	_____hair loss	_____bruising easily	_____muscle cramps

For Females Only:

14. **Do you regularly menstruate? Yes____ No____ If no, go to next section of questionnaire.**
    If so, how many times yearly?____ Have you ever missed 3 periods in a row? Yes____ No____

Pre-,During, and Post- Match Eating and Hydration Habits

1. Do you use any special food /drinks before, during or after matches? Yes____ No____
   If yes, check category and circle type (if your sports food is not listed, describe below):
   _____sports beverages (Gatorade, PowerAde, Hydrafuel, etc.)
   _____energy bars (Power Bar, Luna Bar, Balance Bar, Clif Bar, Pure Protein, etc.)
   _____high carbohydrate recovery drinks (Ultra Fuel, CarboLoad, Gatorade Energy Drink, Cytomax, Endurox, etc.)
   _____energy gels (Powergel, Clif Shot, Goo, Carboboom, etc.)
   _____protein supplements (MetRx, Designer Whey, Weider Weight Gainer, etc.)
   _____meal supplement drinks (Ensure, Gatorade, Nutrament, Go, etc.)
   _____other:_____

2. Please describe any special dietary patterns/products used before, during, and after matches?

Meal/Time	Food, energy bar, or supplement drinks (e. g. Boost, Ensure)	Amount eaten or ounces	Beverage Type	How Often? (times/match or practice)
Pre-Match Meal Hours before:			water sports drink other	NA
During Match Minutes into:			water sports drink other	
Post-Match Minutes After:			water sports drink other	
Post-Match Meal Hours After:			water sports drink other	NA

3. Do you eat solid food on the court? Yes_____ No_____If yes, select below:
   ____energy bars ____crackers ____fruit ____ energy gels ____other:_____

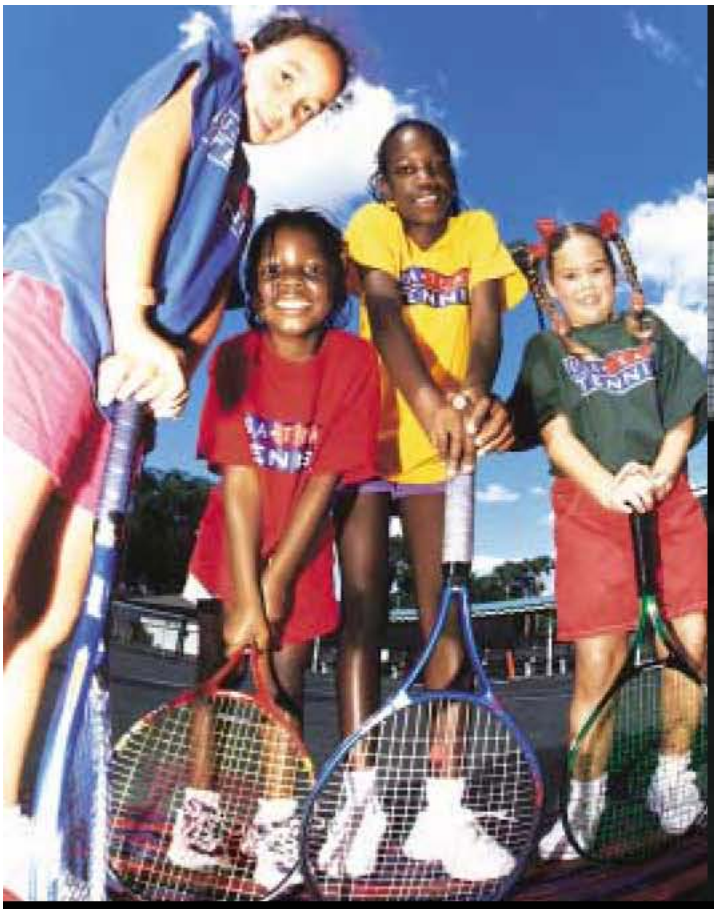
4. In multiple match play situations with limited time, what type of food or supplement choices do you eat/drink between matches? _____sandwiches ____energy bars ____sports beverages ____fruit other:_____

5. List any foods you avoid or limit before/after match play?_____ _____

6. How many ounces do you drink on the court per hour in a: typical match in the heat? _____ounces
   typical match indoors or in a cool environment? _____ounces

7. How many eight ounce or one cup portions of water do you consume daily (off court)? _____cups

8. How many cups of other beverages do you consume daily? Sodas____ Coffee____ Diet sodas____
   Tea Lemonade Smoothies Juices Milk other:



EMERGENCY CARE GUIDELINES

INTRODUCTION

Tournament directors should be prepared for medical emergencies and evacuations in case of disasters. The ordinary standard of care does not require a tournament director to be trained in emergency medical care. However, common sense suggests that tournament directors should be prepared for medical emergencies and evacuations in case of disasters. This pamphlet outlines guidelines for emergency care practices that should be implemented by tournament directors.

TOURNAMENT PREPARATION

It is important to think about the possibility of a medical emergency taking place at your tournament ahead of time. Once you have anticipated this possibility, you have already begun preparation. Consider having the following in place at the start of the tournament:

Emergency Phone Numbers

- Identify at least one working phone on site. If you are using a cellular phone, it must be fully charged and must work on site. Many cellular phones do not work in certain areas or locations.
- Know the phone number and location of the nearest hospital.
- Know the phone number of a local ambulance company. Let the company know beforehand that you are hosting a tennis tournament, and speak to appropriate personnel about the best protocol to follow in case of an emergency.
- 911: Remember, when in doubt or in case of a medical emergency, call 911, which will activate the emergency response system and prompt an emergency medical vehicle to be sent to your site.
- Walk the tournament site in order to know the best way for an emergency vehicle to enter.
- All tournament personnel should be aware of the emergency phone numbers and know how to activate 911.
- When activating 911, or when calling the local ambulance company, instructions should be clear. You should indicate the following:

  The number of people who are in need of emergency medical care
  Their ages (or approximate ages)
  The location
  The person to whom emergency medical services should report

In addition to activating the emergency response system, the parent or guardian of a minor should be located as soon as possible. For adults, the spouse, parent or next of kin should be notified as soon as possible. Remember, for emergency medical care, activating 911/emergency response system takes precedence over calling family members.

Supplies (on-hand)

- Towels (for clean up and for use by players, if necessary).
- Water: Ample drinking water should be available on site.
- Ice: There should be ice available for both heat illness and acute strains/sprains.
- Gloves: Exam gloves should be on site and worn by anyone who may come into direct contact with blood, which includes caring for an injured player or spectator/staff, or cleaning a blood spill.
- First Aid Kit: A basic first aid kit should be on site, but remember, this should only be used within your comfort zone. Medications should not be dispensed except upon the recommendation of a physician on site, and the physician must document such recommendation. First aid kits should include:

  Band-Aids, both small and large
  Medical gauze
  Athletic tape and Elastic (ACE) bandages
  Plastic bags, including red plastic bags
  Scissors
  Sunscreen
  Skin antiseptic cleaner such as Betadine
  Skin antiseptic cream

ON-SITE EMERGENCY CARE

The following sections describe medical situations and conditions the tournament director should be prepared to manage. Remember, the best management often means identifying that someone needs emergency medical care, and then accessing emergency treatment via 911 or a local ambulance company.

Universal Precautions

Universal precautions should be taken with any human blood and body fluids tainted with blood, in that all such fluids should be considered contaminated and potentially infectious. Thus, anyone handling blood or blood products should do so with latex exam gloves, and the individual handling the blood should have no open sores (non-latex exam gloves are available for latex-allergic/sensitive individuals). As a practical example, if a player is bleeding and someone on site is helping the player by applying a bandage or applying pressure with a towel, that individual should be wearing exam gloves. If there is a blood spill on court, this must be cleaned in accordance with current USTA Regulations (Friend at Court: The USTA Handbook of Tennis Rules and Regulations: Medical Time-Out). If a mop and water are not utilized, a towel with water is acceptable. In this instance, the individual should be wearing exam gloves. Blood products should be disposed of in readily identifiable red plastic bags.

Heat Illness

Heat illness refers to an acute medical condition that arises from a combination of dehydration and overheating within the body. Heat illness occurs most commonly in hot, humid conditions, especially if there is little wind. It is important to be aware of the temperature and humidity throughout the day, and to anticipate heat illness occurrences when the apparent temperature, or heat index, is equal to or greater than 90 degrees, as per the chart below.

The symptoms and signs of heat illness include unusual or excessive tiredness, headache, nausea (with or without vomiting), cramps, dizziness, passing out and high body temperature. Heat stroke is a medical emergency, and typically individuals appear acutely ill, have a high body temperature, and are unable to drink any fluids.

Post signs advising players to drink plenty of fluids before, during and after play. Try to provide and identify areas with shade for cooling, as well as plenty of fluids and cold, wet towels or icepacks. If the player cannot drink or has no desire to drink, has lost consciousness or has a change in level of consciousness, or if there is any doubt about the player's condition, emergency transport to the nearest hospital should be arranged via 911 or a local ambulance company. While awaiting emergency transport to arrive, the player should be removed from the heat and cooled with cold, wet towels applied to the body, specifically the armpits, groin and head.

Acute Allergic Reactions/Anaphylaxis

Acute allergic reactions are most likely to occur at a tennis tournament as a result of an insect bite or a bee/wasp sting. The reaction can range from localized swelling and discomfort, to more generalized swelling, to difficulty breathing with wheezing, to a life-threatening cardiovascular collapse. Localized reactions can be treated with ice. If the rash continues to worsen, if there is any difficulty breathing, or if there is wheezing or facial swelling, or any changes in the level of consciousness, the player should be transported immediately to the nearest hospital via 911 or the local ambulance company.

Some players may have an established history of severe allergic reactions and may have experience using Epipen (epinephrine auto-injector). Such players may self-administer Epipen in accordance with their comfort zone. Even in this scenario, the emergency response system/911 should be activated to ensure immediate medical evaluation and management of the individual.

Strains/Sprains

Acute strains and sprains usually occur in the setting of a fall. Symptoms include localized swelling and pain. Acute management includes limb elevation with application of ice and a compression bandage (ACE bandage). Remember: RICE: **R**est; **I**ce; **C**ompression; **E**levation). Players must then follow-up with their physician for further management. For severe strains and sprains, players should be evaluated that day, either in a physician's office or in the emergency room, in order to rule out an underlying fracture. Acute strains and sprains are not life threatening, and the treatment on site should consist of the elevation and ice application. The player or guardian should then be advised to seek appropriate medical follow-up care.

Other Emergencies

Life-threatening emergency can occur at any time, and can include a seizure, heart attack, sudden fall with head trauma, or sudden collapse. Your job is not to make a diagnosis, but to activate the emergency response system via 911 or a call to the local ambulance company. It is important to maintain an environment of calm, and to remove all unnecessary people from the scene.

Medication

You should not administer medication on site, including aspirin, products containing acetaminophen, or over-the-counter cold remedies. Some over-the-counter products contain medications that may be on the anti-doping banned list. It is the player's responsibility to properly take such medications under the direction of his physician, his guardian, or both. In addition, never supply any food supplements, protein drinks, or energy supplements other than standard sport drinks (e.g., Gatorade). These supplements may be tainted with banned substances for doping control.

Thunderstorms and Lightning

Lightning is a potential severe hazard and life-threatening consequence of an approaching storm near outdoor tennis matches, and tournaments should be prepared for immediate cessation of all matches or warm-up in the event of lightning. In essence, if lightning is sighted, all activity should stop and everyone should seek appropriate shelter. A 30-30 rule may be used, which is as follows:

- If lightning is sighted and thunder then occurs in 30 seconds or less, everyone on site should be instructed to seek appropriate shelter. Dividing the number of seconds between lightning and thunder by 5 gives the distance of lightning in miles. (For example, a flash-to-bang count of 30 seconds means a distance of 6 miles.)
- Activity should not resume until a minimum of 30 minutes has elapsed since the last lightening strike was seen.

Once a lightning hazard has been identified, everyone on site should seek appropriate shelter. The primary choice is any substantial, frequently inhabited building with working electricity, telephones and plumbing. While inside, one should avoid using electrical devices or telephones attached to cords, and plumbing, e.g., showers, should not be used. If such a building is not available, the next safest location is a fully enclosed vehicle with a metal roof and closed windows. Do not touch the metal framework while inside the vehicle.

The following locations should be avoided:

- Open fields
- Proximity to open water
- Trees, flag poles, or light poles

If anyone has been struck by lightning, emergency medical services should be activated immediately. If possible, the injured person should be moved to a safer location.

This Heat Index Chart provides general guidelines for assessing the potential severity of heat stress. Individual reactions to heat will vary. It should be remembered that heat illness can occur at lower temperatures than indicated on the chart. In addition, studies indicate that susceptibility to heat illness tends to increase with the very young and the elderly.

1. Across the top of the chart, locate the **ENVIRONMENTAL TEMPERATURE** (i.e., the air temperature).
2. Down the left side of the chart, locate the **RELATIVE HUMIDITY.**
3. Follow across and down to find the **APPARENT TEMPERATURE.** Apparent Temperature is the combined index of heat and humidity. It is an index of the body's sensation of heat caused by the temperature and humidity (the reverse of the "wind chill factor").

Note: Exposure to full sunshine can increase Heat Index values.

HEAT INDEX

	ENVIRONMENTAL TEMPERATURE (F°)										
	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°
Relative Humidity	**Apparent Temperature***										
0%	64°	69°	73°	78°	83°	87°	91°	95°	99°	103°	107°
10%	65°	70°	75°	80°	85°	90°	95°	100°	105°	111°	116°
20%	66°	72°	77°	82°	87°	93°	99°	105°	112°	120°	130°
30%	67°	73°	78°	84°	90°	96°	104°	113°	123°	135°	148°
40%	68°	74°	79°	86°	93°	101°	110°	123°	137°	151°	
50%	69°	75°	81°	88°	96°	107°	120°	135°	150°		
60%	70°	76°	82°	90°	100°	114°	132°	149°			
70%	70°	77°	85°	93°	106°	124°	144°				
80%	71°	78°	86°	97°	113°	136°					
90%	71°	79°	88°	102°	122°						
100%	72°	80°	91°	108°							

*Combined index of heat and humidity…what it "feels like" to the body.

APPARENT TEMPERATURE	HEAT STRESS RISK WITH PHYSICAL ACTIVITY AND/OR PROLONGED EXPOSURE
90° - 105°	Heat cramps or heat exhaustion possible
105° - 130°	Heat cramps or heat exhaustion likely, Heatstroke possible
130° and up	Heatstroke highly likely

Source: National Oceanic and Atmospheric Administration.

Who's Ready to Play…The Weakest Link

This article was originally published in the High Performance Coaching Newsletter 4(2), 2002

Noel Gressner, MEd, ATC, CSCS
Former Administrator of Sport Science

Often, tennis players spend hours on the court improving the all-important technical and tactical components in pursuit of becoming a complete player. Technical and tactical components are indeed important to long-term development, but if the most fundamental physiological components that support technique and tactics are not developed, our players might become a victim of weak links.

CORE STABILITY CONCEPT:

In tennis, there are common functional movements that are universal to all strokes. To support these functional movements there are foundational exercises that are important for coaches and players to employ. A concept in the field of sport medicine and strength and conditioning is that of **core stabilization**. For tennis players, core stabilization is the ability of the deep muscles of the spine and deep abdominal musculature to maintain control and support of the spine while performing tennis-specific movements.

The purpose of this article is to explain a practical assessment that coaches can use to evaluate their player's level of core stability and demonstrate the introductory exercises that can be performed to create the foundation for the performance of higher-level core stabilization exercises.

The goal is to support and enhance the physical components for the ultimate goal of producing a complete player. These initial exercises in a core stability-training program do just that. However, just as a coach uses a teaching progression when teaching new tennis skills, the same concept holds true in establishing a stable core. These exercises initially focus on motor control and high endurance.

What Muscles are Used?

The specific muscles to be activated are the deep underlying abdominal musculature, transverse abdominus (TA) and the deep underlying musculature of the low back (multifidus). The primary exercise is the drawing-in maneuver whereby the athlete is asked to gently draw in the belly button towards the spine. This drawing-in activates the (TA), and the multifidus muscle creating an anatomical corsete. This seems like an easy task, however if you are trying to

perform this exercise right now while reading this article you can appreciate the difficulty. The player in figure 1 is demonstrating the drawing-in maneuver.

How Do I Know if a Player has Good Core Stability Strength?

A practical assessment can be as simple as utilizing the leg-lowering test. The athlete is put into a bent-knee position with knees to the chest while lying on his or her back. The drawing-in maneuver is performed and the athlete lowers the feet to the ground. If you notice that the lower back is arching off the floor as the feet get closer to the ground, then this indicates a weakness in core stability. If the player is able to maintain the drawn-in position as the feet get closer to the ground, then they have a basic level of core strength. Note figure 2 for the start position of the bent knee leg-lowering test. Figure 3 shows that the player is unable to control their core while lowering the feet to the ground while Figure 4 shows that the player has the core strength that enables him to maintain proper trunk mechanics.


Figure 1


Figure 2


Figure 3


Figure 4

Where Should We Start?

Good Control of the TA and Multifidus are essential to having a strong stable core. To begin this strengthening process, the player should perform the drawing-in maneuver as the first exercise in the progression (gently draw in the belly button towards the spine). Perform the drawing-in maneuver 15 to 20 repetitions with a hold of seven seconds.

After being able to increase the number of repetitions from 25 to 30 and maintaining a normal breathing pattern while holding the drawn in position, the athlete may progress to a series of movements called *leg-loading exercises*. Following is a progression for the leg-loading exercises. These exercises should be performed with both legs.

(A) With one knee bent and held stationary on the floor, slide the other leg out along the floor to an almost fully extended position (Figure 5)

(B) With one knee bent and held stationary off the floor, slide the opposite leg along the floor to an almost fully extended position. (Figure 6)

(C) With one knee bent and held stationary on the floor, fully extend the other leg held about four inches off the floor. (Figure 7)

(D) With both knees bent and held stationary off the floor, fully extend and return one leg at a time in a bicycle type fashion. (Figure 8)

These exercises seem easy enough, but maintaining the drawn-in position is very difficult when having to control the weight of one's leg out away from the body.

Figure 5

Figure 6

Figure 7

Figure 8

The Core and the Kinetic Link

You can see from the shots performed on the previous pages how many musculoskeletal components link together to produce the final result. This Kinetic link can be defined as energy or force generated by one part of the body which is in turn transferred to the next body part in the link. If the deep core muscles are not functioning properly, they will not be able to absorb, distribute, and then contribute to the next link in the shot. Often times the more dynamic superficial musculature will overpower the deep stabilizing musculature which lie closest to

the bones, taking away from the efficiency and performance of the shot. If this overpowering repeatedly occurs, the forces within this linkage system can create an environment where an acute or chronic injury could occur.

Prevention and Performance

Interwoven within this concept of stabilization before mobilization is the idea of prevention before performance. By preventing injury we enhance performance by creating a situation where the athlete is appropriately progressed from low intensity/high endurance exercises to more functional tennis-specific exercises. This mode of training can be applied to all aspects of the player's strength training and conditioning. Practice the exercises above and introduce them into your athletes exercise routines because nobody wants to be….. The weakest link.

Wrist Management: Prevention of Wrist Injuries in Tennis Players

This article was originally published in the High Performance Coaching Newsletter 5(2), 2003.

Todd S. Ellenbecker, MS, PT
Chairman USTA Sport Science Committee
Clinic Director Physiotherapy Associates Scottsdale Sports Clinic
Scottsdale Arizona

The repetitive demands placed upon the wrist of elite players frequently lead to injury. Loads placed upon the wrist can result in the development of tendonitis in the muscle tendon units that cross the joint and provide both stability and movement of the forearm wrist and hand. Additionally, stress fractures, ligament sprains, and tears in the cartilage at the end of the forearm bone (ulna) can also occur and limit performance.

Several important factors can be applied to prevent wrist injuries. The first and most important is the use of proper technique. Articles in this newsletter profile the changes in position in the wrist and forearm with different grips. Players using extreme grips place their wrist and forearm in positions that place additional stress on the muscles, tendons, and ligaments and can predispose them to injury. Additionally, the use of the wrist and hand as primary force generators also can lead to injury. The wrist and hand must be viewed as links in the kinetic chain whereby large forces generated from the ground, lower extremity and trunk are transferred. The reasonably delicate tendons crossing the wrist cannot be asked to generate the forces required for powerful strokes in tennis without injury occurring. Other factors in preventing wrist injury are to increase strength and range of motion using specific exercises which will form the basis for discussion in this article.

The muscles that control forearm, wrist and hand movement actually originate near the elbow joint. Hence, strengthening the wrist involves the use of exercises typically thought to increase elbow strength and prevent tennis elbow. These exercises include isolated wrist flexion and extension (figure 1 & 2), and wrist radial and ulnar deviation (figure 3 & 4). Use of these 4 exercises will stimulate muscle development of virtually all the muscles that support the wrist joint. Note that the forearm is stabilized during the performance of the wrist flexion and extension exercises, and that the radial and ulnar deviation exercises are done in standing using one end of the weight to produce a bit of a counter-balance.

Start by using three sets of 15 repetitions of each exercise. Typically a 3-5 pound weight will produce fatigue of these muscles initially, or light to medium resistance elastic tubing which is easier for players to travel with. Avoid doing these exercises immediately before playing tennis as pre-fatiguing the muscles prior to play is not recommended.

An additional exercise that can also improve the strength and endurance of the wrist and forearm muscles is the ball dribble (figure 5). Dribbling a basketball or exercise ball first against the floor and then against a wall at approximately eye level rapidly for 30 seconds or more creates significant fatigue of these muscles. Performing these exercises should be a regular part of a tennis players program.

Fig. 1a
Radial Deviation
Starting Position

Fig. 1b
Radial Deviation
Finishing Position

Fig. 2a
Ulnar Deviation
Starting Position

Fig. 2b
Ulnar Deviation
Finishing Position

In addition to the strengthening exercises, stretches to ensure optimal range of wrist motion are important. Research has shown that tennis players often lose elbow and wrist motion on their dominant side from long-term play. Stretches to improve the flexion and extension of the wrist can be done with the elbow in an extended (straight) position in front of the player. Bending the wrist downward (with the palm down) and rotating the fingers outward using the other hand stretches the muscles on the top side of the wrist and forearm, while repeating a stretch with the elbow straight and hand in the palm up position bending it downward and rotating the forearm inward will stretch the muscles on the underside of the forearm. Holding each stretch for 15-30 seconds will help to

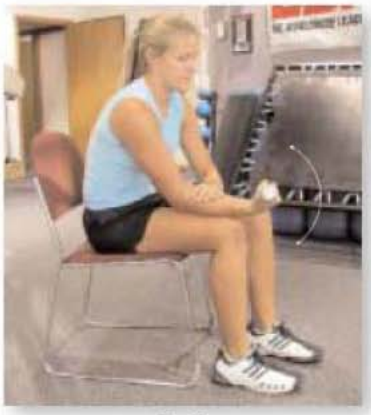


Fig. 3
Wrist Flexion

Fig. 4
Wrist Extension

Fig. 5
Ball Dribble

maintain and even improve wrist range of motion. Remember it is very important to stretch after you play when the muscles are very warm and optimal gains in flexibility can occur.

Following the simple use of exercises to increase wrist and forearm strength and endurance as well as flexibility exercises to prevent range of motion restrictions in the wrist can help to minimize the risk of an injury from the demands of repetitive tennis play. Coupled with proper stroke mechanics, these exercises can help to enhance performance.

Technique and Conditioning: Cornerstones of Injury-Free Tennis

This article was originally published in the High Performance
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Scott Riewald, Ph.D., CSCS, Former Administrator, USTA Sport Science

Introduction

Injuries are a fact of life in almost every physical activity, and tennis is no exception. With the amount of tennis that today's high performance players play it is very unlikely that anyone will make it through their career without sustaining an injury of some sort. With that said, it is important to realize that not all injuries are created equal. Some injuries, like a sprained ankle, are accidents and "just seem to happen;" there is not much a player can do to "better prepare" for that type of scenario. However, there are other injuries that are directly related to preparation and technique. These are injuries that likely can be avoided if a player takes the time to learn, and use, proper technique while also conditioning the body to handle the demands of tennis.

Importance of Technique in Injury Prevention

Technique should be one of the cornerstones of effective, injury-free tennis. The body is an amazing structure and it is incredible what players can make it do on the tennis court. However, there are also limits to how the body can perform. When the muscles, tendons and bones are pushed past their limits, injuries can occur. Probably the type of injury most coaches and players are familiar with is *tendonitis* – especially in the shoulder, elbow or knee. Most types of tendonitis occur as the result of overusing or placing excessive stress on a muscle or tendon. In many instances the added stresses the body experiences are due to improper technique. When practicing the serve, for example, fatigue in the shoulder and scapular muscles and can lead to a breakdown in technique, which in turn places undue stress on the muscles and tendons of the rotator cuff.

While it is not likely that the amount of damage done during one "poor serve" alone cause shoulder pain, every time technique is compromised, a little more damage is done. Over time these repetitive "micro-traumas" add up to produce an injury--in this case tendonitis in the shoulder.

ATP Trainer Doug Spreen stretches an injured player during 2003 Wimbledon.

Historically, the lower back has been another place where injuries occur with regularity. Doug Spreen, one of the Sports Medicine Trainers on the ATP Tour has noted an increased number of low back injuries, and an increased number of tournament withdrawals, over the past two years. While these injuries may be fairly common, most players recover from these injuries relatively rapidly and the number of players who are knocked out for the season is small.

Technique can have an impact on more than just repetitive use types of injuries. Dr. David Altchek, medical director for the ATP Tour, commented that, "There have always been, what we'll call minor injuries – like injuries to the foot, elbow, or lower back - that may impair performance or result in a small amount of lost playing time. But over the past four years we have really seen an increase in hip injuries and shoulder injuries that require surgery. These are major injuries that cause players to lose a great deal of playing time."

The increased incidence of hip and severe shoulder injuries likely has a lot to do with technique and how play has changed over the years. "Pace plays a greater role in today's style of play," says Dr. Altchek. "Players have always served hard. However, it used to be that a player would have a powerful serve and then play the point looking for an opening and an opportunity to score. Now, with the improved racquet technology, it is possible to win points from everywhere. Players are hitting more powerful shots that they were five years ago. This places the body, particularly the hip and shoulder, under much greater stress." Additionally, more players are hitting with an open-stance forehand. This is another factor that can contribute to injury since this style of tennis subjects the rear hip to much larger forces as the player generates the force and power to swing the racquet.

Another area where we are seeing a greater number of injuries is the wrist. Kathleen Stroia, Associate Vice President of Sport Science and Medicine for the WTA comments that, "With the increased wrist action used by many players today, we are seeing a greater number of wrist injuries." As the wrist is engaged during a shot the structures of the wrist are subjected to larger forces. As with

tendonitis, each stroke likely does not produce an injury, but over time these large stresses can lead to and overuse type of injury.

The techniques used in tennis are always evolving. The power of today's game has "forced" players to adopt a style that differs greatly from what was seen 10 years ago. Because of the changing nature of tennis and how it is played, it is important to realize that a player cannot just change technique without preparing the body to handle the added stresses and force it will experience. This brings us to the importance of engaging in a proper strength and conditioning program.

Importance of Conditioning in Injury Prevention

As the physical demands of tennis change, proper conditioning plays an increasingly greater role in injury prevention. The body needs to be better conditioned to perform at these fast paces and generate the power that is behind many of today's tennis shots. Spreen states, "There has definitely been an increase in the number of injuries over the past 10 years. I believe much of that can be attributed to the fact that guys are hitting the ball much harder that they were 10 years ago. The players must also move more quickly and explosively to go get balls. If guys are going to play with more power, the body has to be trained to be able to generate more power."

That is the key. The body must be prepared to withstand the repeated powerful shots today's player is expected to generate. However, in many instances, the body is not prepared to handle these demands. Often times players exhibit significant strength imbalances throughout the body, have poor posture, have limited strength in the body's powerhouse--the core, or exhibit limited range of motion about certain joints.

When a player has a strength imbalance, it means that one group of muscles acting at a joint is appreciably stronger (or weaker) than the other muscle groups that work at that joint. For example, the muscles that internally rotate the shoulder are usually extremely strong in tennis players, but the external rotators are "weak" in comparison. These strength imbalances can cause the shoulder joint to move abnormally, which can lead to injury. To reduce the risk of injuries due to strength imbalances it is important to train all muscle groups around a joint and not just the ones that "make sense" for playing tennis. This approach to strength training will promote proper joint function.

Another place where many tennis players could improve is in the area of core body strength. Kathleen Stroia says, "When I first started with the WTA tour 10 years ago, most of the injuries we saw were tendonitis, now we see this type of pain as more of a symptom of a larger problem – namely muscular instability in the shoulder and/or weakness in the core of the body." The core of the body, which includes the abdominal and lower back muscles, provides power and

balance to a tennis player. Watch Andre Agassi hit a baseline forehand and you will see that he is not just using his arms to generate the power in their swings, he is using his entire body.

The body is made up of a series of segments, a kinetic chain (which is discussed in greater detail below). This chain allows power to be transferred through the body and to the racquet. The core of the body is one link in this chain. If that link breaks, or becomes weaker over the course of a practice or a match, undue stresses are placed on other parts of the body. To be effective, tennis players must consistently train the core of the body to be able to generate the power and balance that is needed by today's tennis player.

The third area that players typically need to develop if flexibility. One of the areas Dr. Altchek identified as a weakness in today's players is inflexibility, "particularly in the shoulders, hips and lower back. Inflexibility causes forces to concentrate at certain points since joints cannot move through a complete range of motion. This places added stress on the other structure around the joint, possibly leading to injury." A proper part of any strength and conditioning program should be flexibility training. Long past are the days where stretching meant only performing static (non-moving and not very exciting) stretches. Today's flexibility programs involve performing dynamic movements in which players stretch while moving in ways they might on the court. Also called a dynamic warm-up, dynamic stretching warms up the player while also improving flexibility. Some sort of flexibility program should be included in every athlete's training plan.

Kinetic Chain

Technique and conditioning both come together when we talk about the kinetic chain. "Kinetic chain" is a term used to describe the linkage between body segments that allows power from one body part to another, and eventually to the racquet.

In tennis, the player is able to generate a great deal of force and power with the legs as they interact with the ground – this is the first and one of the most powerful links in the chain. The power developed by the legs can then be transferred to the trunk of the body where the core muscles of the abdomen and lower back can add to the power that is generated. This process continues and power is transferred to the upper body, the shoulder, elbow and wrist until it finally reaches the tennis racquet. In a player with good technique, power "flows" from the ground to the racquet.

The keys to this flow are proper timing of the tennis stroke and coordinated muscle action. The different links of the body are in essence "connected" by muscles. Strong muscles can provide a rigid link between segments. At the

same time, weak or fatigued muscles can be seen as a broken link. When a link breaks, it generally is due to a lack of strength, fatigue, or a strength imbalance at a certain joint.

If any link in the chain is weak, the tennis player will be forced to adapt and "over-stress" another part of the body. Also, when a link is weak or breaks, another part of the body must pick up the slack and compensate for the power that was lost through the broken link. It is easy to imagine a player's core muscles fatiguing over the course of a three-set match. As the abdominal and lower back muscles fatigue they are unable to generate the force they could at the start of the match. At some point the muscles will weaken to the point that the "link" between the lower body and the torso is broken. When this happens, much of the power generated by the legs never makes it to the racquet during the serve or a forehand. If the player still wants to impart the same velocity the ball, they will have to use the links closer to the end of the chain (shoulder, elbow, wrist) to make up for the lost power. This sets the athlete up for injury.

Conclusion

Injuries can be very damaging to a player's season. An injury occurring at the wrong time can result in a loss of practice time and possible a drop in the rankings. As a result, every coach and player should want to do everything possible to minimize the risk of injury. This article has outlined two of the factors that can contribute to an injury in tennis players: poor technique and poor conditioning. Not all injuries can be eliminated, but by following a couple of basic points, their incidence can be reduced.

- Learning and using proper technique.
- Strengthening the core of the body.
- Strengthening all muscles of the body and not just those that make sense for tennis.
- Maintaining "normal" ranges of motion about joints by engaging in a flexibility program.

By following these steps your players will be on the way to reducing the risk of injury and better tennis.

The USTA High Performance Profile

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Todd S. Ellenbecker, MS, PT, SCS, OCS, CSCS
Clinic Director Physiotherapy Associates Scottsdale Sports Clinic
Scottsdale Arizona
Chairman USTA Sport Science Committee

&

W. Ben Kibler, MD, FACSM
Medical director, Lexington Clinic Sports Medicine Center and Kentucky Shoulder Center, Lexington KY, and USTA Sports Science Committee

Introduction:

To ensure that elite level tennis players perform at their highest level requires extensive practice, physical training and grueling competition. But this high level of performance can ultimately lead to overuse injury. Physical testing is an important part of both optimizing performance and preventing injury.

The USTA Sport Science Committee has developed a series of tests it calls the "High Performance Profile" or HPP. This profile contains a series of musculoskeletal tests that was assembled for the purpose of identifying muscular imbalances and pinpointing areas on which tennis players should focus their physical training in order to prevent injury, and optimize their performance on court. This article will outline some of the key tests in the profile and provide the reasons why each of these tests is important for elite tennis players.

Upper Body Tests:

The HPP contains three tests to evaluate the upper body. Shoulder internal and external rotation range of motion is measured to determine whether a significant loss of flexibility exists in the racquet arm compared to the opposite arm. Figure 1 shows how internal rotation is measured on the right arm of a player. Research has shown that while tennis players can usually *externally* rotate their dominant shoulder (i.e. "cocking" position on the serve), they loose very precious motion in *internal* rotation. This loss of internal rotation range of motion can negatively affect shoulder performance and lead to injury to the rotator cuff and cartilage in the shoulder. Players who are found to have tightness on this test are given specific stretches to increase internal rotation to prevent shoulder injury (Figure 2).

Figure 1. Shoulder internal rotation measurement

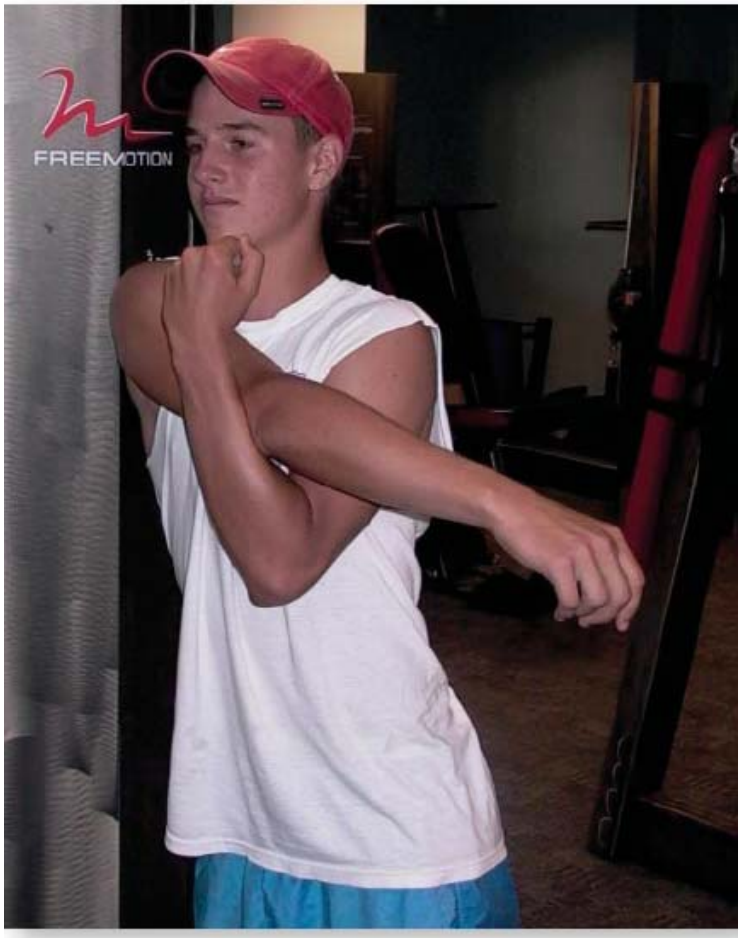


Figure 2. Player performing a cross arm stretch to address a limitation in internal rotation range of motion.

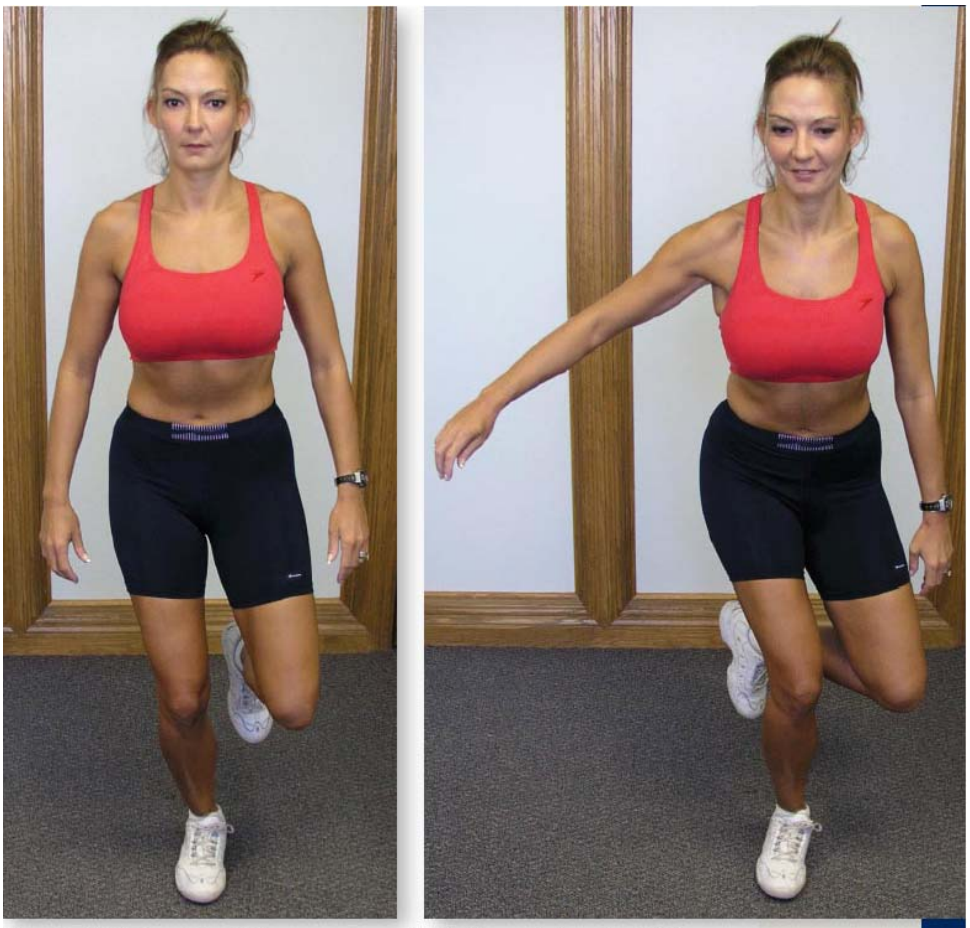


Figure 3a. (left) Normal test finding on one leg squat indicating good strength and balance. Figure 3b. (right) Abnormal test finding. Note how the knee juts inward and the body leans forward indicating muscle weakness in the lower body.

Trunk Tests:

The HPP uses one primary test to assess what is termed "core stability" or the ability of the muscles of the lower back and abdomen to stabilize the spine. This test is important to tennis players since the spine undergoes tremendous stress arching and rotation on the serve as well as the aggressive rotation on virtually every stroke during tennis play.

The test involves the use of a blood pressure cuff that is placed under the players back during testing. This allows the examiner to monitor the player's ability to keep the muscles contracted during testing. From a lying position with the legs raised, the player moves his legs one at a time alternately down toward the ground while tensing the muscles in the abdomen and lower back. Players are evaluated on their ability to maintain a strong, stable back position during the test. If a player does not perform the test well, he or she is given a series of exercises using exercise balls and other low back and abdominal strengthening exercises to address this weakness. Core stability is very important to tennis players and research has identified imbalances in the muscles surrounding the spine in tennis players, which makes this a key area for testing and training.

How do I go about getting my player tested?

Email either Sportscience@usta.com or Coached@usta.com to receive your copy of the USTA High Performance Profile. A physical therapist or athletic trainer in your area can perform the tests and give valuable feedback on the performance of your player on these tests. Perhaps the most important part of the testing is not the tests themselves but rather *what is done with the results of the tests.* The *HPP* provides important information that can be used and applied in the development of tennis specific training programs for elite tennis players. Tests and subsequently re-testing your players is highly recommended at intervals of 3-4 months. Re-testing allows the player, coach and trainer / therapist to measure and track the improvements the player is making with his or her training.

The USTA High Performance Profile is a valuable instrument that can be used in the development of the high performance player.

USTA HIGH PERFORMANCE PROFILE

Player Name:_____ Birthdate:_____

Age:_____ Height:_____ Weight:_____ Dominant Arm: L R

Examiner's Name:_____ Date of exam:_____

1.) Scapular Stabilization (Scapular Dyskinesia)

IMPORTANCE: The scapula is the base for arm movement and an anchor for muscular attachment. The scapula must be lined up and move with the arm like a ball on a seals nose. This test checks for scapular motion and control of that motion.

METHOD: In a standing position, the player holds a 1# weight in each hand. Begin with arms at side. Elevate straight arms 180º in scapular plane. The examiner observes the movement of the scapula, and notes any winging or overuse of neck & upper trapezius muscles during both the ascent and descent phases of elevation. The examiner is instructed to watch scapular motion, note asymmetry. This is especially important as the arms come down. The prominence of the scapular borders are noted and classified according to the Kibler Scapular Dyskinesis System:

Type I: Inferior Angle: The inferior medial scapular border may be prominent dorsally at rest, and during arm motion the inferior angle tilts dorsally.

Type II: Medial Border: The entire medial border of the scapula may be prominent at rest and with arm motion, the medial border tilts dorsally off the thorax.

Type III: Superior Border: The superior border of the scapula may be elevated at rest and with arm motion, a shrug type motion initiates the movement without significant dorsal protrusion of the scapula.

Type IV: Symmetric Scapulohumeral: At rest both scapulae are relatively symmetrical. The dominant shoulder may be significantly lower. During arm motion the scapulae should rotate symmetrically upward such that the inferior angles translate laterally away from the midline and the scapular medial border remains flush against the thoracic wall. The reverse should occur during arm lowering.

Left Shoulder: _____ Right Shoulder: _____

Comments:_____
_____

2.) Shoulder Internal/External Rotation (AROM test)

IMPORTANCE: Loss of shoulder rotation creates abnormal motion of the ball in the socket which predisposes the player to injury and can decrease effective long axis rotation which can negatively affect performance.
METHOD: The player is measured while lying supine on a plinth. Abduct the testing arm to 90º, with elbow flexed to 90º. The examiner is to ensure that the scapula is stabilized by exerting a posteriorly directed force on the front the shoulder throughout test. The player slowly moves their arm into internal and external rotation. The examiner measures and records the angle bilaterally using a universal goniometer. Total rotation is calculated by summing the internal and external rotation measures together.

	Dominant Arm	Non Dominant Arm
External Rotation @ 90 AB	_____	_____
Internal Rotation @ 90 AB	_____	_____
Total Rotation @ 90 AB	_____	_____

Comments:
_____

_____

_____

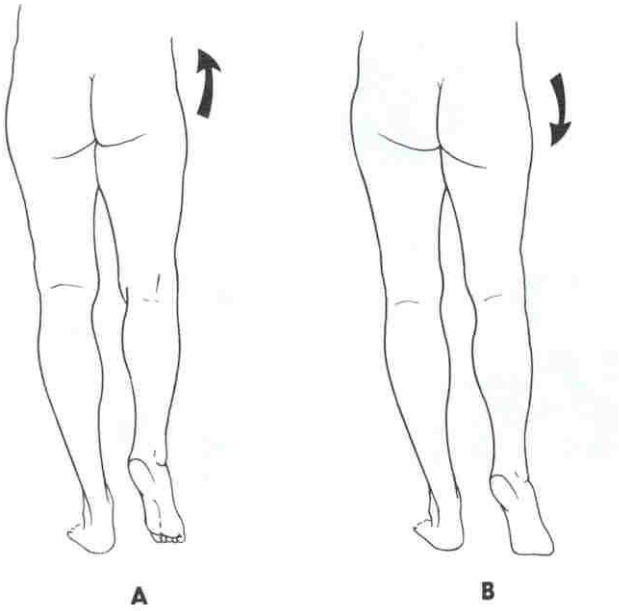
_____

3.) One Leg Stability Test. (tests hip strength during stance and squat, Trendelenburg test)

IMPORTANCE: Indicates the players' ability to control the body over a planted leg. This is important to decrease loads on the knee and leg (injury risk) and allow for explosive starts and stops (performance enhancement)

METHOD: Begin in standing position with arms at side. Bend non-weightbearing knee to 90º. Instruct the player to bend the weightbearing knee to 30. Repeat on both sides. Emphasis is on maintaining good alignment & neutral spine. The examiner is to report Trendelenburg pattern(inability to control pelvis on weight bearing side), as well as other compensations such as increased trunk flexion or rotation (corkscrewing). Repeat up to 10 times.

Squat start Position



Positive Trendelenburg Response

Left Stance Limb: Comments:

_____

_____

Right Stance Limb: Comments:

_____

_____

4.) Core Stabilization.

IMPORTANCE: The core is where the center of gravity is stabilized and where a significant amount of force is generated.
METHOD: Player is placed in a supine position. The neutral spine position is found. The player contracts the transverse abdominis to maintain a level of 40 mmHg. The player then lies supine on the stabilizer, the examiner inflates the cuff to 40 mmHg. The player then performs AROM
alternate knee raises, holding extended leg for 10 seconds, with foot 15 cm. above ground. This is repeated 10 times, maintaining the pressure on the stabilizer at 40mmHg throughout the sets. Ensure the TA is engaged via palpation.

Player has ability to maintain 40 mmHg during testing: YES NO

Comments:
_____

_____

_____

5.) Hip Rotation (Patrick's or FABER Test)

IMPORTANCE: A lack of hip rotation decreases the ability of the player to generate maximal force from the lower extremities and transfer that force to provide power during tennis strokes.
METHOD: Player is supine lying on a treatment table. With a pen, mark the lateral border of the patella on each lower extremity. The examiner then passively flexes, abducts, and externally rotates the hip of one lower extremity placing the lateral malleolus of that extremity just proximal to the patella of the contralateral extremity that remains extended on the plinth. The player is then asked to relax their hip and the distance between the lateral border of the patella and the treatment table is measured with a ruler. The sequence is repeated for the alternate extremity.

Left Hip distance: (cm from lateral border of patella to treatment table): _____

Right Hip distance: (cm from lateral border of patella to treatment table): _____

Comments:
_____

_____

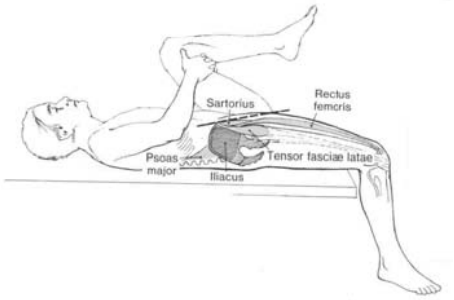
_____

_____

6.) Hip Flexion (Thomas Test)

IMPORTANCE: Tightness of the hip flexors and quadriceps can cause lower back dysfunction and decrease the players' lower body power and movement capability.

METHOD: Player lies supine on a plinth such that both legs are hanging over the edge and the edge of the table is at the level of the middle of the femurs. The player brings both knees up toward their chest. The player holds 1 leg toward their chest & lets the other leg drop over the edge of the plinth. Achieving neutral hip extension (Thigh touching table) is normal length. Inability of the player to achieve neutral hip extension indicates a positive test and a goniometer can be used to measure the angle of resultant hip flexion from horizontal. Additional testing to assess muscle length of the rectus femoris can be performed using the same procedure and ensuring that the leg being lowered can assume a position of 90 degrees of knee flexion without creating a flexion response at the hip. The contralateral leg remains against the patient's chest throughout these maneuvers:



Left Leg: Thomas Test: + - (angle at hip if positive _____) Rectus Femoris Test + -
Right Leg: Thomas Test: + - (angle at hip if positive _____) Rectus Femoris Test + -

Comments:
_____

_____

_____

_____

7.) Hamstring Flexibility Test

IMPORTANCE: Flexible hamstrings allow for optimal hip motion and allows for explosive power in the lower body as well reduces injury risk of lower back and knee injury.

METHOD: The player lies supine on the plinth with a neutral spine position. The uninvolved knee is kept on the plinth with the knee completely straight. The examiner raises testing leg while monitoring the player's ASIS. The leg is raised passively until motion is felt or observed at the ASIS. Hip flexion is measured with a goniometer. This test is performed bilaterally. Normal hip ROM has been reported as 70-80º relative to the trunk.

Straight leg raise left leg: _____ degrees

Straight leg raise right leg: _____ degrees

Comments:

_____

_____

_____

_____

8.) Prone Quadriceps Flexibility Test

IMPORTANCE: Flexibility of the quadriceps is important to decrease knee injury and improve lower body range of motion.
METHOD: The player lies prone on a plinth with the spine in neutral. The limb not being measured is placed in an extended position. The examiner will bend the testing knee toward the buttock for normal results. A goniometer can be used to formally measure in degrees the knee angle achieved during testing. The test is performed bilaterally.

Left Heel to Buttock YES NO angle if available: _____ degrees

Right Heel to Buttock YES NO angle if available: _____ degrees

Comments:
_____

_____

_____

_____

9.) Grip Strength

IMPORTANCE: Strength of the wrist and forearm muscles is important for tennis players to stabilize the elbow and wrist joints. High levels of muscular activity are needed during all tennis strokes.

METHOD: Using a hand grip dynamometer, the player squeezes the dynamometer with the arm held down at their side with the elbow near full extension. Record the result in Kilograms performing the test bilaterally.

Dominant Arm Grip Strength: _____ KG

Non-Dominant Arm Grip Strength: _____ KG

Comments:

_____

_____

_____

_____

10.) Lower Extremity Functional Test: Hexagon Test

IMPORTANCE: Multi-directional movement is critically important in tennis. This test combines lower body explosive strength with both agility and balance.

METHOD: Hexagon Test:
1. Using masking tape, mark a 24” per side hexagon on the floor with angle of 120º.
2. Have the player stand in the middle of the hexagon facing forward, as he/she must for the duration of the test.
3. The player begins by jumping forward over the tape with both feet and immediately back into the hexagon when the command “ready, go” is given.
4. Then, continuing to face forward, the player jumps over the next side and back to the middle for 3 revolutions.
5. This pattern will be continued by jumping over all 6 sides and back to the middle for 3 revolutions.
6. When the feet enter the hexagon after 3 full revolutions, the clock should be stopped and the time recorded.
7. Each player gets one practice trial.
8. The test will be taken 2 times and the fastest time will be recorded using a stopwatch.
9. A .5 (half-second) penalty will be given with each line touch and 1 second penalty will be given for failure to follow the proper sequence.

Comments:
_____

_____

_____

_____

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Tennis Specific Drills to Improve Quickness On Court

E. Paul Roetert, Ph.D

What's the best way to help your players improve their tennis? By playing and practicing tennis skills of course. Therefore, much of the training for tennis should be sport specific. Especially when it comes to footwork. Many players work on their movement and footwork skills, but to have the best results they should emulate the particular movements that they will be performing during a match. I have selected some of the top movement drills used by professionals as well as many of our very best nationally ranked junior players. Performing these drills will help your players too in improving their speed, quickness, and agility. Since during a match they will always have a racket in their hand (I hope so at least), I suggest performing these drills with a racket.

CLOSE AND DROP

Purpose of the drill: Works on both forward and backward movement. Reinforces closing in while at the net.

Set-up: Coach kneels at the net facing the player on the same side service line. Two cones are set up on the other side of the net as targets for the drop shots.

Action: Coach alternates tossing balls to left and right sides, forcing the player to sprint up and hit a drop shot. After each shot, the player backpedals as quickly as possible to the starting position (the center of the service line). After 25 seconds (a long point), the next player jumps into position. This gives the first player a chance to recover.

Coaching tip: Make work/rest ratio similar to an actual tennis point (1:2).

PROTECT YOUR TURF

Purpose of the drill: Improves movement skills around the net.

Set-up: Player stands in the center of one of the service boxes. Coach stands with basket of balls on the opposite side of the center service line.

Action: Coach feeds balls rapidly from the opposite side service line, moving the player back and forth and side to side within the service box. If there is more than one player, the second player quickly jumps in when the first player misses.

Coaching tip: Split step to change direction quickly.

FOREHAND ONLY

Purpose of the drill: Improve lateral movement along the baseline.

Set-up: Player stands in ready position in the center of the baseline. Coach feeds from the other side of the net.

Action: Coach runs player from side to side, but player is only allowed to hit forehands. Coach could designate inside-out or inside-in targets (down-the-line forehands hit from the backhand corner).

Coaching tip: An excellent drill to work on the inside-out and inside-in forehands.

HI-LO DRILL

Purpose of the drill: Teaches players how much reach they actually have at the net, while taking only one step in each direction.

Set-up: Coach feeds from opposite side service line to player at net.

Action: Player alternately hits a high forehand volley followed by a low backhand volley. After a short rest period the sequence is reversed to a high backhand and a low forehand volley.

Coaching tip: Work on proper body rotation while alternating hitting the volleys.

TRANSITION DRILL

Purpose of the drill: Works on hitting a variety of shots as the player advances to the net to close out the point.

Set-up: Coach feeds balls rapidly from the opposite side baseline.

Action: Player shuffles along the baseline, then sprints forward to the center service line, split steps and hits a forehand volley immediately followed by a backhand volley while closing in to the net. The final shot in the sequence is an overhead while backing up.

Coaching tip: Replicates common patterns of play.

2 COACHES DRILL

Purpose of the drill: Improves lateral movement and teaches players to cut off the ball off at an angle.

Set-up: Player stands in the ready position in the center of the baseline. One coach or one coach and a player stands in each doubles alley three feet inside the baseline with three balls in his/her hand.

Action: Player shuffles along the baseline, one coach shouts either "forehand" and drops a ball from shoulder height or shouts "backhand" and the other coach drops a ball. After hitting the groundstroke, the player recovers near the center of the baseline. Coaches can vary their position in the alley from the baseline to the service line.

Coaching Tip: Emphasize balance on the split step and an explosive first step toward the ball.

Circuit Training for Tennis

Donald A. Chu Ph.D.

Circuit training is a method of exercising that involves "stations" where calisthenics, machines, free weights, or plyometrics can be used. This system of training is actually a form of *interval* training. The system usually relies on "timed" bouts of exercise, although traditional sets/repetitions may also be utilized. The athlete will work at each station for a specific period of time with a measured rest or recovery period between each exercise.

Circuit weight training is extremely useful for the tennis player who has only brief periods of time to train for both strength and endurance and does not need maximal levels of either. This type of training is also useful for the tennis player when they are in the peak of their competitive season. It allows for acceptable gains in fitness without maximal time being spent achieving it.

Circuit weight training typically has an exercise to rest ratio of 1:1 or greater. Placing a heart rate monitor on the athlete during the course of the circuit allows the coach to regulate intensity in a very exact way. If the athlete is not working at a high enough intensity the coach would simply reduce the rest period. If the recovery period is reduced to approximately 15 seconds the circuit becomes much more intense for the cardiovascular system.

Many different principles of exercise can be used during circuit training The circuit that is presented is only one example of the various types of circuits that can be devised.

Circuit for Junior Player

Each of the following exercises is done for the prescribed number of set/reps or time intervals. Typically, all of the exercises can be performed for set/reps combinations of 2-3 sets of 8-12 reps or time intervals of 40-45 seconds per station. Work-rest ratio is 1:1.

(1) Seated Row (Machine) - followed by **(2) Chest Press** (Machine); These two exercises, when combined, form a "push-pull" combination that will work, first, the stabilizers of the scapula and the external rotators of the shoulder, and second, the anterior chest and biceps brachii that will help in strength during forehand strokes. The third exercise, **(3) Power Drop** incorporates the use of a Plyo-Ball to form a "shock" exercise for the shoulders. The purpose of this exercise is to familiarize the muscles with absorbing and reacting to impact. This trains the muscles to respond quickly, much the way they have to when hitting tennis strokes.

The next "tri-set" includes a cable exercise, **(4) Lat Pull**, followed by **(5) Dumbbell Pullover.** This set forms a "superset" of the latissimus dorsi muscles. Both exercises work the same muscle group. These two are followed by another Plyo-ball exercise, **(6) Sit-Up Toss,** again directed at the lat muscle group.

Dumbbell exercises are excellent for developing isolated arm muscle strength. The first in this series is **(7) Hammer Curls**, done with the thumb in the "up" position. This exercise stresses the brachioradialis muscle of the forearm. This muscle is essential in having a strong grip and steady hold on the racket. Compound joint movements are useful in developing functional exercises. The **(8) "Thumb-out, Thumb-in"** exercise incorporates rotation of the shoulder joint as well as

abduction of the shoulder. This allows for rotator cuff development as well as large muscle development of the shoulder. Finally, the shoulders are taxed using a total body exercise, **(9) Push Press.** This exercise is done by starting with a slight flex in the knees and using the total body to push the weight overhead. Utilizing dumbbells again allows for the work to be isolated at each shoulder.

Trunk strength is imperative in the success of any athlete. Tennis players are certainly aware of the need for strength and range of motion in this area. The exercise of choice for the low back area is **(10) Back Hyperextension.** The placement of the hands can change the amount of resistance applied during this movement, i.e. hands in the low back area, crossed against the chest, and finally, behind the head. This should always be paired with some form of abdominal strengthening movement such as the **(11) Crunch.** Repeating each exercise in back-to-back sets works the trunk as if it were a cylinder, and maintains muscle balance between the two areas of the body.

The final group of exercises focuses on the lower extremities. It is designed to utilize a sub-maximal Plyometric exercise first to serve as a warm-up and to teach reactivity. **(12) Footwork Pattern,** utilizes a footwork drill in which the athlete jumps to each square along the base then jumps all the way back to the starting point. This works on lateral movement as well as reactivity in general. This is followed by a more intense Plyometric jump drill known as a **(13) Depth Jump.** This exercise requires that the athlete have an existing strength base. However, it is an excellent drill for developing vertical drive and power which would have direct carryover to serving. Finally, a pure strength developer in the form of a free weight **(14) Squat** is used to develop hip and leg strength and stabilization.

The organization of this circuit is done by grouping exercises into mini-circuits known as "tri-sets". All of these exercises could be performed in a series of 14 exercises. They all embody aspects of sound training principles, and have specific goals of isolated muscle development as well as sport specific muscle enhancement. It is truly a testimony to the variety and functional nature of circuit training.

Once a needs analysis and testing/assessment is conducted, a program can be designed that is individual and comprehensive. Each stage in an athlete's development requires constant change and modification of the various modes and methods of training according to the goals and needs determined by the player, coach, and conditioning specialist. The successful athlete will have an optimal mix of various training methods.

*Editor's note: Since exercises **(8)** and **(9)** are performed above shoulder level, they should be avoided by players who have a history of shoulder pain or injury.*

FITNESS TESTING: PREPARTICIPATION PROFILING FOR TENNIS

INTRODUCTION

Traditionally, the goals of a sports participation fitness program have been to prepare the athlete for safe participation in athletics, to uncover any life-threatening conditions the athlete may have and to satisfy legal requirements set forth by various governing bodies (Kibler, 1990). This chapter on preparticipation profiling for tennis players will specifically focus on the physiological aspects of assessment for the purpose of developing baseline information to help strengthen weaknesses and lessen the risk of injury. The main purposes, as outlined by Groppel and Roetert (1992), are to assess fitness levels, develop normative data and establish the basis for longitudinal tracking. In this case the normative data will provide a base for tennis-specific conditioning. From the test results, players and coaches can determine which fitness areas need to be improved for players on an individual basis. Specific training programs can then be designed based on the player's fitness testing results. Practically, the goals are to enhance a player's performance, reduce the risk of injury and design an appropriate training program so that the athlete's playing career can be as long as possible.

GOALS OF FITNESS TESTING

Performance Enhancement

Since tennis has become a sport with year-round involvement, superior fitness and preparation is required. Doesn't every player want to have that extra step of footspeed, hit more powerful shots with less effort, increase the speed of your serve and handle the power of a stronger opponent? In addition, isn't it great to last through a long match and still come back fresh the next day. Research indicates that players achieve the best results when their training activities replicate the actual demands of the sport (Groppel and Roetert, 1992). Practice sessions should challenge the same energy systems, muscle groups and movement patterns stressed in competitive play. Testing the physiological variables of flexibility, strength, power, aerobic endurance and speed and agility will provide a baseline for designing appropriate training programs. Proper flexibility will assist in reaching those wide shots, make quick direction changes and bend for low volleys. Another important aspect of the sport of tennis is the ability to exert muscular force at a high speed. Muscular strength and power allow you to run around the court, as well as to swing your racket forcefully. To be able to last those long matches you want to make sure you have good aerobic endurance. However, throughout a match you will also be asked to sprint around the court in every conceivable direction. Therefore having excellent speed and agility is critical.

Injury Prevention

Another important reason to utilize fitness testing with tennis players is to prevent

injuries. Research using elite tennis players has consistently identified musculoskeletal adaptations from repetitive tennis play. An example of these adaptations include muscular imbalances in the shoulder and trunk (Chandler et al, 1992, Ellenbecker 1991, 1992, 1995, Ellenbecker & Roetert, 1998 & Roetert et al, 1996), as well as postural changes such as depression of the dominant shoulder (Priest & Nagel, 1976). One of the most effective ways of monitoring the progression of these and other musculoskeletal adaptations is with the use of the testing protocol developed by the USTA Sport Science Committee outlined in this chapter.

In addition to the musculoskeletal tests described that clearly aim to prevent injury, the fitness tests and general physiological testing has injury prevention aspects as well as the obvious performance enhancement benefits. Understanding a players aerobic capacity may initially seem like a test geared only toward performance enhancement, but in the big picture has injury prevention goals as well. For example, if a player has a poor aerobic capacity, he or she will recover slower between points and have a greater potential to fatigue, thus, footwork and optimal biomechanics may be jeopardized and ultimately lead to a shoulder or elbow injury due to improper positioning, kinetic link energy transfer, and early fatigue.

The use of a comprehensively developed testing program with specific tests for tennis players will allow sports scientists and coaches to track and monitor all aspects of musculoskeletal and physiological function, and facilitate the design of programs for both preventative conditioning and performance enhancement.

USTA FITNESS TESTING

What follows is a fitness testing protocol designed specifically for top level junior tennis players by the United States Tennis Association Sport Science Committee (Roetert et al, 1995). These tests emphasize critical elements necessary for optimal performance and the prevention of common tennis injuries. The starting positions and performance parameters required for performing these tests are outlined followed by a fitness data chart based on research collected over the past ten years. These data are included to allow interpretation of the test results specific to each player being tested. The ranges provided in the charts are based on fitness testing information gathered at 120 USTA Competition Training Centers.

CTC FITNESS TESTING APPLICATION

The USTA Fitness Testing Protocol was developed to measure speed, coordination, power, balance, strength, flexibility, body composition, and endurance. When conducted properly, it will give tennis athletes a guide of where they need to work to improve their fitness.

With 16 to 24 players the Level II test may take as much as two hours to complete, so it is important to schedule the activities accordingly. With either the Level II or I test it may be desirable to split the testing over two separate sessions, so that the athletes can avoid any

muscle soreness that may occur.

Testing is one of the first things that should occur at Competition Training Centers. As the athletes train, they will be motivated to improve their scores when tested again. Testing should take place in intervals of no less than 10 weeks. This allows the athletes enough time to improve their fitness.

The USTA Fitness Testing Protocol is one of the most important elements in the national research database which the USTA has developed. It is vital to follow the test instructions to the letter and record the results accurately.

ADMINISTERING THE TEST

Before beginning the test, an adequate warm-up period is required. The easiest way to warm up is simply to jog slowly for three to five minutes, or until a light sweat breaks. The idea is to have the body prepared for intense physical activity.

Once the testing has begun, it is important that the athletes not have a chance to cool down. **Consequently, the testing should be done in stations, with several tests conducted at each station.** Once testing is completed at each station, the athletes move on to the next station. A recommended set of stations is included on page 208.

It is very important to have adequate personnel to assist with the testing, as accurate and meaningful results will only be obtained if the instructions for each test are followed exactly. No special training is required to assist with the testing, and this may be an enjoyable activity for the parents and/or coaches of the athletes.

RECORDING THE DATA

At the beginning of the year, each Competition Training Center receives 20 **Player Information Forms** and 20 **Fitness Testing Result Forms**. These forms are on Scantron computer sheets. It is critical to record the data on the Scantron. The players may need assistance in completing the forms accurately, as this may be the first time that they are filling out computer sheets. Always use a **Number 2 pencil** when completing the forms. The administrator or head coach should bring a supply of pencils to the sessions in which they are conducting Fitness Testing.

Player Information Forms

Every player should complete a Player Information Form at the beginning of the CTC calendar year. This form includes important information for tracking the players in the national database. Once they have been completed, the administrator should collect the forms from the players.

Fitness Testing Result Forms

Fitness Testing Result Forms should be completed every time the CTC administers the test. A list of the tests is on page 210. Each CTC is required to conduct the testing once per year, but we recommend that the players be tested once each season. The results will be processed each season, so players can compare their scores with the national average from one season to the next.

Players should record their scores every time they finish a particular exercise. It would be helpful to have a volunteer coach or parent help players with this aspect of the testing.

EQUIPMENT

Level I (required)

Stopwatch
Tennis balls
Sit and reach box (optional)
Chalk or athletic tape
Measuring tape and/or yardstick

The level I test was designed to minimize the need for special equipment, while providing basic information on a player's fitness level. It is required at all USTA Competition Training Centers. Directions for constructing a sit and reach box are supplied on page ?.

Level II (optional):

Blood Pressure Sphygmomanometer
Grip Strength Dynamometer
All the Level I equipment items
Goniometer
Four pound medicine ball
Skin fold calipers

The level II test provides a more detailed evaluation of a player's fitness level. It requires some specialized equipment and is optional for USTA Competition Training Centers. Some of the equipment requires specialized training and a lot of practice to be used correctly. We recommend that someone with the proper training help with the tests using the goniometer, blood pressure cuff (sphygmomanometer), and skin fold calipers.

USTA FITNESS TESTING PROTOCOL

* *Indicates that exercise is part of the Level II test and special equipment is needed*

I. Cardiovascular

A. Resting Heart Rate

1. Have your athletes take their resting heart rate upon awakening in the morning, before getting out of bed.
2. Take the pulse for **30 seconds** and multiply the score by two.

B. Blood Pressure *

1. Measurement taken for both arms while the athlete is resting.

II. Flexibility

A. Sit and Reach

Equipment	Sit and reach box, measuring stick, or tape measure	
Start Position	Athlete	Sit on the floor with legs extended out in front
	Examiner	Hold the knees down to the floor
Performance	Athlete	Place your hands next to one another with the index fingers touching, then lean forward with arms extended as far as possible out over the toes.
	Examiner	Make sure the athlete holds the stretch without bouncing.
Measurement	Examiner	Measure the distance from the toes to the fingertips. • If the hands reach past the toes, the figure is expressed positively in inches. • If the hands do not reach the toes, the figure is expressed negatively in inches. Record the best of 3 trials

Sit and Reach (inches)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>6	4-6	2-4	<2
18 & Under	>8	7-8	5-7	<5

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>3	1-3	0-1	<0
18 & Under	>4	2-4	1-2	<1

B. Hamstring Flexibility*

Equipment	Training table, goniometer, two test examiners	
	Athlete	Lay in supine position on training table

	Examiner 1	Stand next to the hip opposite of the side being tested.
	Examiner 2	Kneel down facing the hip of the side being tested.
Performance	Examiner 1	Hold the pelvis down at the hip with one hand, reach across the body and raise the leg with the other hand (keeping the knee straight) until tightness is felt in the hamstring.
Measurement	Examiner 2	Use the lateral aspect of the leg and lateral border of the trunk as landmarks to align the arms of the goniometer. Measure the angle at the hip with a goniometer. **Record 1 trial.**

C. Shoulder Rotation *

Equipment	Training table, goniometer, two test examiners	
Start Position	Athlete	Lay in supine position on training table, with shoulder abducted at 90°, and the elbow bent at a 90° angle.
	Examiner 1	Stand next to the hip of the side being tested. With the hands, hold down the front of the shoulder, not allowing it to roll forward during rotation. Minimizing scapular motion during this measure is recommended (Ellenbecker et al, 1996).
	Examiner 2	*Kneel down facing the shoulder of the side being tested.*
Performance	Athlete	*Shoulder is internally and externally rotated from a neutral position.*
Measurement	Examiner 2	Angle of rotation of the arm is measured by a goniometer. **Record 1 trial each for dominant and non-dominant arm.**

Shoulder Rotation
Normal Patterns (Ranges) of Motion: (degrees)

Girls

(Ages 11-18)	**Dominant**	**Non-Dominant**
External	95-105	95-105
Internal	45-55	55-65

Boys

(Ages 11-18)	**Dominant**	**Non-Dominant**
External	95-105	90-100
Internal	40-50	50-60

III. Muscular Strength and Endurance

Strength is the amount of weight you can lift or handle at any one time. Muscular endurance is the number of times your muscles can lift a weight or how long your muscles can hold and amount of weight. By increasing your strength you can increase the amount of force with which you hit the tennis ball. By increasing endurance you will be able to perform movements as well at the end of the match

as you did at the beginning.

A. Sit-ups

Equipment	Stopwatch or clock	
Start Position	Athlete	Lay in a supine position with hips flexed to 45° and knees flexed to 90°. Place hands on opposite shoulders, against the body.
	Examiner	Place one knee between the feet of the athlete, and hold the feet stationary.
Performance	Athlete	Elbows must touch the thighs on the ascent, shoulder blades must touch the mat on the decent, and hips cannot leave the mat.
Measurement	Examiner	Record the number of sit-ups performed in **60 seconds** or until exhaustion. **Record 1 trial**

Sit-ups: (number completed)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>53	46-53	42-46	<42
18 & Under	>54	46-54	35-46	<35

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>58	51-58	47-51	<47
18 & Under	>63	56-63	50-56	<50

Important Note: Athletes with any history of low back pain or problems with low back should not perform this test.

B. Push-ups

Equipment	Stopwatch or clock	
Start Position	Athlete	Start in the prone position with hands shoulder width apart and the weight of your lower body on your toes. Keep arms extended and the head, shoulders, back, hip, knees and feet in a straight line.
Performance	Athlete	Bring your arms down so that they are parallel with the ground or below (form a 90° angle). Arms must be fully extended and body alignment straight on the way up to count as a full sit-up.
Measurement	Examiner	Record the number of complete sit-ups in **60 seconds** or to exhaustion. **Record 1 trial.**

Push-ups: (number completed)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>44	36-44	27-36	<27
18 & Under	>42	34-42	20-34	<20

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>49	40-49	33-40	<33
18 & Under	>52	49-52	35-49	<35

C. Grip Strength *

Equipment	Lafayette grip strength dynamometer	
Start Position	Athlete	Stand holding the grip dynamometer in one hand loosely at your side.
Performance	Athlete	Squeeze the dynamometer as hard as possible and hold for 3 seconds.
Measurement	Examiner	Record the result in kilograms. Record the best of **2 trials** for each hand.

Grip Strength: (kilograms)

	Excellent		Good		Average		Needs Improvement	
Girls	Dominant	Non-Dominant	Dominant	Non-Dominant	Dominant	Non-Dominant	Dominant	Non-Dominant
14 & Under	>34	>32	30-34	28-32	24-30	19-28	<24	<19
18 & Under	>39	>27	34-39	24-27	28-34	22-24	<28	<22

	Excellent		Good		Average		Needs Improvement	
Boys	Dominant	Non-Dominant	Dominant	Non-Dominant	Dominant	Non-Dominant	Dominant	Non-Dominant
14 & Under	>50	>31	42-50	27-31	34-42	24-27	<34	<24
18 & Under								

IIII. Power

Power is the amount of work you can perform in a given time period. Power is required during activities requiring both strength (force) and speed. Tennis requires you to move with explosive movements. Greater power allows you to

respond quicker and produce forceful movements with less effort.

A. Vertical Jump

Equipment	Measuring stick , tape,	
Setup	1. Secure a measuring stick vertically to a gymnasium wall or the outside of a building. The athlete should be able to reach the **bottom** of the stick when reaching up over their head, with heels flat. 2. Standing sideways to the wall, have the athlete raise the arm above the head, fingers extended, and touch the measuring stick as high as possible, with heels flat. Record this number as the 'standing reach'.	
Start Position	Athlete	Stand sideways to the wall underneath the measuring stick.
	Examiner	Stand on a ladder or chair next to the measuring stick to have a clear view of the point the athlete touches.
Performance	Athlete	Bend the knees and jump upward with legs together, reaching with one hand as high as possible on the measuring stick.
Measurement	Examiner	The difference between the standing reach and the highest point of the jump is the athlete's score. **Record the best of 2 trials.**

Vertical Jump: (inches)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>21	16-21	16-Dec	<12
18 & Under	>22	17-22	13-17	<13

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>27	22-27	17-22	<17
18 & Under	>28	26-28	21-26	<21

B. Overhead Medicine Ball Toss

Equipment	6 pound medicine ball, tape measure, masking tape	
Setup	Extend a tape measure in a straight line about 50 feet. Secure each end of the tape measure to the court with tape. For a starting line, place a 24 inch piece of tape on the court perpendicular to the beginning of the tape measure.	
Start Position	Athlete	Stand behind the starting line facing forward, and with both hands hold the medicine ball behind your head.
	Examiner	Stand a few feet to the side of the tape measure, near the center.

Performance	Athlete	With both hands, toss the ball over your head as far as possible down the tape measure. One step forward may be taken without crossing the starting line.
Measurement	Examiner	Observe the point on the tape measure where the ball lands. Record the best of **2 trials.**

Overhead Medicine Ball Toss: (feet)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>22	18-22	14-18	<14
18 & Under	>23	19-23	15-19	<15

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>27	22-27	17-22	<17
18 & Under	>34	29-34	23-29	<23

C. Reverse Medicine Ball Toss

Equipment	6 pound medicine ball, tape measure, masking tape	
Setup	Extend a tape measure in a straight line about 50 meters. Secure each end of the tape measure to the court with tape. For a starting line, place a 24 inch piece of tape on the court perpendicular to the beginning of the tape measure.	
Start Position	Athlete	Stand behind the starting line, facing backward. Hold the ball in front of you with both hands at waist level.
	Examiner	Stand a few feet to the side of the tape measure, near the center.
Performance	Athlete	Bend your knees with your back straight and thrust upward with the legs. Toss the ball using both hands backward over your head. No steps are allowed.
Measurement	Examiner	Observe the point on the tape measure where the ball lands. Record the best of **2 trials.**

Reverse Medicine Ball Toss: (feet)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>31	26-31	21-26	<21
18 & Under	>34	27-34	20-27	<20

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>41	32-41	23-32	<23
18 & Under	>46	38-46	31-38	<31

D. Forehand Medicine Ball Toss

Equipment	6 pound medicine ball, tape measure, masking tape	
Setup	Extend a tape measure in a straight line about 50 feet. Secure each end of the tape measure to the court with tape. For a starting line, place a 24 inch piece of tape on the court perpendicular to the beginning of the tape measure.	
Start Position	Athlete	Stand behind the starting line, facing forward. Hold the ball with both hands in front of you, arms extended.
	Examiner	Stand a few feet to the side of the tape measure, near the center.
Performance	Athlete	Using a forehand stroke motion, toss the ball as far as you can down the tape measure. One step is allowed. Concentrate on releasing the ball out in front of you.
Measurement	Examiner	Observe the point on the tape measure where the ball lands. Record the best of **2 trials.**

Forehand Medicine Ball Toss: (feet)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>29	24-29	19-24	<19
18 & Under	>32	26-32	20-26	<20

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>36	29-36	22-29	<22
18 & Under	>42	35-42	28-35	<28

E. Backhand Medicine Ball Toss

Equipment	6 pound medicine ball, tape measure, masking tape	
Setup	Extend a tape measure in a straight line about 50 feet. Secure each end of the tape measure to the court with tape. For a starting line, place a 24 inch piece of tape on the court perpendicular to the beginning of the tape measure.	
Start Position	Athlete	Stand behind the starting line, facing forward. Hold the ball with both hands in front of you, arms extended.
	Examiner	Stand a few feet to the side of the tape measure, near the center.
Performance	Athlete	Using a 2-handed backhand stroke motion, toss the ball as far as you can down the tape measure. One step is allowed. Concentrate on releasing the ball out in front of you.
Measurement	Examiner	Observe the point on the tape measure where the ball lands. Record the best of **2 trials.**

Backhand Medicine Ball Toss: (feet)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	>29	23-29	17-23	<17
18 & Under	>31	25-31	18-25	<18

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	>33	27-33	21-27	<21
18 & Under	>42	34-42	26-34	<26

*V. Body Composition **

1. Body Composition is appraised by the skin fold procedure, using calipers.
2. Two measurements are taken at each of the six sites, all on the right side of the body.
3. The average number of the two measurements is recorded.
4. The sites are: Triceps, subscapular, mid-axillary, suprailiac, abdominal, and anterior thigh.
5. The result will be expressed as the sum of the measurements.

VI. Agility and Speed

Agility and speed are your ability to move around the court quickly and smoothly to position yourself for a shot. Agility is crucial to good court movement. It allows you to be in the correct position and provides a solid platform from which to hit the ball. Speed is important to get to the ball. The faster you can get to a ball the more time you have to prepare for your shot.

A. Hexagon Test

Equipment	Stopwatch, masking tape, goniometer or protractor, test examiner	
Setup	Using masking tape, create a hexagon (6 sides) on the ground. Each side is 24 inches long, with an angle of 120° between each side. Designate one side to be the 'starting line'.	
Start Position	Athlete	Stand inside the hexagon facing the starting line.
	Examiner	*Stand outside the hexagon facing the athlete. Use the command "Ready-Go" and start the stopwatch.*
Performance	Athlete	*1. Jump with both feet over the starting line to the outside of the hexagon.* *2. Immediately jump back inside the hexagon, then jump to the outside of the next adjacent side (remain facing forward).* *3. Continue jumping in and out as you go around the hexagon.* *4. As quickly as possible, make 3 revolutions around the hexagon without touching any of the sides with your feet.*

Measurement	Examiner	Record the time elapsed as the athlete jumps back into the hexagon after 3 revolutions. *Time Penalties: 0.5 seconds for each line touch 1.0 seconds for jumping a side out of sequence **Record the best of 2 trials.**

Hexagon (seconds)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	<10.90	10.90-12.00	12.00-12.90	>12.90
18 & Under	<12.00	12.00-12.10	12.10-12.40	>13.40

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	<11.10	11.10-12.00	12.00-12.80	>12.80
18 & Under	<11.80	11.80-13.50	13.00-13.50	>13.50

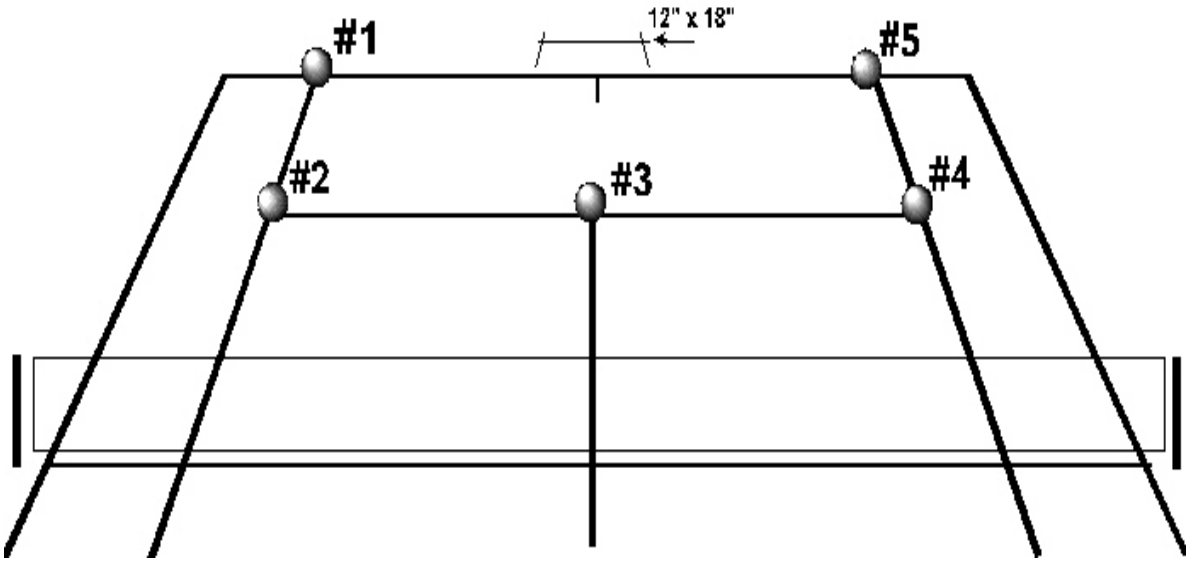
B. 20-Yard Dash

Equipment	Stopwatch, masking tape, test examiner, (*measuring stick optional)	
Setup	Using masking tape, mark off a start and finish line 20 yards apart. (The distance from one baseline to the opposite service line is 20 yards)	
Start Position	Athlete	Stand with toes behind starting line.
	Examiner	*Stand next to the finish line. Raise the arm with the stopwatch up in the air to give the runner a visual clue. Use the command "Ready-Go", and on "Go" drop the arm and start the stopwatch.*
Performance	Athlete	*Sprint to the finish line as fast as possible.*
Measurement	Examiner	Record the time elapsed as the athlete crosses the finish line. **Record the best of 3 trials.**

20 Yard Dash: (seconds)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	<3.30	3.33-3.40	3.40-3.60	>3.80
18 & Under	<3.20	3.20-3.36	3.20-3.54	>3.62

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	<3.20	3.20-3.30	3.30-3.50	>3.50
18 & Under	<2.90	2.90-3.00	3.00-3.30	>3.30



C. Spider Test

Equipment	5 tennis balls, masking tape, stop-watch, tennis court	
Setup	Use masking tape to mark off a 12 inch by 18 inch rectangle behind the middle of the baseline, using the baseline as one of the 18 inch sides. Position five balls as follows: Ball #1: sideline/service line intersection, deuce court Ball #2: baseline/sideline intersection, deuce court Ball #3: center 'T' Ball #4: baseline/sideline intersection, ad court Ball #5: sideline/service line intersection, ad court	
Start Position	Athlete	Stand facing the Ball #1, with one foot touching the taped rectangle.
	Examiner	Stand behind the taped rectangle, out of the court. Use the command "Ready-Go" and start the stopwatch.
Performance	Athlete	Sprint to Ball #1, retrieve it and place (do not throw) it inside the taped rectangle. Continue to retrieve each ball, one at a time in sequence, and place them in the taped rectangle. (counterclock-wise pattern)
	Examiner	Remove each ball after it is placed in the rectangle to prevent the athlete from stepping on it.
Measurement	Examiner	Observe the time elapsed after the last ball has been placed inside the rectangle. **Record the best of 2 trials.**

Spider Test: (seconds)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	<17.52	17.52-18.14	18.14-18.60	>18.60
18 & Under	<17.10	17.10-17.16	17.16-17.34	>17.34

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	<16.80	16.80-17.42	17.42-18.00	>18.00
18 & Under	<14.60	14.60-15.00	15.00-15.40	>15.40

D. Sideways Shuffle

Equipment	Stopwatch, masking tape, tennis court, test examiner	
Start Position	Athlete	Stand at the 'T' facing the net, with one foot on either side of the line.
	Examiner	*Stand a few feet in front of the athlete, with back to the net. Use the command "Ready-Go" to start the test.*
Performance	Athlete	*1. While facing the net, shuffle along the service line and touch the doubles sideline with one foot.* *2. Immediately shuffle back across the service line and touch the opposite doubles sideline.* *3. Shuffle back to the center 'T' to finish* *4. No crossover steps are allowed.*
Measurement	Examiner	Record the time elapsed as the athlete crosses the center 'T', after touching both doubles sidelines. **Record the best of 2 trials.**

Side Shuffle : (seconds)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	<6.0	6.0-7.0	7.0-7.30	>7.30
18 & Under	<7.0	7.0-7.10	7.10-7.40	>7.40

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	<6.40	6.40-6.70	6.70-7.00	>7.00
18 & Under	<5.50	5.50-5.60	5.60-5.70	>5.70

VII. Aerobic Endurance

Aerobic endurance is the ability to take in, transport, and use oxygen. Aerobic energy is used during prolonged, steady-paced activities mainly using the large muscle groups. A strong aerobic base will allow the tennis player to recover more quickly between points, and perform longer before getting tired.

1.5 Mile Run

Equipment	440 yard track (Cinder or Tartan tracks recommended), stopwatch, 1 test examiner	
Start Position	Athlete	Stand with toes behind starting line
	Examiner	*Stand off the track, near the starting line. Use the command "Ready-Go" to start the run.*
Performance	Athlete	*Athlete: Run 6 laps around the track as fast as possible.*
Measurement	Examiner	Record the time elapsed as the athlete crosses the finish line. **Record 1 trial.**

1.5 Mile Run: (minutes:seconds)

Girls	Excellent	Good	Average	Needs Improvement
14 & Under	<11:00	11:00-12:00	12:00-13:00	>13:00
18 & Under	<10:30	10:30-11:00	11:00-11:30	>11:30

Boys	Excellent	Good	Average	Needs Improvement
14 & Under	<10:00	10:00-11:30	11:00-11:30	>11:30
18 & Under	<9:45	9:45-10:15	10:15-11:00	>11:00

Fitness Testing References

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Priest J.D.& Nagel D.A. (1976). Tennis Shoulder. American Journal of Sports Medicine 4: 28-42.

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Level 1

Wall /Fence ↓

Station 1

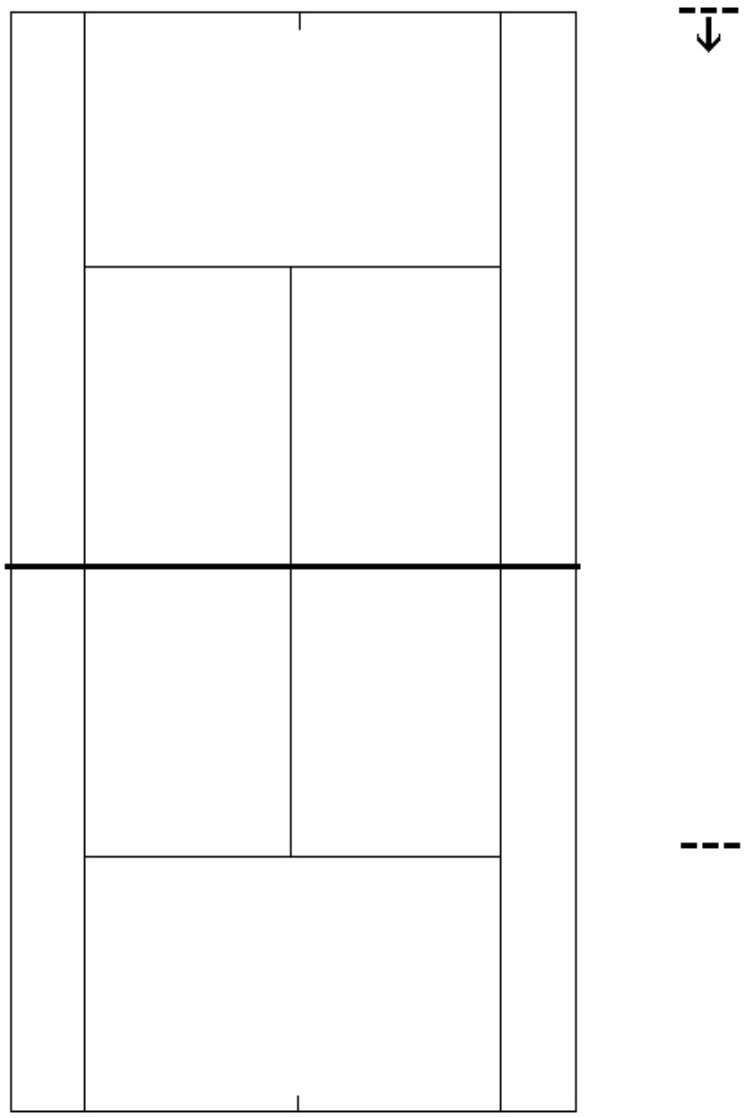
Hexagon Test

Station 2

Vertical Jump

Station 3

20 - Yard Dash



Station 4

Sit & Reach

Sit-Ups

Push-Ups

Station 5

Spider Run

Sideways Shuffle

Constructing the Sit and Reach Box

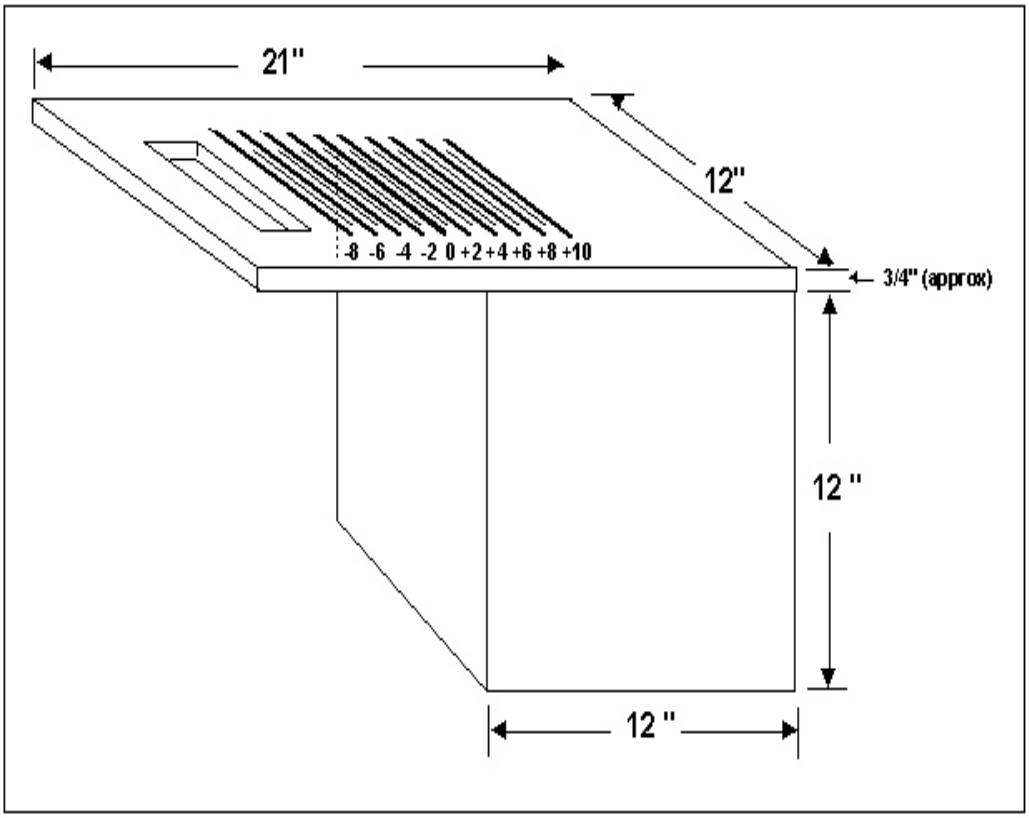


Figure 1 Sit and Reach Box

1. Using any sturdy wood or comparable construction material (3/4 inch plywood or comparable construction material is recommended), cut the following pieces:
   - 4 pieces-12 in. x 12 in.
   - 1 piece-12 in. x 21 in.

2. Assemble the pieces using nails or screws and wood glue.

3. Inscribe the top panel with one-centimeter graduations. It is crucial that the 0 centimeter line is exactly in line with the vertical plane against which the subject's feet will be placed.

4. Cover the apparatus with two coats of polyurethane sealer or shellac.

5. For convenience, a handle can be made by cutting a 1 in. x 3 in. hole in the top panel.

6. The measuring scale should extend from about -6 to +12 inches. Make sure you mark in one inch increments.

Fitness Testing Scorecard

Level I or II (circle one) Dominant Hand: Left Right
Testing Date:_____ Testing Location:_____

Name:_____ Date of Birth:_____

Sex: M F Height:_____ Weight:_____ Ethnicity:_____

TEST

1. **Resting Heart Rate:** _____ sec **Blood Pressure:** _____

2. **Flexibility**
   - A. Sit and Reach _____inches
   - B. Hamstring Flexibility Left_____ Right _____
   - C. Shoulder Rotation: Left Internal _____ Right Internal _____
     Left External _____ Right External _____

3. **Muscular Strength & Endurance**
   - A. Sit-ups in 1 minute: _____
   - B. Push-ups in 1 minute: _____
   - C. Grip Strength: Left_____kg Right _____kg

4. **Power**
   Vertical Jump: Jump_____ less Teach_____ Equals_____inches

   2 Trials (circle best)
   - A. Overhead Medicine Ball Chest Toss: _____ feet/inches _____ feet/inches
   - B. Reverse Medicine Ball Toss: _____ feet/inches _____ feet/inches
   - C. Forehand Medicine Ball Toss: _____ feet/inches _____ feet/inches
   - D. Backhand Medicine Ball Toss: _____ feet/inches _____ feet/inches

5. **Body Composition**

_____	_____	_____	_____	_____	_____
Triceps	Suscapular	Mid-Axillary	Supraliac	Abdominal	Thigh

6. **Agility & Speed**
   - A. Hexagon Test _____Sec _____Sec (2 trials, circle best)
   - B. 20 Yard Dash _____Sec _____Sec _____Sec (3 trials, circle best)
   - C. Spider Test _____Sec _____Sec _____Sec (3 trials, circle best)
   - D. Sideways Shuffle _____Sec _____Sec (2 trials, circle best)

7. **Aerobic Capacity**
   - 1.5 Mile Run _____Minutes/Seconds