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COACHING & SPORT SCIENCE REVIEW

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EDITORIAL

Welcome to issue 74 of the ITF Coaching and Sport Science Review, the first issue of 2018. In this issue, the topics cover a range of aspects in the game including: periodization for juniors, muscle memory and imagery, the inside out forehand, tactical/notational analysis, adapted equipment, and winning or losing at wheelchair tennis Grand Slam tournaments among others.

The ITF is pleased to announce that the inaugural ITF Worldwide Participation Conference will take place in London on Sunday 8 and Monday 9 July 2018. The event, which will aim to create a global conversation for increasing participation in tennis and sport, will be hosted at Chelsea Football Club's Stamford Bridge stadium. The conference, which will bring together leading international experts, will provide an interactive and modern forum for discussing ideas on how to increase participation – both in tennis and in sport more generally. The sharing of best practices from across the world and reflection on successful projects that have contributed to growth and retention in sport, will take significant focus through the two-day event. The inaugural event will be a fantastic platform for our sport to showcase tennis as one of the most participated recreational sports worldwide. Speakers will be confirmed shortly. For more information on how to register for this ITF event, please visit the official page by clicking here.

The ITF Coaches' Commission welcomes new members for 2018/19 elected by the ITF Board of Directors: Ghizela Enslin (RSA), Edgar Giffenig (MEX), Demetris Herodotou (CYP), Antonio Nadal (ESP), Nicole Pratt (AUS), Big Qi (CHN), and Kawaljeet Singh (IND). Its first meeting will be hosted during Roland Garros. We would also like to take the opportunity to thank those who served in the ITF Coaches' Commission during the previous terms.

2018 marks another year that the biannual ITF Regional Coaching Conferences return. The Conferences, sponsored by BNP Paribas, form an important part of the ITF's Coach Education Programme and, as always, will be featuring high calibre international experts. The main topic for this year's Conferences is women's tennis. For more information, dates and venues of the Conferences please click here.

The official research study evaluating 'the impact of the ITF Tennis Play and Stay campaign on the tennis industry, since its inception in 2007' conducted by the Institute of Sport, Exercise and Active Living (ISEAL) at Victoria University, Australia has been completed. The findings will be published shortly in the ITF ebooks app.

In February 2017, the new ITF ebooks app was released. This app now has a total of 80 publications available: 33 in English, 18 in Spanish, 15 in French, 8 in Russian and 6 in Chinese; 46 of which are free to download as ebooks from Google Play for Android devices and from the App Store for Apple devices.

The ITF Tennis iCoach website now has presentations the 2017 LTA National Coaches' Conference and the 20th ITF Worldwide Coaches Conference. Presentations by keynote and workshop speakers feature now on the website. For just $30USD per year you can keep up to date with the most current tennis specific coaching information. You can view this content and register for Tennis iCoach membership here.

The ITF is happy to announce that the Coach Education system of the Swedish and the Polish Tennis Associations have been recognised at Silver level and the Coach Education system of the Colombian Tennis Federation has been renewed at Gold level.

We hope that you will value the information presented in this 74th edition of the ITF Coaching and Sport Science Review. We would like to thank all the authors for their contributions and those who sent proposals. We also hope that you will continue to make use of all the other coaching resources provided by the ITF which can be viewed on the ITF Coaching webpage here.

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How do LTA mini tennis modifications shape children's match-play performance?

Anna Fitzpatrick , Keith Davids and Joseph Antony Stone (GBR)

ITF Coaching and Sport Science Review 2018; 74 (26): 3 - 5

ABSTRACT

Modified versions of tennis, such as Tennis Play and Stay and Mini Tennis (MT) have been implemented around the world to influence children's performance behaviours. However, it is not clear how modified versions of tennis shape match-play behaviours. We analysed 1010 match-play points, across four stages of tennis (MT Red, MT Orange, MT Green and Full Ball), to investigate effects of playing MT on children's match-play performance behaviours (Fitzpatrick, Davids & Stone, 2017). MT Red and MT Orange rallies lasted longer than Full Ball rallies, indicating that MT can afford children more opportunities to develop their skills. Also, MT players performed a higher percentage of forehands and lower percentage of backhands than Full Ball players, which may signal an unintended, imbalanced effect of practice modifications on skill development. Findings suggested that coaches should consider possible effects on match-play behaviours when designing modified practice environments for young players.

Key words: constraints-based coaching; court scaling; ball compression; mini tennis

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INTRODUCTION

Tennis is a challenging sport for young learners, requiring a significant level of physical competence in order to generate and maintain a rally (Farrow & Reid, 2010a). To reduce children's dropout rates and facilitate skill development, tennis federations have implemented modified versions of the sport (e.g. Tennis Play and Stay and Mini Tennis). These formats aim to provide learning environments that better correspond to the current capacities of inexperienced, developing learners (Timmerman et al., 2015). For example, the Lawn Tennis Association's (LTA) Mini Tennis (MT) consists of three progressive stages: MT Red (MTR), MT Orange (MTO) and MT Green (MTG). Game characteristics such as court dimensions, ball compression and scoring format are modified at each stage, assumed to facilitate young learners' transition through MT and into Full Ball tennis (FB). However, these modified versions of tennis were introduced, based solely on the experiential knowledge and subjective opinions of coaches, and there is a need for empirical evaluations to understand how they might influence children's performance skills (Larson & Guggenheimer, 2013).

Since the inception of MT, some research has suggested that manipulating court dimensions and ball compression, individually, can enhance children's skill development (Buszard, Reid, Masters & Farrow, 2016). However, investigating manipulation effects of a single modification (e.g., ball compression) on performance limits the potential practical application of results, because several modifications are applied simultaneously within the MT framework. Furthermore, studies have typically examined children's behaviours within a practice environment, rather than examining how practising in a modified environment transfers to a match-play context. Additionally, several studies (e.g. Kachel, Buszard & Reid, 2015; Timmerman et al., 2015) have analysed performance of national-level players, rather than inexperienced young learners, for whom the modifications were originally designed. For these reasons, we examined the match-play performance of age- and playing standard-appropriate children, across four stages of tennis (MTR, MTO, MTG and FB). Our aim was to understand whether, and how, the modifications applied within the MT framework influenced children's match-play behaviours.

METHOD

Participants

Forty-eight children were recruited and stratified by their age-appropriate tennis stage (see Table 1).

Tennis Stage	n	Age (years)	Tennis-playing experience (years)	Number of points analysed
MTR	18	7.4 ± 0.6	2.1 ± 0.9	230
MTO	16	8.5 ± 0.6	3.2 ± 1.0	253
MTG	8	9.9 ± 0.4	3.8 ± 0.8	280
FB	6	13.7 ± 0.5	6.4 ± 2.5	247

Table 1. Sample sizes, age and tennis-playing experience (mean ± sd) and number of points analysed per stage.

Procedure

Performance during a total of 1010 match-play points (see Table 1) was filmed. Matches were contested on a Plexipave court surface, using new, stage-appropriate Wilson tennis balls, and adhered to MT Rules and Regulations. Video data were coded using a custom-notational analysis system, with 'very good' intra-rater reliability, k = 0.96 (O'Donoghue, 2010). Key Performance Indicators included forehands, backhands, net-play and rally length (for full list see Fitzpatrick et al., 2017). The variables in Table 2 were subsequently calculated in Microsoft Excel.

Dependent variable	Equation
Average rally length	(Rally length$_1$ + rally length$_2$ ... + rally length$_n$) / total number of rallies
Forehand %	[Number of forehands / (total forehands + total backhands + total net-play shots)] x 100
Backhand %	[Number of backhands / (total forehands + total backhands + total net-play shots)] x 100
Net-play %	[Number of net-play shots / (total forehands + total backhands + total net-play shots)] x 100

Table 2. Match-play variables.

Data Analysis

To identify inter-stage differences, data were analysed using a One-way Analysis of Variance (ANOVA) for rally length data, and a mixed design ANOVA for shot type data. Gabriel's post hoc test was used where differences were identified (Toothaker, 1993).

RESULTS

Two key findings are presented here (see Fitzpatrick et al., 2017 for all reported results).

Rally length

Findings showed that MTR rallies (7.4 shots) and MTO rallies (6.6 shots) were longer than MTG (4.3 shots) and FB rallies (3.8 shots), respectively. Figure 1 demonstrates a progressive decline in rally length throughout the stages.

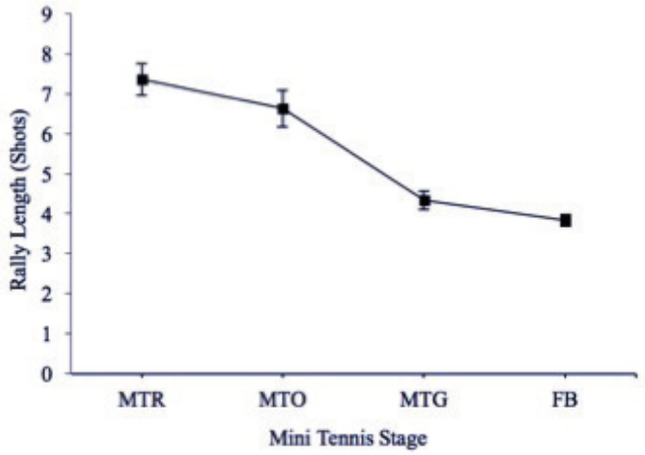

Figure 1. Mean rally length for each tennis stage.

Shot type

Results revealed differences in shot type played; more forehands were played (62.4%) than backhands (35.0%), and net-play shots (2.6%). There was also a difference in the shot type that emerged at different stages of development. Figure 2 shows that as MT stage progressed, the percentage of forehands played decreased: MTR (66.4%), MTO (65.0%), MTG (61.6%) and FB (46.0%); whereas the percentage of backhands played increased: MTR (30.9%), MTO (33.5%), MTG (37.0%) and FB (48.2%).

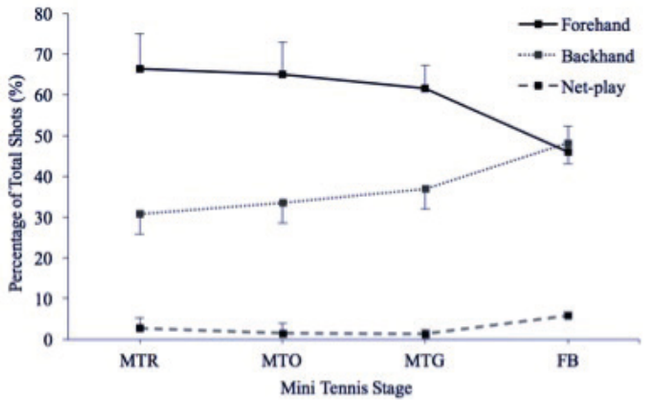

Figure 2. Shot type breakdown for each tennis stage.

DISCUSSION

Our findings showed that MT modifications did indeed influence children's match-play behaviours. When matches were played on smaller courts, using lower compression balls (i.e. MTR), an important outcome for skill acquisition was longer rallies. This finding demonstrates how task simplification can afford young learners more opportunities to perform strokes in a representative performance environment.

There was a gradual decline in rally length as the task became more difficult (i.e. as court dimensions and ball compression increased). Our findings mirror the results of previous work showing how court scaling and ball modification can increase children's rally lengths (Farrow & Reid, 2010b). Smaller courts reduce the distance a player is potentially required to move to retrieve each shot, and lower compression balls travel more slowly through the air and bounce lower, therefore adapting the range of movement responses available to players. In this context, MTR modifications afforded players more time to act (Martens & de Vylder, 2007) and provided a more comfortable ball-contact height, better aligned with a young child's physical stature, facilitating longer rallies; this may be more conducive to their long-term development (Kachel et al., 2015).

Inter-stage differences were also identified in the shot types that emerged. The percentage of forehands performed decreased and the percentage of backhands performed increased as court dimensions and ball compression increased. The relatively high percentage of forehands, compared to backhands, in all three modified stages, suggests that players elected to play forehands more often than backhands (a ratio of approximately 2:1 at MTR), under modified match-play conditions. This behaviour may be due to the reduced distance a player needed to move and the increased time available for him/her to move around the ball and perform a forehand. This is often the first stroke taught to children and, therefore, the favoured stroke. Moving around the ball to perform a forehand is, however, an inefficient movement (using more energy and time), with a possible detrimental effect on recovery to the centre of the court (Hughes & Moore, 1998). This outcome also implies that MT modifications do not afford children as many opportunities to perform and develop the backhand as it does the forehand. However, the reliance on forehands (evident at all three MT stages) declined until FB, where no differences were observed between the percentage of forehands and backhands performed.

Previous work has suggested the disparity between forehands and backhands may be even greater within MT coaching sessions, with Farrow and Reid (2010b) reporting a mean ratio of approximately 6:1 in favour of the forehand. This may lead to a skill imbalance over time, inhibiting a learner's development. For example, if MT modifications do not afford children sufficient opportunity to perform backhands, the stroke may not adequately develop, therefore potentially allowing weaknesses to emerge, which can be exploited by opponents during match-play. Taylor and Hughes (1998) noted that teenage players, who move around the ball to perform a forehand when a backhand may be more appropriate, exhibited relatively high backhand error rates. The importance of developing both groundstrokes is further supported by elite-level match-play data, which

demonstrates forehand-to-backhand ratios closer to 1:1 (Reid, Morgan & Whiteside, 2016).

It is important for coaches to recognise that over-reliance on one set of modifications can cause participants to become dependent on a specific skill, which may result in other skills (i.e. the backhand) not being sufficiently developed. Therefore, creativity is required in coaching practice to design different modifications which can facilitate continuous skill adaptations by players.

CONCLUSION

Our findings demonstrated how MT facilitates children's skill development. MT modifications provided young learners with more opportunities to perform strokes in a representative performance environment. The result was longer rally lengths on smaller courts when using lower compression balls. There was some disparity between the percentage of forehands and backhands performed within the three MT stages. Coaches should be aware of effects that MT modifications can have on the match-play behaviours emerging in young learners. Further research is needed to investigate whether appropriate adaptations can be applied during practice programmes, for coaches wishing to enhance opportunities for balanced stroke development in young players.

A follow-up intervention study was undertaken; results will be presented in an upcoming issue of ITF Coaching and Sport Science Review.

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RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)

TennisiCoach

Tournament planning proposal for a junior player

Francisco J. Penalva (ESP)

ITF Coaching and Sport Science Review 2018; 74 (26): 6 - 7

ABSTRACT

This article proposes a season tournament calendar for a 16 year old player, with a good tennis level, and tries to give priority to training periods, and to adjust tournaments to the player´s level of play. It also values geographical proximity.

Key words: periodization, plan, juniors, competitions

Article received: 26 Oct 2017

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Article accepted: 21 Feb 2018

INTRODUCTION

In order to create an efficient tournament calendar, it is important to plan appropriately (Roetert & McEnroe, 2005). Planning is key for sport performance management, since its structure and contents, as well as the way training is organized, are closely linked to expected performance (Crespo, 2011). In this regard, we must remember that it is almost impossible to improve sport performance if the same training is repeated day after day. Thus, in order to change the training regime, we must periodize. Periodization is, basically, the preparation of a training and competition plan, that structures tasks within a regular interval of time (Fleck and Kraemer, 1996).

All correct planning must start from a comprehensive knowledge of the main tennis characteristics. Our sport is characterized by movements that imply quick sprints and stops, repeated gestures, that is hitting at different heights, involving different muscle groups and combining periods of maximum and sub-maximum intensity, with long periods of moderate or low intensity (Fernández-Fernández et al., 2009). As we know, success, in a professional sport as tennis, is measured by the ranking players reach (Reid & Morris, 2013). And in order to meet their objectives, enter professional or good junior ranking, players must play a considerable number of tournaments during the year (Roetert, Reid & Crespo, 2005).

Bearing in mind what has been described, we could start creating our calendar, still, we find that there is not enough scientific literature about this issue, and the plan junior players have is just the coach´s experience, and the follow up of the calendars that players of their time had (Reid et al., 2009).

Therefore, this article tries to help to plan a tournament calendar for a 16 year old player, and to provide a number of guidelines on the basis of the research available so far.

METHOD

This paper consists of a review of the existing literature on tournament calendar for a junior player between 16 and 18, and the different aspects that must be taken into account, whether those that are typical of their development, or the effect the number of matches may have in their development. It is necessary to say that little has been written concerning this important issue. A calendar has been drafted with all this information, plus the data that previous experience with junior players of the same level provides. Its most important aspect is long term player development, laying emphasis mainly on training, in order to achieve the expected improvements. The economic aspect of the player has also been considered, so international tournaments must be as close to the area as possible, and as long as they enter the draw.

In order to know more about training planning for 14 and under players, please, see Unierzyski (2003; 2005), and others. For 18 and under players, see Molina (2005) and Morris (2005). As to professional tennis players, see Porta & Sanz (2005), Martens & Maes (2005) and Reid, Quinlan & Morris (2010).

CALENDAR PROPOSAL

The calendar proposal is presented below. It is key to highlight several important details. Firstly, our player is 16 years old, lives in Spain, is in good health and starts competition last week in February. This is so because he finished the previous season the first week in December. He had a two week holiday, and then, a ten week pre-season. The idea in mind consists of combining junior tournaments with the most important national tournaments in their categories, like Marca 16 & under Circuit (Figure 1).

While scheduling the calendar, I would like to say that pre-season is very important, that is why it lasts 10 weeks, during this period, we can work well respecting the different times: work, recovery and adaptation of the different tissues (Roetert & Ellenbecker, 2009).

Over the first part of the season, from mid March until the end of April, there is a condensation of tournaments. At this point, I would say that they are high level tournaments, and if the player does not get a great result in qualies, he will not be able to play ITFG2. Thus, during these weeks they will be able to train some days when they do not have to play; and even those weeks when previous tournaments and final draws are played, will be taken as a training week.

The player will end this first part of the season being rewarded a Wild Card for ITF G1 JC Ferrero Qualy or Final Draw, if performance

in previous tournaments was good and fair, and right after, we will have an important tournament for our player, one of the qualies for Marca 16U National Circuit,

Between May and August, players will alternate periods of weeks of preparation for the tournaments with tours of two tournaments or, as in the last case, a tour of three tournaments before a week of rest.

At the end, over the last competition months, more training weeks have been added to enhance technical, tactical, physical and psychological aspects. As we all know, it is at the end of the season when more injuries occur, we intend to intensify prevention work in order to avoid injuries and protect the athlete´s health.

A total of 23 tournaments have been planned, but participation in many of them depends on the player qualifying to play. If results are good, and they qualify to play all events, the number of tournaments could be reduced, since the objective is, to play twenty tournaments at the most, just in line with the recommendations in the literature (Reid et al., 2009).

CONCLUSION

In order to work with a tournament calendar, it is key to respect the evolution stage of our players. This way competition will be motivating and above all, possible injuries will be avoided. It is also important to bear in mind the fundamental idea of the player´s long term development. In this regard, and in line with the above, appropriate training is a key element which must be given a priority over tournament play. This is so because it is necessary to provide the player with enough resources to face the demands of competition, trying not to skip stages but rather going step by step.

A model calendar has been adapted for the country we are in. Even though it may look quite right, it is important to say that this model does not apply in all cases, since, obviously, the coach must individualize competition planning depending on the needs of each tennis player. Still, the proposal presented can be used as a guide which will serve as a base which will have to be constantly adjusted to meet the different needs.

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RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)

TennisiCoach

Training matches in women's tennis (Part 1)

Jean-Luc Cotard (FRA)

ITF Coaching and Sport Science Review 2018; 74 (26): 8 - 10

ABSTRACT

From experience, I know that setting up "confrontation" sessions with a potentially high emotional charge with very young girls requires fine pedagogical skills; using various testimonies from both players and coaches, my goal in this article is to provide an objective assessment of match play in training.

Key words: Women's tennis, skills, tennis match, training.

Article received: 12 Oct 2017

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Article accepted: 25 Jan 2018

INTRODUCTION

The goal of training is to improve. Improving means understanding a situation in order to move to a more advanced stage. Improving is about developing one's abilities, acquiring new skills.

This positive evolution can only happen if the learning environment is driven exclusively by the absolute quest for improvement. The main obstacle is the feeling of "being judged". It is this negative feeling that must be neutralised so that the training match, as a simulation of real match play, is constructive.

For the purpose of this study, the questions that were asked to female players were quite simple:

- What were your goals and feelings during training matches played between the ages of 10 and 14?
- Same question at the neo-pro and pro levels
- For Fed Cup players: Were training matches scheduled during the week of the tie?

As for coaches, only their observations and suggestions were taken into account.

Let's take a look at their testimonies.

Testimony No. 1.

"A lot of players are like me: we don't like training matches very much. When I was younger, I very quickly had the feeling of being evaluated, judged and the whole thing became a real test, but not in a very constructive way, because deep down, I knew this was not a real match. Ironically though, if I lost matches in training, it would hurt my confidence."

"In training matches, I was playing to win, not to experiment new things or improve. I was not taking the chance to do things differently, to practice aspects we had been working on."

Winning without taking risks?

"In Fed Cup, I remember that we played sets, but not matches."

"What I particularly liked was to play series of points with specific themes in mind. During the post-session review, I could see what was working even when I thought it was not possible to do these things."

"When I played with male sparring partners, I was focused on my level of play. I was not comparing myself to them."

Avoidance, undergoes situations without controlling them. Feeling of escape as a result of facing a different kind of opposition (boys) or being focused on a theme that renders the match meaningless.

Testimony No. 2.

"Girls don't play enough matches."

"Practice new things but don't apply them enough in matches."

"Don't like confrontation."

How is it possible to make good use of matches (practice or play?); it is surprising to see such a dichotomy.

"When I was very young, I used to play a lot of matches at weekends with ladies from my club. I was not put in situations where I was being compared."

"When I was at the National Training Centre, I was not very comfortable with the idea of comparison."

"On the pro tour, I preferred to play points with foreign players."

"I remember this French player, a Grand Slam finalist, who did not really attach much importance to the outcome of training matches. She would come and play with us, the younger players at the French Open, to work on her game and her training goals."

"In Fed Cup, we played no more than one set at a time."

"The real comparison point is the official match."

Testimony No. 3.

"Often, at a young age, we did not play full matches, but rather sets, or even short sets or series of points."

“At this age, during league gatherings, we all had to play against each other, so we didn’t have time to play matches with all participants. At the same time, it did not feel like competition; I remember that I preferred to hang around with a good friend rather than with the best player. Clearly, competition was not the first thing on our minds!”

Too much match play defeats the purpose of match play.

“It is true that competition is tough when you’re young. But it is also true that it is at a young age that you realise if you have a competitive spirit or not.”

“What I do remember is that, as these days drew closer, I felt under stress.”

Why?

“Because all the league executives were there and, sometimes, even certain people from the federation. They would watch us, but you felt more judged than observed to tell you the truth.”

Focus on external factors prevails over self-focus. Concentration problem.

About organisation in Fed Cup

“We never play entire matches. Maybe two sets during the week at the most.”

“When you play points, there’s always a bit of tension, especially when you don’t know who will make the team because we all want to earn our spot. But, whatever the outcome, we all give our best for the good of the team. No matter who plays during the weekend or the week, we all push each other.”

The team aspect solves the issue with the focus on external factors. The avoidance strategy is evident as in many matches.

Testimony No. 4.

“When I was young, I approached training matches as a game.”

“I enjoyed playing those matches, which I often planned myself with friends.”

“When I was a pro, I took training matches very seriously and it was hard to experiment and try new things.”

Consistent feedback from the player: the training match is used for what it brings, i.e. being confronted with the stress of the match.

Testimony No. 5.

“I loved competition, it was in my DNA.”

“Playing training matches was not an issue for me. I did not mind being compared to others.”

“As soon as the coach gave the instruction to play, we were ready. Each of us had to deal with it…”

“Training matches are a good way to see if they have guts.”

Good understanding of the goal.

“On the pro tour, during Fed Cup, it’s not easy to schedule matches with the other girls. More often than not, we play 1 set or series of points.”

“To be honest, I was not playing training sets or matches to try out new patterns of play, my only goal was to win.”

Once again, the training match is correctly used for what it brings.

“Real match play remains the most reliable reference.”

“With all players, it is essential to keep a positive attitude at all times. No judgement. Commitment and intensity are essential. The most important aspect is to stay positive, always.”

Could it be that the problem is not the match itself, but how you sell it?

Testimony No. 6.

“When I was 8 years old, playing training matches against girls of my age was a source of stress.”

“By the age of 12, I was able to deal with this better, but it was more the questions I got from boys at the National Training Centre about results that bothered me.”

The issue here is still how you manage match play and what is at stake.

Testimony No. 7.

“During training matches, I always find it difficult to put the result into perspective.”

“What I look for are the same emotional conditions as in a real match, but the priority is not to try new things.”

Conflicting goals; some things need to be clarified.

“Now, I try to assess what I was able to accomplish. In the heat of the moment, I am affected by the outcome, but I try to think in terms of the feedback I can get.”

“My parents’ opinion after a performance still matters to me.”

“When I experiment things in a training match, I have the impression that I lack discipline.”

“When I practice with a better player, I allow myself to have self-improvement goals. But when the opponent’s level is similar to mine, losing is not an option.”

Testimony No. 8.

“I approached training matches the same way as real matches. The pressure was not the same, but almost.”

"Depending on the result, my confidence level increased or decreased. I was not able to be objective."

"As major events drew closer, I would practice my 'operational' game patterns. At other times, I would try new things in training."

"Before turning pro, I remember that we used to play full 5-set matches during the winter. There were no clearly defined goals other than trying to sustain the effort needed to play 5 sets in training so as to be able to play 3 in official competition."

"When I was in Fed Cup, I gave my best in training matches, without any pressure, because I was primarily in the team as a doubles player with no real chance of being selected for singles play."

Quite a boring approach.

Testimony No. 9

"During the gathering events organised by the federation, of course, I felt judged. I wanted to show what I was capable of and these gatherings were the perfect opportunity to do so, which was quite stressful!"

"I never play full matches during the preparation week before Fed Cup. I play enough matches as it is during the year. For me, what is most important during this week is to know where I stand as much as possible in preparation for the weekend, while keeping as much energy as I can."

An overall consistent testimony.

RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)

TennisiCoach

Training matches in women's tennis (Part 2)

Jean-Luc Cotard (FRA)

ITF Coaching and Sport Science Review 2018; 74 (26): 11 - 13

ABSTRACT

From experience, I know that setting up "confrontation" sessions with a potentially high emotional charge with very young girls requires fine pedagogical skills; using various testimonies from both players and coaches, my goal in this article is to provide an objective assessment of match play in training.

Key words: Women's tennis, skills, tennis match, training.

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NOW, LET'S SEE WHAT COACHES HAVE TO SAY NOW

Testimony No. 1.

"They're not playful enough."

"They're not ready enough to take risks."

"Their judgement tends to be based on the win-lose paradigm."

"It is essential to explain, not judge. Learn how to find solutions, find the opponents' weaknesses. Understand the direction in which you want to go, make progress." That is all very well, but where does the notion of fear come into play?

"You need to suggest different game formats, matches based on specific themes so that the player does not feel she is playing a real match."

Comment from a coach who understands that the mind plays a big role, especially in an opposition sport like tennis.

"As a general rule, girls don't like to practice among themselves. It is better to have them play with boys. This is especially true with top players, including foreign players!"

This makes the whole match play concept meaningless: you have players play matches, making sure they're not real matches.

This can be done, but you have to know what you're doing and when to do it.

Testimony No. 2

"Whether or not you give instructions during practice, there is nothing like competition, playing real matches. Let's not create training match experts."

"When I was the Fed Cup team captain, if I decided to have my two top players play a training match against each other and the best player lost, I had suddenly lost both the team's number 1 (loss of confidence) and number 2 (overconfidence) players."

Here, the issue is not the training match itself, but rather that you need to know when to use it and with whom.

Testimony No. 3

"Let's approach (training) matches as a starting point, an individual assessment."

"Using a well-thought-out assessment, you can teach a lot."

"They need to learn how to lose; it is part of group living."

"The match is an opportunity, it provides a framework that goes beyond the win-lose paradigm."

"Stepping out of the comfort zone is essential."

"It is important not to make comparisons, to maintain self-esteem without considering them as little girls."

"Players need to have fun trying to put into practice the things they worked on."

"Inner confidence is not related to performance. Some beliefs need to be broken down."

"Train each player as if she was the world number one."

Words you would expect from a coach.

Based on these testimonies, let's try and define methodological guidelines. Being objective, assessing, maintaining a positive attitude, developing self-esteem, acquiring new skills. Nothing compares to reality. The questions we need to ask ourselves are: "What are we trying to achieve with this simulation exercise?" "What effect (positive or negative) does the outcome of a training match have on the athlete and her coach?"

Overall, coaches and high-level players are in favour of playing matches in training; therefore, it is important to find the right balance.

What is particularly striking on reading the testimonials is that many players say that they find training matches stressful but that only official matches really matter. Quite odd, don't you think?

Some go even as far as saying, not always explicitly, that these matches don't serve any purpose because they are stressful. But that's the whole point, right? This is all very strange.

METHODOLOGICAL PROPOSALS

It is essential to approach match play for what it really is, an opportunity to confront your emotions.

We know that the pathways of neurotransmitters are different depending on the situation, i.e. whether the player is playing an official match or a training match. Therefore, it can be suggested that training matches only serve to train the neural pathways that are specific to... training matches! Thus, this means that the repetition of this situation might trivialise the player's confrontation with her emotions and, consequently, minimise the strategies used to manage emotions. Supposing that training matches are meaningless, as far as confronting your emotions goes, then playing these matches become useless.

Simulation remains an excellent way to prepare players for "official" performance, provided that stress is present or even artificially increased. However, players will be under stress only if the situation, i.e. the training match, is exceptional. The danger with "ordinary routines" is that the result may not matter. Creating exceptional situations of high stress, allowing for preparation, review and feedback, making sure players don't suffer a narcissistic injury: focus needs to be on concrete things.

To simply decide that matches should be played every day or even twice a week because that is how it is done in "academies" seems to make no sense.

Our goal is to make sure that training matches don't turn into as many narcissistic injuries.

What is most striking from the testimonies collected is that the higher the level of the interviewed player on the pro tour, the less influence training matches had on their ego at the junior level as if inner confidence was not negatively affected by performance in training.

This is interesting because all too often we, as coaches, expect our players to display a feisty attitude on court in training matches. In such cases, we unconsciously view the training match not as a tool, but as a response (even a psychological profile)! Coaches who do not know wait for a response, while those who are in doubt look for a solution. One could argue that

future female top players possess, from a very early age, the ability to put things into perspective and make the difference between training and official competition. Should this type of nonchalant, detached attitude also be taken into consideration during talent identification? In contrast, according to her former coach, a recent world number one player refused to practice with an other female player and only wanted male sparring partners for her training matches...

All this to say that this issue is far more complex than it seems. Matches are not a response, but a tool that should not be overlooked and requires skills.

It is therefore necessary to differentiate the goals in order to be able to:

1- Set them;

2- Observe and quantify them;

3- Qualitatively and quantitatively review and analyse them.

Then, 5 different match categories need to be considered:

- Match to improve control of emotions (bad calls, hostile crowd, rewards/penalties system based on the result of the match)
- Match to improve clarity of mind (she's in a good position, I'm not, how can I turn the momentum; I cannot win, but can she lose?)
- Match to work on very specific aspects (1st serve percentage, recovery footwork, etc.)
- Match to work on tactical skills (taking the opponent into account)
- Match to work on strategies (identifying important points, decisive moments, etc.)

CONCLUSION

Match scheduling in training is not an easy task. It requires a lot of thinking and understanding the "why", "what", "who" and "how" in order for the session to transfer effectively to the "real" match. Thus, it needs to be seen as a session to assess technical and behavioural skills during which all kinds of emotions will arise, which in turn will trigger biochemical and environmental reactions. Confronted with this state of emotional awareness, the coach will make use of all the tools available to "sell the training match" as an exceptional and rare moment to experience. The goal of the session will need to be selected carefully in order for the coach to be able to observe and review the session in a constructive way and without being judgemental.

A match in training will never be the same as an official match. If that's the case, can the opposite be true? Is it possible to train neurotransmitters to follow one pathway only, one which leads to the quest for optimal performance whether it be in training or in official competition?

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The effect of a variable practice on tennis groundstroke learning of adult beginners

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ABSTRACT

The aim of study is to determine the effect of a variable practices method on groundstroke performance in tennis. Twenty-two beginner university students participated in the study voluntarily (age:22±3,4). The subjects were randomly assigned to each of the two groups: Constant Group (N=11) and Varied Group (N=11). The Constant Group practiced serve, volley and flat groundstrokes in each training session. The Varied Group practiced serve, volley and flat groundstrokes together with topspin and slice groundstrokes in each training session. Sessions were scheduled for two hours two days a week with a total of eleven weeks of training. A Tennis Skill Test (TST) was applied to all subjects with pre-tests and post-tests. Results showed that a variable teaching methodology in groundstrokes may have increased the ability of beginner and intermediate players to learn variations of groundstrokes more than the constant practice.

Key words: variable practice, constant practice, contextual interference, tennis.

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INTRODUCTION

Players use many different methods to learn a new skill. When the degree of difficulty and interferences from other skills increase, the ability to learn also increases. Determining which method facilitates learning is an important issue for players (Maslovat, Chua, Lee, and Franks, 2004). Optimal training techniques and training programmes have significant impact on the teaching of motor skills (Dadkhah, Shojaei, and Farhadizad, 2013).

One of the training methods that facilitate skill learning is variable practice. In general, the skills in the variable practice conditions are learned by changing some aspects of the task such as, for instance: the distance, the speed and the direction of the shot. Practicing in similar conditions to the ones during the competition will also affect positively the performance (Williams, and Hodges, 2005). In this method, the skills should not be practiced in a repeated sequence. In variable practice conditions, each trial should be different from the previous and the next ones. Research has shown that variable practice methodology could improve skill acquisition and performance in open skill sports such as tennis (Davis, Kimmet, and Auty, 1986).

Variable practice conditions are based on two hypotheses. According to Schmidt's variability hypothesis (Schmidt, 1991) the conditions designed under various situations provide more flexible applications in the learner. It is thus recommended that variable practices should use unpredicted environmental conditions or open skills. When using variable condition practices in open skill tasks such as tennis, the players should face all possible solutions for a given task. Variable practice conditions can have various effects according to the level of difficulty of the tasks given (Moreno and Ordoño, 2015). Some studies conclude that variable practice conditions led to less performance during the acquisition stage of the skill but to an increase in learning during the memory and the transfer stages (Douvis, 2005). Permanent changes are important goals for teaching and learning situations and it has been concluded that variable practice conditions produced more permanent changes than those under constant practices (Memmert, 2006).

The second hypothesis in variable condition practices is the Contextual Interference Effect (Shea and Morgan,1979; see also Magill and Hall, 1990), which suggests that contextual interference would be more effective by increasing in the amount of the task to be learnt and would improve the learning process (Hall and Magill, 1995).

Variable condition practices are important in tennis because every stroke is different from the previous one. Tennis is a sport in which there are many unpredictable situations. Many variables such as unpredictable tactics, shot selection, strategy, competition/match conditions, and weather conditions affect the complexity of our sport (Schmidt and Wrisberg, 2004).

There are three main spin variations in tennis groundstrokes: flat, topspin and slice. Classically, flat stroke technique is considered as the basic stroke technique and it is the one taught in the initial stages of learning. Topspin and slice stroke techniques are the variations of the flat stroke technique and they are taught in later stages (ACEP, 2002; Höhm, 1997).

The aim of the study is to determine how a variable practice method will affect groundstroke performance in tennis by teaching the three spin variations of the groundstroke at the same time.

MATERIALS AND METHODS

Subjects

A total of 22 university students participated in the study voluntarily. The subjects were randomly divided into two groups (n=11 in each group) and they were instructed using two different tennis coaching methods. One group (21.62±1.54 years) was taught the groundstrokes using a constant practice (CG) method. Another group (21.80±2.07 years) was taught the groundstrokes using a variable practice method (VG). None of these subjects have had a tennis experience before.

Application

All participants were given detailed information about the study at the start. After the same tennis training program was applied to both groups for two weeks (coordination training and flat groundstroke technique), at the end of a 8-hour tennis training, a Tennis Skill Test (TST) was applied as a pre-test. Tennis training was given to the participants in both groups for 11 weeks (two hours in two weeks). At the end of 44-hour tennis

training in total, TST was applied as post-test again. Main strokes (groundstrokes, volley, serve) were taught to both groups in the study. However, while only the flat groundstroke was taught to the CG group; flat, topspin and slice groundstrokes were taught in each training session to the VG group.

Tennis Skill Test (TST)

The coach alternately feeds 11 balls to both the left and right sides of the player. The player should try to direct the ball above a rope located 1.5 m over the net to the area with the highest score (2 points). A ball bouncing into the service boxes counts 1 point. Balls at the net count as 0 points. 22 is the maximum score per trial. The percentage point of 11-stroke trial was calculated by the formula "taken point/22x100" and the best one of three trials was recorded. All the participants rested for 3 minutes after each 11-ball trial breaks.

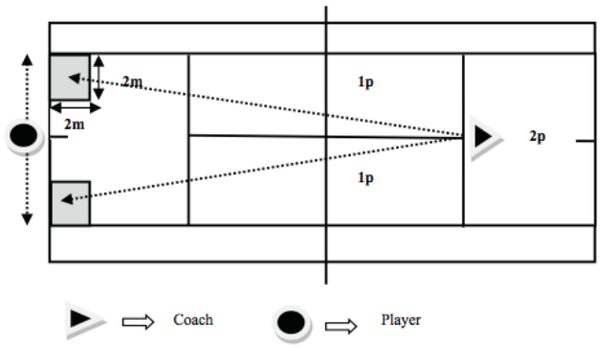

Figure 1. Tennis Skill Test application.

Statistics Analysis

Shapiro-Wilk Normalization test was performed to pre-test and post-test parameters of each group and showed normal distribution (pre-test p=0.97; post-test p=0.16). Paired t test was used to evaluated of the difference between pre-test and post-tests and independent t test was used to compare two groups in pre-tests and post-tests.

RESULTS

Average lengths of the participants were determined to be (174±44 cm), average weights to be (55±10.3 kg), and average ages to be (22±3,4 year).

(n=22)	Pre-test(%)		Post-test(%)	Difference(%)	Effect size
Constant group(n=11)	45,86± 18,68	t=-2.94 p=0.02*	64,05±10,65	18.19	1,30
	t=0.16 p=0.87		t=-1.99 p=0.06		
Varied group(n=11)	44,63±16,86	t=-5.16 p=0.00**	74,38±13,52	29.75	2,06

*p<0,05 **p>0,01

Table 1: Tennis Skill Test Results of Constant and Variable Groups.

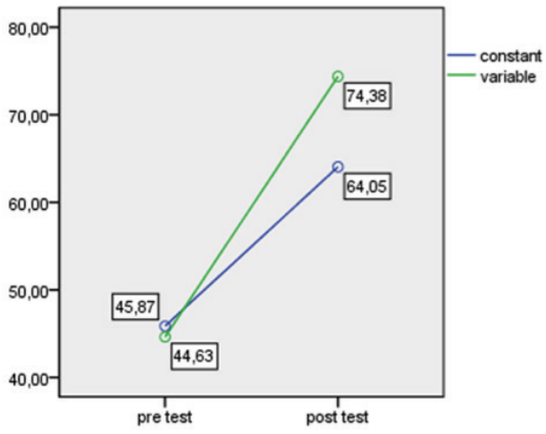

Figure 2. Comparison of the group's pre-post test improvements and differences.

DISCUSSION

We investigated the effects of the variable practice conditions on tennis groundstroke performance. In this study the variability was ensured by working on different variations of the stroke.

In a study performed on the acquisition of a basketball skill, the performances of shooting the ball of both groups as constant and variable practices were evaluated. Learning and transfer (by changing the stroke distance and ball size) performances were evaluated before and after the sessions. It was found that skill retention performances of the constant practice group gave better results than the random practice group (Memmert, 2006). In a study investigating variable applications of football on long distance shoot performance, the accuracy of shooting the ball of the variable practice was found to be better in both post-test and the retention tests than the constant practice group (Yamamoto, 2004). In another study performed to detect the effects of alternative approaches on the learning of tennis, two different groups were used one using a constant practice method and another one a varied practice method. In this study, variability of the forehand and backhand strokes was ensured by alternating each stroke. It was concluded that the varied practice group showed greater increase in their performance than the constant practice group (García, Menayo, Sánchez, 2017).

In our study, we conclude that during the learning of open sports such as tennis, which include complex tasks and require high level of performance, variable practices increase performance more than constant practices.

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RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)

TennisiCoach

Muscle memory and imagery: Better tennis. An introduction

Archie Dan Smith (USA)

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ABSTRACT

Muscle memory is what determines your strokes and makes your tennis game what it is – for the good or for the bad. I propose the following laws of muscle memory. By understanding these laws, you can apply them to your training and your tennis game. You will become a better player.

Key words: motor learning, acquisition, skill development

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LAWS OF MUSCLE MEMORY

Law 1 – Your tennis strokes are due to muscle memory.

Muscle memory is performing a specific specific motor action without conscious effort.

Law 2 – Muscle memory is the result of permanent changes in the brain, nerves, and muscles.

Your muscles "memorize" due to changes in the neural circuitry involving the brain, nerves, and muscles. This causes you to do it "that way" during a match. Technically, this is called "procedural memory". It primarily involves retention of motor skills created by repetition. All the neural networks function together smoothly recreating the complex motor movement without conscious thought or attention. Once formed, these connections persist. They are permanent. A straightforward example would be riding a bicycle

Law 3 – Permanent changes occur through repetition in a concentrated period of time.

I define repetition over a concentrated period of time, as it applies to tennis strokes, as 45-90 minute sessions 3 to 4 times per week over a 3-week period. The practice time needs to be concentrated because the passage of time quickly erodes the neurochemical processes. Any skill obtained during a practice session is lost within 2 to 3 days if not reinforced.

Furthermore, the practice time needs to last at least 3 weeks (optimally) for permanent changes to occur related to muscle memory. For one example, 3 weeks is the usual time period for inpatient rehabilitation after a significant stroke or cerebral accident. That is, this is the minimal time period for new connections and skills to be really learned.

Law 4 – Repetition by doing it right is how you hit good strokes during a match

In order to train yourself to hit good strokes, the ones that win points, most of the practice strokes you hit must be good. Forget about immediate results. Repeatedly hitting good strokes is the way to get results that matter – the ones that make for a winning difference in your matches. The ones that stay with you over time.

For example, a student hits 250 forehands during practice. 25 are hit poorly as you warm up. The next 200 are hit in a mediocre fashion (the "so-so stroke" you want to improve). Then 25 are hit well because you have improved. One then tends to start

another stroke. But what have you taught your muscle memory to do. The result is that you have trained your motor memory to hit poorly, or reinforced your mediocre "so-so" stroke 90% of the time. Little wonder one ends up hitting like always the next day. To make your good stroke into muscle memory, you must hit at least several hundred strokes after you start hitting it well. Science supports this. Joiner and Smith (2008, p. 2949) note, "after reaching a high level of performance during an initial training period, additional training that has little effect on performance can lead to substantial improvements in long-term retention".

Therefore, good strokes are the result of muscle memory developed by doing it properly over and over again until the permanent changes occur. Muscle memory occurs by acquisition, then consolidation. Acquisition is the process of first mastering the skill. It is learning within a session, or perhaps 2 to 3 sessions. It is short term. It fades in just a few short days, unless reinforced. Consolidation is when you develop, master, and retain the skill by much repetition in a concentrated period of time. The result is that the motor skill (your "good" and much improved tennis stroke) is retrieved without conscious effort during match play. Consolidation is a slow phase of learning developed over many training sessions – days to weeks.

Law 5: Learning different patterns back to back may cause forgetting of the initial one.

In other words, a newly practiced skill is easily broken down or diminished. It is unstable. Therefore, when you add practicing another skilled motor activity immediately after learning the first, it creates "interference". This disrupts the improvement that previously occurred. In one study, the authors concluded

that when the learning of a motor task was followed immediately by the learning of a second different motor task skill, the "subjects were unable to benefit from their previous training" (Brashers-Krug, Shadmehr, & Bizzi, 1996). Another study notes "Interference with motor learning occurs when multiple tasks are practiced in sequence or with short interim periods… Analysis of movement after-effects suggested learning of the second task within 6 hours of learning of the first task led to an unlearning of the first task, or overwriting of the learning effects for the first task" (Chapman, Vicenzino, Blanch, & Hodges, 2007, p. 504, 513). That's right, the previous training did no good. This means any and all benefit from the previous training effort were wasted. This biological fact is strong being confirmed across multiple studies. Simply put, if you practice your forehand then immediately practice your backhand, science suggests the short-term improvement in your forehand is transient, and will be lost in terms of long term retention. In effect, you just wasted the entire time spent practicing your forehand related to establishing muscle memory.

Law 6: Once your muscle memory is in place it "forgets" slowly, if at all.

This is why someone who played tennis in high school or college still plays well the first time out in 20 years, even if they have not picked up a racket during that time. Muscle memory is permanent. That path does not go away. To get better, what you have to do is make the new path, and have it be the preferred path. You do this by repeated use. The frequent use turns the new path into the preferred path. This is especially important in matches. You will initially have a tendency to return to the old memory path instead of the new one, until you train yourself to utilize the new path.

Law 7: The temporary improvement that occurs during practice or matches should not be considered learning, but rather a transient performance effect.

As noted previously, creating muscle memory is a very dynamic process. After a single (or even a few) session or match, any base for the improvement starts going away quickly, beginning in the 24 to 48 hour period after your practice – meaning, little if any basis for subsequent muscle memory is lost. When you practice just once, there is little muscle memory to build on 3 to 4 days later. Brain chemistry is constantly building and deconstructing all the time. Short-term memory (acquisition) erodes quickly. Per Vaswani & Shadmehr (2013), muscle memory "that was acquired during training decays immediately and automatically". It only becomes long-term memory (muscle memory) by frequent repetition in a concentrated period of time.

Temporary performance improvement is an excellent thing to do 2-3 days before a match, but if you really want to really take your game to a permanent higher level, you need to have Muscle Memory Practice. Temporary performance improvement is a transient effect – a brief reinforcement on the current pathways. It is acquisition, not consolidation. It does not establish new improved pathways. Instead it reinforces your usual game, or your previous practice session, so do not expect much more.

HOW NOT TO IMPROVE

Take a friend or a pro. Go out – hit some forehands, then backhands, etc. It does not matter that you did not hit that well. It does not matter if you never found a groove. After all, you got some "good" practice. You hit some balls, and got some practice in on all your shots, therefore you will get better. After all, "Practice Makes Perfect!"

Hopefully by now, with your knowledge of how muscle memory really works, you know how wrong that thinking is. What really happened is that you practiced (reinforced) your poor to mediocre shots. Even if you did hit some better than average shots (you probably did) – was it a high percentage? Usually not. Guess what –you play the way you practice. Practice does not make perfect if what you practice on a percentage basis is being mediocre (or worse). You so have to get over the mindset that to hit a bunch of balls makes your shots better, and/or makes you a better player. Practice does make perfect (or at least improves your skills) only if you mostly hit "better than your usual shots". Also Law #5 suggests you should only work on one shot at a time during your practice

CONCLUSION

The best ideas are the ones that help you make better choices and take wiser actions. The book goes into Muscle Memory Theory and Practice – why it should work and how it is done. Science suggest there is a different way, a better way to train your muscle memory. Break away from the traditional training and try something different. Review the science and incorporate it with your knowledge and experience, tweak it, and come up with something useful.

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The inside out stroke in men´s tennis: Strategies and tactics

Encarna Martín, José Campos and Miguel Crespo (ESP)

ITF Coaching and Sport Science Review 2018; 74 (26): 19 - 21

ABSTRACT

Understanding the strategy and tactics in tennis will help to make decisions when preparing a match against a certain opponent, depending on the different aspects of tennis performance, on the basis of the indicators of sport performance (efficiency, accuracy, technical command...). In line with the direction and their intention, players will use a certain technical movement for greater effectiveness and to increase the possibilities of success. In tennis, the inside out forehand provides a new possibility in the set of tactical and strategic variables. This article presents some ideas on the strategies and tactics of the inside out forehand, as well as several examples for its on-court training.

Key words: Groundstroke, inside out forehand, training

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INTRODUCTION

In current tennis, players rely on a certain stroke to help them out in difficult situations (break points, set points...). Of all the possible strokes (service, approach to the net, ...) the forehand is the one that helps to cover the court more easily (Brabenec, 2000); approximately 65% of the space and even 85% of the court, for players of a certain level with greater feet speed.

Moving towards the backhand in order to hit a forehand, automatically reduces the area of the backhand return as an option to the return of the opponent, and increases the possibilities of playing other shots from this position. To simulate the direction of the forehand stroke is easier, but footwork is much more natural in the backhand. The forehand produces more winners and relatively less errors, if compared to the backhand.

Figure 1. Roger Federer.

THE INSIDE OUT FOREHAND AS AN OBJECT OF TACTICAL ANALYSIS

To consider the inside out forehand from the back of the court as a new challenge for the analysis of the strategies and tactics in tennis is based on the relationship between tactical planning and its consequences. The tactical development of the inside out forehand offers the player a new possibility to hit the ball towards new directions and more open angles. This helps, a priori, to play more offensively.

All along the XXth century, the inside out forehand was already used in the 60´s by players like Neale Fraser (1960) and Manuel Santana (1966) who used it mainly to return the service from the advantage side. In the 70´s, inside out forehand was not only used for the return as in the case of Stan Smith (1972), it was also used during rallies. The most notable example is Björn Borg, who, from his beginnings in 1973, already used the inside out forehand in long rallies, although he lacked the offensive intention of the present game (Figure 2).

Figure 2. Björn Borg.

In the 80´s the inside out forehand was used as an attack game, but its focus was on changing the rhythm of the rally. Ivan Lendl or Boris Becker, should be taken into account as a reference (in the 90´s). But the most significant change will occur during the new millennium: those players at the top ATP ranking represent a new model that will adapt better to all the surfaces. Novak Djokovic, Rafael Nadal, Roger Federer or Andy Murray, with triumphs in all surfaces, confirm that we are facing a more versatile player. They are more polyvalent players, the so called "all court tennis players", who, with a complete playing pattern become a player who can win in any type of surface.

Another change described is the progressive increase in the number of rallies. We now observe players playing more time from the baseline. Players, from their strategic position, at the back of the court, have acquired a new playing pattern that lets them face the stroke offensively, looking for new angles at a greater speed (Takahashi, Wada, Maeda, Kodama, Nishizono & Kurata, 2009).

It is at this point where the inside out forehand entered the tour with more strength during this last decade. More and more tennis players are using this technical tool, a stroke that produces "imbalance" during rallies, as will be seen later.

Players have been incorporating the inside out forehand more and more frequently to their playing patterns. Nowadays, all players include this technical gesture in their motor toolkit. Modern tennis could not be understood without the inside out forehand in its two versions: down-the-line and cross-court.

THE STRATEGY OF THE INSIDE OUT FOREHAND

Using the inside out forehand at the strategic level implies a new contribution to space distribution, direction and intention of the inside out forehand from the left side. In order to execute this stroke a quick movement towards the left is mandatory. It is normally hit when the ball lands on the left of the opponent, and lets him add more speed to the ball.

On the other hand, the movement towards the left opens a greater area on the right side, so that if the stroke has no offensive intention (power and placement), the opponent can surprise hitting an open shot to the right.

In this regard, we notice that most ATP players have laterally shifted from the centre of the tennis court, between 90 to 150 cm. towards the left (Kovacs, 2009). Strategically, they are supposed to be able to hit the ball with the forehand, it could be said that there has been a lateral "decentralization" of more than two thirds of the court. This new space "gained" to the court is the right one to execute the movement towards the left side. It is a broader movement, in which the speed of the racquet head increases continuously during all the swing, making the transfer of the ball energy more fluent and faster.

If the player´s forehand is stronger than his backhand, not only will he be using it to "cover" the left side, but also to counterbalance continuous rallies. For example, in matches between Roger Federer and Rafael Nadal, Federer took a strategic position on his left side, since with Nadal´s topspin cross-court forehand on the backhand (single handed), Federer makes many errors.

THE TACTICS OF THE INSIDE OUT FOREHAND

Performance analysis is important for the analysis of players´ tactics. Players never play against an "average" player, on an "average" court surface, with "average" balls. These variable factors meet along a tennis match and greatly condition the decisions that will be made. Therefore, it is important for players´ profiles to represent their tactics in the different types of competitive situations

As to the inside out forehand, it is tactically employed when players are making steady backhand rallies, and the inside out forehand lets them hit with their forehand from the backhand zone, providing the technical gesture more power, opening the angles even more in order to surprise their opponents. This action can continue with a change of direction to the right side or else, with a new stroke aiming at the same zone. (Wrong foot) (Figure 3).

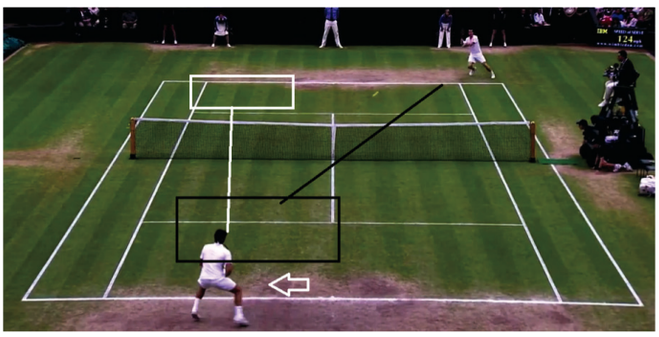

Figure 3. The tactics of the inside out forehand.

PRACTICAL APPLICATION

Below are some on-court exercises with tactic objectives which aim at putting in practice the main target of our study, the inside out forehand in men´s tennis.

Exercise 1

Purpose: Specific footwork, hitting and aiming the inside out forehand in a semi-open situation.

Place and material: A tennis court, a basket with balls, rackets.

Methodology: Rally with the coach.

Description: Similar to the above, but the coach is on the other half of the court, in the net area, rallying with the player for him to make the movement towards the ball with the appropriate footwork. The coach volleys a minimum of four balls per series, to different court zones, preferably towards the left. The player will hit all balls inside out towards the coach for him to volley (Figure 4).

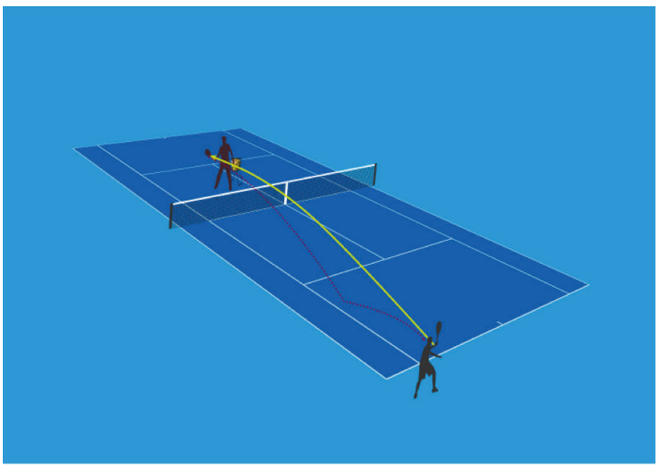

Figure 4. Exercise 1.

Exercise 2

Aim: Footwork, hitting and aiming the inside out forehand depending on previous indications.

Place and material: A tennis court, a basket with balls, rackets.

Methodology: The coach feeds from the basket.

Description: The player, at the back of the court, will play an inside out forehand, making the previous gesture according to the indications of the coach, jumping with his feet together, stepping on the sideline..., by means of numbers, words, mathematical calculations, hand gestures....(Figure 5).

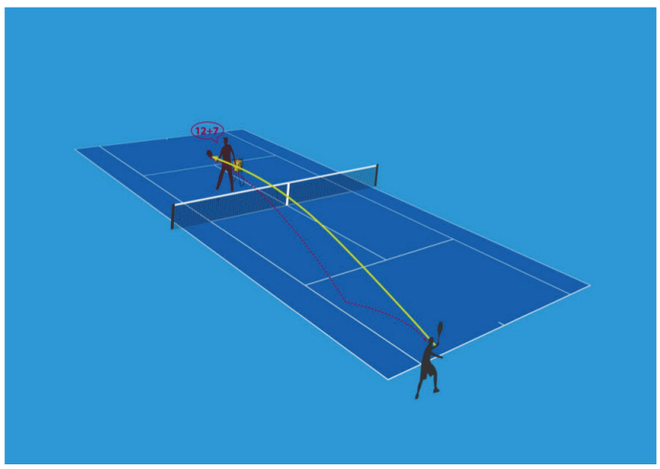

Figure 5. Exercise 2.

Exercise 3

Aim: Footwork, hitting and aiming the inside out forehand depending on the visual stimulus.

Place and material: A tennis court, a basket with balls, rackets.

Methodology: The coach feeds from the basket.

Description: The player will play an inside out forehand depending on the position of the cones on court. Cones of different colours are used, and depending on their colours, the inside out forehand will be played down-the-line or cross-court (Figure 6).

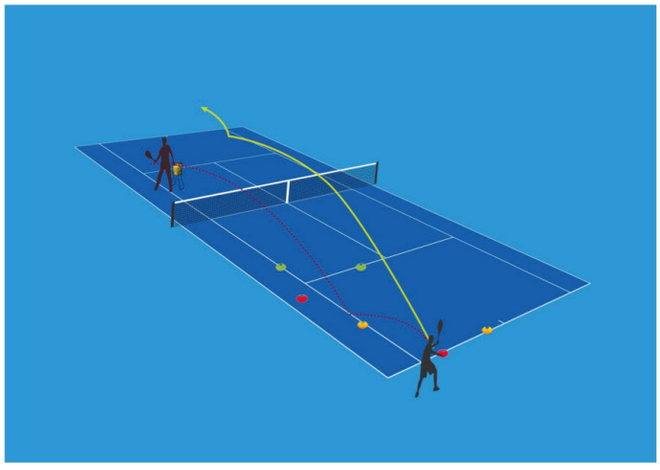

Figure 6. Exercise 3.

Exercise 4

Purpose: Specific footwork, hitting and aiming the inside out forehand in an open situation.

Place and material: A tennis court, a basket with balls, rackets.

Methodology: Rally between players.

Description: The players will be on both sides of the court. The coach will be on one side of the court. The coach starts the rally feeding a ball from the basket towards the left of one of the players. This player has to hit an inside out forehand and so does his opponent. The point is played after 6 balls without making an error (Figure 7).

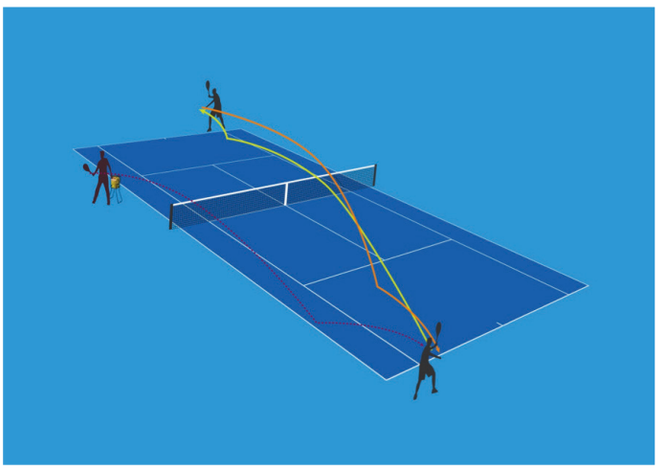

Figure 7. Exercise 4.

The crosscourt inside out forehand rally from the outside of the court is a specific exercise for support, since the player must move laterally positioning his body according to the direction of the ball. As Groppel (1993) indicates, the lateral movement of the tennis player is based on the footwork that determines the hitting position.

CONCLUSIONS

The only scientific study on the inside out forehand of men´s professional tennis has come to the conclusion that most of the inside out forehands are hit in a diagonal direction. However, most winners are played down-the-line. Besides, data demonstrate that those tennis players who hit more inside out forehands are the ones who win the match. Likewise, those players who hit the greatest number of winners with the inside out forehand, win the match (Martín-Lorente (Martín-Lorente, E.; Campos, J.; & Crespo, M., 2017).-

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Tactical analysis in tennis: From its origins to the present

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ABSTRACT

Even though the first studies of tactical analysis are dated several decades ago, and new technologies have greatly helped to advance in this area, the practical application of this type of analysis has been carried out in a very rudimentary fashion and is subject to the coaches´ subjective criteria. This article, apart from providing a context and a historic perspective of tactical analysis, shows some of the tools that are currently available for this analysis and provides examples for clear and practical application.

Key words: Tactical analysis, notational analysis, strategy

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INTRODUCTION

Tactical analysis is related to the sport´s strategic and tactic aspects. The strategy can be defined as the plan that is set up prior to competition, to maximize the players´ strengths and reduce their weaknesses, while minimizing the opponents´ strengths and taking advantage of their weaknesses (O'Donoghue, 2010). On the other hand, tactic is associated to decision making during play, on the basis of the options available and the risks and opportunities associated to each (Fuller y Alderson, 1990).

This analysis has traditionally been made in a non systematic way, on the sole basis of the coach´s direct observation during matches or training. This way of analysing tactics, as Murray and cols. indicate (2007) entails a number of problems related to the perception capability, the memory and interpretation of the observation of coaches, who convey biased information to the tennis players, and is interpreted totally subjectively. Therefore, there seems to be an apparent need to use observation and analysis methods to get objective data on which the information received by the coach, and later by the tennis players, can be based.

NOTATIONAL ANALYSIS

Notational analysis permits to record, in a reliable way, those indicators that are of interest to evaluate the tactical performance of players, in such a way that the information obtained by the coach and the athlete is much more accurate and precise (Martínez-Gallego, 2015)

As you will see later, the technologic advances and the incorporation of personal computers to notational analysis have significantly shaped its development and evolution. Thus, it is possible to differentiate between two types of analysis, manual notational analysis, and computer notational analysis.

Manual notational analysis

This kind of analysis was already used at the time of the Egyptians, and by means of symbols and hieroglyphs, they represented dance patterns and movements (Over y O'Donoghue, 2008). Later on, it was precisely dancing that was used as a basis for the development of a system of general notation for movement. In fact, the first system to analyse and record human movement was Labanotation, created by Rudolph Laban (Laban, 1975). As to tennis, the first manual system for notational analysis was carried out by Downey (1973). This system was used to record the strokes, the position on court, the result of the stroke, and the type of effect used in each stroke. Due to its complexity, both to record information and to analyze it, this system was seldom used in practice, nonetheless, it was important for further research based on these ideas.

Manual notational analysis has been continuously used with simpler record systems which were more appropriate for the demands and possibilities of coaches. In fact, in spite of the appearance of new technologies, it is still frequent to find coaches making manual notations during match development.

Computer notational analysis

IT development and the technological advances over the last decades, have brought about a revolution in the concept of notational analysis, allowing for a more accurate and simpler way of recording information, facilitating the creation of data bases, providing the tools that make data representation more aesthetic, agreeable and intuitive, and thus, easier to understand for coaches and athletes (Murray et al., 2007).

At the moment, there are a number of devices and IT programmes that are being used more and more to analyze the tactical performance of athletes (Barris y Button, 2008). Likewise, the number of specific programmes on notational analysis in sport is greater and greater. IT programmes that help to perform this kind of analysis can be classified in two big categories: "tagging systems" and "tracking systems".

Tagging systems generally consist of a video player with an interface of buttons that can be defined and tagged by the analyst. Events introduced by means of buttons are synced with the video and stored on a data base, to be visualized later exporting the information to data bases for statistical analysis. Because of the flexibility of these programmes, it is possible to create an unlimited number of templates to analyse all aspects of the game. Some of these programmes are: Dartfish (TeamPro version), Focus or Longomatch.

Tracking systems are more complex systems, normally used by professional players or for professional events. By means of the images that have been captured by several cameras, these programmes create a vision in two or three dimensions. With these images, the programme, automatically or semi

automatically, detects the position of the players and/or the ball at each instant. Then, the different kinematic variables are calculated. They can be related to tactical and physiological aspects. Hawk-eye, Amisco and Prozone are some of the commercial tracking programmes.

CURRENT TACTICAL ANALYSIS STUDIES

Finally, and by way of example, we will mention some of the most recent studies related to tactical analysis that have used some of the tools described above, and that we think can be interesting due to their practical application: to coaching.

The first one was carried out by Reid, Morgan, y Whiteside (2016), they analyzed the differences between men and women in the Australian Open: the stroke dynamics and movement. The results are the following:

- The service was the stroke that showed more differences, men served faster, achieved more direct services, forced errors in the return, and won a higher percentage of points when serving.
- As to the return, women hit closer to the net, lower and flatter than men.
- The frequency of ground strokes was similar for both sexes, though men hit at a greater speed, flatter and a greater number of strokes landed on court.
- As to the distance travelled per point, there were no differences between men and women, though men showed higher average speeds when running.

Later, Kovalchik and Reid (2017) compared playing statistics and physical demand between professional and junior players, getting the following conclusions:

- Professional players had a greater advantage with service.
- Junior players got a higher percentage of break points.
- Generally, professional players achieved more power and accuracy in their strokes, this was particularly evident in service.
- Junior players served to the centre of the court twice as much as compared to professional players.
- In men, the physical load of professional players during matches doubled that of juniors, while junior women doubled the physical load when compared to professional players.

More recently, Martínez-Gallego et al. (2018) carried out a study with professional players. They analyzed the existing differences between winners and losers of points, on the one hand, considering volume and intensity of their movements, depending on their position on court, and, on the other hand, the differences between winners and losers of the games as to winners, unforced errors and effectiveness, depending on their position on court. The main conclusions drawn were the following:

- Winners of points used more offensive strategies, remaining longer time in offensive areas and forcing their opponents to run a greater distance and at a higher speed.
- When the losers of points were in offensive positions, they did not profit from that positional advantage, since they were too pressed by their opponents who made them move at a high speed.
- The winners of the games got a greater number of winners, and made less errors, and were more efficient than the losers.

- In defensive zones there were no differences as to the number of winners, however, the winners of the games made less unforced errors.

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RECOMMENDED ITF TENNIS ICOACH CONTENT (CLICK BELOW)

TennisiCoach

Winning or losing in wheelchair Grand Slam tournaments

Alejandro Sánchez, Antonio Ortega and David Sanz

ITF Coaching and Sport Science Review 2018; 74 (26): 24 - 27

ABSTRACT

In 2016, Wimbledon included Wheelchair Tennis within their competition programme for the first time. Thus, today, this sport is present in all three main types of surface (hard, clay and grass). Competition statistics can help to understand the differences in the game depending on the surface. Therefore, the objective of this study will be to observe the possible differences in service between winners and losers in elite wheelchair tennis, both masculine and feminine players, in different surfaces. 42 matches that consisted of 101 sets in three of the 2016 Grand Slams were analysed: Australian Open (AO), Roland Garros (RG) and Wimbledon (W). Results showed that between winners and losers performance varies depending on the surface. The conclusions of this study can help coaches to adapt their training sessions in relation to the competition surface.

Key words: Adapted sport, performance, surfaces, tennis

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INRTODUCTION

Wheelchair Tennis can be played on different surfaces (cement, carpet, grass and clay). Since 2016, wheelchair tennis has been played in all 4 Grand Slams (GSs) (Australian Open, Roland Garros, US Open and Wimbledon). There are differences in these tournaments concerning the speed of the ball after bounce, and the characteristics of the movement of the players, all that can be summarized as what we call the rhythm, which is imposed by the surface on which the game is played. 1 (paused rhythm), 2 (semi-paused rhythm), 3 (medium rhythm), 4 (medium accelerated rhythm, and 5 (accelerated rhythm). In this sense, the study of competition statistics offered important information to determine the possible differences depending on the surface (Sánchez-Pay, Palao, Torres-Luque, & Sanz-Rivas, 2015) or, to set possible performance indicators between winners and losers (Sánchez-Pay, Torres-Luque, Cabello Manrique, Sanz-Rivas, & Palao, 2015).

Some studies show significant differences in the four GS tournaments when observing the speed on the different surfaces. Roland Garros is played on clay (slow surface), Wimbledon is played on a faster grass surface, and the US Open and Australia are played on a hard surface of average speed, so technical efficiency and effectiveness vary. (Cross & Pollard, 2009).

Wimbledon 2016 saw the first singles wheelchair tournament played on grass, no studies have compared the influence of this surface on competition statistics. Therefore, the objective of this research will be to observe the possible performance differences among elite wheelchair players in the different surfaces, and we will concentrate on one of the strokes that can make the difference: the service, both the first and the second, to prove its efficiency as a performance indicator in wheelchair tennis singles and on the different surfaces.

METHODOLOGY

The sample consisted of 48 wheelchair tennis players (24 masculine and 24 feminine). 100% of the matches played, during the 2016 season, in the Australian Open, Roland Garros and Wimbledon were analysed (table 1). It is important to point out that wheelchair Grand Slams are only played by the top 8 players in the ITF ranking (ITF, 2018). The study was made according to the Helsinki declaration, and all procedures were approved by the Bio-ethics and Research Commission of Murcia University.

	Australian Open	Roland Garros	Wimbledon
Masculine	7	7	7
Feminine	7	7	7

Table 1.Number of wheelchair matches analysed per tournament and gender.

The sample was divided into sub-groups for analysis: a) tournament: Australian Open (AO), Roland Garros (RG) and Wimbledon (W), and, b) result: winner of the set, or loser of the set.

All statistical data of the competition were drawn from the information published in the Official Websites of each tournament (www.usopen.org, www.rolandgarros.com and www.wimbledon.com), like previous studies of the analysis of competition statistics in tennis (Cross & Pollard, 2009; Knight & O'Donoghue, 2012). Wilcoxon test was performed to analyse the differences between winners and losers. The set was the analysis unit and the significance was set in $p < .05$.

RESULTS

The following figures show the differences in the variables that are the object of the research (% first service, % points won with the first and second services, and % of break points won) both, for men and women, and for those in which there are statistically significant differences ($p < .05$).

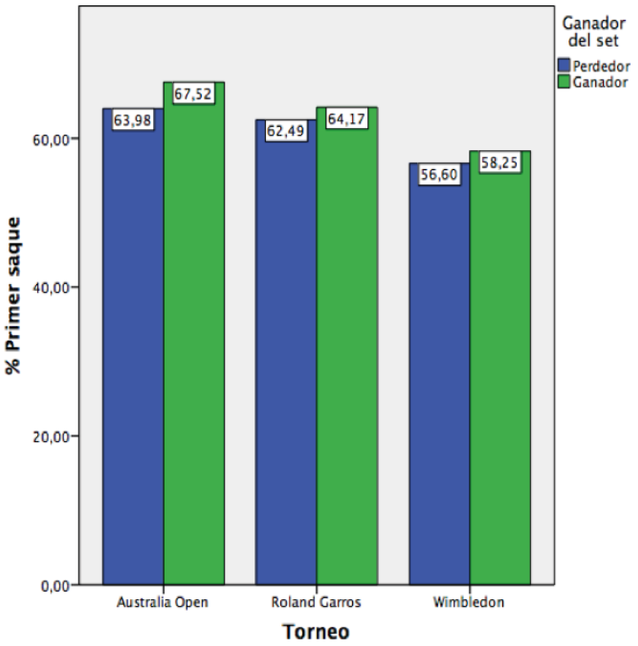

Figure 1. Description of the % of first services in masculine wheelchair tennis.

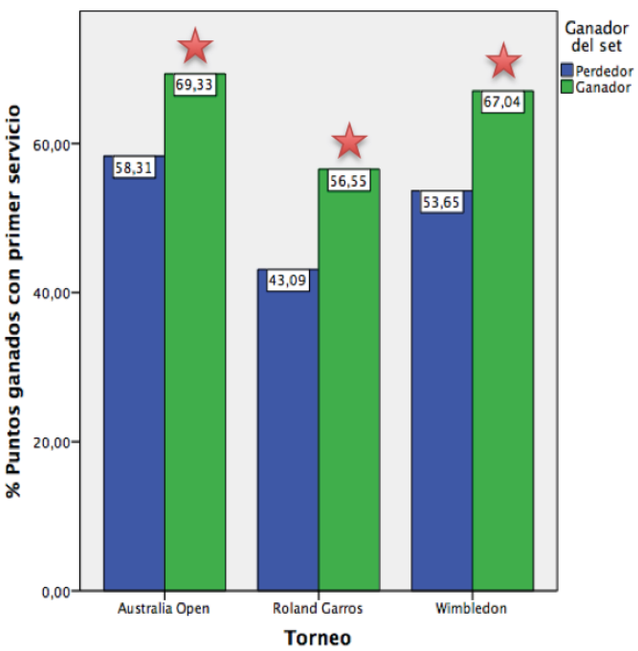

Figure 2. Description of the % of points won with the first service in masculine wheelchair tennis.

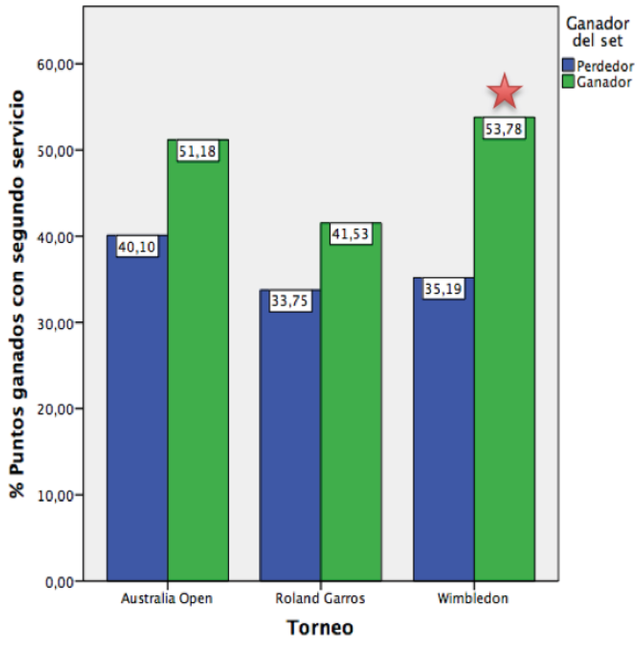

Figure 3. Description of the % of points won with the second service in masculine wheelchair tennis.

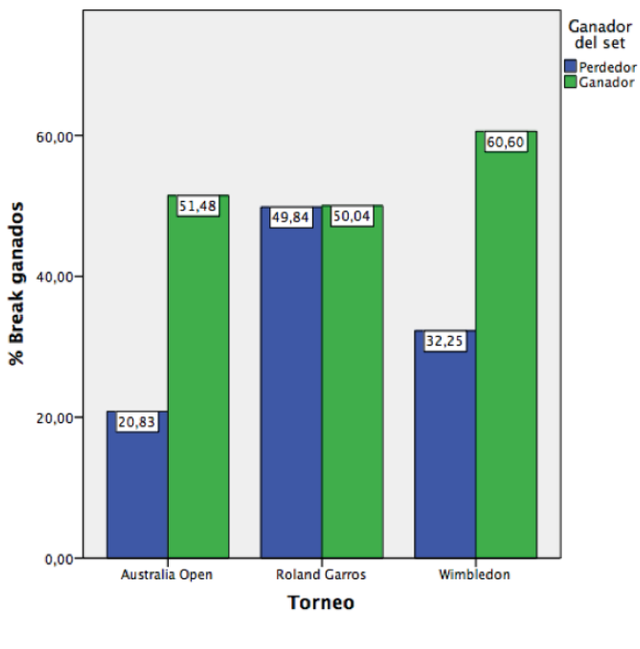

Figure 4. Description of the % of break points won in masculine wheelchair tennis.

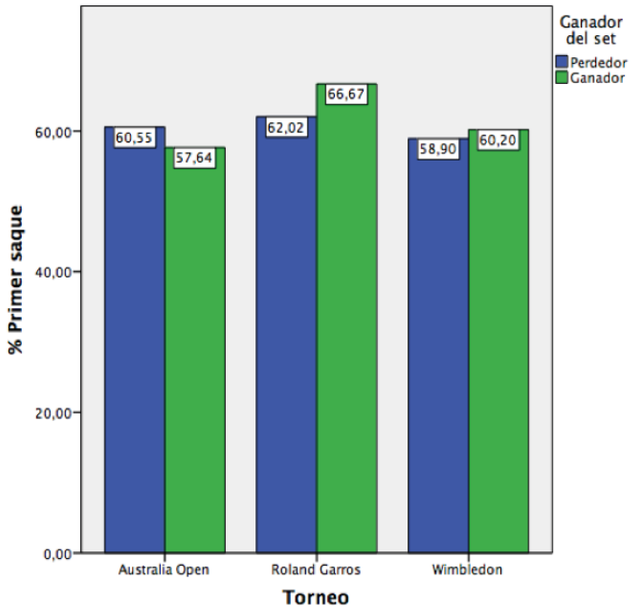

Figure 5. Description of the % of first services in feminine wheelchair tennis.

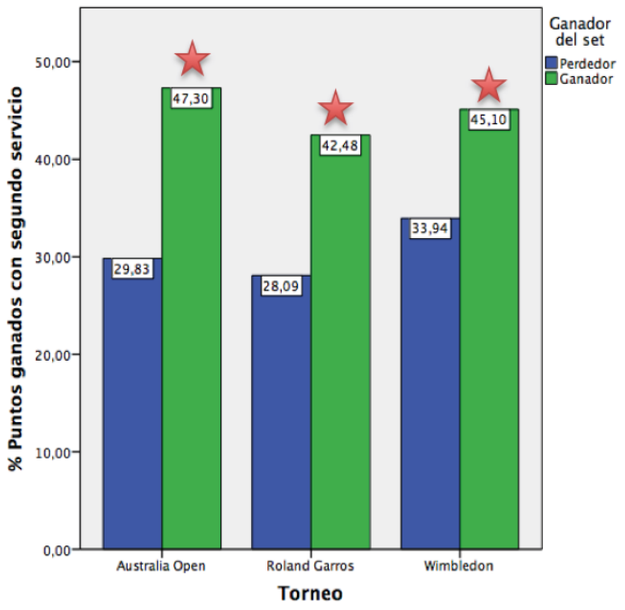

Figure 7. Description of the % of points won with the second service in feminine wheelchair tennis.

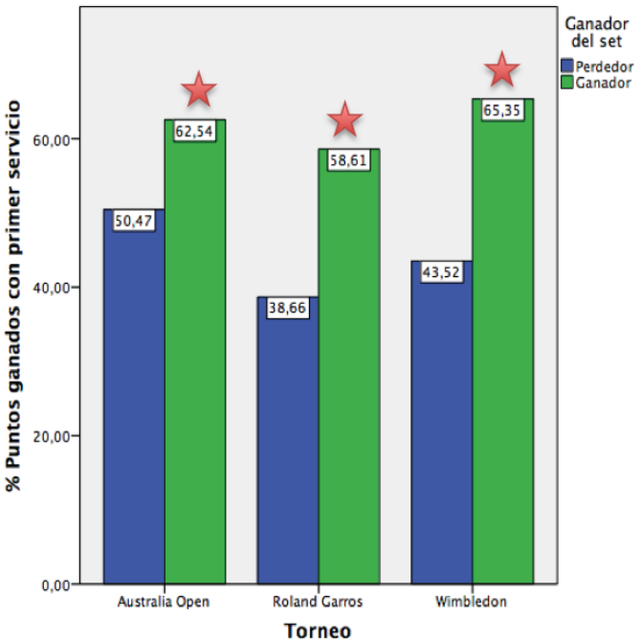

Figure 6. Description of the % of points won with the first service in feminine wheelchair tennis.

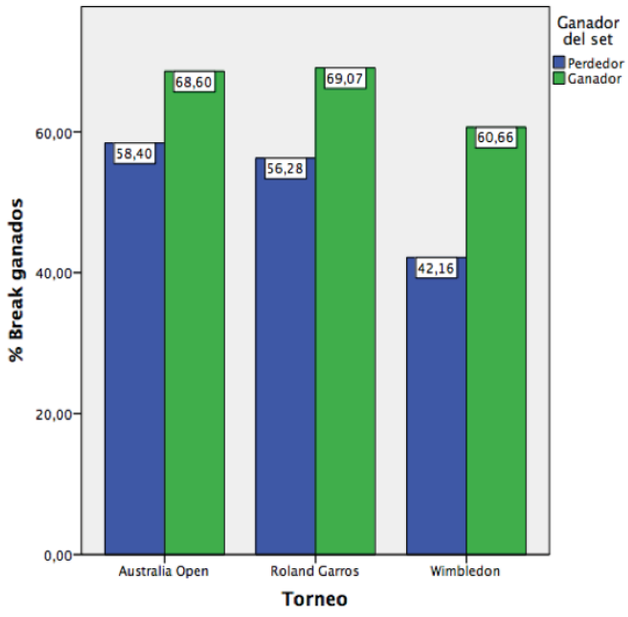

Figure 8. Description of the % of break points won in feminine wheelchair tennis.

COMMENTS

The analysis of competition statistic data provides information about the player requirements during matches, and helps to improve the quality of training in order to increase performance. (Lago-Peñas, Lago-Ballesteros, Dellal, & Gómez, 2010; Ortega, Villarejo, & Palao, 2009). Wheelchair tennis can be played on different surfaces, and up to now there existed no data about matches played on grass, so this work will try to determine the possible differences among the surfaces used, (hard, clay and grass) in Grand Slam tournaments, and to analyse the differences in service performance of elite winners and losers.

The % of first services of masculine wheelchair tennis players is slightly higher for the winner of the set than for the loser, even though there are no statistically significant differences (Figure 1). Still, the differences in the % of points won with the first service (Figure 2) are over 10% in all tournaments ($p<.05$). This difference of a little more than 10% is lower than the values found in literature between winners and losers (47vs72%) on hard courts in Paralympic Games (Sánchez-Pay, Torres-Luque, Fernandez-García, Sanz-Rivas, & Palao, 2017). This may be due to the equality in Grand Slam tournaments where only the top 8 of the international ranking are competing, that is why parity maybe greater among players. As to the second service, the values follow the same trend as with the first, except in Wimbledon, where the difference between winners and losers is higher ($p<.05$).

As to the % of break points won, Roland Garros shows no difference between the winner of the set and the loser; however, Australian Open and Wimbledon show percentages close to 30%, demonstrating that fast surfaces seem to have greater impact on the differences in level between the two players. This can be understood as an indicator of equality in the result of the matches, in which the greatest number of points per game are played, and more breaking opportunities happen in slow surfaces (RG) than in fast surfaces (Australia and US Open) (Sánchez-Pay, Palao, et al., 2015). Likewise, the fact that the service speed is not very high due to the position of the players, (hitting plane) and their restriction to use their lower limbs for the mechanics of the movement (Cavedon, Zancanaro, & Milanese, 2014; Reid, Elliott, & Alderson, 2007), cause the service to be more vulnerable than, for example, in conventional tennis, and on top of it, if the surface is slower, it equally contributes for the service not to be so tough to return, and start the rally.

On the other hand, we must bear in mind that wheelchair players, after service, have a greater difficulty to react and move quickly than able players, so the return can become a definitive stroke in many cases, mainly, when the surface contributes to the travelling speed of the ball after bounce, something, which, again, reduces the leadership of the service.

In relation to feminine wheelchair tennis, the differences between winners and losers are in line with what was said for men, even though there are more outstanding differences for the % of points won with the first and the second services, as well as the % of breaks won in all three tournaments. This can be due to the fact that there is less homogeneity in the level of the participants and matches are less even.

CONCLUSIONS

Taking into account the findings obtained from this study related to competition statistics for wheelchair tennis between winners and losers in the different playing surfaces, the following conclusions can be drawn:

- The % of playing with the first service is similar between winners and losers, for men and women, regardless of the tournament.
- The % of points won with the first and second service in masculine wheelchair tennis is higher for the winners of the set than it is for the losers. In feminine wheelchair tennis, the differences are evident, therefore, even though less crucial in wheelchair tennis, it is very important to get an advantage with it, either in power and accuracy or in terms of moving the opponent using effect.
- Fast surfaces (Australian Open and Wimbledon) seem to impact on the level differences to a greater extent between winners and losers than in slow surfaces (Roland Garros).-

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Description of the morpho- functional characteristics of junior tennis players

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ABSTRACT

The description of the morpho-functional characteristics of junior tennis players through basic and easy to access protocols that evaluate relevant aspects for performance in tennis, help the development and evolution of physical preparation and sport training.

Key words: Imagined practice, visualization, sensations, exercises

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INTRODUCTION

Tennis players' sporting performance depends on their morpho-functional qualities; therefore, it is important to quantify them in order to control and plan sport training. (Sánchez-Muñoz et al., 2007).

Tennis players usually exceed the 50th percentile in height (Myburgh et al.,2016), and their body fat percentages are lower than in sedentary persons (Kovacs, 2007). As to physical demands, in tennis there is a predominance towards explosive movements such as accelerations, decelerations, and changes of direction (Fernandez-Fernandez et al., 2015; 2016; Berdejo & González, 2009; Kovacs, 2007). During a point, a tennis player typically runs between 8 - 15m, and changes of direction are very common (Fernandez-Fernandez et al., 2009). Thus, it is very useful to evaluate and train explosive strength, short distance speed, agility and RSA (Repeated Sprint Ability) .

The structural characteristics of competition in young tennis players have also been studied (Torres-Luque et al., 2011); however, in junior tennis we cannot neglect aspects such as long term training, avoiding early specialization and excess training (Balyi & Williams, 2009). Thus, factors like predicting adult height and assessing the age of peak growth rate are great support tools.

A very trendy subject over the last years is the capacity to assess the maturation of young people, and one of these is at the somatic level using growth curves, i.e. the age of peak speed growth rate proposed by (Mirwald et al., 2002) which is used by Balyi and Williams (2009 in their proposal to plan training in different sports, including tennis. However, this method has been discussed over the last few years and it is mainly recommended in boys between 12-15 years old and girls between 10-13 years old as these are the ages when the growth jump occurs (Malina & Koziel, 2014).

This paper intends to describe the morpho-functional characteristics, the prediction of the adult height and the age of peak growth rate in a sample of juniors Colombian tennis players.

METHODOLOGY

Participants

76 Colombian tennis players, females (n=38) and males (n=38), out of which all players between 10 and 16 years old, who are in the national ranking of this country.

Procedure

After getting informed consent, parents or guardians authorized the use of the data for this investigation. Data were gathered in a set format: date of birth, height of the parents (verbal communication) and anthropometric measurements considering the recommendations of the International Society for the Advancement Kinanthropometrics.

We evaluated tests of: horizontal jump, 5m sprint, 10m sprint, agility 10x5mts, spider test and Repeat Sprint Ability 10x20mts with a 20 second rest between each repetition. The evaluation was made by a trained team that included sport and physiotherapy professionals.

Finally, protocols were developed: for body fat percentage at young ages (Slaughler, 1988), for prediction of adult height (PAH) (Kamis & Roche, 1994) and, for the age peak growth velocity (PGV) (Mirwald et al., 2002).

Statistical analysis

The descriptive analysis included average and standard deviation using SPSS programme version 24.

FINDINGS AND DISCUSSION

Tables 1 and 2 show the descriptive statistics for males and females per age groups. The morphologic characteristics increase in size, in weight, and height as age naturally increases, also, the girls, have more fat mass, with the exception of the 10-11 age group, since boys at these ages are normally heavier and have more fat mass than girls. In this age group there are only 4 boys and 9 girls, and just one single boy in low form modifies the averages of the results.

Variable	Unit	8 years (n=3) x̄ ± SD	10/11 years (n=9) x̄ ± SD	12/13 years (n=12) x̄ ± SD	14/15 years (n=12) x̄ ± SD	16 years (n=2) x̄ ± SD
Chronological age	Year	8.5±0.42	10.8±0.51	13.0±0.46	14.8±0.46	16.4±0.14
Height	Cm	130.8±6.23	141.9±5.59	158.1±6.40	168.4±5.71	168.0±1.76
Weight	Kg	27.8±3.67	36.5±7.66	45.3±5.57	49.2±6.97	68.3±2.40
Sum Pl 3	mm	21.0±1.0	32.0±10.9	27.6±7.92	25.1±7.49	34.0±4.24
Sum Pl 7	mm	47.6±4.51	75.6±25.5	67.5±21.0	58.2±15.9	76.0±15.5
% fat	%	12.2±1.12	18.3±6.33	16.0±4.98	14.2±4.36	16.8±0.51
K&R	Cm	179.0±8.7	179.2±7.05	178.8±6.49	177.2±5.30	169.6±0.04
PGV age	Year	-	13.7±0.23	14.4±0.56	14.7±0.49	-
Horizontal jump	Cm	139±25	144.6±16	173.2±18	199.1±15	211±15
5mts	Sec.	1.97±0.28	1.80±0.30	1.64±0.26	1.54±0.23	1.49±0.08
10mts	Sec.	2.99±0.21	2.82±0.31	2.68±0.18	2.37±0.22	2.20±0.14
Agility	Sec.	20.56±2.11	21.83±1.07	20.26±0.98	18.88±0.77	19.40±1.26
Agility Spider W	Sec.	21.53±1.27	22.31±1.22	19.40±1.33	18.05±0.67	18.36±1.07
RSA 10X20 P	Sec.	-	-	3.78±0.21	3.51±0.27	3.55±0.00
RSA 10x 20T	Sec.	-	-	37.87±2.12	35.19±2.75	35.51±0.07

*Sum Pl= sum of skin folds. *K&R= Kamis and Roche adult height prediction, 1994.

*PGV=Peak Growth Velocity as of maturity-offset (Mirwald et al., 2002)

*RSA= Repeat Sprint Ability 10 times, 20mts, A=average T=Total of all 10 covered.

Table 1. Descriptive statistics for males per age range (n=38).

Variable	Unit	7/9 years. (n=4) x̄ ± SD	10/11 years (n=4) x̄ ± SD	12/13 years (n=14) x̄ ± SD	14/15 years (n=16) x̄ ± SD
Chronological age	Year	9.0±0.82	10.8±0.52	13.1±0.64	14.8±0.39
Height	Cm	131.1±7.17	145.5±7.17	157.0±6.30	160.7±4.78
Weight	Kg	25.8±1.13	31.5±4.10	49.1±7.86	55.3±7.73
Sum Pl 3	mm	23.5±5.50	22.5±1.73	38,7,6±9,44	41.6±9.52
Sum Pl 7	mm	54.5±8.34	61.2±2.63	94.7±23.18	104.3±25.6
% fat	%	16.2±3.46	13.4±0.76	21.0±4.24	22.8±3.98
K&R	Cm	164.7±7.85	169.0±4.12	163,,0±5,16	162.6±4.51
PGV age	Year	-	12.1±0.39	12.3±0.47	-
Horizontal jump	Cm	139±11	148±19	162±11	162±15
5mts	Sec.	1.76±0.32	1.92±0.17	1.79±0.15	1.72±0.13
10mts	Sec.	2.88±0.36	2.92±0.11	2.67±0.21	2.66±0.15
Agility	Sec.	23.40±1.36	22.49±0.57	20.84±1.10	20.56±0.85
Agility Spider T	Sec.	22.46±1.74	22.48±0.27	20.24±1.15	20.05±1.19
RSA 10X20 P	Sec.	-	4.21±0.31	3.99±0.24	-
RSA 10x 20T	Sec.	-	42,19±,3,11	39.99±2.41	-

*Sum Pl= sum of skin folds. *K&R= Kamis and Roche adult height prediction, 1994.

*PGV=Peak of Growth Velocity as of maturity-offset (Mirwald et al., 2002)

*RSA= Repeat Sprint Ability 10 times, 20mts, A=average T=Total of all 10 covered.

Table 2. Descriptive statistics for females per age range (n=38).

The functional characteristics of males showed better results than females, and that the differences increase with age. In the 10-11 year old age group, the results are similar in both sexes, there is even a better horizontal jump in girls than in boys.

In general, the results of morpho- functional characteristics are less representative if compared with tennis players with a junior national ranking in the US (Roetert et al., 1992) as well as ITF ranking (Sánchez-Muñoz et al., 2007). However, we should take into account the fact that few works describing morpho-functional characteristics have been made with base samples of South American players, and in this case, the sample is fromColombian junior national ranking players. PAH ranges between (169-179cm) for males and (162-169cm) for females, which are low height results for current professional tennis. Finally, PGV varies between 13.7-14.7 years of age for males and 12.1-12.3 years of age for females.

CONCLUSIONS

Morpho- functional characteristics in Colombian tennis players show lower results than studies made on national rankings in the US and ITF rankings. PAH for men and women is low for current professional tennis and PGV keeps normal values.

This study is a practical tool for coaches and trainers, with basic standardized protocols, of easy access and application, it also evaluates relevant aspects for tennis performance, and it contributes to talent identification, as well as long term training. Proposals for player evaluation allowing the control of junior tennis players at a morpho-functional level could be an important step for developing countries.

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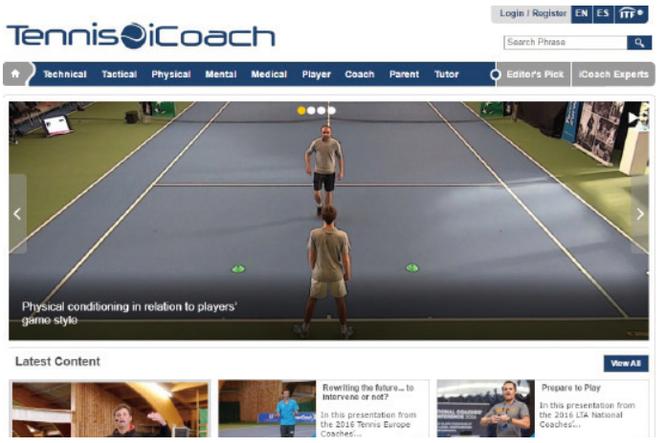

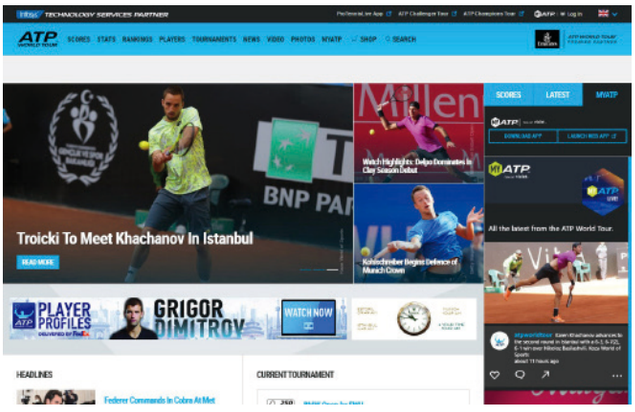

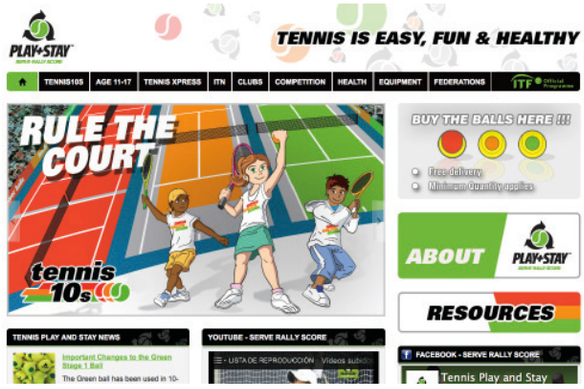

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