

The Official Coaching and Sport Science Publication of the International Tennis Federation

Editorial

Welcome to issue 35 of the ITF Coaching and Sport Science Review. This is the first edition for 2005 and it signals a new era for the publication as it is the first edition that will be published in an electronic form only. It is anticipated that this change will enable us to deliver the Review to a greater number of coaches worldwide more efficiently and increase the use of the ITF coaching weblet, www.itftennis.com/coaching. We are currently in the process of having the first 16 editions of the Review converted into an electronic format that can then be added to the weblet.

This edition includes articles on a variety of topics including junior tennis, psychological, physiological and nutritional methods to enhance performance, as well as an article on national coach education programmes. We would like to take this opportunity to thank all the coaches and experts who have contributed to the current Review and previous Reviews and we encourage you to continue submitting articles for publication. Information for authors who wish to submit an article can be found by visiting the CSSR article submission link on the weblet, www.itftennis.com/coaching/sportsscience/submission.asp. Due to the size constraints of the Review we are now also publishing articles from coaches and experts as online articles on the weblet. The purpose of the online articles is to make available as much information as possible to coaches from around the world, to enhance the continual coach education process.

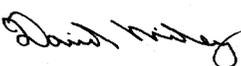
The highlight of the ITF's coach education programme is the bi-annual ITF Worldwide Coaches Workshop. We know that many of our readers have attended previous workshops and will therefore be interested to know that the 14th edition is due to be held later this year at Club Ali Bey in Antalya, Turkey. The dates for the event, which will be coordinated in conjunction with Tennis Europe and the Turkish Tennis Federation, are Monday 17th to Sunday 23rd October. We will include a tentative programme of the Workshop on the weblet as soon as it is ready. Confirmed speakers thus far include: Craig Tiley (RSA), Prof. Bruce Elliot (AUS), Carl Maes (BEL), Gustavo Luza (ARG), Marchar Reid (AUS), Dr. Paul Roetert (USA), Eliot Teltscher (USA), Dr. Ann Quinn (AUS), Dr. Stuart Miller (ITF), Dr. Patrick Schamasch (IOC), Georges Goven (France) and Prof. Per Renstrom (SWE).



This issue has some great stories on the junior game.

Information about the venue, speakers and the programme is also on the coaching weblet.

We hope you enjoy the 35th edition of the ITF Coaching and Sport Science Review and we welcome your feedback on the new electronic only format.



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The ITF Junior Boys' Circuit and its Role in Professional Player Development

By Machar Reid (University of Western Australia), Miguel Crespo, Luca Santilli & Dave Miley (ITF)

INTRODUCTION

In tennis, the ages of 15-18 are considered key from a player development perspective. It is here, where the best male and female players add physical power and tactical nous to their already well-honed technical games. These four years also represent a period where important decisions must be made with respect to a chosen competitive pathway.

Long considered one of the primary breeding grounds for budding professional players (MacCurdy, 2000), the International Tennis Federation Junior Circuit's (ITFJC) importance to player development is anecdotally, very



Roberto Bautista (ESP) helping Spain win the Junior Davis Cup 2004.

well recognised (van Fraayenhoven, 2004). However, only Miley and Nesbitt (1995) have attempted to link ranking achievement in the junior game to later, professional success. It is this article's intention to explore this relationship in the male game for all top 20 ITF-ranked juniors between 1992-98. A future paper will discuss the implications of the ITFJC for female player development.

RESULTS AND DISCUSSION

The seven year period from 1992-98 saw a total of 116 boys, from 40 countries, achieve a top 20 ITF junior ranking (JR). Twenty-four players were ranked inside the top 20 on more than one occasion. Argentina and the United States each had nine players with a top 20 JR, while 14 countries had three or more top 20-ranked juniors in this seven year stretch.

Table 1 illustrates that 91% (106 / 116) of these top 20 juniors went on to attain a professional men's ranking. Superficially, a comparison of the ranking highs within the junior top 20 suggests that higher ranked junior players tend to also achieve higher professional rankings. The mean age at which all top 20 juniors achieved their highest professional ranking was 23.5 ± 2 years.

The percentage of top ranked junior players to build on their U/18 successes and reach common ranking goals in the professional game is depicted in Table 2. Forty-five percent of all top 20-ranked junior players from 1992-98 broke into the professional top 100, while slightly more than one in every third went on to reach the top 50. These figures increase to 56% and 44% respectively when only top 5-ranked juniors are considered. Indeed, one in every four of this group of players reached a top 10 professional ranking. Some similarity exists between the professional ranking progression of the top 6-10

ITF Junior Ranking	Professional Ranking			
	Top 100	Top 50	Top 20	Top 10
1-5	56%	44%	34%	25%
6-10	42%	36%	16%	10%
11-15	48%	34%	19%	15%
16-20	31%	19%	19%	8%
All	45%	34%	22%	15%

Table 2. Likelihood (in percentage terms) of top 20-ranked juniors reaching a top 100, 50, 20 and/or 10 professional ranking.

and the top 11-15 ranked juniors, and although fewer top 16-20 juniors reached the professional top 100, their representation in the professional top 20 and 10 compares favorably.

ITF Junior Ranking	Total Junior Players	Players to be ranked professionally	Highest Ranking	Age at highest ranking	
				Mean	St Dev
1-5	32	31	89.2	23.5	1.9
6-10	31	29	142.9	22.8	1.5
11-15	27	24	168.5	23.6	2.1
16-20	26	22	175.3	24.2	2.4
All	116	106	139.7	23.5	2.0

Table 1. Mean highest professional ranking for top 20 junior boys and mean age at which it was achieved.

CONCLUSION

The selection of the appropriate means through which to develop the necessary personal, physical and game-based skills for successful, professional tennis performance is one that confronts all serious, competitive players. The achievement of a boys' top 20 junior world ranking would appear to be a reasonable yardstick of playing talent and a

worthwhile developmental goal for all aspiring male professionals. A comparison of the significance of the ITFJC with that of other developmental pathways such as the US College system is eagerly anticipated.

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Improving Serving Speed in Young Tennis Players

By George Mamassis (Tennis professor, Dept. of Sport Sciences, Serres, Greece)

INTRODUCTION

The tennis serve has become the most important shot in both the men's and women's game in recent years. Therefore, increasing its speed is vital in today's game. Traditionally, when talking about how to teach the technique of a particular shot, it comes to mind that a student executes the specific shot and then the coach either verbally (giving verbal instructions) or visually (shows the movement) tries to make the appropriate corrections. With the advancement of science, new ways of teaching skills have evolved. One such method is imagery. That is, having the student see a model player executing a particular shot and then trying to rehearse it in his mind. Imagery works better in conjunction with physical practice, the player sees the shot, visualizes it, and then executes it physically.



Mental imagery combined with physical practice is the most effective way to improve serving technique and increase serving speed in young tennis players.

Another way to improve serve speed is through strength training. Given that quality of technique as well as all other physical characteristics of two players are the same (height, weight etc.), the stronger player will serve faster. The fundamental strength training exercise for improving throwing speed in all throwing based sports such as baseball, javelin, etc. and therefore tennis serve, is the bench press.

METHOD

After taking into consideration all the above information, the aim of this research was to investigate the effects of the coach's feedback, imagery rehearsal, strength training and their combination on the tennis serve speed of young tennis players. The intervention program lasted for 8 consecutive weeks. The participants, 48 young tennis players aged 8-12 years old (Mean=10.20) had 2-4 years of tennis experience and were randomly assigned to 5 groups (all groups practiced with a certified coach 3 times per week for 90 min per practice): The Control group (C) participated in tennis practices without practicing their serve. The Serve Practice group (SP), whose participants executed 30 serves per practice under the supervision of a coach who, made corrections (traditional way). The Serve Practice and Strength Training group (SPST), whose participants followed the (SP) group training regiment but, after their tennis practice, they were involved in strength training (3 sets of bench-press at 50%, 75% & 100% of 10RM). The Mental Training and Serve Practice group (MTSP), who took part in a mental training program prior to their tennis practice. Specifically, the participants of this group watched a video tape with a 14-year-old elite tennis player (whose service technique was rated as perfect by 3 expert

tennis coaches) serving 9 serves; the first 2 at normal speed, the next 2 at half speed, the next one frame by frame having an expert coach emphasize 5 technical elements of a correct serve¹, the next 2 at half speed and finally the last 2 at normal speed. Then, the participants closed their eyes, focused on their breathing for 30 sec and then tried to visualise themselves executing their serves as they saw in the video tape (2 min). Finally, they rated the quality of their imagery and went to the court where they also executed 30 serves.

The Mental Training, Serve Practice and Strength Training group (MTSPST) followed a combination of the (MTSP) and (SPST) training regiments. One week before the initiation and one week after the end of the intervention program, all participants were measured on their serve speed using a radar gun (the mean speed of 6 serves that landed into the service box were taken into account - young players served from the service line to ensure success), imagery ability, and bench press strength (10RM).

RESULTS

Interestingly, the results showed that the MTSP group had the largest increase in the tennis serve speed, followed by the MTSPST and SPST groups who had about the same amount of increase. The SP group showed a small improvement while the participants of the C group increased their serve speed by only 1.5miles/hour.

As for upper body strength, the strength training group participants significantly improved on their bench-press 10RM. On the contrary, those players who did not participate in strength training showed only a slight

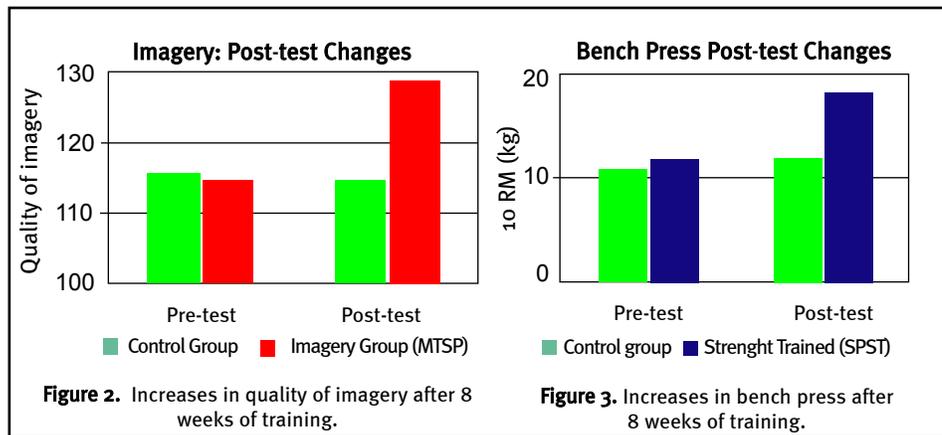
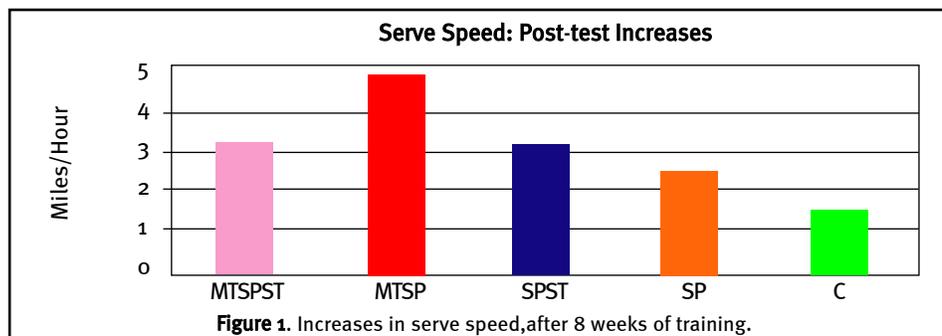
¹These were: 1. Start with the body weight on the front foot and bounce the ball. 2. Bring both the hitting and the tossing arm together while the body weight moves to the back foot. 3. Toss the ball and have the shoulder of the tossing arm higher than the one of the hitting arm. 4. Immediately after tossing the ball, bend the knees, put the racket in to the backscratch position and then jump and hit the ball over an imaginary high volleyball net (high). 5. Land in front of the baseline with the left foot first and then the right one.

increase in strength due to biological maturation. Similarly, only the mental training group participants improved their imagery quality

score after the mental training program. The results are depicted in the charts and are discussed below.

DISCUSSION

The results of the present study clearly show that mental imagery is the most effective way to increase serving speed in young tennis players. Given that the players of the MTSP did not participate in strength training, this increase was obviously due to the improvement of their serving technique, which is crucial for this age group. Although it was not the scope of this investigation to study its improvement, all 3 expert tennis coaches agreed that on average the participants of the imagery group improved their technique much more than the other groups. Strength training improved serve speed to a certain degree but then it was shown to plateau whether it was used in combination with mental imagery or alone. This probably occurred because the effects of strength training on performance are apparent after a certain amount of time, which differs according to the training regiment followed. The traditional method of teaching technical skills in tennis through instructions from the coach led to slight increases in serving speed (meaning that there was a small improvement in serving technique), and therefore its effectiveness is questionable.



Power Training for Youngsters

By Piotr Unierzyski (University School of Physical Education, Poznan, Poland)

INTRODUCTION

Power, especially dynamic and explosive power is considered one of the most

important factors affecting tennis performance (Schönborn, 1984; Elliott, 1989; 1990). Our research (Unierzyski, 1996)

conducted on young players showed that the influence of power on tennis performance increases with age. The correlation between results of various power tests and tennis performance is already significant at the age of 12. From age 13 dynamic power seems to be one of the strongest factors determining rankings for boys and girls. Research conducted on Polish players showed that the correlation between sport performance and the level of power was as significant as agility and almost as meaningful as speed - probably the most important motor ability in the game. Thus confirming the importance of power, agility and speed for a successful tennis career and emphasising the need to pay close attention to its development.



It is widely known the period before puberty favours the development of coordination, speed and flexibility. Power can also be trained during that period but the most trainable period for its improvement starts around 13 years of age. The best period for maximal strength and maximal power development starts later -

Multi Jumps: Great for developing dynamic power, muscular co-ordination and creating a good base for explosive power training.

around the age of 16-17. This information is crucial for the long-term planning of power and strength training. As we can see the development of power, power-speed and explosive power should be the main goal of power training at the ages of 13-17.

It is important to remember the golden rule: "**do not harm**". This rule is especially important during puberty, where results of overload are remarkably dangerous as growth plates can be affected, and ones growth can be stunted. Despite the fact that the load (both volume and intensity) of training is gradually increasing with age and experience, whole body exercises should be dominant.

GOALS OF POWER TRAINING FOR 13-17 OLD TENNIS PLAYERS

- Dynamic power development.
- Further progress in whole body power and strength (including injury prevention).
- Developing muscular endurance.

POWER TRAINING METHODS

Power training methods for tennis can be divided into 3 groups: All-round (AR), semi-specific (SS), and tennis specific (TS).

Repetitive Method (AR)

The main goal is to improve whole body power and strength (including injury prevention). It is designed for less trained or younger players or it can be used after a break in power training or at the beginning of the preparation period. It is usually organised as circuit training and it develops overall strength and power - forms a base for tennis-specific power training. The task is to perform several repetitions with the same steady intensity, with the break between drills being unspecified - can be up to full recovery. Nine to twelve exercises should be completed and exercises should develop all main muscle groups. This training should be very consistent but versatility maintained (exercises should be changed from time to time).

Example session:

1. Exercises against own body resistance.
2. Exercises with partner resistance.
3. Medicine ball throws.
4. Exercises with dumbbells.
5. Isometric exercises.
6. Exercises against resistance.

Moderate Load Method (SS)

This is the typical method of power training for this age group. It develops dynamic power, muscular co-ordination and creates a good base for dynamic and explosive power training. It also develops overall fitness and endurance (injury prevention) but does not affect speed or influence muscle mass growth. It is usually organised as circuit training with 8-12 exercises with a load of 50% of the maximal possible load and participants complete 15-20 repetitions or 1 minute duration at each station. The main difference compared to the repetitive method is that there is no rest between exercises. Must be used for around 4-6 weeks to get good results.

Example session:

1. Jogging 6 minutes, warm up.
2. Push ups.
3. Broad jumps.
4. Weight lifting (e.g. Stone or wooden branch).
5. Brandishes left-right when hanging on a tree branch.
6. Multi-jumps up the hill .
7. Pulls up on tree branch.
8. In laying position raising legs and trunk .

Fartlek Designed for Power (AR or SS)

The main goals are overall development, to complement other training methods and/or prepare for greater loads. It is completed in rough terrain (Off-road) and used during transition, preparation period (phase 1) and between tournaments to maintain power abilities. Lots of improvisation and freedom is required and exercises for different muscle groups should be integrated (e.g. Arms, trunk, and legs). It can be used at an early age (11-12 years) or with less prepared players and can be more or less tennis specific according to the needs.

Example session:

1. Warm up:
 - Jogging, stretching and co-ordination and jumping drills (e.g. Jump-and-turn).
2. Main part:
 - Medicine ball throws (both arms).
 - Exercises against own body resistance (jumps, stands on tiptoe, etc.).
 - Exercises against partner's resistance.
 - Wrestling exercises.
 - Abdominal exercises.
 - Competitions or games using above mentioned drills.

3. Cool down:
 - Jogging, stretching and breathing exercises.

Model Interval Training Designed for Power (SS or TS)

Completed at the end of the preparation period or during the competition period. Improves specific power through the use of 6-8 exercises with movements specific to the game such as medicine ball throws or (multi) jumps. All drills must be performed with maximal speed for around 5-15 sec or 4-8 repetitions with 1-2 min rest between sets. It should be performed twice a week during pre-competition period (mesocycle) or once a week during competition period and can be connected with training of other abilities (especially for advanced players).

Example session:

1. Warm up.
2. Main part:
 - Medicine ball throws (service motion both hands) - 6 sets of 6-10 throws, rest 10-15 sec.
 - Skipping over obstacles - 6-8 sets, rest 20 sec.
 - Medicine ball throws (2-3 kg) fore-hand and/or backhand motion- 6 sets of 15 sec, rest 20 sec.
 - Skips left-right over a rope or obstacles or low wall- 6 sets lasting 8 sec each, rest 15 sec.
 - Medicine ball throws (2-3 kg) fore-hand and/or backhand motion- 6 sets of 15 sec, rest 20 sec.
 - 4-6 multi-jumps with short sprints (5 meters) - 6 sets (can be up the hill) 20 sec rest.
3. Cool down.

Tennis Specific Power Training (TS)

The main goal when completing this type of power training is to transfer dynamic power into tennis specific power with technique execution. Complex on court drills in which power is used should be performed at maximal speed with full recovery. Anaerobic alactacid work should also be included and it must have a complex character (motor abilities training with technique and tactical tasks).

Examples of drills:

- Power with co-ordination theme (e.g. Stroke - turn/changes of direction- stroke).
- Power with technical goal (e.g. Tough volleys and smashes).
- Feeling drills (slow, slow, winner) topspin, slice, winner.

- Power with tactical theme (decision hit or not to hit).
- Practice games (e.g. winning shot: 3 points; drive volley winner: 5 points).

These drills can be mixed with light weights drills (e.g. forehand imitation) or medicine ball throws.

CONCLUSION

Intervals between exercises or sets of exercises should be used for stretching or even co-ordination exercises. It is important to continue power training during the competition period because:

1. It is easier to maintain a level of power once achieved and then continue to develop it starting from a higher point, than to regress and have to regain it from the beginning.
2. As power is a very important factor affecting tennis performance if it is to decrease during most important competitions it may contribute to poor performance.

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Endurance for Tennis

By Anna Skorodumova

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INTRODUCTION

Endurance is the ability to maintain the quality of performance over an extended period of time. One may say that endurance is the ability to resist fatigue. There are 2 types of endurance; general and specific.

General endurance is the ability to withstand continuous dynamic work involving all the muscular system at a moderate load. This type of endurance is characterised by a high-level of aerobic metabolism and provides the basis for developing many other types of endurance.

Specific endurance is the ability to complete specific work (play tennis) for an extended period of time without any alteration in performance. Tennis players display general endurance when they go for a swim or a run etc., but whilst playing tennis the ability to maintain stroke accuracy, impact force, speed etc. requires specific endurance. Specific endurance for tennis players requires them to maintain performance during a point, a set, a whole match and the series of matches that is a tournament.

FACTORS AFFECTING ENDURANCE CAPACITY:

1. Personal and psychological factors related to personal characteristics

There is a great number of features and qualities that defines ones personality however there is no complete definition. One can assume that a personality is "a definite person with all its individual characteristics". It is highly important to identify significant and substantial features of the character of a person which would influence their actions in complex situations. Characteristics of high class

Energy System	Initiation time	Maximal capacity	Duration of maximum capacity	Fuel for ATP production	Time for fuel recovery	Biomechanical basis of physical quality
ATP-Pc	0.5 - 0.7 sec.	3.8 kJ/kg/min. 1.2 - 2 times higher than glycolytic, 3-4 times higher than aerobic.	10 - 45 sec.	Phospho-creatine.	2 - 5 min.	Local muscular power, alactate anaerobic endurance e.g. serving, sprinting to the ball.
Glycolytic	20 - 30 sec.	3.1 kJ/kg/min. 2 times higher than aerobic.	30 sec - 6 min.	Muscle glycogen.	30 min - 2 hrs.	Specific speed endurance activity lasting 30 sec - 2.5 min e.g. movement during long rallies.
Aerobic	2 - 4 min.	1.6 - 1.8 kJ/kg/min.	Almost unlimited.	Muscle and liver glycogen. Triglyceride (fat).	2 - 24 hrs .	General endurance e.g. recovery between points.

Table 1. Energy systems.



Running/Jogging is a good exercise for developing general endurance and increasing aerobic fitness.

sportspeople include self confidence, determined character, initiative, reduced anxiety etc. But we must also know what motivates a player? Do they desire to beat higher ranked opponents and to succeed or do they desire for material rewards such as money. These features of a person's character will influence their ability to endure strain, resist exhaustion and achieve their intended goals.

2. Energy Power Factors

Any activity of a human being, including playing tennis requires the use of energy. The main source of energy for muscle activity is ATP (Adenosine-triphosphate), a combination that is rich in energy. At any given time all 3 energy systems are contributing to ATP production, however

which is the dominant during a tennis match is dependant upon a variety of factors including style of play, court surface, balls etc.

Because tennis is so dynamic and every match is different there is no precise answer with regard to the amount of energy each system contributes. However, we do know that at least 80% of match time is consumed by the intervals between points and games and that during this time the aerobic system predominates. Therefore, approximately 80% of ATP production comes from the aerobic system and the other 20% from a combination of the ATP-Pc system and the glycolytic system. Specific information about each of the three energy systems is provided in Table 1.

3. Economy of Performance

To play tennis economically, is to perform the same activity as another player (e.g. running to play a wide forehand and then recovering to the centre of the court) but with a lower level of oxygen consumption and/or heart rate. Economy of play is connected with the technical performance of shots, the efficiency of movement on the court, etc. as well as the efficient functioning of internal organs such as the heart and lungs.

Functional economy is directly dependant upon the skill level and fitness level of a player. Our research tested the reactions of the cardiovascular and respiratory systems of tennis players using a ball fed activity (move-hit-recover etc.) which simulated match play. The results showed that more skilled players had a significantly lower heart rate, lung ventilation and oxygen consumption.

This means that a more skilled player can perform an activity more economically than a less skilled player. For example, the more skilled player's heart rate shall be about 160 heartbeats/min and the other player's around 170 heartbeats/min. This means that the first player will perform the activities aerobically, while the second will rely on the anaerobic supply of energy, which is less efficient and causes fatigue earlier. With tennis matches often lasting over 2 hours this difference in heart rate and energy supply may eventually be of critical importance.

CONCLUSION

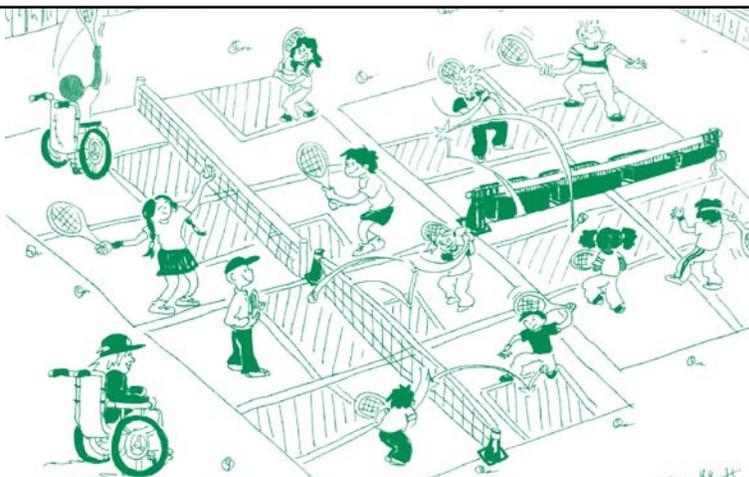
Knowing the physiology of endurance for tennis is very important. As we know there are a number of ways to improve a player's endurance: technically, psychologically and physiologically to name a few. Hopefully this knowledge will now be used on the training court and you can further assist your players in becoming a more complete player.

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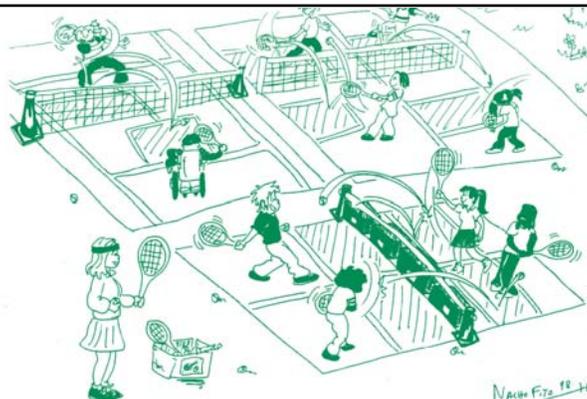
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2 ONE HOUR LESSONS FOR CHILDREN 5 - 8 YRS OLD

LESSON 21	Theme: PROPELLING, RECEIVING AND MOBILITY
Objective	To bounce the ball off the wall.
Warm up	<u>Basketball:</u> Students are divided into teams. Each team has a basket, each student has to throw the ball into the basket with his hands. Team with the most balls in his basket wins.
Games/Exercises	<u>Archery:</u> Students are in pairs. Each pair has a big target on the wall. Pairs take it in turns to hit the ball with the racket to the target. One or more bounces allowed. Pair with the most hits in his target area wins.
Variations	Hit the ball up as many times as possible, after several or one bounce, holding the racket in different ways, etc.



LESSON 22	Theme: PROPELLING THE BALL WITH THE RACKET
Objective	To hit the ball in a target or area on the floor.
Warm up	<u>Rolling balls goalkeeper:</u> Students form pairs. One student rolls the ball to his kneeling opponent who has to try and block it. Students change positions after 10 balls. Students who has scored most goals wins.
Games/Exercises	<u>Tennis Basket Ball:</u> Students are divided into teams. They are positioned at a distance from a basket. Each team should try to hit the balls with their rackets into their basket. Team with the most balls in their basket wins.
Variations	Changing the racket face, changing the target area, changing the hitting zone, etc.



2 ONE HOUR LESSONS FOR CHILDREN 8 - 10 YRS OLD

LESSON 21	Theme: PROPELLING, RECEIVING AND CO-OPERATING: SERVE AND RETURN
Objective	To develop the two strokes which used by all students to start a point.
Warm up	<u>Back to back ball pass:</u> Students in pairs with their backs to each other. They have to pass a ball around both of them, moving a little further apart each time. Then pass through legs, over head, etc.
Games/Exercises	<u>Start it out!:</u> Students rally in pairs. Student A serve to a specific zone in the court, B returns the serve to a specific zone in the court. If a pair manage to serve and return to the correct specified zone, they score a point. The player the most points wins. Students rotate positions.
Variations	Vary the direction, depth and power of the shots.



LESSON 22	Theme: PROPELLING, RECEIVING AND CO-OPERATING: SERVE AND GROUNDSTROKE
Objective	To develop the strokes which are used by all students to start a point and to rally.
Warm up	<u>4 corner relay:</u> Students are in teams. Each student of each team should run from one corner to the next round the whole court. Next student should start when his team-mate finishes his run.
Games/Exercises	<u>Tasmania Devil:</u> Students rally in pairs. Student A serves to a specific zone in the court, B returns the serve to a specific zone in the court and they start rallying. A rally of four groundstrokes = 1 point. The pair with the most points is the winner. Students rotate positions.
Variations	1st pair to reach 10 points wins.



Can We Delay Fatigue in Tennis Players by Dietetic Manipulations?

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INTRODUCTION

Fatigue in tennis players during long matches is caused by:

- a. - Central origin factors. The increase of serotonin (a very important neurotransmitter at brain level) has been proved to be directly related with prolonged effort (so called "central fatigue").
- b. - General overload factors (joint, musculo-skeletal, etc.)
- c. - Factors related to thermoregulation, which are crucial when exercising in high environmental temperatures.
- d. - Local factors. Mostly due to energy expenditure at a metabolic level.

In our research we studied the manipulation of serotonin concentration on ones ability to cope with the feeling of "central fatigue".

What are the functions of serotonin?

Serotonin has a role in many functions such as motor activity, cognitive functions, sleep, sensory perception, regulation of temperature, nociceptive function, appetite, sexual behaviour and hormonal secretion. It also regulates the smooth muscles in the cardiovascular and digestive apparatus and vasoconstriction.

Why serotonin is related to fatigue in long duration sports?

When athletes are given drugs that increase serotonin concentration, there is an increase in their fatigue levels during efforts of almost 2 hours in duration. These conditions commonly occur in 3 set matches played on clay.

Can we reduce the concentration of serotonin in the brain?

1. - Serotonin can not cross the blood-brain barrier, which is a very sophisticated system that isolates our brain from non desirable substances. However, an amino acid that turns into serotonin in the brain (tryptophan) can cross this barrier. Thus, the concentration of serotonin the neurotransmitter in the brain depends a lot upon the concentration of tryptophan in the blood.

2. - Bio molecules competing against tryptophan to cross the blood-brain barrier, will reduce the production of serotonin. Amino acids competing with tryptophan in this

process are ramified amino acids (leucine, isoleucine and valine), as well as phenilalanyne and tyrosine.

3. - Many studies have shown that the ingestion of a drink rich in ramified amino acids and with no tryptophan will cause changes in the content of this amino acid in plasma.

As per the above, the synthesis of serotonin will depend on:

- a) Free tryptophan concentration in plasma (between 10 and 20% of total tryptophan).
- b) Plasma concentration of ramified and aromatic amino acids that use the same transporter to cross the blood-brain barrier.

Why research diet changes to look for alterations in the perception of fatigue in long duration matches?

Even though previous research to find an overtraining marker using free tryptophan concentrations in plasma and ramified amino acids has not been conclusive, there is conclusive evidence in animals. There are studies in rats, but the results are more evident in race horses, in which the infusion of tryptophan (100 mg/kg) before effort clearly lowers performance.

On another hand, studies done with athletes using ramified amino acids supplements until now do not evaluate long duration (more than two hours) efforts nor do they use high enough doses of those amino acids to provoke substantial alterations of tryptophan.

OUR RESEARCH WITH TENNIS PLAYERS

Originality of the study

We prepared two different drink combinations. One containing ramified amino acids with typical doses from previous studies done in this field. The other with ramified amino acids to which we added other amino acids, that are also competitors of tryptophan, but are not ramified amino acids, such as phenilalanyne and tyrosine.

One of the combinations was given to a group of male fasted athletes and the other to a group of female fasted athletes.

Results of the study

In the athletes that only had ramified amino acids the other amino acids (phenilalanyne and tyrosine) were reduced significantly, whereas in the other group they increased.

Therefore, if an athlete ingests ramified amino acids before physical effort, there will be a decrease of up to 40% in the plasma concentrations phenilalanyne and tyrosine in less than 100 minutes. We should not forget that the competency in the blood-brain barrier with tryptophan it is not exclusive to the ramified amino acids, since the common transport that creates the competence also does the same for the phenilalanyne and tyrosine. Thus, decreases in these two amino acids will compensate, at least in part, for the increase in the other.

The drink designed in our study, which added phenilalanyne and tyrosine to the ramified amino acids, maintained the levels of all of these amino acids, lowering much more the income of tryptophan into the brain and, thus, its conversion into serotonin.



Remaining hydrated via the intake of fluids plays an important role in resisting fatigue, but is water really enough?

The timing at which this combination of amino acids was given to the athletes is also relevant since several studies have shown that if amino acids are administered together with carbohydrates before and during the effort, the anabolism is bigger than if they are administered after the effort is finished. The dose used was 6 g. of AA and 35 g. of CH.

It also seems that it is better that the substances are administered in one dose, since continued ingestion does not create a peak of aminoacidemia.

With regard to the possible increase in catabolism and ammonium production and the consequent reduction in effort tolerance, research does not lead us to think that this alteration in performance was due to the increase amount of ammonium which was produced to reach levels of 308 mg/k.

However, these values are much higher than usual, and of course, well above the ones recommended in our formula, which are around 100 mg/k.

CONCLUSIONS

The conclusions from our research are the following:

1. A drink created by our team based on ramified amino acids (valine, leucine and isoleucine), phenilalanine and tyrosine provokes a significant reduction of both plasma and free tryptophan, thus a probable reduction of the neurotransmitter serotonin in the brain and a lower feeling of fatigue.

2. If we add carbohydrates in a proportion of 6 gr. amino acid per 35 gr. of carbohydrates, we are making a sports drink which can be consumed before and during long duration exercise (longer than 2 hours), which will

improve the anabolism and decrease the feeling of fatigue.

3. The relationships between the level of serotonin in the brain and ingestion of tryptophan will be studied in the second phase of this research.

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Ingest	Before effort (1 hour)	During effort	After effort
RRAA alone	↓ TRP (desirable) ↓ TYR and PHE (non desirable)	↓ TRP (only in long duration efforts) (desirable) = TYR and PHE (desirable)	↑ Proteic anabolism (desirable)
AA essential without TRP	↓↓ TRP (desirable) = TYR and PHE (desirable)	↓↓ TRP (only in long duration efforts) (desirable) = TYR and PHE (desirable)	↑↑ Proteic anabolism (desirable)
RRAA without TRP + CH	↓↓ TRP (desirable) = TYR and PHE (desirable) ↓ Glycaemia (non desirable)	↓↓↓ TRP (only in long duration efforts) (desirable) = TYR and PHE (desirable) = Glycaemia (desirable)	↑ Proteic anabolism (desirable) ↑ Synthesis of glycogen
AA essential without TRP + CH	↓↓↓ TRP (desirable) = TYR and PHE (desirable), ↓ Glycaemia (non desirable)	↓↓↓↓ TRP (only in long duration efforts) (desirable) = TYR and PHE (desirable) = Glycaemia (desirable)	↑↑ Proteic anabolism (desirable) ↑↑ Synthesis of glycogen

RRAA (ramified amino acids); TRP (tryptophan); TYR (tyrosine); PHE (phenilalanine)

Table 1. The effects of different drink combinations.

Tennis Coaches Education: A Worldwide Perspective

By Miguel Crespo, Machar Reid & Dave Miley (International Tennis Federation)

INTRODUCTION

Coaches' education is considered fundamental to most national association tennis development programmes. With some of the most established tennis nations starting their coaches' education programmes (CEP's) in the early part of the 20th century, emphasis on coaching didactics is not new. Late in the 20th century however, the International Tennis Federation (ITF) - the sport's governing body - became progressively more involved in coaches' education the world over. The underlying intention was to help educate all

nations as to the importance of coaches' education and ultimately assist them develop their own CEP's (Miley, 2003).

Validating the status of coaches' education

In 2003 the ITF Coaches' Commission asked the ITF Development Department to survey the characteristics of the different CEP's worldwide. In doing so, the ITF formulated the following research goals:

— Collate and compare the characteristics

(pre-requisites, contents, contact hours, reference material, assessments...) of the CEP's of as many ITF member nations as possible.

- Produce a comparison chart to highlight the structure of the different CEP's worldwide (ITF, 2003).
- Use the information gathered as criteria to establish normative teaching loads and requisites between programmes to facilitate assimilation of coaching certification inter-country/association.

MATERIAL AND METHODS

The research consisted of two parts:

– Coaches' education programmes in the most developed tennis nations:

A group of experts comprised of the ITF Development Officers, Research Officers, other Development staff and members of the ITF Coaches' Commission formed the ITF Questionnaire on Coaches' Education (ITF, 2003b).

The group then decided that the questionnaire be sent to the world's top 25 tennis nations, as determined by the guidelines set for the ITF Marketing of the Game Summit. These nations were: Argentina, Australia, Austria, Belgium, Brazil, Canada,

Croatia, the Czech Republic, Egypt, France, Germany, Great Britain, Israel, Italy, Japan, Mexico, Morocco, Netherlands, Poland, Portugal, Russia, Spain, Sweden, Switzerland, and the USA.

– Coaches' education programmes in less developed nations:

Many of the less developed tennis nations have been exposed to the ITF CEP so it was decided that the ITF Development Officers would be in the best position to expand on the different CEP's in their region. These

experts were asked to classify the nations into four groups: 1. national associations that follow the ITF syllabi almost entirely, 2. national associations that follow the ITF syllabi combined with own programme, 3. national associations that have their own CEP, and 4. national associations that have no CEP in place.

RESULTS

With statistical analysis ongoing, the study's preliminary descriptive results are presented below.

A) Top tennis nations:

- Total number: Twenty two of the top 25 tennis nations (88%) completed and returned the questionnaires.
- Main features of their CEP's were:
 - Ownership: Top tennis nations have their own CEP's.
 - Delivery: Most national associations exhibit control over and run the CEP by themselves. Only a handful have outsourced coach education to a private or independent company (coaches' association, etc.).
 - Names of the courses:
 - Lower / introductory levels: Instructor, teacher, trainer, initiator, development, and volunteer.
 - Higher levels: Professor, advanced, elite, club pro, high level, and tournament coach.
 - Other: A, B, C, 1, 2, 3.
 - 54% have names, 27% have numbers (1,2,3), while 18% use letters (A,B,C).
 - Course structures: The number of certification courses/tiers varies from 1-7, with a mean of 3-4 levels.
 - Number of formal hours: There is considerable difference in the number of formal hours spent with a tutor present. Lower levels courses have as few as 6 tutor-

AVERAGE formal contact hours with tutor present				
	Level 1	Level 2	Level 3	Level 4
Total hrs (22)	2265	3419	3992	2926
Average (22)	102.9	155.5	199.6	365.8

Table 1. Formal contact hours with tutor present in courses of most developed tennis nations.

	<i>National Associations following the ITF syllabi almost entirely</i>	<i>National Associations following the ITF syllabi combined with own programme</i>	<i>National Associations with own coaches education programme</i>	<i>National Associations with no formal coaches education programme</i>	<i>Total</i>
North America	0	0	2	0	2
CA & Caribbean	19	3	3	6	31
South America	8	1	1	0	10
Europe	5	5	34	4	48
Africa	45	1	2	3	51
Asia	31	2	1	7	41
Pacific Oceania	0	0	2	14	16
TOTAL	108	12	45	34	199

Table 2. The coaches' education status of 199 nations affiliated to the ITF.

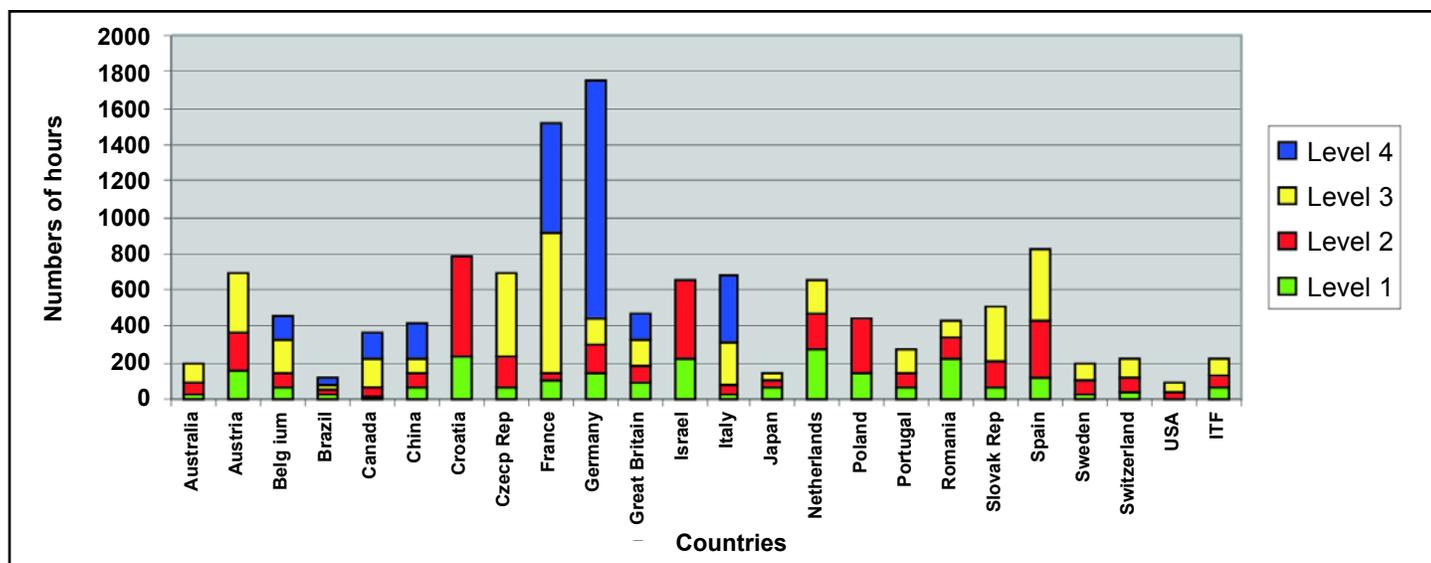


Figure 1. Levels 1, 2, 3 and 4 contact hours (with tutor present) in courses of most developed tennis nations plus nations using the ITF syllabi.

coach contact hours and as many as 270. On the other hand, the higher levels of certification require coaches to complete anywhere from 700 to 1300 hours or even a University degree (four years). Table 1 shows the contact hours of these courses.

- Course hours: Most CEP's have fewer hours in the introductory levels than the higher levels. There are however, a few CEP's that have adopted the opposite structure. Figure 1 depicts the course hours in the different levels.
- Hours per subject: On court training is the subject that attracts the most number of hours in almost all coaches' courses. Again, while there is significant variation in the number of hours per subject between courses, information on the majority of the sport sciences, computing and even languages form part of the course content in most courses.
- Testing: All programmes include diverse theoretical and practical assessment procedures.
- Pre-requisites: Criteria that help govern course participation such as age, playing level, education, and minimum time between courses/levels are common to most CEP's.
- Other relevant information: In general, there are no pre-course hours to be completed, however, some courses do require work/projects to be finalised outside formal course hours.

B) Less developed nations:

- Total number: Information on CEP's was collected from a total of 176 ITF member nations other than those identified as the top 25 nations.
- These nations were divided into the four aforementioned groups as related to the use of the ITF coaches' education syllabi.
- 34 (19.3%) out of the 176 nations do not have a formal CEP, while 20 (11.3%) nations do have their own CEP in place.
- 108 (61.3%) out of the 176 nations follow the ITF syllabi almost entirely.
- A further 7.9% of the nations follow the ITF syllabi in combination with their own CEP.

General results:

- In summary, general information on CEP's was collected from a total of 199 ITF member nations. With 200 nations affiliated to the ITF, this represents a 99.8% return.
- Table 2 highlights the use of the ITF CE syllabi among all nations that participated in the research.
- Of the 199 nations surveyed, 82.9% (165) have a CEP in place. A finding that does not account for the ITF-organised coaches' courses, which have been held in almost all member nations (Miley, 2004).
- Of these 165 nations 27.2% (45) have developed their own CEP, 65.4% (108) use the ITF syllabi, and 8.4% (12) combine their own CEP with that of the ITF.
- Europe is the region in the world that possesses the highest number of nations with their own CEP.

CONCLUSIONS

This research effort should be considered a first step in the process of gathering more information about CEP's worldwide. Indications are that a significant number of NA's have CEP's in place, with approximately a third of all nations leading their programmes and most other nations adopting either the ITF syllabi entirely or alongside their own programmes. Preliminary findings also illustrate tremendous diversity in the characteristics of the CEP's of the top 25 tennis nations. In turn, this reveals the need for establishing equivalence between existing CEP's.

Ultimately, it is hoped that this research will lead to the establishment of more uniform guidelines and criteria for coaching courses, as well as aiding all nations in the creation of their own CEP's. More specifically, it may provide for the assimilation of CEP content, minimum entry standards, coach competencies and assessment procedures among the multitude of other pressing issues in the field.

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How to Manage Stress Before and During Matches

By Antoni Girod (Master in Neuro Linguistic Programming, France)

INTRODUCTION

Certain matches labelled as "important" can produce anxiety and insomnia in the days before. And while approaching the "D day" certain players can feel unusually tense and have stomach aches. These are the classical symptoms of "before match stress". Likewise, during a match, a point mentally identified as important can trigger muscle tension or an abnormally fast heart rate. Suddenly, the player is paralysed by the situation. He is unable to think clearly or accurately. That is "during the match stress".

Yes, "a priori", STRESS IS GOOD!

Stress is a natural reaction of an organism when adapting to environmental instability. When all is stable around me, I do not need to



Remember, in times of frustration: breathing deeply with a diaphragmatic breath will help decrease stress levels.

adapt myself and stress is not necessary. On the other hand, at the precise moment I have to react to stress, my "organism under stress effect", prepares myself for action through a general neuro-physiologic activation. The stress is positive when my reaction intensity is adjusted correctly to the situation. My stress becomes negative when I misevaluate the situation; either overestimating or underestimating it. Hyperstress is produced by overestimating, e.g. I send a nuclear submarine to attack a duckling. Hypostress is the result of underestimating the situation e.g. to face Gengis Khan Cavalry I come with beach sandals and a pair of sunglasses. In both cases, my response is inappropriate.

A good stress manager is a player who is able to find his optimal activation zone. Certain

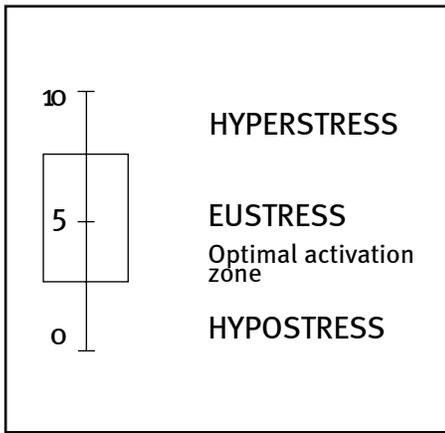


Figure 1. Stress Continuum

players are in the zone when they are "fired up" and they need a high level of activation but not too high. Other players are efficient when they feel "calm" and their activation level should be lower. Hey! Wake up! Not too low because you risk falling asleep (See Figure. 1.)

7 TOOLS TO MANAGE STRESS

1. Prepare

Study the opponent and the specificity of the match environment. Prepare the bag and racquets. Visualise different game plans...

2. Avoid pressure

Stay calm before the match in a quiet place to find a concentration rhythm. During changeovers close your eyes or put your head under a towel.

3. Sing a song

Before the match, listen to music on a walkman or radio. Between points or during changeovers you can sing mentally.

4. Read

The day before the match read a good book to help you get to sleep. If you have to wait for a match or 2 to finish, put your mind on something else by reading comics, magazines or a book.

5. Zoom lens

Don't give the match too much importance. From Mars, what does my match look like? In one hundred years, what was the importance of the match?

6. Breathe

During the 5 minute warm up, concentrate on breathing out while hitting the ball. Between points or during changeovers think of breathing deeply with a diaphragmatic breathe.

7. Smile

When confronted with difficulties or unexpected events smile.

These seven tools tend to reduce anxiety. Alternatively to increase activation you just have to get motivated e.g. concentrate on match goals and move with energy. And now, good stress!

The Medical Travel Kit

By Babette Pluim, MD.,PhD.

(Doctor of the Royal Netherlands Lawn Tennis Association, Member of the ITF Sport Science and Medicine Commission)

Travelling is an important part of professional and international tennis. Therefore, a player should be adequately prepared to handle minor and major medical issues when away from home. A minor injury, such as a blister, can become a major issue or even a cause for withdrawal, if not treated properly. At major tournaments sports physicians, physiotherapists and trainers may be available, but in the satellite circuit, ITF futures, and the veteran and wheelchair tournaments medical staff may be scarce.

The contents of the travel kit will vary depending on the destination and the local facilities available. It is advisable to be as self-sufficient as possible when travelling. Thus, the first step the player should take when in travel preparation is to obtain information regarding the destination. This should include climate, altitude, level of pollution, accommodation, food, water, vaccination requirements and available medical support. E.g. in Western Europe, antibiotics or sterile needles need not be part of the medical kit, whereas it may be advised to include those when travelling to countries where it may be difficult and time-consuming to obtain medication or when the hygienic standards are not very high.

CONTENTS:

Instruments

- Thermometer.
- Scissors.
- Sterile blister puncture needles.
- Spare glasses or lenses, for those who wear them.

Wound dressings and tape

- Steri-strips.
- Antiseptic solution (betadine).
- Band-aid plastic strips.
- Fixomull stretch.
- 2 roles of sports tape (3.8 cm).
- Compressive bandage.
- Skin care pad (second skin).

Medication

- Oral analgesics (paracetamol, NSAID's).
- Antidiarrheal (imodium).
- Antihistamines.
- Short-acting sleeping tablets.
- Anti-nausea tablets.
- Throat lozenges.

Miscellaneous

- Sunscreen.
- Safety pins.
- Tampons (women).
- Spare shoelaces.
- Plastic bags (for ice).
- Sterile gloves.

- Medical passport (if using medication).
- List of banned substances.

EXPLANATION:

Instruments

- Thermometer, to determine whether it is safe to continue play (not advised with a temperature over 38.5°C).
- Scissors: self-explanatory.
- Sterile needles to puncture a blister.



Some of essential supplies required for every players and coaches medical kit.

Wound dressings and tape

- Steri-strips can be used for (scar free) healing of a deep cut.
- Antiseptic solution should be used to clean a wound or blister.
- Band-aids can be used for minor cuts and wounds to control bleeding and prevent contamination.
- Fixomull stretch is used to cover larger wounds or abrasions. Due to the stretch, it is easy to apply and usually holds very well.
- It is to be advised to carry two roles of tape with you. The tape can be used to prevent blisters in area's of friction (fingers, palm of the hand, feet). Also, the tape can be used to treat or prevent minor sprains and strains (ankle, thigh etc). Even if you do not know how to tape, there may be people around you who do.
- Compressive bandage is used for a larger injury, such as a major ankle sprain or pulled muscle. It is applied immediately after the injury has occurred, in order to stop the bleeding. In addition, it can be

used to give stability to a joint.

- Skin care pad (second skin). Blisters are a common complaint among tennis players. Use of a skin care pad may allow a player to continue, even when there is raw skin beneath the blister.

Medication

- Paracetamol can be used for a minor headache.
- NSAID's such as diclofenac or advil are more useful when you are suffering from sprains or strains.
- Antidiarrheal: Traveller's diarrhea is the most common infectious illness encountered when travelling. An aggressive approach can be adopted when the illness occurs near the time of competition or when you have to travel by bus or plane, commencing treatment with loperamide (Imodium), two tablets initially and then one tablet with each loose bowel action until symptoms abate.
- Antihistamines and/or bronchodilators should be included by those players that suffer from hayfever and/or exercises-

induced bronchospasm. Remember that bronchodilators require a TUE (Therapeutic Use Exemption).

- A short-acting sleeping tablet may be useful to regulate sleeping patterns or to induce sleep during a long flight.
- Anti-nausea tablets should be brought by those players that tend to suffer from travel sickness.
- A nasal spray may be very helpful when your sinuses are congested and you have to fly. The spray will relieve some of the congestion and prevent an earache due to differences in air pressure.

Miscellaneous

- Sunscreens are useful to prevent solar damage.
- Sterile gloves are advised to prevent infections.
- Plastic bags may come in handy, because although ice is usually available, the means to transport and store it may be lacking.

Recommended Books and Videos

BOOKS

Modern Tennis Management.

Author: Tennis Australia and the Australian Sports Commission. **Year:** 2002. **Language:** English. **Level:** All levels. **ISBN:** 1 74013 029 4. This product contains 14 books of approximately 20 pages and covers different topics related to modern tennis management. Topics include: Club planning, volunteer management, sponsorship,

legal issues and marketing to name a few. This kit is ideal for the new club coach or for those who wish to refresh their approach to tennis management. For more information contact: www.tennisaustralia.com.au



El Tenis en la Escuela (Tennis in the school).

Author: David Sanz Rivas. **Year:** 2004. **Language:** Spanish. **Level:** All levels. **ISBN:** 84-8019-734-X. This book gives a comprehensive presentation of introducing tennis to junior level players in schools. It contains a brief history of the game and then discusses the basic technique of all the strokes. It also contains a chapter with some great lesson plans for coaches and school teachers. It has excellent illustrations that make the book easy to read and increase the understanding of activities and technical points that have been described. For more information contact: www.paidotribo.com



Tenis Bez Tajni (Tennis without secrets).

Author: Vjeran Friscic. **Year:** 2004. **Language:** Croat. **Level:** All levels. **ISBN:** 953-99629-0-0. This book "Tennis without secrets" is intended primarily for players but it is also very useful for coaches as it serves as an instrument for achieving better communication between a coach and a player. This book consists of basic information concerning general and specific knowledge, for all the phases of a player's development. All the key concepts are comprehensively explained and illustrated with photos or drawings. The book covers every aspect of the game and is comprehensive and "user friendly". For more information contact: bayofriscic@inet.hr



Enseignement Dans le Club (Teaching in the Club).

Author: French Tennis Federation. **Year:** 1998. **Language:** French. **Level:** All levels. **ISBN:** 2-907267-63-9. This book discusses many issues related to coaching juniors in the club environment. It discusses, with the use of colourful animation, how to introduce juniors into the club and provides information about different equipment that can be used to modify activities for junior and beginner players. It also has information on mini-tennis and different games that can be played to create and increase in the participation of the players. For those coaching junior and beginner players it would be a valuable source of information. For more information contact: www.fft.fr



COMPACT DISCS

Tennis Mind

Volume 1 Mental Toughness: **Author:** Dr. Robert Heller. **Year:** 2004. **Language:** English. **Level:** All levels. Developed in conjunction with Subconscious Training Corporation, it is designed to teach tennis players of all levels to improve their performance and play better tennis under pressure. It contains 10 brief lessons on how to train your body and mind to optimally respond during match specific situations. You simply insert the CD into your computer; select the lesson you want to train with and the visual and auditory programming begins. The lessons are approximately 7 minutes in length, allowing you to train easily and often for maximum learning and retention. Topics range from coping with choking and



managing mistakes to controlling anger & frustration and overcoming gamesmanship. For more information contact: <https://secure.directyourmind.com/sitemap.html>

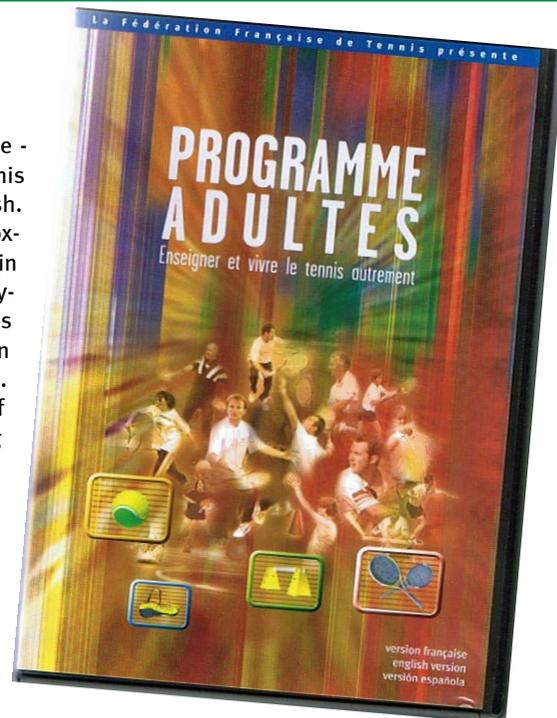
Art of Tennis, Coach Vol. 1: **Author:** Jurgen Muller and Oliver Heuft (Art-of-Tennis). **Year:** 2004. **Language:** English and German. **Level:** All. This CD is visually stimulating from the moment it starts. It contains an easy to use contents page with direct links to different topics. Topics covered in this CD include technique, warming up, mental training, point play, mini-tennis and many more. With the integration of diagrams and still shots this is a complete package. Not only is it a good tool to help the coach but it could also be used for teaching students indoors on a rainy day. For more information contact: kontakt@tectennis.com



DVD

Programme Adultes

- Enseigner et vivre le tennis autrement (Adult Tennis Programme - Teaching and experiencing tennis differently): **Author:** French Tennis Federation. **Year:** 2004. **Languages:** French, English and Spanish. **Level:** All. This informative DVD which has a running time of approximately 30 minutes discusses the changing needs environment in which we now live and the different needs of the adult tennis player. It breaks down the needs of adult players into 3 groups Discovery, Fitness and Performance and then provides information about how to cater a coaching program for each of these groups. The 'discovery' trend is focused on the immediate enjoyment of the game, the 'fitness' trend is focused on the quest for well being and physical condition and the 'performance' trend is about making progress in match play or improving a specific stroke. Through real situations and with lots of video footage of modified activities for adults it presents the benefits of conducting programmes for adults within the club. Therefore, it provides a useful guide to those who want to work with adult players. For more information contact: www.fft.fr



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